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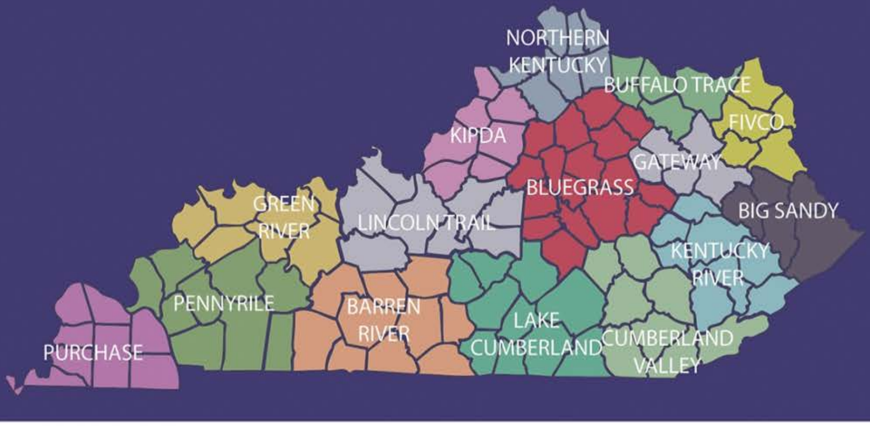
COMMONWEALTH of KENTUCKY ENHANCED HAZARD MITIGATION PLAN

2013 VERSION



Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version

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STANDARD PORTION

INTRODUCTION

PART I:
Executive Summary

The *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* was conceived and written implicitly arguing the following:

1) That, specifically in Kentucky's past and perhaps generally for all states, statewide planning documents have been written from the "top down," i.e. as if Kentucky (and states generally) has some central planner.
2) That despite being written in such a manner, the quotidian administration of statewide hazard mitigation efforts in Kentucky does not typically reflect the "top-down" management implied in planning documents.

The "top-down" presentation of what is characteristically a very "bottom-up" administration is most noticeable in how past iterations of Kentucky's hazard mitigation plans have derived its mitigation actions and overall mitigation strategy: The Commonwealth of Kentucky defines a set of goals, considers general objectives toward meeting defined goals, and then specifies mitigation actions that comply with the objective(s) toward meeting the goals. Granted, and in accordance with expressed desires from the federal government, such mitigation actions historically have been informed by Kentucky's local jurisdictions. After all, this is planning: The process *must* include significant input from others besides the de facto central planner, lest all of administration produce shoes but no shoelaces.

However, simply being informed by the sagacity of invaluable yet ultimately self-selecting stakeholders is not sufficient for statewide hazard mitigation planning. And this plan argues this largely is due to one very obvious fact: *The Commonwealth of Kentucky has never nor will ever suffer from a natural hazard.* The Commonwealth of Kentucky has never been nor will ever be flooded. However, the counties housed under the Cumberland Valley Area Development District certainly have and will continue to be. An earthquake has never nor will ever tremble violently beneath the Commonwealth of Kentucky. It has and will, however, shake Hickman County to its metaphorical knees.

In other words, at least regarding hazard mitigation (and perhaps more generally), the Commonwealth of Kentucky cannot be viewed separately from the local jurisdictions of which it is comprised. Hazards destroy the properties and critical facilities and wreak havoc on the populations of those living within the counties, cities, metropolitan districts, etc. *of* the Commonwealth of Kentucky. They do not affect the Commonwealth of Kentucky separately.

This update of the Commonwealth of Kentucky's hazard mitigation plan attempts to convey, then, that implicitly it has acknowledged this lack of separation between itself and its local jurisdictions that comprise it in the past and continues to operate for the sake of its local jurisdictions. Kentucky's entire hazard mitigation plan has been updated to reflect this day-to-day mindset of its hazard mitigation administration.

Kentucky's quotidian mitigation administration reflects constant outreach and constant interagency and inter-jurisdictional cooperation: Kentucky Emergency Management (KYEM) has on staff an intergovernmental liaison whose years of experience with Kentucky's local governments and their public officials and politics provide an ever-present and effective link between the Commonwealth and its local jurisdictions as well as reflects Kentucky's desire to increase the participation of its localities in mitigating hazards. This plan will show mitigation-oriented organizations and groups comprised of a wide array of public, private, and nonprofit partners. Shown in this plan is a sample of such organizations. However, from only the appointment to the Kentucky Hazard Mitigation Council (KYMC) to membership into the Kentucky Association of Mitigation Managers (KAMM) to its Private Sector Work Group, it is apparent that Kentucky is well-advised by many mitigation stakeholders from many different fields and with many different perspectives and interests.

Kentucky Emergency Management (KYEM) (who ultimately oversees statewide mitigation activity) constantly is providing outreach to Kentucky's local jurisdictions regarding planning. Its path-breaking Applicant Agent Certification Credentialing program; its many trainings and presentations performed out in Kentucky's communities; that it partners with the Universities of Kentucky and Louisville who specialize in customer service and outreach and in technical assistance, respectively; and even that the organization of its mitigation staff centers around Kentucky's geographic regions to ensure the customer service that can only come from specialization all reflect "bottom-up" administrative outreach regarding hazard mitigation. Kentucky rarely has told its local jurisdictions what they should do; rather, Kentucky always has sought to facilitate and coordinate the mitigation actions of its local jurisdictions in as many ways as it can.

In presenting a statewide hazard mitigation plan, the Commonwealth of Kentucky was compelled to distinguish "types" of planning. Thusly, the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* operates within a framework where Kentucky recognizes *inductive planning* and *deductive planning*.

Perhaps inappropriately broadening the adjective, like "inductive" used to describe "reasoning," the idea behind articulating an *inductive planning* focus is to make explicit that Kentucky's final or generalized hazard mitigation plan largely is an aggregation, or a culmination, of the specific planning components developed by its local jurisdictions. Such systematic incorporation of the planning of its local jurisdictions occurred through consistent outreach and constant review of local jurisdictions' plans. The *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* uses a Risk Assessment developed by its Center for Hazards Research and Policy Development at the University of Louisville. The risk assessment is further augmented with the planning work of Kentucky's Division of Forestry (KDF) and Division of Water

(KDOW). Finally, the planning ideas developed by the Federal Emergency Management Agency (FEMA) were incorporated into an analysis of risk posed by human-made hazards.

Most of Kentucky’s mitigation actions for the state merely are reflections of the extensive planning performed by its local jurisdictions: Thorough reviews of each of Kentucky’s local hazard mitigation plans provided a list of actions which were then categorized. These categories became the Commonwealth’s mitigation actions under the assumption that what local jurisdictions deem important is what Kentucky itself deems important. These categories were then re-categorized using FEMA’s planning work regarding mitigation actions. This allowed the Commonwealth’s mitigation actions (i.e. the aggregated mitigation actions of its local jurisdictions) to be evaluated in terms of FEMA’s notable work.

Comprehensive reviews of each of Kentucky’s local hazard mitigation plans also provided a systematic and fair method to prioritize future mitigation actions that will be subject to Commonwealth and federal approval: If the Commonwealth of Kentucky partially prioritizes mitigation actions based upon what a local jurisdiction has identified as its most devastating and feared hazards, then, accompanied with Benefit-Cost Analysis, the Commonwealth of Kentucky can ensure that mitigation projects are distributed where they address the most problematic areas and concerns, e.g. repetitive-loss areas, communities with the most need for development considerations, etc.

A thorough incorporation of Kentucky’s local jurisdictions’ planning mechanisms is apparent in this plan’s analysis of local capability to administer and fund mitigation projects. For any audience, this 2013 update of Kentucky’s hazard mitigation plan both summarizes-via-categorization each of Kentucky’s local jurisdictions’ capabilities and records in full those same capabilities.

Finally, Kentucky’s plan maintenance reflects its derivation of the term *inductive planning*: Monitoring, maintenance, evaluation is performed through outreach, through frequent reporting from local jurisdictions, and through technology. This particularly concerns the Community Hazard Assessment and Mitigation Planning System (CHAMPS) developed and newly-implemented throughout the state. CHAMPS is elaborated upon below.

Inductive planning is contrasted with *deductive planning* which, again following the definition of the adjective, involves starting from a general plan and using pieces of the general plan to influence planning “top-down.” Despite this 2013 update of its hazard mitigation plan’s emphasis on *inductive*, “bottom-up” planning, it remains true that there is a vital role that the Commonwealth must play in order to facilitate and coordinate the planning efforts of the local jurisdictions that comprise it. This mainly involves identifying what this plan terms *Public Goods-Type* mitigation actions. The *Public Goods-Type* describes those mitigation actions that benefit everybody within the Commonwealth but that (because of that fact) are not pursued by individual local jurisdictions. It is a classic “public goods theory” and “free-rider problem” motivation behind such mitigation actions. Ironically, engaging in *inductive planning* provided excellent examples of *deductive planning*: The Division of Forestry (KDF) and the Division of Water’s (KDOW) wildfire and dam failure mitigation insights that were incorporated into this plan’s risk assessment also serve as examples of how *deductive planning* works. KDF and KDOW are executive, state agencies pursuing research regarding wildfires and dams that will benefit all of Kentucky’s local jurisdictions even as no one local jurisdiction has any incentive to individually pursue such projects.

Concluding, a note on about the organization of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*: It is immediately apparent that subsections of this plan are not organized in alphabetical or chronological order. The use of letters to signify a subsection within this plan has no ordering purpose. The letters have a direct reference to the letters used to distinguish criteria for approval from the Federal Emergency Management Agency’s (FEMA’s) State Plan Review Tool, or “Crosswalk.” The wording of subsection titles further clarifies this: Subsections within this plan are titled according to the wording in the State Plan Review Tool.

So, for example, the subsection of the Planning Process entitled “B. Indicating Who Was Involved in This Current Planning Process,” refers to FEMA’s State Plan Review Tool’s “element” B. under the Planning Process section whose criterion for approval asks that the Commonwealth of Kentucky “indicate who was involved in the current planning process.”

Finally, Appendices are numbered in the order in which they are cited within the plan.

INTRODUCTION

PART II:
Community Hazard Assessment and Mitigation Planning System (CHAMPS)

A brief discussion of Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) is a particularly relevant inclusion in the Commonwealth of Kentucky's 2013 update of its hazard mitigation plan. In the 2010 update, CHAMPS was highlighted considerably. In 2010, development was still largely conceptual. In the three years' time since Kentucky previous hazard mitigation plan update, the first version of CHAMPS (CHAMPS v1) became implementable with official training sessions for interested mitigation stakeholders taking place. CHAMPS' second version (CHAMPS v2) is newly implementable and preliminary training and seminars already have begun to take place. CHAMPS v2 represents a dramatic revision from CHAMPS v1 in terms of its functionality and user-friendliness. CHAMPS is discussed and appended here due to its current and future all-encompassing role for all parts of the mitigation planning process.

CHAMPS Generally:

CHAMPS is a joint project being implemented by Kentucky Emergency Management (KYEM), the Kentucky Department of Local Governments (DLG), the University of Louisville's Center for Hazards Research and Policy Development (CHR), and Stantec. The project is being federally-funded jointly by the Federal Emergency Management Agency (FEMA), the Department of Housing and Urban Development (HUD), and the Economic Development Administration (EDA).

The goal of CHAMPS has been and continues to be to enhance a local community's "resiliency." "Resilience" in this context refers to a local jurisdiction's ability to utilize resources to prepare for, respond to, and recover from disasters.

In its current phase, i.e. CHAMPS Version II (CHAMPS v2), the emphasis is on *real-time* disaster management. CHAMPS is intended as a tool that aids and enhances communication, collaboration, standardization, and the overall planning process.

CHAMPS v1 (Version I) Description:

The Community Hazard Assessment and Mitigation Planning System (CHAMPS) is a web-based system designed to help communities in the Mitigation Planning process needed to secure funding through FEMA's Hazard Mitigation Program. CHAMPS v1 was brought online in the fall of 2012 and is currently being used to assist Area Development Districts in the creation of Hazard Mitigation plans that cover Kentucky's 120 counties, develop Mitigation Project Proposals, and complete Mitigation Projects.

CHAMPS v1 has five modules:

- *Disaster Management* – This module captures state and federal disaster information, including incident types, counties affected, damages reported, declaration status of affected communities and Hazard Mitigation funds available as a result of the incident.
- *Briefings* – This module is a calendaring module that lists post-disaster briefings, award briefings, project meetings (such as quarterly inspections), and close-out briefings. Documents, maps, and contact info relating to the briefings are housed in this module.
- *Planning* – Local communities, Area Development Districts (ADDs) and the Commonwealth of Kentucky use this module to develop the FEMA-mandated local and Commonwealth hazard mitigation plans. This module is designed based on FEMA's Plan Review Tools ("Crosswalks"). The hazard mitigation plan can be updated in the system at any time and can be cloned from one version to another when submitting for renewal. This module includes an extensive state and federal review process to ensure that only quality plans are submitted to FEMA.
- *Mitigation Action Forms* – This module is the "warehouse for good mitigation ideas" and draws from the Planning module. As the local and state Hazard Plans are created and updated, mitigation actions are formed and moved into a proposal status. This module contains basic project information including project description, points of contact, scope of work, project timelines, project budget, and project location. These project proposals can be updated at any time and are housed in the system until the project manager submits the project for funding by FEMA.
- *Projects* – This module migrates the chosen and abovementioned "good mitigation ideas" into projects for FEMA's consideration. Kentucky's State Hazard Mitigation Team chooses mitigation projects for FEMA funding consideration and the applicants, with support from KYEM Grant Managers, complete the application process to FEMA. During this time, the application is fine tuned in the system and submitted to FEMA for approval. Upon approval, work relating to the project is tracked in the Projects module using a project time tracking system until the project is completed and closed out.

CHAMPS v2 (Version II) Description/Improvements:

CHAMPS Version I very much was intended to be a stepping stone to a system that was far more interactive and far more user-friendly. CHAMPS Version II (CHAMPS v2) makes great strides in accomplishing this intent.

CHAMPS v2 emphasizes the *real-time* advantages that an interactive, connected, web-based tool can offer to disaster management. The program has become “app-based” with intuitive and aesthetically-pleasing designs provided by the University of Louisville’s Center for Hazards Research and Policy Development (CHR).

CHAMPS generally, but v2 especially, is intended to enhance communication, collaboration, standardization, and the overall planning process:

CHAMPS v2 attempts to accomplish enhancing communication through its current ability to coordinate interaction between interdependent agencies. In a sense, federal, regional, state, and local agencies can all “talk” to each other through CHAMPS v2. This is because CHAMPS v2 acts a common or community room for all of the players involved in a certain mitigation project and/or planning project. CHAMPS v2 provides a forum to host meetings, provide all of the material before the meetings, and post debriefings and results post-meetings.

CHAMPS v2 is intended to enhance collaboration amongst mitigation stakeholders by providing an easy mechanism to include any relevant party to a mitigation project or plan.

CHAMPS v2 intends to enhance standardization by providing its users multiple project and planning templates by which to organize, revise, and keep information current regarding projects and plans.

Finally, related to its “common-” or “community-room” design, CHAMPS intends enhance the overall planning process by offering, essentially, one-stop mitigation shopping and a common place by which any mitigation stakeholder within any level of government or within the private sector can inform, update, prepare, and submit project and planning materials.

Provided as appendices to this section are multiple CHAMPS-oriented materials that visually explain in a way words cannot what CHAMPS has become and what it is intended to do for the Commonwealth of Kentucky.

INTRODUCTION

PART III:
Credits and Acknowledgements

While the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) chiefly wrote the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*, the entire planning process involved the entire staffs of Kentucky Emergency Management (KYEM) and its de facto administrative arms, the UK-HMGP and the University of Louisville's Center for Hazards Research and Policy Development (CHR).

This section, then, elucidates who all was involved in which portions of the planning process.

<u>Administrative Credits</u>

- John Heltzel, (Former) Director, Kentucky Emergency Management (KYEM)
    - Provided the positive culture, high standards, advice, edits, and revisions that resulted in this plan and with the many valuable statewide mitigation programs administered by Kentucky Emergency Management (KYEM)

- Michael A. Jones, (Acting) Director, Kentucky Emergency Management (KYEM)
    - Has further provided the support necessary to complete all portions of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*

- Stephanie Robey, Assistant Director, Kentucky Emergency Management (KYEM)
    - Further provided the positive culture, high standards, advice, edits, and revisions that resulted in this plan and in the superior planning process that brought it about; wrote portions of the plan; (heavily) edited the plan; was an invaluable source of information and institutional knowledge, as well as much-needed support to the chief writer of this plan

- Leslie R. (Mahoney) Kennedy, (Former) State Hazard Mitigation Officer, Kentucky Emergency Management (KYEM)
    - Was State Hazard Mitigation Officer during most of the 2010-2013 planning cycle; thus, was integral to the planning process and ultimate write-up of this plan.

- Geneva J. Brawner, State Hazard Mitigation Officer, Kentucky Emergency Management (KYEM)
    - Is currently State Hazard Mitigation Officer, and took on the role as “Acting” after Leslie R. Kennedy. Thus, was involved administratively during the development and write-up of the Enhanced Portion of this plan.

- Josh Human, Director, University of Louisville Center for Hazards Research and Policy Development (CHR)
    - Administered an effective and innovative risk assessment portion of this plan

- Brian D. Gathy, Director, University of Kentucky, Martin School of Public Policy and Administration Hazard Mitigation Grants Program (UK-HMGP)
    - Provided the ideal work environment conducive to such an involved undertaking; was an invaluable source of information, insight, support, and institutional knowledge
    - Provided guidance related to the Enhanced Portion of this plan

Writing Credits (By Section): Standard Portion

Introduction	W. Nick Grinstead with Doug Eades
Planning Process	W. Nick Grinstead and Stephanie Robey with Geni Jo Brawner and Leslie Kennedy
Risk Assessment	Josh Human, Andrea Pompei Lacy, Ben Anderson (University of Louisville Center for Hazards Research and Policy Development) with W. Nick Grinstead (Human-Made Hazards Section)
Mitigation Strategy	W. Nick Grinstead and Stephanie Robey with Nate Kratzer and Zachary D. Turner
Coordination of Local Mitigation Planning	W. Nick Grinstead and Stephanie Robey
Plan Maintenance	W. Nick Grinstead and Stephanie Robey

Writing Credits (By Section): Enhanced Portion

Integration with Other Planning Initiatives	W. Nick Grinstead and Stephanie Robey
Project Implementation Capability	W. Nick Grinstead and Stephanie Robey with Esther White
Program Management Capability	Federal Emergency Management Agency
Assessment of Mitigation Actions	W. Nick Grinstead and Stephanie Robey with Zachary Turner, Esther White, Ryan Hubbs, Todd Neal, and Geni Jo Brawner
Effective Use of Mitigation Funding	W. Nick Grinstead and Stephanie Robey with Esther White and Brian D. Gathy
Commitment to Comprehensive Mitigation Program	W. Nick Grinstead and Stephanie Robey with Esther White and Brian D. Gathy

Writing Credits (Appendices): Standard Portion

Appendix 2-1: Kentucky Hazard Mitigation Council (KYMC) By-Laws	Kentucky Emergency Management (KYEM)
Appendix 2-2: Silver Jackets…	W. Nick Grinstead
Appendix 2-3: Kentucky Association of Mitigation Managers (KAMM)…	W. Nick Grinstead
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Appendix 2-5: Local Jurisdictions' Hazard Mitigation Plan Summaries…	W. Nick Grinstead and Geni Jo Brawner
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Appendix 6-5: Plan Maintenance Process from 2010 Update	University of Louisville Center for Hazards Research and Policy Development (CHR); Stephanie Robey; Esther White
Appendix 6-6: "CHAMPS v1 ADD Training Feedback Final Report"	University of Louisville Center for Hazards Research and Policy Development (CHR) and Kentucky Department of Local Governments (DLG)
Appendix 6-7: Individual Project Progress Report (IPPR)	Adapted from work by University of Louisville Center for Hazards Research and Policy Development (CHR)
Appendix 6-8: Period of Performance Extension Request – 180-Day	Brian D. Gathy
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Writing Credits (Appendices): Enhanced Portion

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Planning Process Credits

- Nancy Price, Intergovernmental Liaison, Kentucky Emergency Management (KYEM):
    - Facilitated the Area Development District stakeholder meetings; administered many of them; provided outreach to local communities and their public officials

- Amanda B. LeMaster, Project Manager and former Acting State Hazard Mitigation Officer, Kentucky Emergency Management (KYEM):
    - During the time when much of the formalized planning process was being implemented, was acting State Hazard Mitigation Officer along with being lead in the planning process; administered many of the Area Development District stakeholder meetings while administering projects and maintaining the sources of information necessary to this planning document

- Ryan Hubbs, Todd Neal, Ann Culbertson
    - Administered many of the formal Area Development District stakeholder meetings; are primarily responsible for Kentucky's Loss Avoidance study to be submitted with the Enhanced Plan; edited appendices

Research Assistants

- Nate Kratzer, University of Kentucky Martin School of Public Policy and Administration
    - Was invaluable in the research and compilation that comprises the significant (and useful) portions of the Mitigation Strategy section of this plan; provided rough drafts of appendices; helped review local plans

- Zachary D. Turner, University of Kentucky Martin School of Public Policy and Administration
    - Was instrumental in the many revisions that were required of the Mitigation Strategy section for its "Revised Submittal"; edited passages from "Original Submittal"; compiled new information; helped review local plans

INTRODUCTION

PART IV: Adoption by the Commonwealth of Kentucky

REQUIREMENT §201.4(C) (6):

The Commonwealth of Kentucky's hazard mitigation plan must be formally adopted by the Commonwealth of Kentucky prior to submittal to FEMA for final review and approval.

REQUIREMENT §201.4(C) (7):

The Commonwealth of Kentucky's hazard mitigation plan must include assurances that the Commonwealth of Kentucky will comply with all applicable federal statutes and regulations in effect with respect to periods for which it receives grant funding, in compliance with 44 CFR 13.11(c). The Commonwealth of Kentucky will amend its plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11(d).

A.: Adopting the Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version

The Commonwealth of Kentucky formally adopted the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* on **10/02/2013**, after addressing revisions requested of it by the Federal Emergency Management (FEMA) upon its review of the "original submittal." The *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* was submitted to the Federal Emergency Management Agency (FEMA) for final review and approval (as a "revised submittal") on **10/17/2013**.

B.: Assuring That the Commonwealth of Kentucky Will Continue to Comply with All Applicable Federal Statutes and Regulations during the Periods for Which It Receives Grant Funding

The *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* was submitted to FEMA for final review and approval by Kentucky Emergency Management (KYEM) under the presumption that Kentucky Emergency Management (KYEM) and, hence, the Commonwealth of Kentucky would continue to comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c). Thus, Kentucky Emergency Management (KYEM) and the Commonwealth of Kentucky *assures* that compliance with all applicable federal statutes and regulations during the periods for which it receives grant funding will continue.

Further, Kentucky Emergency Management (KYEM) and, hence, the Commonwealth of Kentucky will amend its *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11(d).

PLANNING PROCESS

PART I:
Documentation of the Planning Process

REQUIREMENT §201.4 (C)(1):

The Commonwealth of Kentucky must include a description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.

A. Providing a Narrative Description of How the 2013 Version of the Commonwealth of Kentucky's Hazard Mitigation Plan Was Prepared

In discussing the preparation of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan, two (2) terms that will be used throughout this document must be discussed: *inductive planning* versus *deductive planning*. Ultimately, these two neologisms describe a philosophy of planning that will be implicit throughout this document. However, introducing the terms here does result in narrating how this plan was prepared generally.

Inductive versus Deductive Planning

The use of the adjectives "inductive" and "deductive" to distinguish between planning processes relies upon a somewhat loose interpretation of those adjectives.

Induction, when applied to logic, occurs when specific observations or details result in a general principle. Technically, a necessary part of the definition (because it relates to argument) is that the premises of an inductive argument do not necessarily support the general principle.

Deduction occurs when the general principle results in specific observations or details. Technically, because the definition is used in logic and argument, the premises that result from deduction are guaranteed to support the general principle.

For the purposes of the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan it is the process that differentiates *induction* from *deduction* that is relevant: *Inductive* reasoning occurs when specific observations or details are observed and compiled upward in order to conclude something general. Thus, *inductive planning* occurs when the planning initiatives, products, and mechanisms of specific entities are compiled upward into a general plan. Perhaps, *inductive planning* can be seen as the ideal planning process in which the general plan is a culmination of the planning efforts of an assemblage of individuals and individual entities.

Similarly, *deductive* reasoning occurs when a general principle is established that yields specific observations or details disaggregated from the general or the whole. Thus, *deductive planning* occurs when a general plan is established that yields planning initiatives, products, and mechanisms that can disaggregated from it and disseminated to an assemblage of individuals and individual entities.

The Commonwealth of Kentucky's Hazard Mitigation Plan as Inductive Planning

The purposes of distinguishing between an *inductive* versus *deductive* planning process is to be able to make the claim that the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan is the result of *inductive* planning[1].

This document was developed "inductively". The individual planning initiatives, products, and mechanisms developed by Kentucky's local jurisdictions were aggregated into this general plan. As a result, the scope of this *statewide* hazard mitigation plan and the subsequent scope of the administration of hazard mitigation do not far exceed the scopes of Kentucky's individual local hazard mitigation plans. The philosophy behind this limited scope will be elaborated upon later in this plan.

For the purposes of describing how this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan was prepared, the specific components that were aggregated and molded into a general statewide plan (thus supplying the *inductive* nature of the planning process) derived from two (2) general sources and processes:

1) Thorough review throughout the 2010-2013 planning cycle of all of Kentucky's local hazard mitigation plans
2) Outreach to local jurisdictions (i.e. the implementation of the Commonwealth of Kentucky's 2010 update of its hazard mitigation plan)

FOR CONTEXT, TO NOTE:

Deductive Planning: *Occurs when planning primarily is conducted centrally. There may be some input from those to whom the planning is intended; but, a general plan is established first with portions relevant to those for whom the planning is done being disseminated to them. Think deductive reasoning.*

Inductive Planning: *Occurs when the planning primarily is NOT conducted centrally. The sources of what will establish the general plan primarily is a culmination of the individual planning conducted by those for whom the general plan is intended. Think inductive reasoning.*

Review of Local Jurisdiction Hazard Mitigation Plans

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[1] The Commonwealth of Kentucky does propose some *deductive* planning processes to be implemented via this hazard mitigation plan. These will be discussed in the *Mitigation Strategy* section of this plan.

The process of local mitigation plan review was (and is) an ongoing endeavor.

Of course, the review of many of Kentucky's local jurisdictions' hazard mitigation plans was performed solely as a result ongoing of contractual responsibilities. Throughout the 2010-2013 planning cycle, the majority of Kentucky's local hazard mitigation plans were being updated as their five-year planning cycles were ending and local plans were subsequently expiring.

The University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) was responsible for the review and final submissions to FEMA of all updates to local jurisdictional hazard mitigation plans. A fortunate side-effect of UK-HMGP's (as an administrative arm of Kentucky Emergency Management) monopoly of local plan reviews included specialization. UK-HMGP was able to provide the Commonwealth's planning process with significant local plan expertise and planning context.

Beyond the thorough review of local hazard mitigation plans, due to it being the responsibility of paid staff within KYEM/UK-HMGP, thorough local mitigation plan review was conducted systematically and repeatedly in order to prepare this statewide hazard mitigation planning document.

The systematic review of local mitigation plans further was linked with outreach (discussed below) in a feedback loop. The need and desire on the part of the Commonwealth of Kentucky to increase and improve outreach to its local jurisdictions prompted systematic review of these local jurisdictions' hazard mitigation plans and systematic review of local jurisdictions' hazard mitigation plans catalyzed increasing and improving outreach to local jurisdictions.

Outreach

Essentially, throughout the 2010-2013 planning cycle five (5) series of outreach initiatives resulted in the philosophy and process underlying this 2013 update:

1) Kentucky Association of Mitigation Managers (KAMM) Conferences
2) Kentucky Hazard Mitigation Council (KYMC) Meetings
3) Applicant Agent Certifications
4) Community Hazard Assessment and Mitigation Planning System (CHAMPS) Trainings
5) Stakeholder Meetings Presented at Each of Kentucky's 15 Area Development Districts (ADD) between 2012 and 2013.

Each of the abovementioned initiatives is described in greater detail later in this section. The important point relevant for this discussion concerns the inevitable feedback loop that resulted in the philosophy and planning process apparent in this 2013 update.

The Kentucky Association of Mitigation Managers (KAMM) is an expanding association that currently includes, and is constantly actively recruiting, many local managers that deal with mitigation in any capacity. Each year, KAMM organizes a conference, and, every year, participation and attendance at the conferences increases and, more relevantly, represents a wider array of “mitigation manager.” The representation at these conferences (and at accompanying regularly-scheduled KAMM membership meetings) provides significant input and feedback that inevitably is included in statewide planning. Completing the feedback loop, the KAMM conferences also serve to showcase mitigation planning to the ever-increasing and ever-varied membership into KAMM.

Related, the Kentucky Hazard Mitigation Council (KYMC) is a collection of, essentially, all manner of mitigation stakeholders who meet quarterly to discuss, receive advised about, and offer advice to mitigation activity that is being pursued by Kentucky Emergency Management (KYEM). It is relevant for outreach to note that, technically, there is no limited “membership” per se to the KYMC. Rather, KYMC quarterly meetings are open to any agency and to any mitigation stakeholder that desires to take part. KYMC is inclusive.

The KYEM Applicant Agent Certification is a leading-edge weeklong foundational seminar held quarterly and resulting in an official, state-recognized certificate that attracts a wide variety of participants from all of Kentucky’s local jurisdictions. For the planning process, such participation is ideal. The “applicant agent” is a broad category applied to those persons designated to represent entities participating in various FEMA programs. Hence, training to be certified as one has wide practical appeal to any local official and public service representative that will or may have to deal with hazard mitigation at any point in time in their career or life. Consequently, by holding such widely-appealing certification courses, simultaneously is providing information that aids in local planning and incentivizing increased participation in local planning by those who normally might not consider themselves stakeholders. To complete the feedback loop, KYEM is receiving input and insight relevant for planning from individuals who normally are only tangentially involved in statewide and local planning processes.

While itself a tool of *inductive planning* (that increases the number of specifics to be aggregated into statewide mitigation planning), the training for the Community Hazard Assessment and Mitigation Planning System (CHAMPS) provides a feedback loop similar to that experienced with participants in Applicant Agent Certification training. The main difference between the two (2) aforementioned feedback loops involves the audience. The CHAMPS training primarily includes those individuals most prominently or intimately involved in mitigation activity as CHAMPS represents a new tool that standardizes project management, provides a universal database, and democratizes planning participation across jurisdictions and amongst those most prominently and intimately involved in mitigation. The feedback loop still is obvious. CHAMPS training implies training in mitigation planning from Kentucky (via KYEM) and those participants involved in the training constantly improve CHAMPS and, hence, statewide planning efforts.

Finally, Kentucky Emergency Management (KYEM), along with the University of Kentucky Martin School of Public Policy and Administration’s Hazard Mitigation Grants Program (UK-HMGP), hosted Stakeholder Meetings specifically scheduled to elicit feedback from local jurisdictions regarding local and statewide planning. It is these stakeholder meetings, conducted throughout 2012 and the first quarter of 2013, which most influenced the nature and preparation of Kentucky's planning process.

The dramatic influence can be attributed to a subtle planning process change that will become codified into future administration at Kentucky Emergency Management (KYEM). Rather than arrange a series of stakeholder meetings whereby representatives of local jurisdictions were required to travel to the state capital to participate, KYEM (along with UK-HMGP) traveled statewide to the local jurisdictions to conduct multiple stakeholder meetings. Relieving local jurisdictions of the significant burden of travel incentivized increased attendance with a wider array of stakeholders at these locally-scheduled meetings. It also implied that meetings were more focused on the localities represented. A stakeholder meeting was not a meeting that shifted its focus or scope of presentation depending upon who showed up and from where. Now, each stakeholder meeting would be targeted toward one audience at the outset. Previous stakeholder meetings did not contain adequate representation from the farthest regions of the state. However, this approach by KYEM (and UK-HMGP) of conducting stakeholder meetings where it was convenient for the audience ensured vital input from the entire commonwealth.

Further, despite the obvious benefits of agency travel to local jurisdictions, such travel usually is quite cost-prohibitive. Kentucky has alleviated some of this cost-prohibition that ensures better community service and more locally-centered planning through its development of the Area Development Districts (ADDs) and through its contracting with the University of Kentucky to establish what, in essence, is a branch office of KYEM called the Hazard Mitigation Grants Program.

Area Development Districts (ADD) are discussed below. For the purposes here, ADDs dramatically decreased the number of locales to which KYEM, wishing to address local jurisdictions and communities, needed to travel. The ADDs, administratively at least, collapsed Kentucky's 120 counties into 15 "regions." KYEM can travel to one ADD region and still command a wider audience that includes multiple counties than would ever be achieved holding presentations from a central location.

The UK-HMGP functions mainly as an extension of KYEM. But, because KYEM contracts with the University of Kentucky's Martin School of Public Policy and Administration, the budget allotted to UK-HMGP as a simple expenditure from KYEM is no longer subject to KYEM or general executive agency budgeting. KYEM's money operates under the University of Kentucky's budgeting rules. So, if KYEM needs money to travel but is constrained through its own budget availability or rules, it can request travel from UK-HMGP which will be acting on behalf of KYEM.

Summary of Plan Preparation

Having discussed the aforementioned, the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan was prepared largely through a compilation and generalizing of local planning garnered through systematic local plan reviews and frequent, regular outreach that yielded multiple feedback loops.

Since the completion of the 2010 update of the Commonwealth of Kentucky's hazard mitigation plan, KYEM has experienced significant growth within its Hazard Mitigation staff. This allowed for full-time staff dedicated solely to the planning process and preparation for the 2013 update of Kentucky's mitigation plan. Planning staff created a timeline that would allow for all elements of the plan to be evaluated and revised. Monthly meetings were held to analyze the progress of the revisions and discuss the remaining items that needed to be addressed within the plan.

Such plan preparation and the overall planning process is termed here as *inductive planning*.

B. *Indicating Who Was Involved in This Current Planning Process*

The 2013 update of the Commonwealth of Kentucky's hazard mitigation plan and its *inductive planning* process could not have been implemented nor completed without involvement of the following noteworthy partners:

Kentucky Emergency Management Hazard Mitigation Program (KYEM)

The KYEM Mitigation Program staff who were most actively involved in all phases of plan development include: KYEM Director John Heltzel; KYEM Assistant Director Jimmy Richerson; KYEM Assistant Director and Recovery Branch Manager Stephanie Robey; State Hazard Mitigation Officer (SHMO) Leslie R. Kennedy; Intergovernmental Liaison Nancy Price; Systems Integration Manager and Acting SHMO Doug Eades; Planning Specialist and Acting SHMO Geni Jo Brawner and Hazard Mitigation Project/Planning/Grant Managers/Specialists (in alphabetical order), Ann Culbertson, Robert Duff, Ryan Hubbs, Amanda LeMaster, and Todd Neal[2].

Areas of particular emphasis for KYEM regarding the 2013 Kentucky mitigation plan update were program execution, disaster data analysis, and quality control. KYEM is, of course, the driving force behind the execution of both the planning process and plan document itself.

University of Kentucky, Martin School of Public Policy and Administration Hazard Mitigation Grants Program (UK-HMGP)

KYEM contracts with the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP). As will be discussed and alluded to throughout this plan document, the contracting relationship is one of efficiency-enhancement for KYEM: UK-HMGP functions as a de facto branch office of KYEM whose staff perform and supplement KYEM functions by managing mitigation projects, pursuing mitigation funding, serving as a storehouse for project files, and, generally, providing direct customer-service for individuals and local jurisdictions.

Staffing at UK-HMGP includes: Director Brian Gathy, Project Grants Manager Esther White, Planning Grants Manager W. Nick Grinstead, and two (2) graduate students from the Martin School of Public Policy and Administration at the University of Kentucky.

UK-HMGP was responsible for implementing the writing of the 2013 update of Kentucky's hazard mitigation plan. Whereas KYEM devised, scheduled, and implemented the planning process, W. Nick Grinstead acted as the manager and writer for this update. Esther White wrote about Project Implementation and provided much of the plan's data and documentation. Brian Gathy supervised, provided support, and implemented measures to ensure timely deliverables. Recovery Branch Manager (now

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[2] At the time of publication of this update, KYEM has experienced some staff turnover and promotion: State Hazard Mitigation Officer Leslie R. Kennedy, KYEM Assistant Director Jimmy Richerson, and Manager/Specialist Robert Duff no longer work with KYEM. KYEM Recovery Branch Manager Stephanie Robey has been promoted to KYEM Assistant Director.

Assistant Director) Stephanie Robey and (former) State Hazard Mitigation Officer Leslie R. Kennedy also supervised, provided support, and ensured deliverables from both UK-HMGP and KYEM.

University of Louisville Center for Hazards Research and Policy Development (CHR):
CHR is a Board of Trustees-recognized research unit at the University which was established in 1989. Under the direction of Dr. David Simpson and throughout its history, CHR has performed theoretical research regarding all phases and aspects of disasters, hazards, and general homeland security issues. CHR operates under numerous practitioner-oriented contracts that include work for the National Science Foundation, the United Nations, various state and local governments, and, of course, Kentucky Emergency Management (KYEM).

Regarding the 2013 update of Kentucky's hazard mitigation plan, under a contractual relationship between KYEM and itself, CHR performed extensive research in the area of and ultimately provided and incorporated the risk assessment of this 2013 update of Kentucky's hazard mitigation plan. The risk assessment's development and analysis were co-managed by CHR's Associate Director Josh Human and project managers Ben Anderson and Andrea Pompei Lacy.

Kentucky Hazard Mitigation Council (KYMC)
The Kentucky Hazard Mitigation Council (KYMC) was established in 1995 and meets at least quarterly to offer advice to and consult with the KYEM Mitigation Program staff. The KYMC is a vital component in the management and oversight of KYEM Hazard Mitigation Program efforts.

The official purposes of the Kentucky Hazard Mitigation Council are to:

- Identify and evaluate state and local hazards and vulnerabilities;
- Identify hazard mitigation strategies;
- Coordinate hazard mitigation resources;
- Review, rank, and recommend mitigation actions that have applied for funding under the FEMA Hazard Mitigation Grant Program (HMGP);
- Implement hazard mitigation projects and programs;
- Assist the State Hazard Mitigation Office on interim and final project inspections.
- Provide technical assistance to the State Hazard Mitigation Officer and local officials to reduce the hazard vulnerability of people, property, and infrastructure;
- Survey selected damages following a Presidential Disaster Declaration in order to develop (in conjunction with the Federal Hazard Mitigation Council) an Interagency Hazard Mitigation Report;
- Participate in regular and special business meetings;
- Receive and conduct hazard mitigation training;
- Assist Area Development Districts (discussed below) in developing regional (and oft-times multi-jurisdictional) hazard mitigation plans; and
- Plan for and develop the Commonwealth of Kentucky's hazard mitigation plan.

The Kentucky Hazard Mitigation Council membership is limited to 25 voting members, which includes the State Hazard Mitigation Officer who chairs the Council. Any program manager in state, local, or federal government or a private sector mitigation specialist who is responsible for a hazard mitigation program is eligible for membership. A mitigation program manager may request to become a Council member or the State Hazard Mitigation Officer may receive recommendations from sources such as other Council members or the Director. Current membership includes:

- ***Voting Members:***
  - Kentucky Emergency Management Director
  - Stephanie Robey, Kentucky Emergency Management Assistant Director
  - Kentucky Emergency Management Recovery Branch Manager
  - State Hazard Mitigation Officer (SHMO)
  - Mike Hale, Department for Local Governments
  - Jim McKinney**,** Louisville/Jefferson County Metro Government
  - Carey Johnson, Kentucky Division of Water
  - Wendell Lawrence, Lincoln Trail Area Development District
  - Nancy Price, Kentucky Emergency Management Governmental Liaison
  - Jerry Rains, Kentucky Emergency Management Regional Response Manager
  - Angela Satterlee, Hopkinsville Community Development Services
  - Paul Whitman, Shelby County Emergency Management Director
  - Noah Taylor, Kentucky Division of Water
  - Josh Human, University of Louisville Center for Hazards Research and Policy Development
  - Susan Wilkerson, Kentucky Office of Homeland Security
  - Joe Sullivan, National Weather Service
  - Stephen Noe, Kentucky Association of Mitigation Mangers
  - Kentucky Transportation Cabinet Representative

- ***Technical Advisors:***
  - Doug Eades, Acting SHMO Kentucky Emergency Management
  - Geni Jo Brawner, Acting SHMO Kentucky Emergency Management
  - Ann Culbertson, Kentucky Emergency Management
  - Ryan Hubbs, Kentucky Emergency Management
  - Amanda LeMaster, Kentucky Emergency Management
  - Todd Neal, Kentucky Emergency Management
  - Brian Gathy, University of Kentucky HMGP
  - W. Nick Grinstead, University of Kentucky HMGP
  - Esther White, University of Kentucky HMGP

Typically, the KYMC includes voting members representing the Kentucky Division of Water (KDOW), Department of Local Governments (DLG), the Kentucky Office of Homeland Security (KOHS), the Area Development Districts (ADDs), the Kentucky Transportation Cabinet (KYTC), and the National Oceanic and Atmospheric Administration (NOAA).

Non-voting members providing technical assistance include but are not limited to the following: the University of Louisville's Center for Hazards Research and Policy Development (CHR), the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP), the U.S. Army Corps of Engineers (USACE), and the Federal Emergency Management Administration (FEMA).

KYMC plays an integral role in statewide Hazard Mitigation planning efforts. Of the functions listed previously and regarding planning specifically, it is the responsibility of the KYMC to select and prioritize initiative and planning projects that will be submitted to FEMA to request funding. It is the responsibility of the KYMC to ensure that program efforts and funding opportunities are harmonious with the hazard risks and solutions identified in the local and state plans.

Further, the KYMC monitors both the five-year planning cycle and subsequent multi-jurisdictional hazard mitigation plans carried out by each of Kentucky's fifteen (15) Area Development Districts (ADDs) and the three-year planning cycle leading to the update of the Commonwealth of Kentucky's Hazard Mitigation Plan.

The regular KYMC meeting schedule is developed a year in advance. Meetings occur at least quarterly. "Scheduled Meetings" are included in the KYEM Master Calendar. "Called Meetings" are held in accordance with the official by-laws of the KYMC[3]. It is the responsibility of KYEM to notify council members of dates, times, and locations in advance of meetings. Meeting minutes are posted to the official Kentucky Emergency Management website.

Statewide Mitigation Stakeholders

Most importantly, there was invaluable input from mitigation stakeholders throughout the Commonwealth in the development of Kentucky's 2013 State Mitigation Plan. Hundreds of stakeholders representing state and local governments, institutions of higher learning, and private and non-profit entities provided input during 15 Area Development District (ADD) meetings.

Area Development Districts (ADDs)

Kentucky Revised Statute 147A.050 creates and establishes fifteen (15) Area Development Districts (ADDs). The ADDs provide the systematic linkage between the local leadership of a county, the Governor's Office, state and federal agencies, and private organizations. The ADDs served as host for all of the stakeholder meetings

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[3] KYMC By-Laws are appended to this plan as ***Appendix 2-1***.

throughout the Commonwealth that were so integral to Kentucky's hazard mitigation planning process.

C. Indicating How Other Agencies Were Involved in the Current Planning Process

A point consistently to be implied throughout this plan is that Kentucky possesses an administrative advantage in mitigation activity due to its state agency (Kentucky Emergency Management) having such a close relationship with two (2) outside university-sponsored agencies. This relationship extends beyond the sub-contractual: The University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) is very much in function (if not in form) a branch of Kentucky Emergency Management that is able to offer added efficiency and continuity to the state agency itself. UK-HMGP's scope and goals do not vary from the scope and goals of Kentucky Emergency Management (KYEM) itself. And while the University of Louisville's Center for Hazards Research and Policy Development (CHR) operates as a separate entity with separate goals whose funding is dependent on multiple sources outside of Kentucky Emergency Management, the agency still is intimately and directly involved with many of the mitigation functions and actions performed and/or spearheaded by Kentucky Emergency Management. CHR is especially involved with the more research-oriented and systems improvement actions undertaken by KYEM, such as the CHAMP System (Community Hazard Assessment and Mitigation Planning System).

Further, interagency associations such the Kentucky Association of Mitigation Managers (KAMM) and the Silver Jackets indicate considerable involvement from a wide array of agencies. Particularly, the Silver Jackets (comprised of representatives ranging from Kentucky Emergency Management to FEMA to City of Augusta to the United States Department of Agriculture) was presented drafts and ideas from sections of this 2013 update of Kentucky's hazard mitigation plan for input and advice regularly. To convey the interagency cooperation implied merely in seeking counsel from an association such as the Silver Jackets, a list of organizations accompanied by what percentage representation each organization possesses within the Silver Jackets is appended to this section via ***Appendix 2-2***. The many and varied organizations represented within KAMM is provided as ***Appendix 2-3***.

Finally, inasmuch as other on-going planning efforts throughout the Commonwealth of Kentucky that take place outside of the walls of Kentucky Emergency Management will need to be implemented by some entity that is most likely an agency, this discussion will be continued when this plan documents the Commonwealth's "program integration" below.

D. *Documenting How the Planning Team Reviewed and Analyzed Each Section of This Updated Plan*

This 2013 update of the Commonwealth of Kentucky's hazard mitigation plan represents a full revision of all sections of previous iterations of the plan.

As previously mentioned, the successful implementation of the planning process described in the 2010 update of Kentucky's hazard mitigation plan and the parallel implementation of a few relatively new Kentucky Emergency Management initiatives[4] resulted in a new realization and generalization of Kentucky's mission and philosophy in mitigation planning for the state: Kentucky's planning is the culmination of its localities' planning. *Inductive* processes dictate the mitigation goal and strategy animating state-wide planning. Kentucky facilitates and coordinates the planning activities of its local jurisdictions by limiting its scope to focus on initiatives that will aid mitigation activities state-wide and universally and to focus upon customer service and specialization. These themes will all be elaborated upon throughout this plan.

This is not a new focus for Kentucky and Kentucky Emergency Management. This merely is an articulation of the administrative and planning processes that have been normalized within Kentucky and KYEM throughout multiple of FEMA's planning cycles. It is also a reflection that Kentucky Emergency Management maintained responsibility for its hazard mitigation plan rather than rely on the terms of a contract for its development.

Part of this need to re-articulate Kentucky's role in hazard mitigation and planning for it required substantial review and analysis of each section of Kentucky's 2010 update of its enhanced state hazard mitigation plan.

Reviews and analysis of past sections generally occurred throughout the planning process in one of two mutually exclusive settings: The first setting involved extensive review and analysis in group settings amongst all of the Kentucky Emergency Management (KYEM) and University of Kentucky, Martin School of Public Policy and Administration (UK-HMGP) planning team during regularly-scheduled monthly planning meetings that were held in Frankfort, Kentucky at KYEM offices. It was during these meetings that stakeholder meetings and other *inductive* planning processes were synthesized with review of what the 2010 Commonwealth of Kentucky Hazard Mitigation Plan had recorded. The point here is that the *inductive* planning process and subsequent regular-yet-piecemeal synthesis with review of the 2010 update of Kentucky's mitigation plan eventually led the planning team to decide on almost an entire rewrite for the 2013 update.

Thus, the second setting began whereby the UK-HMGP was assigned central management and chief writing responsibilities for the 2013 update with scheduled

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[4] E.g. the innovative Applicant Agent Certification seminars and that CHAMPS has progressed beyond skeletal implementation to having developed a finished product in its second and usable version (described below).

deliverables being reviewed, analyzed, and revised by Kentucky Emergency Management staff.

E. Indicating Which Sections Within the 2013 Update of the Commonwealth of Kentucky's Hazard Mitigation Plan Were Revised as Part of the Updating Process

It will be readily apparent throughout this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan that all sections have been thoroughly revised.

The revisions reflect clarity in mission and in implementation regarding *statewide* hazard mitigation: Kentucky's local jurisdictions take prominence in hazard mitigation activities. This is reflected through the abovementioned *inductive planning* process that informs most sections of this plan. That local jurisdictions are prominent is reflected in a limiting of Kentucky's own goals in order to defer to the goals and actions of Kentucky's local jurisdictions. It is further reflected in the actions and initiatives undertaken by Kentucky that are described within this plan and that are intended to be undertaken in the future in order to improve hazard mitigation throughout the state. Kentucky, as its overall mitigation strategy, will focus on the mitigation actions of its local jurisdictions as they are the entities that experience the dramatic and devastating effects of natural hazards.

To enhance a mitigation strategy focused on facilitation and coordination of local jurisdictions' demands, Kentucky as a separate entity plans to focus its mitigation actions on activities that benefit the entire Commonwealth, but would not be pursued by any one local jurisdiction necessarily. Such activities include focusing resources on collecting better and more localized data; improving identification and subsequent risk assessment on those hazard types that define so much of Kentucky but that either occur so frequently that records are scarce (e.g. karst/sinkholes) or whose identification and assessment is so cost-prohibitive (e.g. landslides) as to be avoided in favor of more cost-effective direction of resources; and on increasing outreach even further than will be described in this update.

Consequently, all sections of this 2013 update have fully or nearly-fully rewritten. There is very little that remains from the 2010 update. Such revision will be readily apparent with even a superficial comparison of the 2010 vis-à-vis 2013 updates.

Of particular import, the revisions to the risk assessment section of this plan should briefly be discussed:

While the *Risk Assessment* section of this 2013 update appears similar to the risk assessment conducted for the 2010 update of Kentucky's hazard mitigation plan, it is only similar in *format* and in *fundamental methodology*. The University of Louisville's Center for Hazards Research and Policy Development (CHR) integrated into this update a heavily-revised risk assessment process that better utilized and increased accuracy of its fundamental "Hazard Vulnerability Score" methodology[5] and mirrors the process by

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[5] Please see the *Risk Assessment* section of this plan for elaboration.

which risk assessment will be performed by users of the Community Hazard Assessment and Mitigation Planning System (CHAMPS). Essentially, the story to be told regarding this revision revolves around CHAMPS: CHAMPS, as a currently fully-implementable software program, allows its users to enter in hazard assessment data by responding to survey-like questions that once completed results in a risk assessment analysis. For accessibility, CHR has included three (3) different models within CHAMPS that yields different analyses depending upon how much information a CHAMPS user is able to provide to the program. If a user possesses only “basic” amounts of data regarding hazard vulnerability within his or her area, CHAMPS offers a risk assessment tool that best utilizes that limited amount of information. Similarly, there is a second “higher- or medium-level” risk assessment model for those users with more detailed information. However, users have significant, very-detailed hazard information for their area, then they can use CHAMPS’ third, highest-level risk assessment model and tool, enter in the data (by answering survey-like questions), and obtain a risk assessment analysis that is highly accurate by virtue of its model accounting for the most explanatory variables.

It is this “highest-level” model that has been incorporated into CHAMPS that CHR has used in order to revise its risk assessment from the 2010 update of Kentucky’s hazard mitigation plan. Consequently, it serves not only as the best-available analysis that Kentucky has to offer at the moment, but also serves as an example of the potential power of Kentucky Emergency Management’s CHAMP System for hazard risk assessment.

PLANNING PROCESS

PART II:
Coordination Among Agencies

REQUIREMENT §201.4 (B):

The Commonwealth of Kentucky's mitigation planning process should include coordination with other Commonwealth executive agencies, appropriate Federal agencies, interested groups, et al.

A. Describing Federal and State Agency Involvement in the Current Planning Process

State (Commonwealth) Agency Involvement

Generally state agency involvement is described later in this plan when addressing "Program Integration." State agency involvement with the current planning process is linked with "ongoing" Commonwealth-wide planning efforts, i.e. necessarily Kentucky's agencies administer "ongoing" Commonwealth-wide planning efforts.

Commonwealth Agency Involvement includes (in alphabetical order of abbreviation):

Commonwealth Agency	*Abbreviation*
Kentucky Department for Local Government	DLG
Kentucky Energy and Environmental Cabinet's Division of Water	KDOW
Kentucky Department of Housing, Building, and Construction's Division of Building Codes Enforcement	K-DBCE
Kentucky Division of Forestry	KDF
Kentucky Department of Insurance	K-DOI
Kentucky Heritage Council	KHC
Kentucky (Division of) Emergency Management	KYEM

Again, Commonwealth agency involvement is linked with Commonwealth-wide planning effort integration. Thus, agency involvement is discussed in the *Program Integration* section below.

Area Development District Stakeholder Meeting - 2012

Federal Agency Involvement

Generally and historically, there has been limited or merely indirect federal agency involvement outside of the involvement of the Federal Emergency Management Agency (FEMA) regarding any of Kentucky's planning processes. This fact remains regarding the current planning process.

Technically, Kentucky Emergency Management (KYEM) (the agency ultimately responsible for this 2013 update of Kentucky's hazard mitigation plan) works with federal agencies when other Kentucky agencies working with KYEM simultaneously work with federal agencies. As previously stated, this is an indirect relationship. Where these relationships occur, they are discussed below regarding "Program Integration" as federal agency involvement, even in an indirect sense, is tied to individual programs that KYEM integrates into its planning process.

B. *Describing How Businesses, Non-Profit Organizations, et al. Were Involved in the Planning Process*

Whereas state and federal agency involvement generally is piecemeal and tied to specific programs, the 2013 update of the Commonwealth of Kentucky's Hazard Mitigation Plan involves significant participation from business, nonprofit organizations, and other interested parties. This has to do with the nature of hazard mitigation and the nature of Kentucky itself: Hazard mitigation is a field that compiles many specializations. It is very difficult and arguably quite flawed to expect a polymath in all areas of hazard and their effects. At best a factotum would result with such expectation; at worst, a dilettante. Further, Kentucky is a highly geographically (and social-economically) factious state with disparate regions. Consequently, Kentucky Emergency Management in providing effective and efficient administration relies upon the specialized expertise of many nonprofit et al. partners.

Discussed here are the following most prominent nonprofit et al. partners:

University of Louisville Center for Hazards Research and Policy Development (CHR)

The University of Louisville, as a nonprofit entity, and its Center for Hazards Research and Policy Development (CHR) plays an integral role in the planning for the mitigation of hazards throughout Kentucky. Mainly, it is able to contract for technical, statistic, and research assistance to Kentucky Emergency Management (KYEM) and to other state and federal entities and agencies involved in hazard mitigation. CHR also provides direct planning process assistance for local jurisdictions and other nonprofit entities (e.g. other universities) interested in being able to systematically plan for the effects of hazards.

Regarding the current planning process, CHR provided the methodology and write-up of the risk assessment portion of this 2013 update of Kentucky's hazard mitigation plan.

University of Kentucky, Martin School of Public Policy and Administration Hazard Mitigation Grants Program (UK-HMGP)

The University of Kentucky, as a nonprofit entity, and the Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) functions very similarly to a branch office of Kentucky Emergency Management (KYEM). While operating under the University of Kentucky's labor, budgeting, payroll, and travel rules (which differ significantly from the like rules of Kentucky executive-branch agencies), UK-HMGP staff perform most of the same functions of KYEM itself. Thus, by contracting with UK-HMGP, KYEM gains access to a de facto branch agency with professional staff that is able to supplement the quotidian functions of KYEM staff, to manage offloaded projects in order to free up KYEM to pursue improvements in administration and to pursue broader initiatives, to provide institutional knowledge and continuity, to travel at will, to elicit and recruit participation in hazard mitigation grant programs (and mitigation activities more generally), and to provide customer service.

Regarding the current planning process, UK-HMGP, with KYEM oversight, has centrally managed and chiefly written up this 2013 update of Kentucky's hazard mitigation plan that allowed KYEM to focus its energies on innovation in and improvement in the actual planning process.

Private Sector Working Group (PSWG)

In March 2010, KYEM established Kentucky's Private Sector Working Group (PSWG). The PSWG, administered by KYEM, endeavors to build partnerships within the private sector community to help identify and fill gaps in the resources and supply chain during emergency response and recovery efforts. The PSWG is designed to act as a force multiplier between the private and public sectors in order to mitigate the impact of critical incidents, natural disasters, and crisis response events.

The goal in the creation of the program was to draft a comprehensive disaster mitigation, response, and recovery plan that would build upon the strengths, experience, and expanding capabilities of all partners. The resulting group forms a well-organized collaborative network of Commonwealth corporate, business, and industry entities that work in concert with emergency management tasking to protect and re-establish the necessary community infrastructure required to minimize damages and speed the recovery process.

The PSWG meets on a bi-monthly basis, supplemented with conference calls and KYEM annual workshop educational tracks. Meeting agenda items include updates of KYEM mitigation, response, and recovery efforts, member presentations, technology updates, training initiatives, and sector-based workshop sessions.

The primary objective of the program is to build on the strengths, experience, and expanding capabilities of KYEM's private sector partners. To that end, the PSWG has demonstrated the effectiveness of the program during exercise events and response to Commonwealth disasters. The composition of the PSWG includes membership representing utilities, commodities, transportation, communications, infrastructures, logistics, food, and hospitality. ***Appendix 2-4*** records which organizations currently serve in the PSWG.

Kentucky Geological Survey (KGS)

Though there will be no product presented in this 2013 update of Kentucky's hazard mitigation plan, the current planning process must include the initiation of and future work that the nonprofit Kentucky Geological Survey (KGS) is pursuing and plans to pursue.

Kentucky suffers extraordinarily from the effects of karst (namely sinkholes) and landslides. Perhaps and seemingly counter-intuitively, Kentucky suffers so dramatically from these geologic hazards that there exists scant data (both statistical and historical) regarding such events. In other words, Kentucky is one of the most famous karst regions in the world[6]: The entire "Bluegrass" region sits atop karst; Kentucky is defined by its limestone; Kentucky has the massively expansive Mammoth Cave system. Karst (and its effects), then, is so commonplace that very few events are considered important enough to warrant time in recording and storing data concerning them. The same mindset applies for landslide hazards and their identifications.

Thus, the current planning process (which never truly ends, of course) includes the KGS as an "interested group/party" attempting to alleviate these deficiencies in Kentucky's data.

Area Development Districts

Area Development Districts (ADDs) are the means by which to collapse the complexity that results from the extraordinary number of counties that the Commonwealth of Kentucky possesses: Kentucky maintains 120 counties. While certainly not maintaining the most quantity of counties[7], 120 counties for which to facilitate and coordinate planning (in this specific case) are at best cumbersome and time-consuming. Within a finite geographic space, a larger quantity of counties implies smaller individual units of autonomous local governments. Governments cannot "earn" money, "create" wealth, or "produce" resources. Governments can only "obtain" revenue from other sources that have earned it (e.g. the individual who works and pays a proportion of what is earned to his or her government in the form of taxation) or acquired it (e.g. federalism allowing the federal government and/or states to share "revenue" with its local entities). Thus, smaller individual units of local governments typically imply that each unit will be more limited in its ability to "obtain" finite resources.

The idea that would become the "Area Development District," then, was conceived for Kentucky in the early 1960s with the creation of Area Development *Councils* that were organized *within* each county comprising "Kentucky." The federal Appalachian Regional Development Act and the Public Works and Economic Development Act (both passed in 1965) allowed for the establishment and authorization[8] of the Area Development *District* which provided an organizational and administrative linking of counties who shared common economic and general development interests[9]. The Appalachian Regional

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[6] Currens, James C. [2002]. "Kentucky is Karst Country!: What You Should Know About Sinkholes and Springs." *Kentucky Geological Survey Information Circular 4, Series XII.*

[7] In ascending order, Virginia, Georgia, and Texas maintain 134, 159 and 254 counties, respectively.

[8] Kentucky Revised Statute 147A.050 legally establishes the fifteen (15) Area Development Districts (ADDs).

[9] This, of course, implies that most such "Districts" are arranged according to "geographic" commonalities: Geography is assumed to be correlated with economic and development needs. Thus, economic/development commonalities are correlated with geographic

Development Act of 1965 was the vehicle for direct federal aid to Appalachia which spurred the need for ADDs specifically in that region. The Public Works and Economic Development Act established the Economic Development Administration within the U.S. Department of Commerce which would provide federal grants aimed toward employment and industrial policy within economically distressed areas more generally. This, provided impetus to establish the ADD concept state-wide: Professional administration and substantial resources would be required to apply for these grants and manage them.

From 1966 to 1972, all fifteen of Kentucky's ADDs were established. ADDs are not state agencies. They are partnerships of local city and county governments: By sharing the ADDs' staffs, local governments collectively are able to access the professional expertise which many counties and cities individually could not afford.

Thus, the ADDs' mission: "To bring local civic and governmental leaders together to accomplish major objectives and take advantage of opportunities which cannot be achieved or realized by those governments acting alone[10]."

Related, "the ADDs are designed to be the focal point of a necessary Federal-State-Local partnership for improvement of the quality of life in the Commonwealth. Contained in that effort is the elimination of, or certainly lessening of, parochialism; establishment of a forum to discuss and deal with common problems among counties; provision of a professional staff for units of government who individually cannot afford a staff; and to provide a vehicle for the delivery of services in a consistent manner where no other efficient system exists[11]."

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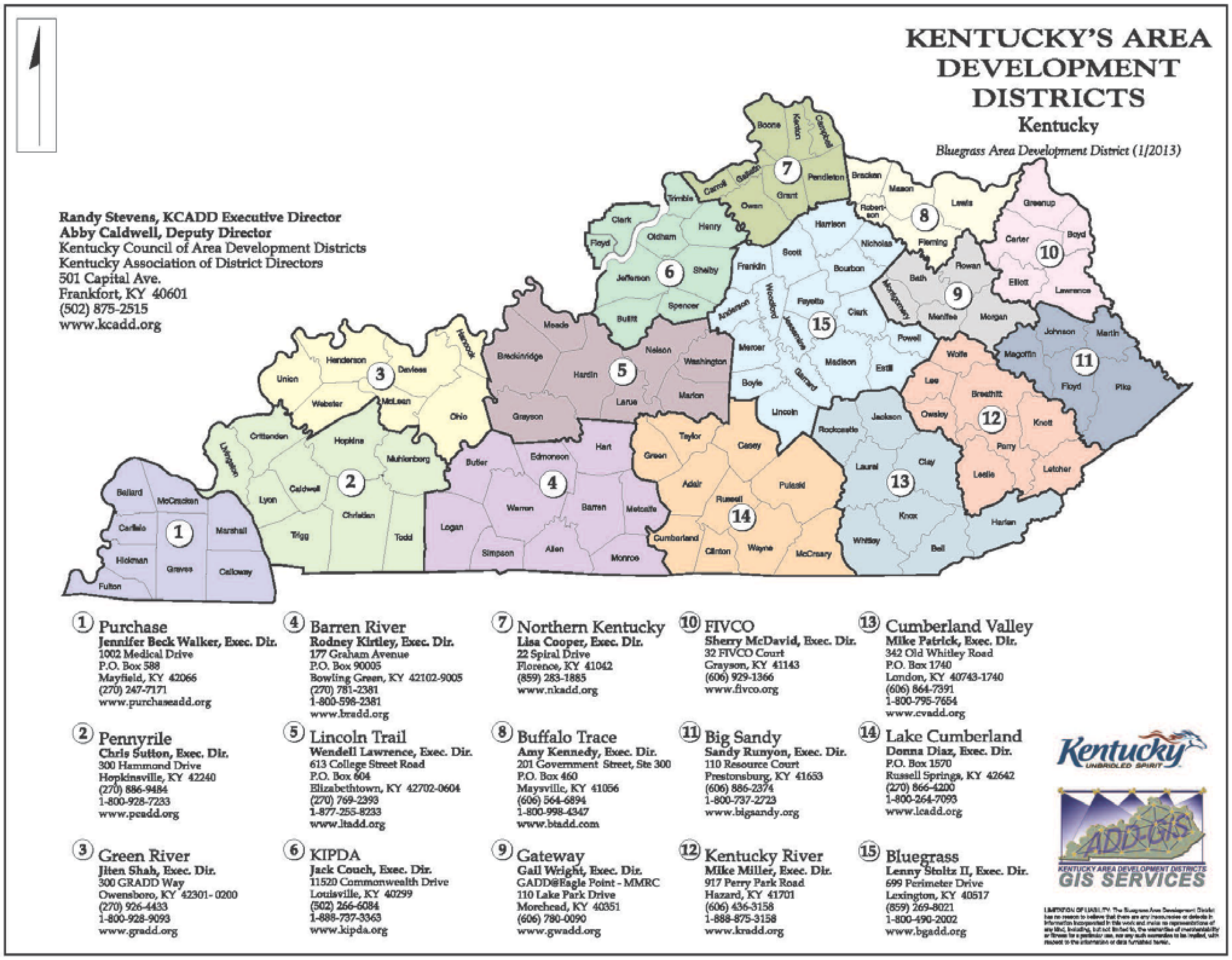
commonalities. This geographic commonality to Area Development Districts is an important assumption to the use of them to evaluate and prioritize project and grant selection via the process described in the *Mitigation Strategy* and *Coordination of Local Planning* sections of this document.

[10] Kentucky Council of Area Development Districts. [2009]. "Our History." http://www.kcadd.org/Our_history.html.

[11] Kentucky Council of Area Development Districts. [2009]. "Our History." http://www.kcadd.org/Our_history.html.



KENTUCKY'S AREA DEVELOPMENT DISTRICTS
Kentucky
Bluegrass Area Development District (1/2013)

Randy Stevens, KCADD Executive Director
Abby Caldwell, Deputy Director
Kentucky Council of Area Development Districts
Kentucky Association of District Directors
501 Capital Ave.
Frankfort, KY 40601
(502) 875-2515
www.kcadd.org

① Purchase
Jennifer Beck Walker, Exec. Dir.
1002 Medical Drive
P.O. Box 588
Mayfield, KY 42066
(270) 247-7171
www.purchaseadd.org

② Pennyrile
Chris Sutton, Exec. Dir.
300 Hammond Drive
Hopkinsville, KY 42240
(270) 886-9484
1-800-928-7233
www.peadd.org

③ Green River
Jiten Shah, Exec. Dir.
300 GRADD Way
Owensboro, KY 42301- 0200
(270) 926-4433
1-800-928-9093
www.gradd.org

④ Barren River
Rodney Kirtley, Exec. Dir.
177 Graham Avenue
P.O. Box 90005
Bowling Green, KY 42102-9005
(270) 781-2381
1-800-598-2381
www.bradd.org

⑤ Lincoln Trail
Wendell Lawrence, Exec. Dir.
613 College Street Road
P.O. Box 604
Elizabethtown, KY 42702-0604
(270) 769-2393
1-877-255-8233
www.ltadd.org

⑥ KIPDA
Jack Couch, Exec. Dir.
11520 Commonwealth Drive
Louisville, KY 40299
(502) 266-6084
1-888-737-3363
www.kipda.org

⑦ Northern Kentucky
Lisa Cooper, Exec. Dir.
22 Spiral Drive
Florence, KY 41042
(859) 283-1885
www.nkadd.org

⑧ Buffalo Trace
Amy Kennedy, Exec. Dir.
201 Government Street, Ste 300
P.O. Box 460
Maysville, KY 41056
(606) 564-6894
1-800-998-4347
www.btadd.com

⑨ Gateway
Gail Wright, Exec. Dir.
GADD@Eagle Point - MMRC
110 Lake Park Drive
Morehead, KY 40351
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www.gwadd.org

⑩ FIVCO
Sherry McDavid, Exec. Dir.
32 FIVCO Court
Grayson, KY 41143
(606) 929-1366
www.fivco.org

⑪ Big Sandy
Sandy Runyon, Exec. Dir.
110 Resource Court
Prestonsburg, KY 41653
(606) 886-2374
1-800-737-2723
www.bigsandy.org

⑫ Kentucky River
Mike Miller, Exec. Dir.
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Hazard, KY 41701
(606) 436-3158
1-888-875-3158
www.kradd.org

⑬ Cumberland Valley
Mike Patrick, Exec. Dir.
342 Old Whitley Road
P.O. Box 1740
London, KY 40743-1740
(606) 864-7391
1-800-795-7654
www.cvadd.org

⑭ Lake Cumberland
Donna Diaz, Exec. Dir.
P.O. Box 1570
Russell Springs, KY 42642
(270) 866-4200
1-800-264-7093
www.lcadd.org

⑮ Bluegrass
Lenny Stoltz II, Exec. Dir.
699 Perimeter Drive
Lexington, KY 40517
(859) 269-8021
1-800-490-2002
www.bgadd.org

KENTUCKY AREA DEVELOPMENT DISTRICTS GIS SERVICES

Kentucky's fifteen (15) Area Development Districts are tabulated below, accompanied by the (informal) acronym most typically used to refer to each ADD and by the counties housed under each ADD jurisdiction:

Table 2-1: ADDs and Their Counties

Area Development District	*Acronym*	*Number of Counties within*	*Counties Covered*
Barren River	BRADD	10	Allen, Barren, Butler, Edmonson, Hart, Logan, Metcalfe, Monroe, Simpson, Warren
Big Sandy	BSADD	5	Floyd, Johnson, Magoffin, Martin, Pike
Bluegrass	BGADD	17	Anderson, Bourbon, Boyle, Clark, Estill, Fayette, Franklin, Garrard, Harrison, Jessamine, Lincoln, Madison, Mercer, Nicholas, Powell, Scott Woodford
Buffalo Trace	BTADD	5	Bracken, Fleming, Lewis, Mason, Robertson
Cumberland Valley	CVADD	8	Bell, Clay, Harlan, Jackson, Knox, Laurel, Rockcastle, Whitley
FIVCO	FIVCO[12]	5	Boyd, Carter, Elliott, Greenup, Lawrence
Gateway	GWADD	5	Bath, Menifee, Montgomery, Morgan, Rowan
Green River	GRADD	7	Daviess, Hancock, Henderson, McLean, Ohio, Union, Webster
Kentuckiana Regional Planning and Development Agency	KIPDA	7	Bullitt, Henry, Jefferson, Oldham, Shelby, Spencer, Trimble
Kentucky River	KRADD	8	Breathitt, Knott, Lee, Leslie, Letcher, Owsley, Perry, Wolfe
Lake Cumberland	LCADD	10	Adair, Casey, Clinton, Cumberland, Green, McCreary, Pulaski, Russell, Taylor, Wayne
Lincoln Trail	LTADD	8	Breckinridge, Grayson, Hardin, Larue, Marion, Meade, Nelson, Washington
Northern Kentucky	NKADD	8	Boone, Campbell, Carroll, Gallatin, Grant, Kenton, Owen, Pendleton
Pennyrile	PeADD	9	Caldwell, Christian, Crittenden, Hopkins, Livingston, Lyon, Muhlenberg, Todd, Trigg
Purchase	PADD	8	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken

Related to involvement within the current planning process by “other interested” parties, each ADD is governed by a Board of Directors. This Board of Directors is comprised of elected officials from within the individual counties and individual sub-jurisdictions (cities, communities, et al.) comprising the “District,” and from non-elected citizens from across a wide range of social and economic agencies and institutions housed within the “District.”

Further, two (2) administrative bodies have been created that oversee all fifteen individual ADDs: 1) The Kentucky Council of Area Development Districts (KCADD),

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[12] FIVCO is a portmanteau of “Five” and “Counties.”

includes all ADD Board Members; and 2) the Kentucky Association of District Directors (KADD), which is the administrative body comprised of each ADD's Executive Director. The ADDs' staffs are professionals representing a wide range of fields: economic development, human services, management, grant development, and, most relevantly, planning.

For the Commonwealth of Kentucky and regarding the planning process and the FEMA five-year planning cycle for local jurisdictions generally, it has been each ADD that ultimately has been responsible for the local hazard mitigation plans under which the counties and communities for which the ADD was designated operate and request funding from FEMA for projects that mitigate their specified hazards. Consequently, most of Kentucky's local hazard mitigation plans are "multi-jurisdictional."

Further, once a local (multi-jurisdictional) hazard mitigation plan has been reviewed by both the Commonwealth of Kentucky and FEMA and has been approved by FEMA and adopted by the counties and communities toward which the hazard mitigation plan was developed, ADD "Project Coordinators," "Local Government Analysts," and "Community Development Specialists" (upon request) assist local communities with the application process necessary to apply for funding for projects intended to mitigate the hazards identified in the local hazard mitigation plans. The ADDs will assist in project grant application development, compliance, implementation, data collection necessary to conduct Benefit-Cost Analysis, and other relevant capabilities related to successful project management.

It must be emphasized that though historically it is Kentucky's ADDs that have developed for counties' and communities' local hazard mitigation plans, these plans and recommendations included within them ultimately represent professional advice only. ADDs are not regulatory agencies. They do not have the power to enforce compliance with the plans. Thus, official, FEMA-approved adoption of the ADD-developed plan by the ADD's counties and communities is especially important and actively sought by Kentucky Emergency Management (KYEM) and its partners (namely the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program). The importance of adoption for the ADDs and, by proxy, for Kentucky's counties and communities ensures that the ADDs devote a disproportionate amount of time on the *planning process* and on incentivizing as much participation from as many of its counties and communities as possible: After all, it is a strain on the resources of the ADD if the ADD has to devote extra time and money after a multi-jurisdictional plan has been approved to address the concerns of a community that wanted to adopt the plan but feels it cannot because the plan is deficient in concerns relevant to that community.

Finally, regarding this current *statewide* planning process, the individual ADDs were the predominate partner to the update of the 2010 version of Kentucky's hazard mitigation plan (to this 2013 update): The ADDs were the primary source of Kentucky's mitigation strategy and its prioritization and evaluation of hazard mitigation action calculus.

Related to *inductive planning,* it was the intent of the Commonwealth to ensure that all regions and potential stakeholders were afforded the opportunity to participate in the development of the Commonwealth's 2013 Hazard Mitigation Plan. In an attempt to identify and recognize regional hazards and solutions, Kentucky Emergency Management (KYEM) conducted stakeholder meetings across the state during the latter portion of its planning process. These "stakeholder meetings" were held at the individual ADDs themselves and partially directed using analysis of that ADD's local (multi-jurisdictional) hazard mitigation plan.

Invited attendees included Area Development District (ADD) staff, elected local officials, congressional staff, emergency management professionals, private mitigation grant practitioners, educators, and KYEM/UK-HMGP staff. To facilitate dialogue and the thought process, attendees were provided information regarding the impact of hazards within their region, information regarding previously-funded mitigation actions, and the general composition of their regional hazard mitigation plan. ***Appendix 2-5*** is provided that documents this information disseminated at stakeholder meetings. Further, ***Appendix 2-6*** records participation at each stakeholder meeting.

Listening to Stakeholder's concerns

During the meetings, attendees identified and ranked both hazards that they considered relevant to their area and interim and long-term strategies that could be pursued to mitigate the previously-identified and ranked hazards. Further, stakeholders defined goals and objectives that would aid in directing implementation toward meeting said strategies.

In other words, during the meetings, participants were training for their own future plan processes while simultaneously providing Kentucky Emergency Management (KYEM) with much-needed insights for its state-wide mitigation planning efforts.

The dates and locations of the stakeholder meetings are as follows:

Table 2-2: Stakeholder Meeting Dates

Date of Stakeholder Meeting	*ADD Toward Which Meeting Was Directed*	*Acronym of ADD for Reference*
November 7, 2012	Gateway	GWADD
November 26, 2012	Purchase	PADD
November 27, 2012	Pennyrile	PeADD
December 4, 2012	Barren River	BRADD
December 5, 2012	Green River	GRADD
December 6, 2012	Lincoln Trail	LTADD
January 22, 2013	Big Sandy	BSADD
January 23, 2013	FIVCO	FIVCO[13]
February 11, 2013	Kentuckiana Regional Planning and Development Agency	KIPDA
February 12, 2013	Bluegrass	BGADD
February 13, 2013	Northern Kentucky	NKADD
February 26, 2013	Buffalo Trace	BTADD
March 4, 2013	Lake Cumberland	LCADD
March 5, 2013	Cumberland Valley	CVADD
March 19, 2013	Kentucky River	KRADD

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[13] Again, FIVCO is not an acronym. Rather, it is a portmanteau of “Five” and “Counties.”

Intergovernmental Liaison and Elected Officials

The stakeholder meetings held at the Area Development Districts that were so fundamental to the Commonwealth of Kentucky's planning process for this 2013 update of its hazard mitigation plan were well-attended by politicians, congressional representatives, and, generally, elected officials.

This represents a marked achievement in the planning process: Arguably, there are few stakeholders that are so important as local elected officials when it comes to planning for their jurisdictions' futures. This especially applies when the planning primarily is aimed toward capital improvements such as planning for hazard mitigation implies. Elected officials are the catalyst for the work of the bureaucrat, public official, emergency manager, et al. In other words, who will inevitably be involved in planning, how those individuals perceive and perform their public tasks, and what they are able to contribute to the substantial amount of input necessary in order to effectively plan and fund capital projects intended to best mitigate the devastating effects of nature and other hazards, is tied directly to a jurisdiction's elected officials. However, because citizens spend the time required to choose those public officials that will best represent them, it is oft-times reflected as superfluous by elected officials that they need to partake directly in the a process that will result in substantial financing for capital improvements.

Kentucky Emergency Management (KYEM), then, fittingly relied upon an experienced and effective Intergovernmental Liaison who was able to cajole elected officials to the all-important stakeholder meetings where their input was invaluable.

Commonwealth Emergency Response Commission (CERC)

The Commonwealth Emergency Response Commission (CERC)[14] serves as an advisory committee for the overall and total emergency management and emergency response programs of the Commonwealth of Kentucky.

Membership consists of appointed and advisory positions. Membership is substantial: Members of CERC encompass all of the primary and secondary stakeholders and partners entrusted with the responsibility to protect and restore the Commonwealth in times of emergency and against the devastating effect of hazards. The CERC organizational structure has been provided as ***Appendix 2-7***.

The CERC holds public meetings on a bi-monthly basis. Further, to enhance the participation and accessibility to as many potential stakeholders in emergency management as possible, CERC uses "Live Stream" and other relevant technological sharing and video tools to broadcast each meeting. CERC also hosts a Facebook group page[15] so that members and other interested parties are regularly updated about emergency management and mitigation activity.

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[14] Founded under Kentucky Revised Statute (KRS) Chapter 39A

[15] See ***Appendix 2-8***.

The CERC and its delineated “workgroups” and subcommittees (operating under the authority of CERC’s primary committees) coordinate information received from stakeholders and partners-in-emergency management. Further, the workgroups and subcommittees perform analysis, evaluation, and program development that will result in specific recommendations to the full CERC membership to be voted on by the full body for advancement.

All of this input results as one of CERC’s products a strategic plan that has hazard mitigation as a specific goal for “[a] Commonwealth that is organized, efficient, and effective at identifying threats and hazards and taking action to reduce the impact of manmade or natural emergencies.”

A meeting of the Commonwealth Emergency Response Commission

Specifically and currently, the CERC strategic plan[16] houses the following mitigation-oriented objectives:

- ***Objective 1:*** *That the Commonwealth of Kentucky maintains a fully-recognized Enhanced Mitigation Program that includes broad private and public involvement and that identifies opportunities for coordinated efforts that will reduce or eliminate risk in all Area Development Districts (ADDs) and the eleven (11) Kentucky Emergency Management (KYEM) Regions by December 2015*

- ***Objective 2:*** *That the Commonwealth of Kentucky, by December 2016, can ensure that over 50% of Kentucky’s counties and accompanying local communities have documentable and robust capabilities to implement successful and meaningful identification of community risk and can subsequently implement solutions that will mitigate said identified risks*

- ***Objective 3:*** *That the Commonwealth of Kentucky, by December 2014, has recorded completed Disaster and Risk Resilience Assessments that improve community planning and coordination efforts for 75% of Kentucky’s counties*

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[16] “The Commonwealth Emergency Response Commission (CERC) Strategic Event Cycle”

Further, the results of mitigation efforts are reported regularly during each of CERC's bi-monthly meetings.

Specifically related to the development and process behind this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan:

- CERC is headed by the Director of Kentucky Emergency Management.
- As described above, a direct objective of the CERC is the successful development of the Enhanced Hazard Mitigation Plan.
- The CERC, then, affects the planning process by being the administrative body to which Kentucky Emergency Management (KYEM) receives its goals for mitigation and to which it is accountable as the vehicle through which this plan is developed.

Emergency Management Accreditation Program (EMAP)

For the current planning process (that will produce this 2013 update of Kentucky's hazard mitigation plan), the Emergency Management Accreditation Program (EMAP)[17] is an "interested party" that has had outsized importance.

In an effort to use accountability as a means by which to constantly improve and make more efficient planning for hazard mitigation, Kentucky Emergency Management (and, hence, the Commonwealth of Kentucky) has sought accreditation by the Emergency Management Accreditation Program (EMAP).

EMAP is a standards-based and voluntary assessment and peer review accreditation process for government programs that are responsible for coordinating prevention, mitigation, preparedness, response, and recovery activities for natural and human-caused disasters.

Accreditation is based on compliance with the *Emergency Management Standard by EMAP*[18]. These are a set of nationally-recognized standards intended to "foster excellence and accountability in emergency management and homeland security programs[19]," of which a subsection of the "EMAP Standard" is devoted solely to hazard mitigation.

KYEM will be undergoing the assessment phase of EMAP in the fall of 2013. The hazard mitigation plan will be used as documentation to show that KYEM is compliant with the portions of the "EMAP Standard" related to hazard mitigation.

The "EMAP Standard" devotes five (5) "standards" to hazard mitigation, all under a "Chapter 4.4":

Hazard Mitigation Staff presenting on State Plan

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[17] The Emergency Management Accreditation Program (EMAP) is headquartered out of Lexington, Kentucky and is affiliated with the Council of State Governments (CSG). It is, however, an independent 501(c)(3) nonprofit organization.

[18] Abbreviated as "EMAP Standard"

[19] Emergency Management Accreditation Program. [2012]. "Professional Development Series: Hazard Mitigation: Student Manual."

Table 2-3: EMAP Standards

STANDARD 4.4.1	“The Emergency Management Program shall develop and implement its mitigation program to eliminate hazards or mitigate the effects of hazards that cannot be reasonably prevented. The mitigation program identifies on-going opportunities and tracks repetitive loss. The Emergency Management Program implements projects according to a plan that sets priorities based upon loss reduction.”
STANDARD 4.4.2	“The mitigation program includes participation in applicable federal, state/territorial, tribal, local, and/or public/private mitigation efforts.”
STANDARD 4.4.3	“The mitigation program provides technical assistance consistent with the scope of the program such as implementing building codes, fire codes, and land-use ordinances.”
STANDARD 4.4.4	“The Emergency Management Program shall implement a process to monitor overall progress of the mitigation strategies, document complete initiatives, and resulting reduction or limitation of hazard impact in the jurisdiction.”
STANDARD 4.4.5	“The mitigation plan shall be based on the natural and human-caused hazards identified by the Emergency Management Program and the risk and consequences of those hazards. The mitigation plan for the jurisdiction is developed through formal planning processes involving Emergency Management Program stakeholders and shall establish interim and long-term strategies, goals and objectives, and actions to reduce risk to the hazards identified. The Emergency Management Program implements a process and documents project ranking based upon the greatest opportunity for loss reduction and documents how specific mitigation actions contribute to overall risk reduction.”

Related to the current FEMA Commonwealth-wide planning process, then, the desire to be accredited by EMAP influenced the content and the format of this planning document and some of the methodology behind the planning process. While a cursory glance at the “standards” by which the Commonwealth of Kentucky (via Kentucky Emergency Management) will be evaluated by EMAP conveys a seamless integration with the standards by which FEMA will approve this hazard mitigation plan, EMAP has contributed to the planning process calculus resulting in this hazard mitigation plan in the following ways:

General Heltzel leading discussion during an EMAP meeting.

1) *Kentucky Emergency Management (KYEM) has been very specific about its repetitive-loss property assessment*. FEMA devotes a whole section of its “Plan Review Tool/Crosswalk” to repetitive-loss and severe repetitive-loss mitigation strategies that can be considered “optional” in the sense that it is only required if the state desires to participate in FEMA’s Severe Repetitive-Loss (SRL) mitigation program which allows 90% reimbursement for actions successfully mitigating repetitive-loss effects from hazards. In other words, repetitive-loss inclusion for FEMA-approved state-wide hazard mitigation is an “opt-in” program. Whereas language regarding repetitive-loss and severe repetitive-loss always has been included in Kentucky’s hazard mitigation plan (i.e. Kentucky always has “opted-in” to FEMA’s Severe Repetitive-Loss program), EMAP certainly was involved in the calculus to continue “opting-in” to FEMA’s SRL program and to ensure that this plan document displays such “opting-in” language prominently and obviously.

2) *Kentucky Emergency Management (KYEM) has devised a far more systematic and redundant method for prioritizing its mitigation project selection that emphasizes “the greatest opportunity for loss reduction.”* This method is described in the *Mitigation Strategy* and *Coordination of Local Planning* sections of this hazard mitigation plan.

3) *Kentucky Emergency Management (KYEM) has considered human-caused hazards.* Included as parts of Kentucky’s mitigation strategy and risk assessment are considerations for human-caused disasters.

C. Discussing How Coordination among Federal and State Agencies Changed since Approval of the 2010 Update

As far as who as participants were involved in the planning process, this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan does not represent dramatic change from those participants involved during the 2010 planning process: The Area Development Districts (ADDs) were predominate to the 2010 planning process; the Commonwealth Emergency Response Commission (CERC) was still the inclusive administrative body giving impetus to Kentucky Emergency Management (KYEM); Kentucky Emergency Management (KYEM) ultimately was still responsible for the Commonwealth's hazard mitigation plan; the relationships between state and federal agencies still were program-linked (in the case of state agencies) and indirect (in the case of federal agencies); and the University of Louisville's Center for Hazards Research and Policy Development (CHR) and the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grant Program (UK-HMGP) played vital roles in the planning and documentation process.

However, while the "who" has not changed considerably, the "how" indeed has: As described above, the Area Development Districts (ADDs) were even more predominate in the planning process than was involved for Kentucky's 2010 update of its hazard mitigation plan. Quite literally, for this 2013 update, the ADDs acted as the fulcrum which propped, supported, and moved the planning process and this subsequent document. No other (set of) stakeholders could claim as much centrality to the final outcome of Kentucky's hazard mitigation planning efforts than the ADDs. Related, Kentucky Emergency Management's use of its Intergovernmental Liaison to ensure participation by elected officials as an addition to the centrality of the ADDs is new for this 2013 update of Kentucky's hazard mitigation plan.

The roles of CHR and UK-HMGP have differed in degree for this current planning cycle, as well: UK-HMGP centrally managed and chiefly wrote the hazard mitigation plan for this 2013 update, with CHR providing necessary and innovative technical support and a dramatically retooled and user-friendly risk assessment section. This has changed since the 2010 update when CHR centrally managed the assembly of all plan components upon contract, with Kentucky Emergency Management (KYEM) and UK-HMGP writing, revising, and editing the components. The shift in degree of involvement from CHR to UK-HMGP in the production of the planning document implicitly signifies an increase in the role of Kentucky Emergency Management (KYEM) in its planning activities: UK-HMGP functionally is quite different from CHR in its de facto KYEM "branch office" status vis-à-vis CHR's autonomous status. KYEM not only implemented an effective planning process for this iteration of its hazard mitigation plan; it also created its blueprint and administered a broader array of planning tools that UK-HMGP would later codify and organize resulting in this planning document.

PLANNING PROCESS

PART III:
Program Integration

REQUIREMENT §201.4 (B):

The Commonwealth of Kentucky's mitigation planning process should be integrated to the extent possible with other ongoing Commonwealth planning efforts as well as other FEMA mitigation programs and initiatives.

A. Describing How Its Planning Process Is Integrated with Other On-Going Planning Efforts

As mentioned above, integrating the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan with on-going state-wide planning efforts is equivalent to coordinating state agency involvement in the planning process: The following mitigation programs described here and that are so important to the overall planning process are tied to state agencies. Those programs not tied to state agencies will be the second part of this discussion.

PROGRAMS TIED TO COMMONWEALTH AGENCIES

Kentucky Department for Local Governments (DLG)

Long-Term Recovery Plan

This on-going project will create long-term economic redevelopment and mitigation strategies which address economic development challenges in areas impacted by federally-declared disasters. This is a collaborative effort between the Department for Local Government (DLG), Kentucky Emergency Management (KYEM), the Federal Economic Development Administration, and the University of Louisville's Center for Hazards Research and Policy Development (CHR). The proposed deliverables of this plan will be directly linked to the Community Hazard Assessment and Mitigation Planning System (CHAMPS) and will build collaboration among multiple agencies. The goals of the project are as follows:

1. Development of a Long-Term Recovery Council (LTRC) to broaden stakeholder awareness and strategies while uniting economic recovery leadership throughout the State
2. Development of a Long-Term Recovery Plan—coordinated by LTRC—which evaluates past losses and best practices for economic and social recovery
3. Incorporation of resulting data products and strategies into the Community Hazard Assessment and Mitigation Planning System (CHAMPS)
4. Development of comprehensive training sessions and outreach of project findings to maximize stakeholder buy-in and participation.

The DLG Action Plan specifically references mitigation efforts statewide in the *Long Term Recovery Plan* section as follows:

> *"Kentucky consistently promotes land-use planning at the local level. The state believes that land-use decisions must originate with local government with input from state and federal partners. In response to the flooding, state and federal agencies are providing tools such as enhanced floodplain mapping and mitigation analysis tools to aid local governments in making decisions, particularly on home buy-out programs. Once plans are complete, the state is committed to expedite the regulatory requirements under its purview. In addition, with the Disaster Recovery funds, Kentucky is developing a comprehensive planning and assessment tool that will be designed to integrate planning and mitigation project management into a comprehensive solution that supports local planning for mitigation with statewide management capabilities and transparency. The tool will support community planning, economic recovery and preparedness for the individual, including housing, and for the community including utilities and public infrastructure and local business.*
>
> *The state, through the Area Development Districts (ADDs), promotes the adoption of hazard mitigation plans for each local government."*

Thus, the DLG long-term recovery plan integrates common mitigation goals from the Enhanced Commonwealth Hazard Mitigation Plan with its internal action plan for response and recovery.

Kentucky Energy and Environmental Cabinet's Division of Water (KDOW):

<u>Dam Safety Program</u>

The Kentucky Energy and Environment Cabinet's Division of Water Dam Safety Section periodically inspects all functional and operational dams. Each inspection starts with a complete file desk review to identify any deficiencies. The inspector also reviews all hydrologic evaluations. Some dams do not have hydrologic evaluations, or the evaluation needs to be updated.

When sufficient data is available, the inspector performs a field evaluation. In the field, the inspector conducts a complete visual inspection. Surveys are completed for dams with missing measurements. Photographs help provide a permanent record of observations. Following the inspection, a letter and report are prepared for the owner. The letter and report describe the observations and instruct the owner to remedy any deficiencies. As necessary, the inspector follows up to ensure required remedial work is completed. Sometimes it is necessary to take enforcement actions to prompt an owner to properly maintain or modify a dam. Approximately 300 dams are inspected each year.

The Dam Safety Section takes emergency action if a structure is in danger of failing and poses a threat to life or may cause serious property damage. KRS 151.297 empowers the Natural Resources and Environmental Protection Cabinet to take emergency action if an owner abandons a dam or refuses to take necessary action.

Dam failure has been identified as a potential hazard. However, many mitigation specialists across Kentucky do not work directly with dam safety and may be uninformed regarding the dangers of dam failure and how dams are monitored for safety. To address this, educational opportunities are provided through cooperative efforts between the Kentucky Association of Mitigation Managers (KAMM) and the Dam Safety Program of the Kentucky Division of Water (KDOW).

For example, past presentations by KDOW's Dam Safety Program have included lectures on the *National Levee Safety Program* and *Dam Failures: Manmade Natural Hazard.* These lectures fully explained the overall potential hazard of dam failures and the ways in which the Dam Safety Program works to prevent losses and injuries. In this way, the partnership between KYEM and the Dam Safety Program integrates the hazard of dam failure with FEMA's mitigation programs to provide information and guidance to mitigation specialists and government officials statewide.

Dam Failure Mitigation Plan

Related to the Dam Safety Program, during this 2010-2013 planning cycle, Kentucky's Division of Water (KDOW) was approved for funding to conduct methodological improvements on assessing the risk resulting from dam failure. The grant resulted in a dam failure mitigation plan that represents Kentucky's desire to work with its executive agencies and focus its mitigation strategy on *Public Good-Types*[20] and on the role that Kentucky can play in facilitating and coordinating the mitigation planning efforts of its local jurisdictions.

While this plan includes a risk assessment of dam failure that uses a revised model previously developed and implemented by the University of Louisville's Center for Hazards Research and Policy Development (CHR), the results deriving from the KDOW's methodological study is an important contribution to future risk assessment methodology that Kentucky Emergency Management and CHR will incorporate.

An excerpt of the results of this dam failure mitigation plan is provided as an appendix to this plan (***Appendix 4-3***).

Floodplain Management

Floodplain Management is interwoven throughout Kentucky's hazard mitigation efforts and is a crucial element of mitigating flood damages and injuries. Through state and local statutes and ordinances, National Flood Insurance Program (NFIP) participation, education and training, and implementation of flood control projects, floodplain management is an integral component of Federal Emergency Management Agency (FEMA) mitigation efforts throughout Kentucky.

Chapter 151 of the Kentucky Revised Statues (KRS 151) addresses the development of floodplain areas. The most pertinent sections of KRS 151 are (1) KRS 151.250 which establishes the requirements for obtaining a floodplain development permit; and (2) KRS 151.125 which establishes the authority and powers of the Secretary of the Kentucky Energy and Environment Cabinet to administer KRS 151.

Based on KRS 151, the Kentucky Department for Environmental Protection's Division of Water (KDOW) is designated as the state's coordinating agency for the National Flood Insurance Program (NFIP). As the coordinating agency, the Division of Water assists local governments and state agencies by answering all questions concerning the program.

In general, to apply for FEMA mitigation funds, communities must be participants in "good standing" in the NFIP. As meeting this requirement is fundamental to the success of the mitigation program, KYEM partners with KDOW to ensure communities understand this requirement as related to mitigation. During post-disaster briefings to mitigation fund applicants, Kentucky Emergency Management (KYEM) explains NFIP-compliance as integral to local sub-grantee eligibility. Additionally, KYEM has worked

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[20] To be defined and discussed in the *Mitigation Strategy* section of this hazard mitigation plan.

with local communities and KDOW to inform those communities about the steps necessary to move from NFIP non-compliance to compliance. While KDOW works with local communities to ensure that all NFIP requirements have been met to maintain good standing, KYEM promotes the importance of compliance to all interested applicants.

Floodplain Management education and training is offered for mitigation specialists through annual state (e.g., KAMM[21]) and national (e.g., ASFPM[22]) conferences, FEMA and KDOW training opportunities, and the Emergency Management Institute (EMI) classes and workshops. Mitigation specialists statewide participate in many of these sessions as both trainers and attendees.

Mitigation specialists also have completed the EMI course *National Flood Insurance Program/Community Rating System (NFIP/CRS) (E278)*. This course covers the CRS, a nationwide initiative of FEMA‘s National Flood Insurance Program. It describes activities eligible for credit under the Community Rating System (CRS), how a community applies, and how a community modifies an application to improve its classification. This course assists those performing floodplain services for local governments in learning about the CRS in order to provide technical assistance to communities seeking to apply for CRS credit. Participants are required to work specifically with floodplain management.

The National Flood Insurance Program (NFIP) also is a prominent component in KYEM’s signature Applicant Agent Certification Seminars.

KYEM works with communities across the State to develop and implement flood control projects. Several of these projects are funded through FEMA’s HMA programs and have mitigated property damage, injuries, and loss of life in many flood-prone areas. Past mitigation projects have included acquisition and demolition of structures damaged by flooding, drainage improvements and culvert upgrades, and the construction of detention and retention basins. Kentucky has mitigated many Repetitive-Loss and Severe Repetitive-Loss properties through the use of FEMA mitigation funds, and through the implementation of flood control projects has reduced losses associated with flood damages to public and private property, swift water rescues and other emergency dispatches, injury accidents, and loss of life.

Business Plans and Grants

The Kentucky Division of Water (KDOW) Business Plan addresses issues related to floodplain management and dam safety. The plan is a working document and is updated annually. KDOW and Kentucky Emergency Management (KYEM) have a strong relationship and continue to jointly plan projects which are focused on mitigating flood-related damages.

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[21] KAMM: Kentucky Association of Mitigation Managers

[22] ASFPM: Association of State Floodplain Managers

The Division of Water (KDOW) receives several federal grants which fund mitigation activities. These include:

- Cooperating Technical Partners (CTP) grants for the scoping, production, and post-preliminary processing and mapping the floodplains of all of Kentucky's counties
- Map Modernization Management and Support (MMMS) grants for management, outreach, and public information purposes
- Community Assistance Program (CAP) grants used to further the provisions of the National Flood Insurance Program (NFIP) and to increase statewide awareness of floodplain management
- RiskMAP activities that have presented an opportunity for KYEM and the Division of Water to collaboratively focus on mapping, assessment, and planning. The two agencies continually have been working with their respective local, state, and federal partners to create an overarching vision of complete hazard mitigation needs and opportunities through hazard mitigation planning and RiskMAP activities. Also, the Community Hazard Assessment and Mitigation Planning (CHAMP) System aids in the overall RiskMAP process.

In addition to administering the NFIP for the Commonwealth and monitoring dam safety, the KDOW supports and enhances both Kentucky and FEMA hazard mitigation efforts through its planning and subsequent plans, its active participation and leadership in mitigation activities, and its use of grants to promote floodplain management awareness and techniques.

KYEM has collaborated and continues to collaborate with KDOW regarding what once was "Flood Map Modernization" (i.e., Map Mod) and is currently "Risk Mapping, Assessment, and Planning" (RiskMAP) programs. KDOW, with FEMA, has initiated the RiskMAP program in Kentucky. FEMA and KDOW's vision for the RiskMAP program is to deliver quality data that increases public awareness and leads to mitigation actions that reduce risk to life and property. To achieve this vision, FEMA and KDOW have transformed the traditional flood identification and mapping efforts into a more integrated process of accurately identifying, assessing, communicating, planning for, and mitigating natural hazard-related risks.

Building on the success of the Map Modernization (Map Mod) effort, FEMA and KDOW continue to collaborate with federal, commonwealth, and local community stakeholders, with KYEM being a key stakeholder in the process. As such, KYEM staff members consistently have been selected to participate in RiskMAP focus groups that have helped create a Risk Communication Toolbox that is used in Kentucky (and potentially in other states and communities nationwide) to identify short- and long-term outreach needs, to define pertinent audiences, and to develop potential tools that aid in enhancing risk mitigation.

KYEM's commitment to this effort is extremely valuable to helping to achieve the goals of RiskMAP, which have been integrated into Kentucky's planning process.

The stated RiskMAP goals are and regarding:

1) *Flood Hazard Data:* Address gaps in flood hazard data to form a solid foundation for risk assessment, floodplain management, and actuarial soundness of the National Flood Insurance Program (NFIP).

2) *Public Awareness and Outreach:* Ensure that a measurable increase of the public's awareness and understanding of risk results in a measurable reduction of current and future vulnerability.

3) *Hazard Mitigation Planning:* Lead and support states and local communities to effectively engage in risk-based mitigation planning, resulting in sustainable actions that reduce or eliminate risks to life and property from natural hazards.

4) *Enhanced Digital Platform:* Provide an enhanced digital platform that improves communication and sharing of risk data and related products to all levels of government and the public.

5) *Alignment and Synergies:* Align Risk Analysis programs and develop synergies to enhance decision-making capabilities through effective risk communication and management.

Mitigation Staff working with KDOW partners

In addition to its other mitigation activities, the Kentucky Division of Water (KDOW), through FEMA funding, has compiled new Digital Federal Insurance Rate Maps (DFIRMs) for the Commonwealth of Kentucky. The maps created through this process are invaluable to hazard mitigation activities.

During the benefit cost analysis and application-development process for FEMA, Hazard Mitigation Assistance[23] (HMA) grant proposals, KDOW provides updated Flood Insurance Risk Maps (FIRMs) and Flood Insurance Studies to KYEM mitigation staff and local communities working to develop hazard mitigation projects. Access to these resources is crucial to the accurate determination of project sites relative to mapped flood zones.

Repetitive-Loss Property Buyouts

Kentucky Emergency Management (KYEM) works to eliminate or reduce damages to property and the disruption of life caused by repeated flooding of the same properties. A specific target group of repetitive-loss properties is identified and serviced separately from other National Flood Insurance Program (NFIP) policies.

The Kentucky Division of Water (KDOW) maintains a listing of properties which have experienced severe and repetitive losses due to flooding.

Consistently, KYEM's UK-HMGP Office notifies the relevant local official regarding affected properties as to the availability of buyout opportunities. Through this and like work, KYEM has mitigated numerous Repetitive-Loss and Severe Repetitive-Loss properties through the use of Federal Emergency Management Agency (FEMA) mitigation funds. When these property acquisitions occur, KYEM notifies KDOW of the removal of the structure. KDOW in turn updates its records accordingly.

These records are of obvious importance to Kentucky's current (and past) planning processes.

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[23] Hazard Mitigation Assistance programs are discussed below.

Kentucky Department of Housing, Buildings, and Construction Division of Building Codes Enforcement (K-DBCE)

Kentucky Building Code

The Kentucky Building Code proactively addresses issues concerning seismic and severe wind construction in response to the Commonwealth's potential earthquake and wind threats. The Kentucky Department of Housing, Buildings, and Construction's Division of Building Codes Enforcement (K-DBCE) regulates the Kentucky Building Code as it pertains to the construction of new buildings and alterations, additions, and changes of occupancy to existing buildings.

Responsibilities for the enforcement of the Kentucky Building Code are shared between K-DBCE and the local government building departments. The K-DBCE reviews architectural plans prior to construction and conducts field inspections to ensure compliance with the Kentucky Building Code. Inspections are conducted of approved projects to ensure construction is completed according to approved plans. Any variations must be approved. Upon successful completion of the final inspection, an occupancy permit is issued and the case file is transferred to the General Inspection Section of the Division of Fire Prevention for future inspections. All inspectors must be certified with the Kentucky Building Inspector Certification.

Kentucky Building Codes support the overall goals of both Commonwealth and FEMA mitigation efforts by helping to ensure that new construction statewide is resistant to damages from severe winds, tornados, and seismic activity, thus helping Kentucky Emergency Management (KYEM) to meet the local jurisdiction-centered mitigation strategy later identified in this mitigation plan by helping local jurisdictions perform better construction aimed toward mitigating hazards.

Kentucky Division of Forestry (KDF)

Wildfire Mitigation Program

The Kentucky "Firewise" program encourages local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in the effort to protect people and property from the risk of wildfire. Kentucky Firewise is part of the National Firewise Communities program organized by the National Fire Protection Association (NFPA) and co-sponsored by the U.S. Department of Agriculture's (USDA) Forest Service, the U.S. Department of the Interior, and the National Association of State Foresters. Kentucky Emergency Management (KYEM) works with the Firewise programs in an effort to promote mitigation of wildfires.

The work of the Firewise program and subsequent wildfire mitigation program has been integrated into Kentucky's current planning process. Kentucky's Division of Forestry (KDF) has submitted an appendix that concerns the wildfire mitigation program (***Appendix 4-2***).

Kentucky Department of Insurance (K-DOI)

Mine Subsidence Insurance Fund (KMSIF)

The Mine Subsidence Fund (KMSIF) is administered by the State Risk and Insurance Services Division of the Kentucky Department of Insurance. The fund provides insurance to property owners in 34 coal producing counties to protect property against possible loss from mine-related subsidence. The purpose of the KMSIF is to establish reasonable and fair policy endorsement terms and conditions which provide standard and uniform coverage and rates for all like risks, similarly situated, without regard to the primary direct insurer chosen by the property owner to provide other basic insurance coverage on structures eligible for mine subsidence coverage.

Mine subsidence has been identified as a hazard to be mitigated in the Commonwealth. Examples of hazards that can be found from abandoned mine sites include landslides, water-filled pits, open mine portals, and dilapidated equipment and buildings. The KMSIF exists to help property owners mitigate personal losses associated with abandoned mines.

Mitigation specialists are educated through annual Kentucky Association of Mitigation Manager (KAMM) conference sessions that are led by professionals from Kentucky's Energy and Environment Cabinet - Department for Natural Resources Division of Abandoned Mine Lands. One particularly oft-repeated training session concerns "Hazards Caused by Mining and Reclaiming Hazards Caused by Mining." Training such as this enables mitigation specialists to more fully assist local communities in developing mitigation projects which reduce the impacts of subsidence from abandoned mines and to more fully disseminate the KMSIF information statewide.

Kentucky Heritage Council (KHC)

The Kentucky Heritage Council protects the Commonwealth's historic legacy. The Council assists individuals, communities, and local governments with making historic preservation an important and well-understood component of planning and development. Through Section 106 Review of the National Historic Preservation Act (NHPS) of 1966, federal agencies must consider the effect of their activities on properties listed or determined eligible for listing in the National Register of Historic Places. These activities include any federally-funded, permitted, or licensed projects, under which encompass Kentucky Emergency Management's (KYEM) hazard mitigation program activities.

KYEM coordinates with the Council to ensure historic properties will not be negatively impacted by the mitigation actions and projects toward which FEMA's funding is designated. One important consideration unique to Kentucky concerns the historic sites of Native Americans whose lineage no longer resides within the Commonwealth of Kentucky.

Kentucky Division of Emergency Management (KYEM)

Applicant Agent Certification

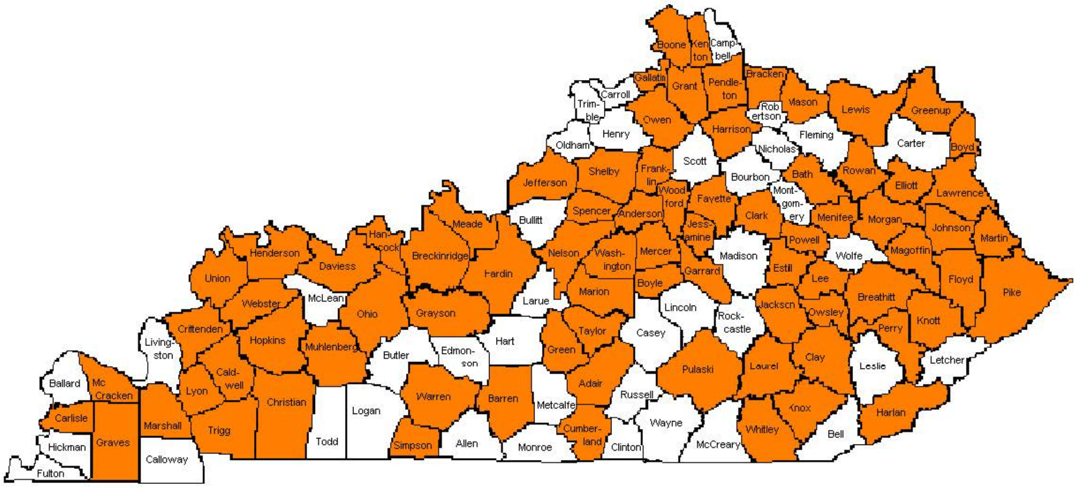
The KYEM Recovery Branch has implemented the first Applicant Agent Certification Program in the United States. This certification enables designated “Applicant Agents” to maximize federal disaster-related funding associated with the FEMA disaster-related programs. Certification is awarded to those who successfully complete the Applicant Agent training.

Certified Applicant Agents are better prepared to ensure that a devastated county or city is included within a presidential disaster declaration. This course includes a wealth of information regarding Public Assistance such as disaster project management and tips on how to avoid de-obligation of federal funding on projects. Course topics include detailed information regarding Individual Assistance, Volunteer Coordination, 404 and 406 Hazard Mitigation, and other potential funding sources such as the Natural Resources and Conservation services, the Small Business Administration, and various State agencies with disaster-designated assistance funds and services.

Related to the current planning process, these courses also act as de facto outreach to local communities: The topics covered that lead to certification explicitly include and indirectly provide information relevant to successful planning as well. Further, this course provides an economic and professional incentive to attend (i.e. one does not simply attend because he/she must or “is being trained” or has an intrinsic interest in the subject matter): Certification incentivizes a broad array of interests that is so important to a planning process. Through Applicant Agent Certification, Kentucky Emergency Management has trained local Judge/Executives, Treasurers, Emergency Management Directors, Road Foremen, Fire Chiefs, private contractors, representatives from Kentucky’s executive agencies (e.g., Transportation, Fish and Wildlife, Parks, Health and Family Services, Auditor of Public Accounts), and even some FEMA staff. Consequently, in learning about things ultimately relevant to planning, Kentucky Emergency Management received feedback that was so important for its planning process from Judge/Executives, Treasurers, EM Directors, Road Foremen, Fire Chiefs, private contractors, representatives from Kentucky’s executive agencies, and, perhaps, from FEMA.

The course is offered quarterly and to date approximately 400 attends have obtained certification. To convey how broad the reach of Applicant Agent Certification across the state of Kentucky, below is inserted a map conveying from where participants in the program traveled.

Applicant Agent Certification Course County Representation
November 2011 – June 2013 – 8 Courses



80 Counties Represented
222 Attendees

Entities Represented – County Fiscal Court, Cities, Emergency Management Agencies, Sanitation Districts, School Districts, Local Health Departments, County Road Departments, Area Development Districts, Electrical Cooperatives, Housing Authorities, Consulting Firms

State Agencies - KY Transportation Cabinet, Department for Public Health, KY State Police, KY Court of Justice, KY Department of Parks, KY Fish and Wildlife, University of Louisville, University of Kentucky, KY National Guard

Region 1 – 6 Counties Represented
Region 2 – 11 Counties Represented
Region 3 – 4 Counties Represented
Region 4 – 7 Counties Represented
Region 5 – 6 Counties Represented
Region 6 – 9 Counties Represented
Region 7 – 9 Counties Represented
Region 8 – 8 Counties Represented
Region 9 – 8 Counties Represented
Region 10 – 5 Counties Represented
Region 11 – 6 Counties Represented

Governor's Emergency Management Workshop (GEMW)

As required by statute, KYEM conducts an annual training conference which is designed to better prepared local elected officials and emergency manager for disaster events. This multi-day event typically will provide instruction to more than 500 attendees. All facets of disaster preparation, response, and recovery are covered in multiple training tracts, roundtable discussions, and presentations from nationally-known subject matter experts.

One of the most popular components of this workshop is the Hazard Mitigation tract which has covered numerous topics such as: mitigation planning, mitigation solutions, application development, benefit cost analysis, and CHAMPS. The other sections of the Recovery Branch are also regular presenters of information regarding volunteer coordination, individuals and households assistance, and public assistance, including 406 mitigation opportunities.

This workshop is always a tremendous opportunity for the KYEM mitigation staff to interact with elected officials who ultimately decide how limited resources will be invested in their communities and as will as emergency mangers who are oftentimes more aware of potential projects which could protected lives and property.

Mitigation Staff Presenting at the 2012 GEMW

Kentucky Weather Preparedness Committee (KWPC)

The Kentucky Weather Preparedness Committee (KWPC) (operating under the support of the Kentucky Emergency Management) is dedicated to raising the awareness of how weather events can impact Kentucky and demonstrating to all citizens how they can better prepare for and protect against potentially life-threatening weather events. The purpose of the committee is to: bring attention to Kentucky's weather events and their related consequences, educate and prepare Kentuckians for said weather-event consequences, and engage in a variety of efforts (e.g., multi-media campaigns, workshops, conferences) designed to raise weather-event awareness.

Through a FEMA Hazard Mitigation Grant Program[24] (HMGP)-funded grant, the KWPC successfully completed an educational initiative which included the purchase and distribution of weather radios, the production and distribution of educational materials on severe weather hazards and preparedness, and an exhibit at the Kentucky State Fair. In this way, KWPC (in partnership with FEMA) furthered the educational goals of the Commonwealth of Kentucky's mitigation past (2010) mitigation plan. Such educational and awareness goals continue with this 2013 update of Kentucky's hazard mitigation plan, thus continuing the relevance of KWPC to the planning process.

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[24] See element B. of this section for a discussion of HMGP and other FEMA-funded grant programs.

PROGRAMS NOT TIED TO ONE COMMONWEALTH AGENCY

Community Hazard Assessment and Mitigation Planning System (CHAMPS)

The Community Hazard Assessment and Mitigation Planning System (CHAMPS) is a state-wide program that develops a tool that local jurisdictions, executive branch agencies, and generally stakeholders involved or wanting to get involved in hazard mitigation can utilize.

Entities involved with its development include:

- Federal Emergency Management Agency (FEMA)
- Kentucky Emergency Management (KYEM)
- Kentucky Department of Local Government (DLG)
- University of Louisville's Center for Hazards Research and Policy Development (CHR)
- University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP)
- Stantec

The purpose of CHAMPS is to:

- assist local jurisdictions with their hazard assessments;
- highlight mitigation efforts and allocated funds that can be used toward such efforts;
- guide local jurisdictions through hazard mitigation planning, funding, and project management; and
- store information relevant to hazard mitigation and risk assessment in one centralized location that thusly can be more readily accessed.

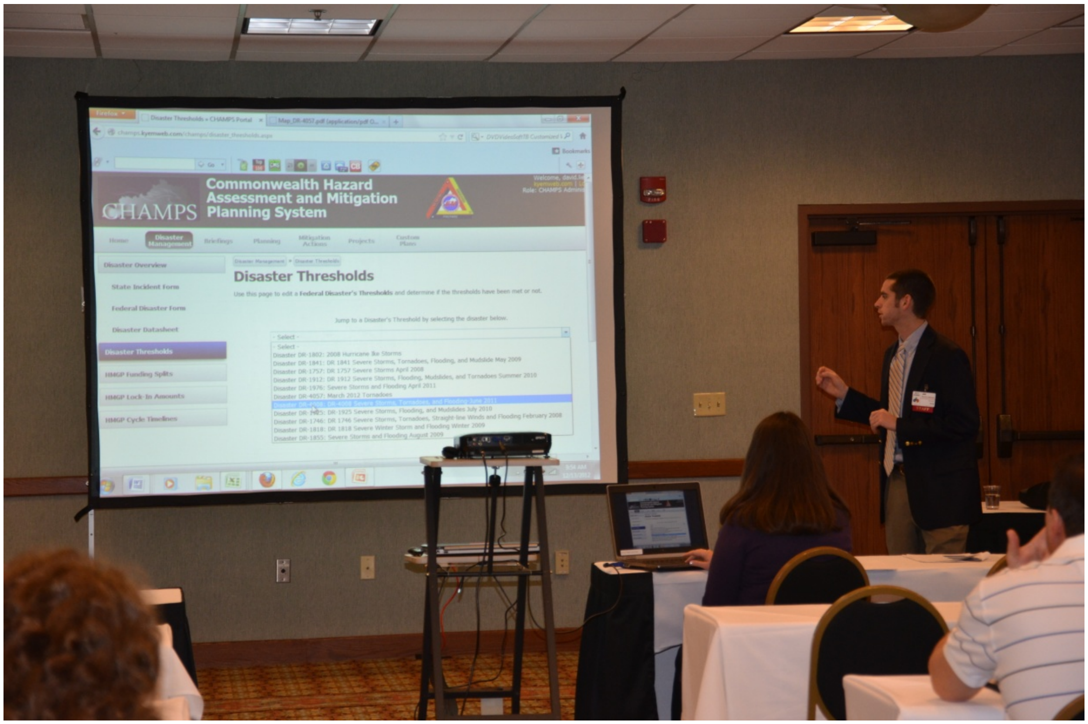
CHAMPS, ultimately, is a software program. Since the 2010 planning cycle, a "version 1" (v1) has been developed and implemented with all relevant stakeholders recovery trained. By the publication of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan, a "version 2" (v2) will have been fully developed and available for use.

The difference and improvements between CHAMPS version 1 (v1) versus its version 2 (v2) is tabulated below:

Table 2-4: CHAMPS v1 vis-à-vis CHAMPS v2

CHAMPS v1	*CHAMPS v2*
Completely mitigation-based	Deals with all areas of emergency management
Templates cannot be changed or altered from original design.	New customizable modules were added.
The Planning Module includes FEMA's "Plan Review Tool/Crosswalk." However, there is little option available to adjust the "Plan Review Tool"-guided Planning Module if FEMA makes any changes to it.	New templates guiding plan-writing can be used to create custom plans. While hazard mitigation planning still is guided by FEMA's "Plan Review Tool," the ability to create new templates allows for the ability to make changes to the "Plan Review Tool" if FEMA makes such changes.
Disaster damage assessment data must be submitted to Frankfort where it is manually input into the system	Apps have been created that will allow data to be input into the CHAMP System in real time by damage assessors at impacted sites

It is obvious how Kentucky's hazard mitigation planning process is integrated with this on-going and state-wide program: If the goal of CHAMPS is to be a tool that makes planning more accessible, more logical, and more efficient, then in this development stage, the goals of the hazard mitigation plan must be in harmony with the goals of CHAMPS. Further, this plan very much reflects the ideal behind CHAMPS: That local jurisdictions lead hazard mitigation within a state. CHAMPS' impetus is the ability for increased local contribution by providing software and a system that streamlines and makes more logical hazard mitigation activities for the local jurisdictions. This 2013 update of Kentucky's planning process reflects this ideal, as well.



Hazard Mitigation Staff presenting about CHAMPS

Kentucky Association Mitigation Managers (KAMM)

The Kentucky Association of Mitigation Managers (KAMM) was formed to promote floodplain management and mitigation in Kentucky. Its members represent local floodplain coordinators, planning and zoning officials, engineers, surveyors, GIS specialists, hydrologists, and local emergency managers.

The purpose of KAMM is to provide a means for state and local floodplain managers to join with others regarding floodplain management policies and activities. Additionally, KAMM exists to advance the study, research, and exchange of information on the technical aspects of floodplain management to reduce flood damage within the Commonwealth of Kentucky. KYEM Mitigation staff has a history of serving on the KAMM board, helping to ensure mitigation is interwoven into floodplain management activities.

Kentucky Silver Jackets Program

Kentucky participates in the Silver Jackets Program; a state-level program which includes participation of the US Army Corps of Engineers (USACE), FEMA, other Federal agencies, and multiple state agencies. The goal of the program is to create an interagency team to develop and implement solutions to state natural hazard priorities. The Silver Jackets Program provides a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with natural hazards. The program‘s primary goals are to leverage information and resources, improve public risk communication through a united effort, and create a mechanism to collaboratively solve issues and implement initiatives.

The Silver Jackets program provides communities with an opportunity to work with all appropriate state and Federal agencies to develop a comprehensive flood risk management program. The KYEM State Mitigation Officer and staff will promote mitigation project development through its representation on the Silver Jackets team, thereby integrating both FEMA and the State‘s goals to mitigate flood-related damages and losses statewide.

PROGRAMS TIED TO FEDERAL AGENCIES AND LEGISLATION

Section 406 Mitigation

The mission of the Federal Emergency Management Agency (FEMA) Public Assistance Program is to assist communities in recovering from the devastating effects of disasters by providing technical assistance and financial grants. Mitigation, if delivered effectively, can restore communities in a manner which prevents or reduces the threat of future damage.

Continually since approval of Kentucky's 2007 "enhanced" mitigation plan, Kentucky Emergency Management (KYEM) employed a Public Assistance Officer who must successfully complete the FEMA 406 Hazard Mitigation course regularly. The training, which also is frequently shared with other KYEM staff, has proven invaluable in the recognizing and advancing of mitigation opportunities.

As previously mentioned, KYEM conducts a weeklong Applicant Agent Certification Course regarding recovery and mitigation programs one significant area of emphases is 406 Mitigation funding available for PA projects attendees are encouraged to constantly assess and identify potential 406 opportunities. Additionally agents are encouraged to maintain detailed damage records from nom-declaration events.

As required by FEMA, KYEM conducts disaster applicant briefings with all potential Public Assistance Program (PA) applicants immediately after a declaration is issued. In addition to instructing potential applicants regarding PA recovery matters, there is an in-depth discussion regarding hazard mitigation opportunities. Members of the KYEM's Recovery Branch Hazard Mitigation Program Section attend each PA briefing and present information on both 404 and 406 Hazard Mitigation projects. These briefings generally are well-attended and all of Kentucky's 120 counties have been represented as such briefings.

Potential applicants are encouraged to carefully review disaster damages prior to their first meeting with FEMA PA teams to determine if mitigation opportunities exist. The KYEM Recovery Branch Manager and Public Assistance Officer meet with FEMA prior to FEMA "Kickoff Meetings" and project worksheet development to ensure there will be a focused attempt by FEMA PA staff to identify, develop, and obligate projects with 406 Mitigation efforts.

In situations where a specific community has experienced intense, repetitive losses KYEM conducts a focused meeting to explore the mitigation needs and potential for the community. In addition to KYEM staff, other attendees will include agencies such as the Natural Resource Conservation Service, the Kentucky Division of Water (KDOW), and the U.S. Army Corps of Engineers (USACE). Further, community leaders, FEMA 404 representatives, FEMA 406 representatives, FEMA Emergency Support Function (ESF) staff, and representatives from the National Flood Insurance Program (NFIP) will attend these repetitive-loss meetings.

The guidelines and rules of the FEMA 406 program necessarily are integrated into the state-wide planning process: It is to the FEMA 406 program that applicants and sub-applicants will request funding for the inclusion hazard mitigation efforts within PA projects for which local jurisdictions and the Commonwealth of Kentucky itself planned.

National Earthquake Hazards Reduction Program (NEHRP)

In October 1977, Congress passed the Earthquake Hazards Reduction Act to lessen the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program. Consequently, the Act established the National Earthquake Hazards Reduction Program (NEHRP) to accomplish its goal.

The four (4) participating NEHRP agencies are the:

1) Federal Emergency Management Agency (FEMA),
2) National Institute of Standards and Technology (NIST),
3) National Science Foundation (NSF), and
4) United States Geological Survey (USGS).

The mission of NEHRP includes:

- improved understanding, characterization, and prediction of hazards and vulnerabilities
- improved model building codes and land-use practices
- risk reduction through post-earthquake investigations and education
- development and improvement of design and construction techniques
- improved mitigation capacity
- accelerated application of research results

The Act designates FEMA as the program’s lead agency and assigns it several planning, coordinating, and reporting responsibilities.

Organizations such as the NEHRP assist Kentucky communities through dissemination of information which may be useful in developing seismic mitigation projects. The work of NEHRP and like organization is integrated into Kentucky’s hazard mitigation planning process.

Abandoned Mine Land Program

The Abandoned Mine Land (AML) program is 100% federally funded. All federal funds received for AML must be used solely for the administration of the AML program and on-ground reclamation. The program is authorized under Title IV of the Surface Mining Control and Reclamation Act of 1977, P.L. 95-87. Kentucky Revised Statute (KRS) 350 contains language mirroring the federal AML legislation in order to authorize Kentucky's AML program.

Each year the Commonwealth of Kentucky receives an annual AML federal grant of approximately $14 million. Each grant has a three-year lifecycle. AML funds must be expended for program administration and projects which reduce hazards from mines abandoned prior to May 1982. Hazards caused by abandoned mines include landslides, dangerous "high-walls," mine drainage, sedimentation and flooding, dangerous impoundments, open portals and shafts, open pits, dangerous piles and embankments, refuse piles, refuse fires, mine fires, effects from hazardous facilities and equipment, and polluted water (including polluted surface- and ground-water).

To promote the mitigation of abandoned mine hazards, mitigation specialists receive training at the annual Kentucky Association of Mitigation Managers (KAMM) conference that is conducted by AML professionals. Among others, topics have included "Hazards Caused by Mining" and "Reclaiming Hazards Caused by Mining." Training such as this enables mitigation specialists to more fully assist communities in coal production areas to develop mitigation projects which reduce the impacts of subsidence from abandoned mines.

This training influences the feedback that Kentucky receives regarding the planning process.

B. *Describing That the Planning Process Is Integrated with FEMA Mitigation Programs and Initiatives*

The integration of Kentucky's current planning process with Federal Emergency Management Agency (FEMA) programs and initiatives primarily have involved the hazard mitigation grant programs that FEMA historically has offered. Commonwealth of Kentucky's hazard mitigation plan necessarily must consider the needs and requirements of what is termed FEMA's Hazard Mitigation Assistance (HMA) grant funding. It is to these that mitigation strategies, both local and Commonwealth-wide, will appeal for funding in order to implement the strategies.

Typically and historically, Kentucky Emergency Management (KYEM) has administered five (5) FEMA hazard mitigation grant programs which exist under the umbrella of Hazard Mitigation Assistance (HMA) grant funding:

1) Hazard Mitigation Grant Program (HMGP)
2) Pre-Disaster Mitigation Program (PDM)
3) Flood Mitigation Assistance Program (FMA)
4) Repetitive-Flood Claims Program (RFC)
5) Severe Repetitive-Loss program (SRL)

These programs provide a significant portion of the resources used by state, local, university, and relevant nonprofit organizations to implement mitigation strategies. Funding from the PDM and HMGP programs assist Kentucky's local governments and universities in developing and updating their local hazard mitigation plans.

During the 2010-2013 planning cycle about which this update of Kentucky's hazard mitigation plan addresses, there have been some (potentially temporary) changes in the availability of the above five (5) hazard mitigation grant programs. Pre-Disaster Mitigation Program (PDM) funds have been discontinued and the future status of the program is uncertain at the time of this plan's publication. Further, the Repetitive-Flood Claims Program (RFC) and Severe Repetitive-Loss (SRL) programs may be collapsed into the Flood Mitigation Assistance (FMA) Program. Finally, the FMA program may offer funding for plan-creation/-updating; though, such planning by definition will focus uniquely upon planning for the effects of flooding.

Regardless, the Commonwealth's hazard mitigation plan serves as the foundation for project selection, after which selected projects are submitted to FEMA for approval as funds become available. The plan contains the Commonwealth's project selection criteria relevant for these programs. The Commonwealth's mitigation strategy defines the goals, objectives, and activities of the state. Grant funds from these programs are used to help achieve many of those goals, objectives, and activities.

Past mitigation projects funded through FEMA HMA grants have included the acquisition and demolition of flood-prone structures, the installation of nonresidential safe rooms, the burying of overhead utility lines, the improvement of drainage and the upgrading of culverts, the construction of detention and retention basins, the relocation of flood-prone utilities out of flood zones, the stabilization of soil stabilization, the installation of early-warning systems, the installation of emergency backup power for critical facilities, and the implementation of public educational campaigns.

RISK ASSESSMENT

Overview

The 2013 State Hazard Mitigation Plan assesses the Commonwealth of Kentucky's risks over the last three (3) years. This section will be used to understand each identified hazard and as the blueprint for the Commonwealth's mitigation strategy. The risk assessment section has been redesigned from the 2010 plan to capture the newly defined Kentucky Emergency Management (KYEM) hazard categories and hazard classifications developed under Kentucky Revised Statutes (KRS) 39A.010.

These modifications are designed to create a common operating picture for each hazard and threat identified within the organization of KYEM. This process is motivated by KYEM's involvement in the Emergency Management Accreditation Program (EMAP), which is an accreditation program for emergency management organizations.

KYEM identified six (6) hazard categories and organized each of the KRS 39A.010 identified hazards within their suitable hazard category. This process provided the foundation for the newly defined identified hazards for the 2013 State Hazard Mitigation Plan. The following table describes the transition from the 2010 hazard classifications to the 2013 hazard classifications, along with which KYEM hazard category the 2013 identified hazards are situated within.

	2010 Hazards	2013 Hazards	KYEM Hazard Category
1.	Dam Failure	Dam Failure	Human-Made
2.	Drought	Drought	Severe Weather
3.	Earthquake	Earthquake	Geologic/Earthquake
4.	Extreme Heat	Extreme Temperature	Severe Weather
5.	Flood	Flood	Flood
6.	Hail	Hail storm	Severe Weather
7.	Karst/Sinkhole	Karst/Sinkhole	Geologic/Earthquake
8.	Mine Subsidence	Mine/Land Subsidence	Geologic/Earthquake
9.	Landslide	Landslide	Geologic/Earthquake
10.	Severe Storm	Severe Storm	Severe Weather
11.	Severe Winter Storm	Severe Winter Storm	Severe Weather
12.	Tornado	Tornado	Severe Weather
13.	Wildfire	Forest fire	Natural Hazards (Non-Severe Weather)

The most note-worthy changes have occurred with Extreme Temperature, which was Extreme Heat. The newly formed Extreme Temperature category will now include extreme cold as well as extreme heat. Some other minor changes have occurred in the naming conventions of some of the hazards. This was directly related to creating a standard naming convention based on the KRS 39A.010 hazard classifications. Hail has changed to Hail Storm, Wildfire has changed to Forest Fire, and Mine Subsidence has been changed to Mine/Land Subsidence.

The 2013 risk assessment section was developed by KYEM and their long-standing partnership with the University of Louisville’s Center for Hazards Research and Policy Development (CHR). While developing the previous plans, best available data was used for the Risk Assessments. To enhance and update the 2013 plan, enhanced detailed data was required in order to better utilize GIS capabilities and to perform an accurate risk assessment to indicate areas of vulnerability to each identified hazard across the entire Commonwealth.

The flow of the 2013 risk assessment section follows the same format as the 2010 State Hazard Mitigation Plan. This format provides answers to all of the required components of the State Hazard Mitigation Plan Crosswalk “Risk Assessment”.

- Identifying Hazards: 44 CFR §201.4(c)(2)(i)
- Profiling Hazards: 44 CFR §201.4(c)(2)(i)
- Assessing Vulnerability by Jurisdiction: 44 CFR §201.4(c)(2)(ii)
- Assessing Vulnerability of State Facilities: 44 CFR §201.4(c)(2)(ii)
- Estimating Potential Losses by Jurisdiction: 44 CFR §201.4(c)(2)(iii)
- Estimating Potential Losses of State Facilities: 44 CFR §201.4(c)(2)(iii)

As in 2010, KYEM and CHR developed a “Hazard Risk Assessment Overview” for each hazard sequentially. This format allows the reader to see each step of the risk assessment associated with each hazard to improve flow and comprehension.

Throughout the risk assessment, Geographic Information System (GIS) spatial data provides the baseline for the 2013 plan. GIS provides the architecture to facilitate an inventory of assets and hazards as well as providing the platform to calculate vulnerabilities and losses. The maps developed through GIS production are used whenever possible to convey where spatially defined vulnerable areas are located. The maps created from this production also provide a visual tool for analysis of the data. The information developed throughout this section was guided and developed using best available data and modeling techniques.

Uncertainties are inherent in any vulnerability/risk assessment and loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural and man-made hazards and their effects on the built environment. Uncertainties can also result from approximations and simplifications that are necessary for a comprehensive analysis (such as incomplete/duplicate inventories, socio-economic data, loss data or occurrence data). These uncertainties are particularly prevalent when completing a state-wide risk assessment. CHR reviewed multiple sources of data to make an informed decision on each data set used for each identified hazard. Each source of data (occurrences, losses etc.) routinely will contrast from each other. CHR attempted to use standard/analogous data sets in order to maintain an apple to apples comparison of each identified hazard.

Identifying Hazards: Overview

REQUIREMENT §201.4(C)(2)(I):

The Commonwealth of Kentucky shall include an overview of the type of all natural hazards that can affect the state.

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

Due to its diversified geology and geographical setting, the state of Kentucky is vulnerable to a wide array of natural hazards which threaten life and property. To identify the appropriate hazards for the 2013 plan, CHR reviewed the historical impacts of all hazards affecting the commonwealth along with the following items:

- Past Presidential, Major Disaster and Emergency Declarations
- Annual rates of hazard occurrences
- Dollar losses to date attributable to past disasters
- Comparison to local plans and previous state plans (See ***Appendix 3-1*** "Local Plans Identified Hazards")

As mentioned, the 2013 plan marginally altered the listing of identified hazards. Also, the hazards have been categorized within the newly formed KYEM hazard categories. The hazards are chronicled within their KYEM hazard categories instead of alphabetical order, as in the past.

The identified hazards for the 2013 plan are as follows:

2013 Hazards	KYEM Hazard Category
1. Flood	Flood
2. Earthquake	Geologic/Earthquake
3. Karst/Sinkhole	Geologic/Earthquake
4. Mine/Land Subsidence	Geologic/Earthquake
5. Landslide	Geologic/Earthquake
6. Dam Failure	Human-Made
7. Forest fire	Natural Hazards (Non-Severe Weather)
8. Drought	Severe Weather
9. Extreme Temperature	Severe Weather
10. Hail Storm	Severe Weather
11. Severe Storm	Severe Weather
12. Severe Winter Storm	Severe Weather
13. Tornado	Severe Weather

Each hazard will have an individual "Identify" section where the hazard will be defined followed by the remaining components of the "Hazard Risk Assessment Overview".

Profiling Hazards: Overview

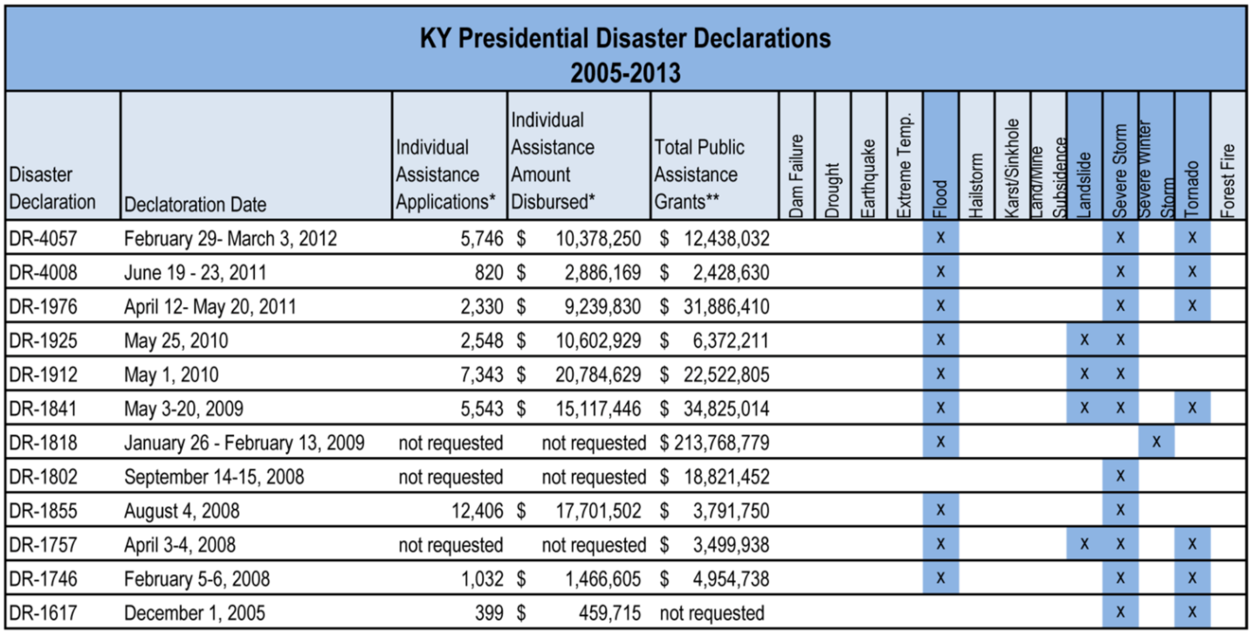
As noted in the last section, due to Kentucky's varied geology, climate, and geographical setting, the state is vulnerable to a wide array of hazards (see section titled, Identify Hazards) that threaten life and property. The profiling hazards section describes each hazard's past, present and future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

The 2013 profiles have been created using the best available data from a variety of resources, including but not limited to the National Climatic Data Center (NCDC), National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA), SHELDUS, Kentucky Office of Geographical Information, Kentucky Geological Survey (KGS), Kentucky Emergency Management Agency (KYEM), Kentucky Division of Water (KDOW), Kentucky Division of Forestry, Division of Abandoned Mine Lands (AML), USGS, FEMA, multiple other state and local agencies, and local newspaper articles, as well as the approved 2010, 2007, and 2004 Kentucky State Hazard Mitigation Plan and local hazard mitigation plans.

REQUIREMENT §201.4(C)(2)(I):

The Commonwealth of Kentucky shall include a location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate ... .

The profile section provides the historical context for identifying the hazards. The following table displays past presidential declaration occurrences along with the Public Assistance and Individual Assistance distributed. These Disaster Declarations and assistance numbers provide an understanding of the hazards disrupting Kentucky's communities.



KY Presidential Disaster Declarations 2005-2013

Disaster Declaration	Declatoration Date	Individual Assistance Applications*	Individual Assistance Amount Disbursed*	Total Public Assistance Grants**	Dam Failure	Drought	Earthquake	Extreme Temp.	Flood	Hailstorm	Karst/Sinkhole	Land/Mine Subsidence	Landslide	Severe Storm	Severe Winter Storm	Tornado	Forest Fire
DR-4057	February 29- March 3, 2012	5,746	$ 10,378,250	$ 12,438,032					x					x		x	
DR-4008	June 19 - 23, 2011	820	$ 2,886,169	$ 2,428,630					x					x		x	
DR-1976	April 12- May 20, 2011	2,330	$ 9,239,830	$ 31,886,410					x					x		x	
DR-1925	May 25, 2010	2,548	$ 10,602,929	$ 6,372,211					x				x	x			
DR-1912	May 1, 2010	7,343	$ 20,784,629	$ 22,522,805					x				x	x			
DR-1841	May 3-20, 2009	5,543	$ 15,117,446	$ 34,825,014					x				x	x		x	
DR-1818	January 26 - February 13, 2009	not requested	not requested	$ 213,768,779					x						x		
DR-1802	September 14-15, 2008	not requested	not requested	$ 18,821,452										x			
DR-1855	August 4, 2008	12,406	$ 17,701,502	$ 3,791,750					x					x			
DR-1757	April 3-4, 2008	not requested	not requested	$ 3,499,938					x				x	x		x	
DR-1746	February 5-6, 2008	1,032	$ 1,466,605	$ 4,954,738					x					x		x	
DR-1617	December 1, 2005	399	$ 459,715	not requested										x		x	

*Source: KY Division of Emergency Management, Recovery Branch. IA Disaster Summary by County.
**Source: FEMA.gov

Understanding risk and each hazard's potential effect on the Commonwealth is imperative to the mitigation strategy and provides the information needed to produce an effective risk assessment. In order to accomplish this, CHR captured data on hazard occurrences and losses, which are commonly used to capture risk. The following "Risk Matrix" table provides quantitative data that portrays which hazards have been the most destructive based on occurrence and loss data. CHR reviewed multiple sources of hazard data for each identified hazard in order to create the Risk Matrix table. The table provides a state-wide overview of each hazard and provides a baseline to be used by the state hazard mitigation council to prioritize which hazards should receive the most consideration when justifying potential mitigation projects.

Risk Matrix

Hazard Type	Time Period	Range – Years of Data Collection	Occurrences	Total Losses	Annual Rate of Occurrence	Average Losses	Average Annual Loss
Flood	1960-2013	53	5,934	$2,301,445,697	111.96	$387,841	$43,423,504
Earthquake	1960-2011	53	1	$2,763,158	0.02	$2,763,158	$52,135
Karst/Sinkhole	Unknown	Unknown	101,632	$0	Unknown	Unknown	Unknown
Mine/Land Subsidence	1981-2013	32	133	$5,550,000	4.16	$41,729	$173,438
Landslide	1975-2013	38	1,393	$28,365,706	36.66	$20,363	$746,466
Dam Failure	1973-2013	30	13	$0	0.43	Unknown	Unknown
Forest Fire	1997-2012	25	22,467	$41,250	898.68	$2	$1,650
Drought	1960-2013	53	121	$301,317,375	2.28	$2,490,226	$5,685,233
Extreme Temperature	1960-2013	53	1,175	$1,141,306	22.17	$971	$21,534
Hail Storm	1960-2013	53	4,882	$983,340,017	92.11	$201,422	$18,553,585
Severe Storm	1960-2013	53	21,481	$898,499,257	405.30	$41,828	$16,952,816
Severe Winter Storm	1960-2011	53	3,951	$435,706,556	74.55	$110,278	$8,220,878
Tornado	1960-2013	53	11,36	$1,020,237,467	21.43	$898,096	$19,249,764
TOTALS			164,319	$5,978,407,789		$6,955,913	$113,081,003

Source: SHELDUS, NCDC, National Dam Safety, Ky. Division of Forestry, Division of Abandoned Mine Lands and Kentucky Geological Survey

The Risk Matrix table provides a view of the risk each hazard poses to the Commonwealth. Combining the average occurrence and loss statistics formulates an average annual loss for each hazard, and therefore provides a model for loss estimation by hazard. Clearly, the flood hazard has the most potential to do damage to the Commonwealth with tornado, hail, and severe storm posing a high risk as well.

It is important to note, that hazards without an average annual risk should still be considered a threat to the Commonwealth. This is mainly caused by lack of current data (occurrences or losses) for some of the hazards. Importantly, hazards can have a very low probability but a potentially high magnitude of losses (Earthquake). Please note, the Risk Matrix data will be used for multiple purposes throughout the risk assessment section.

Profiling Hazards

To disseminate the profile information, CHR developed a common format for each hazard. The "Profile Risk Table" summarizes key data elements that allow the end user to view the hazard. Below is an example of the "Profile Risk Table" along with an explanation of each data element.

Hazard: Profile Risk Table	
Period of occurrence:	When does this hazard occur?
Number of events: (Year - Year)	Number of hazard events in Kentucky based on county occurrences for each hazard. So you could have one state event count as 50 county-level events within this data capture.
Annual Rate of Occurrence:	Expected annual number of state-wide occurrences per year based on county-level occurrence data.
Warning time:	Average warning time for this type of hazard.
Potential impacts:	The potential impacts this hazard could produce.
Recorded losses:	Amount of damages captured within Kentucky for each hazard (This data is very diverse).
Annualized Loss:	The expected annual loss state-wide per year from each hazard.
Extent:	Worst case scenario based on historic data.

Assessing Vulnerability by Jurisdiction: Overview

The Assessing Vulnerability by Jurisdiction section uses data from national, state, and local data sources and was created using best available data and modeling techniques. The 2013 assessing vulnerability section provides two (2) levels of assessment. KYEM desired a county-level assessment along with a more refined model. The two models created for the 2013 State Hazard Mitigation Plan are based on the University of Louisville's Center for Hazards Research and Policy Development (CHR) recognized expertise in the field. These models have been used for multiple states, local and university hazard mitigation plans.

The models are flexible and can be adjusted to fit the data and needs of particular consumers. These models provide an understanding of relative risk and vulnerabilities from hazards across Kentucky. Uncertainties are inherent in any vulnerability/risk assessment, arising in part from incomplete scientific knowledge concerning 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 or duplicate inventories, socio-economic data, loss data, or occurrence data).

REQUIREMENT §201.4(C)(2)(II):

The Commonwealth of Kentucky shall include an overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State owned critical or operated facilities located in the identified hazard areas shall also be

The 2013 Risk Assessment incorporates multiple methods and data resources, and integrates them into specific models geared toward answering the questions asked by FEMA in this section. FEMA requires state partners to assess each jurisdiction's vulnerability to their population, property, infrastructure, critical facilities, and state owned facilities.

To gain an understanding of vulnerabilities and loss estimations throughout the state CHR completed a review of the current local plans. This review mainly influenced the determination of identified hazards (See ***Appendix 3-1*** "Local Plans Identified Highest Risk Hazards"). As discussed in the 2010 plan, several of the local plans have begun using the State's Risk Assessment model to complete the risk assessment sections of their plans.

This has been encouraged at the State level and will continue to be pushed as the State expands it use of the Community Hazard Assessment Mitigation Planning System (CHAMPS) system. With CHAMPS v2, locals will be able to add their local data occurrences inside the system through a module called Significant Incident Events (SIE). These SIEs will start building a significantly better picture of where hazard events occur in the Commonwealth. As this data matures it will be used to provide an enhanced data resource for State and local risk assessments as well as for Benefit Cost calculations. Also, in CHAMPS v2, KYEM and CHR are developing a Risk Assessment Module that will capture local data inputs and eventually drive State data outputs. The future of the Commonwealth's risk assessment methodologies is very positive. Comparing different risk/vulnerability assessments creates a significant challenge, due to the fact that the outputs are not created equally. Of course this is one of the main reasons that the State has been pushing for a common risk assessment model that can be used at the State level as well as the local level.

It is important to note that CHR did use local exposure data created at the local level for the State's vulnerability model. This included several of the Exposure Score variables including: Critical Facilities, Utilities, and Transportation Infrastructure. This data is crucial for creating an accurate account of what is potentially exposed to each hazard and therefore an important part of the State's Vulnerability Assessment Model. The local data capture will continue as several of the facilities identified are maintained and updated by our local partners. These data inputs will also become easier to capture through CHAMPS v2's Infrastructure Module. This specific module allows users to add local, regional, and State infrastructure into the system through a standard data format. This format has been developed to fold into the Risk Assessment model in the future.

As mentioned before, this iteration of the Kentucky Risk Assessment has two (2) models. One created for county-level review and one created for a more granular intake, which can also be used for local hazard mitigation plans. The county-level risk assessment will be identified as the County-Level Risk Assessment model and the more refined model will be identified as the Grid-Level Risk Assessment model. Creating these two (2) models provide different perspectives for KYEM to use for various purposes.

Grid-Level Risk Assessment Model

A very important step in creating a Vulnerability Assessment Model is to define the planning area. Through the creation of the last three (3) State Hazard Mitigation Plans, KYEM and CHR have continued to develop a risk assessment that has become more granular. During the creation of the 2010 plan CHR used its knowledge of creating local plan vulnerability assessments and created a statewide census block level assessment.

This model produced a more equal playing field but still tended to get skewed in areas that were more rural, based on the fact that the census blocks within these areas were typically larger in size. The lack of equal area distribution caused the census block model to still have some particular issues when comparing individual census blocks due to the unequal size of each census block.

During the 2013 development of the plan, CHR was looking for a planning area that provided a granular approach as well as providing an even playing field in terms of equal area distribution. CHR and KYEM decided to go with a 1 Kilometer (KM) Military Grid Reference System (MGRS) for their planning areas of capture for the entire State. 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 promotes usage at the State level as well as the local level. The Grid-Level Risk Assessment Model specifically provides the following improvements:

1. Equal area calculations based on each unit being equal sized
2. Allows better comparisons between planning areas in different parts of the State
3. Potential for better policy decisions and dollar allocation
4. Improved visual interpretations
5. Enhanced tools for local planning usage
6. Military grid provides enhanced usage during response and recovery

The Grid-Level Risk Assessment methodology allowed the state to provide enhanced data for use in local plans and provide policy and decision makers a refined view of where risk is located and what areas need mitigation. There are a total of 106,178 individual grids across the Commonwealth. CHR and KYEM's goal is to provide local leaders with a useful assessment model. The model is also being developed to facilitate assessment standardization and with the realization of locals eventually populating the system with their local data.

Methodology

There are multiple models that attempt to determine risk and hazard vulnerability. KYEM relied heavily on CHR's knowledge of the "Risk Assessment" research field to develop the Vulnerability Assessment Model used for the State Hazard Mitigation Plan.

In order to follow and comprehend the Hazard Vulnerability Assessment Model the following definitions are very important to comprehend:

Important definitions associated with this vulnerability assessment model:

- **Hazard Identification**: Anything which either threatens the residents of a community or the things that they value
- **Exposure**: A community's assets: people, property, essential facilities, and infrastructure potentially exposed to a hazard
- **Vulnerability**: What part of an "exposure" is at "risk" to each "hazard"

CHR's staff researched and conducted test runs to develop an updated methodology. The revised model relies heavily on GIS spatial analyses and provides the user with several layers of integrated information which can be used individually to display different planning scenarios. This approach enabled the creation of a Hazard Vulnerability Score for each hazard.

Model

Hazard Vulnerability Score = Exposure Score + Hazard Score

When measuring vulnerability, CHR first measured what would be exposed to each hazard. Exposure Score was built on multiple layers of data and provides the foundation for assessing vulnerability. For this model the exposure score was comprised of these three (3) variables:

1. Population Score
2. Property Score
3. Critical Infrastructure Score

Exposure Score

Exposure Score = Population Score + Property Score + Critical Infrastructure Score

Definition of Variables

1. ***Population Score*** – To develop an improved population density model for use within the MGRS 1 KM grid system, CHR used a method called Dasymetric Mapping (http://pubs.usgs.gov/fs/2008/3010/fs2008-3010.pdf). This method of mapping population data uses an aggregation area model using a combination of population data and land cover data. For this model, 2010 census block data was used to capture population and 2006 USGS National Land Cover Database (NLCD2006) was used for land cover data. Basically, this type of mapping assigns population density based on different types of land cover (high density, low density, non-urban inhabited, uninhabited). Each one of the specific land cover areas is assigned a population number based on the census blocks population. This method attempts to distribute a census blocks population number to where there is actual land cover, instead over the entire area. This data was then aggregated to each 1 KM MGRS grid for consumption. Each grid within Population Score is scored from 0-1. This score is multiplied by .33 so it accounts for 33% of the composite Exposure Score.

2. ***Property Score*** – Comprised of 2010 census block group total household value (# of housing units x average household value) aggregated to the 1 KM MGRS grid. This data was then scored 0-1 and multiplied by .50 so it accounted for 50% of the Property Score. Next, a total number of businesses acquired from ESRI's business analyst were then counted within each 1 KM MGRS grid. This data was then scored 0-1 and multiplied by .50 so it accounted for 50% of the Property Score. These two (2) scores were then added together to create the composite Property Score. This score is multiplied by .33 so it accounts for 33% of the composite Exposure Score.

3. ***Critical Infrastructure Score*** – Comprised of multiple Critical Facilities (points and lines) across Kentucky. This data was retrieved from KYEM, Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky office of Geographic Information (OGI), Kentucky Transportation Cabinet and Public Service Commission. This included data ranging from several different classes of GIS points and lines. The point data included the following:

   > *fire stations, police stations, prisons, primary schools, hospitals, emergency operation facilities, nursing homes, public health facilities, emergency medical service facilities, sewer treatment facilities, sewer package treatment and lift station facilities, water pumps, water treatment plants, sewage treatment plants, water tanks, electric power plants, pressure and storage gas facilities, refinery and storage oil facilities, airport facilities, Highway bridges, rail facilities EPA FRS Facilities and State owned facilities.*

The total numbers of critical facilities (points) were then counted within each 1 KM MGRS grid. This data was then scored 0-1 and multiplied .80 so it accounted for 80% of the Critical Infrastructure Score. The line data included the following:

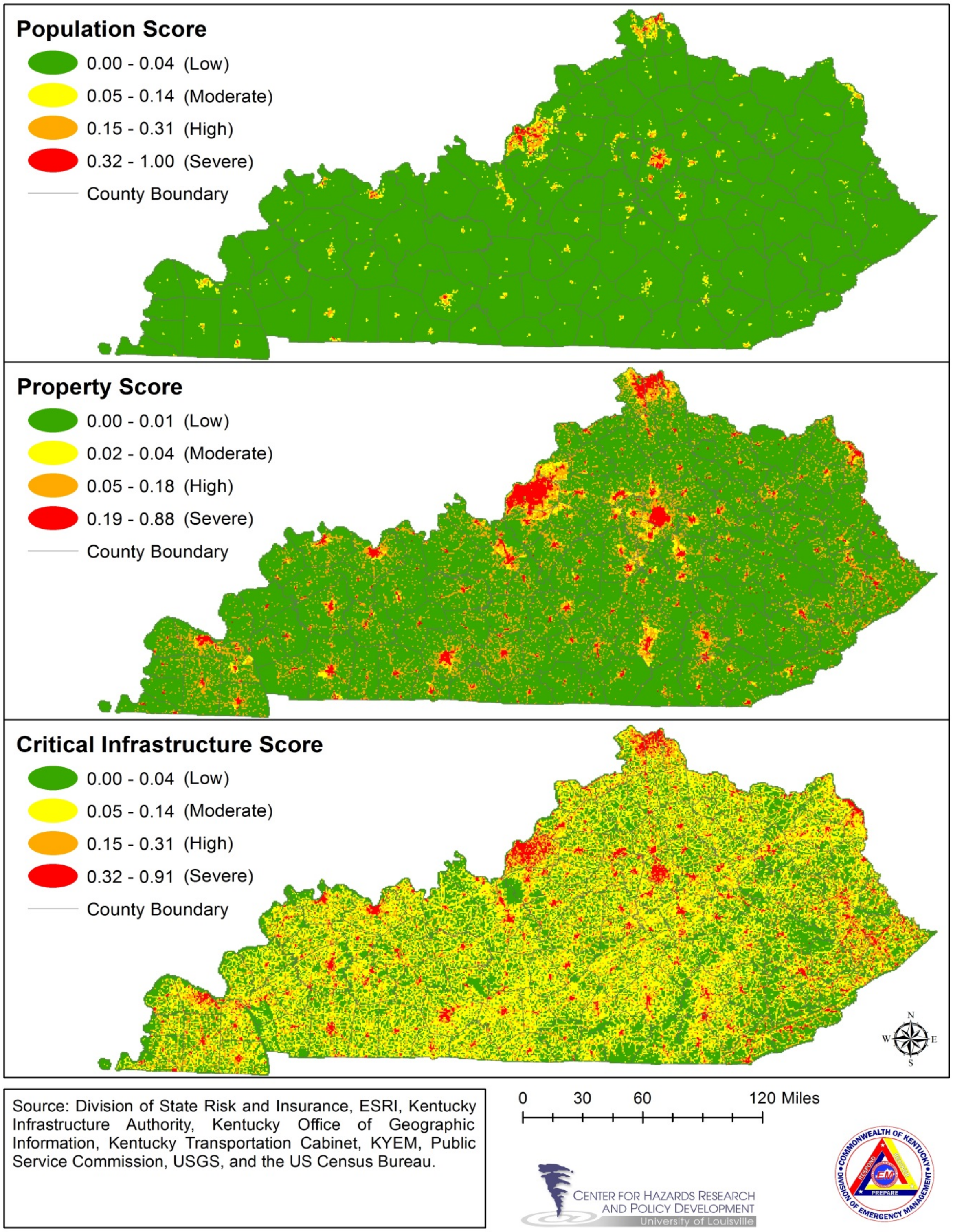
> *sewer lines, water lines, power transmission lines, pipelines, Kentucky Transportation Cabinet all roads mapped and railroads.*

The total length of each line was captured within each 1 KM MGRS grid and combined. This data was then scored 0-1 and multiplied by .20 so it accounted for the other 20% of the Critical Infrastructure Score. These two (2) scores were then added together to create the composite Critical Infrastructure Score. This score is multiplied by .33 so it accounts for 33% of the composite Exposure Score.

The Exposure Score places the asset variables into the Hazard Vulnerability Score. This data is critical for Emergency Managers to use in order to comprehend where high concentrations of need could be during or before a disaster. Each exposure variable was calculated and scored 0-1 and then multiplied by .33 to create a weighted score of 33% for each category. Once all three (3) were added together to create the composite exposure score they were broken into four (4) categories, using Natural Breaks classification The four (4) categories provide different levels of severity displayed on each map:

1. Low
2. Moderate
3. High
4. Severe

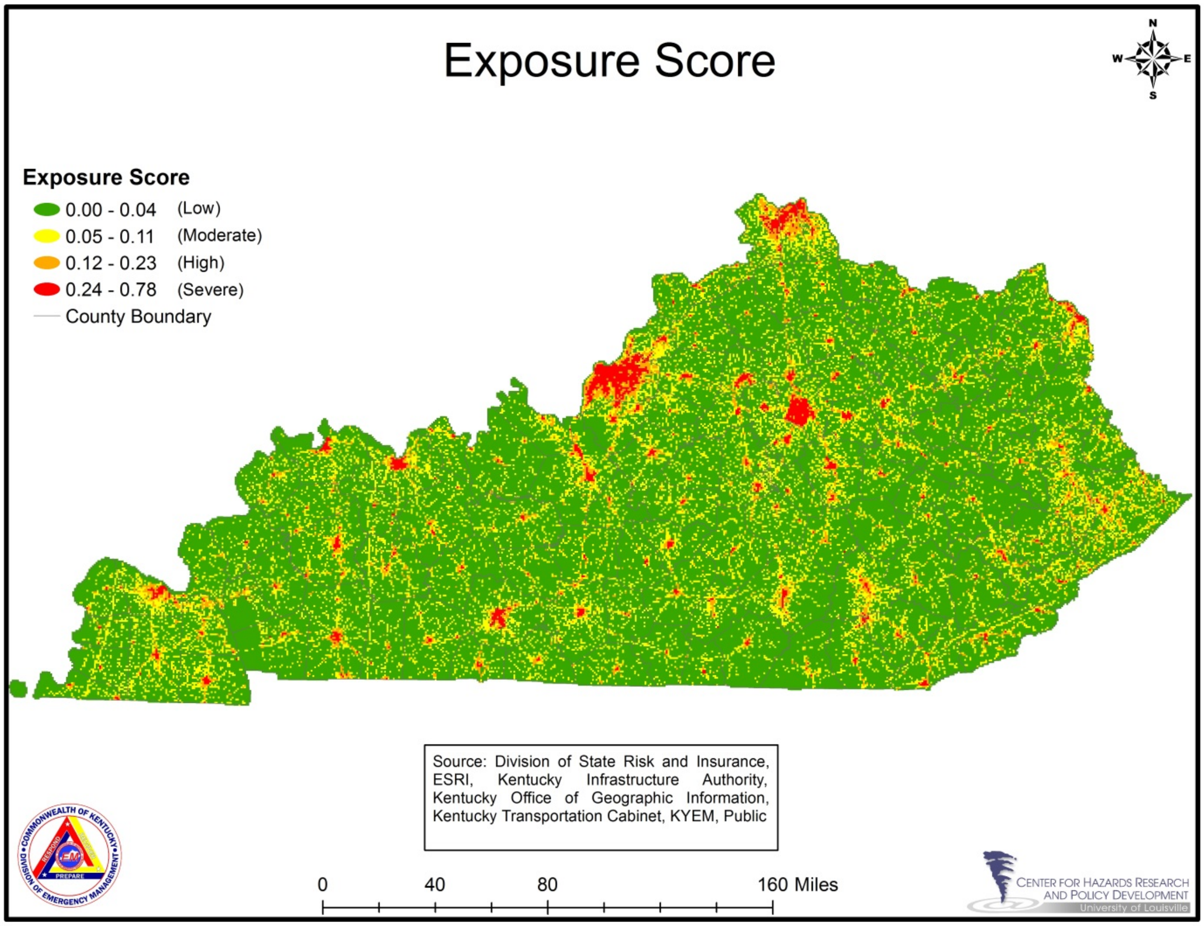
The following displays each Exposure Score component followed by the composite Exposure Score.


Population Score

Property Score

Critical Infrastructure Score

Source: Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, USGS, and the US Census Bureau.



Source: Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public

Hazard Score

The Hazard Score assigns a hazard variable to the Hazard Vulnerability Score. The Hazard Score varies with each hazard due to the fact some hazards have area boundaries for analysis, like flooding, while numbers of occurrences are best for those hazards occurring anytime or anyplace, like severe storms. Due to the variation on how each Hazard Score was calculated a description for each hazard will be provided within each "Hazard Risk Assessment Overview".

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

County-Level Risk Assessment Model

REQUIREMENT §201.4(C)(2)(III):

The Commonwealth of Kentucky shall include an overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State shall estimate the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.

The county-level model provides assessments of which counties throughout the State are experiencing the most risk. This display of the data provides a comparative view of each county. This model also ties to the current Risk Assessment Module within CHAMPS, which captures risk currently at the county-level.

To create the County-Level Risk Assessment Model, CHR used the Risk Matrix data to convey risk. Specifically, the Annual Rate of Occurrence and the Average Annual Loss categories were used. For hazards that averaged over a million dollars in losses per year at the State level were assessed using each county's Average Annual Loss number (See ***Appendix 3-2*** "Hazard Average Annualized Loss" for County Average Annual Loss numbers). For those hazards that did not have a noteworthy amount of loss data it was decided to use their Annual Rate of Occurrence numbers (See ***Appendix 3-2*** "Hazard Average Annualized Loss" for County Annual Rate of Occurrence numbers).

A complete description of each hazard's County-Level Risk Assessment will be provided within each "Hazard Risk Assessment Overview".

Estimating Potential Losses of Jurisdictions and State Facilities

A key piece to any risk management system is to understand a community's potential losses. CHR decided to capture loss using two (2) different methodologies. The methodologies differ in that one is a county-level assessment, which was used to capture jurisdictional potential loss, where the other is geo-spatially specific, which was used to capture both vulnerability and loss estimates on State facilities. The two (2) models that were used for the 2013 State Hazard Mitigation are the ***Average Annualized Loss Model*** and the ***Hazard Boundary Overlay Loss Estimation Model.***

As has been mentioned before, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural 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 or duplicate inventories, socio-economic data, loss data, or occurrence data).

Jurisdictional: Average Annualized Loss Model

This model uses annual rate of occurrence data and average losses data to calculate an Average Annual Loss for several of the identified hazards (See Risk Matrix Table). Annual rate of occurrence is based on past occurrences and average losses are based on past losses.

Knowing both the "annual rate of occurrence" and the "average losses" produces the ability to predict an Average Annual Loss for any given year by multiplying the two values together. This model provides a suitable understanding of general loss for each county within the Commonwealth. The model relies on capturing historical event data and therefore it is fundamental that future hazard occurrence data is captured (Occurrence and Loss Data).

It is important to note that hazard occurrence data is what the SIE module within CHAMPS version II is developed to capture. CHR and KYEM has longed recognized some deficiencies in this type of data capture and have used best available data for each hazard. The SIE module will provide specific hazard occurrence data capture at the local level that will provide an enhanced view of real losses that can be used to better estimate potential losses.

As mentioned above, data capture limits the effectiveness of this model. CHR and KYEM were able to acquire sufficient data to develop an Average Annual Loss estimate for the following eleven (11) Hazards:

1. Flood
2. Earthquake
3. Mine/Land Subsidence
4. Landslide
5. Forest Fire
6. Drought
7. Extreme Temperature
8. Hail Storm
9. Severe Storm
10. Severe Winter Storm
11. Tornado.

Currently Karst/Sinkhole and Dam Failure do not have suitable loss data to capture an Average Annual Loss number. However, loss estimates were developed for these hazards through analyzing the property values within each "Severe Hazard Score" grids. This methodology assumed a complete loss of all property within each Karst and Dam Failure Severe Hazard Score grid (See ***Appendix 3-3*** *"Karst & Dam Failure Loss Estimates").*

For the other eleven (11) hazards, CHR developed an Average Annual Loss number for every county within the Commonwealth. This was developed in order for each county to have a general understanding of the potential effects for each hazard posed in terms of average dollar loss per year. As mentioned above, this data model was developed using the best available data for each hazard. SHELDUS data was used for Flood, Earthquake, Forest Fire, Drought, Hail Storm, Severe Storm, Severe Winter Storm, and Tornado’s. While SHELDUS is the best available data source for many events, it does at times provide a simplified view of events within a state, taking the total losses from the event and dividing the losses evenly among the affected counties. This is done due to shortcomings in the source data that SHELDUS uses and while each affected county does not necessarily have equal losses as you may see in the table, a more refined breakdown of losses for all events is currently not available due to the data capture limitations of SHELDUS.

For the assessed hazards not listed above, alternative data sources were used due to the availability of Kentucky specific data and/or the lack of SHELDUS data, the breakdown of those sources and hazards follows. Data from the Kentucky Division of Abandoned Mine Lands (AML) was used for Mine/Land Subsidence. This particular data provided a specific loss location that has been tracked by AML. Again, this data is the best available data for this specific hazard at this moment. Kentucky Geological Survey (KGS) data was used for Landslide data capture. KGS, a long-standing partner with KYEM and CHR have recently began to track specific incident data through a created GIS database. For Extreme Temperature CHR used both SHELDUS and NCDC data in order to capture extreme cold events, which were only present in the NCDC data records.

In order to capture potential losses for each hazard CHR and KYEM scoured the best available data sources. Again, this data will be enhanced with the SIE data capture within CHAMPS for future iterations. This potential loss data can be found in ***Appendix 3-2*** “Hazard Average Annualized Loss”

State Facilities: Hazard Boundary Overlay Loss Estimation Model

The vulnerability assessment and potential loss estimate for state-owned facilities were determined using the same methodology. The Division of State Risk and Insurance which insures state-owned facilities provided CHR with an updated list of state-owned facilities and the total insurance coverage on each structure. The database contained 6,881 state-owned, addressed facilities.

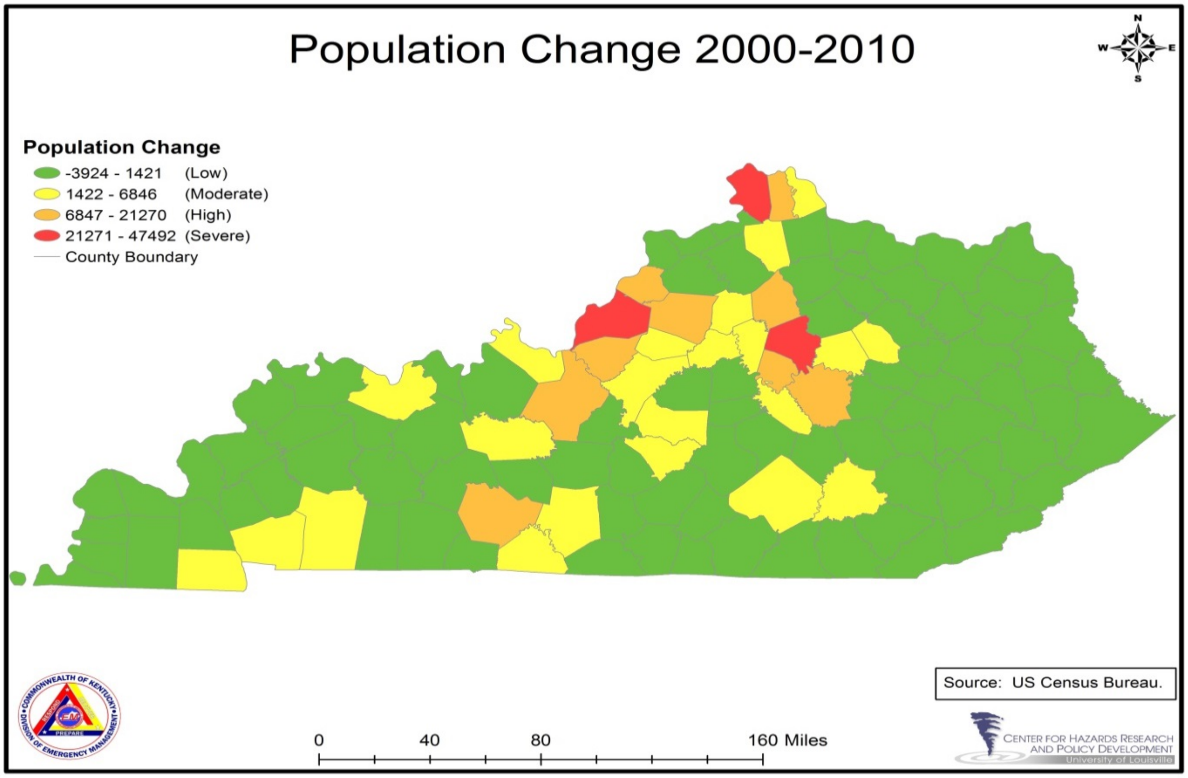
To work with the addressed state-owned facilities, each had to be geo-coded in a GIS system. Geo-coding is a GIS process where an address is assigned a geographic location according to addressed road coverage. This method gives the address from the database an x, y coordinate position in the world. The CHR team performed this geo-coding process using ArcGIS Street map. This data was geo-coded and then double checked for accuracy for the 2013 plan.

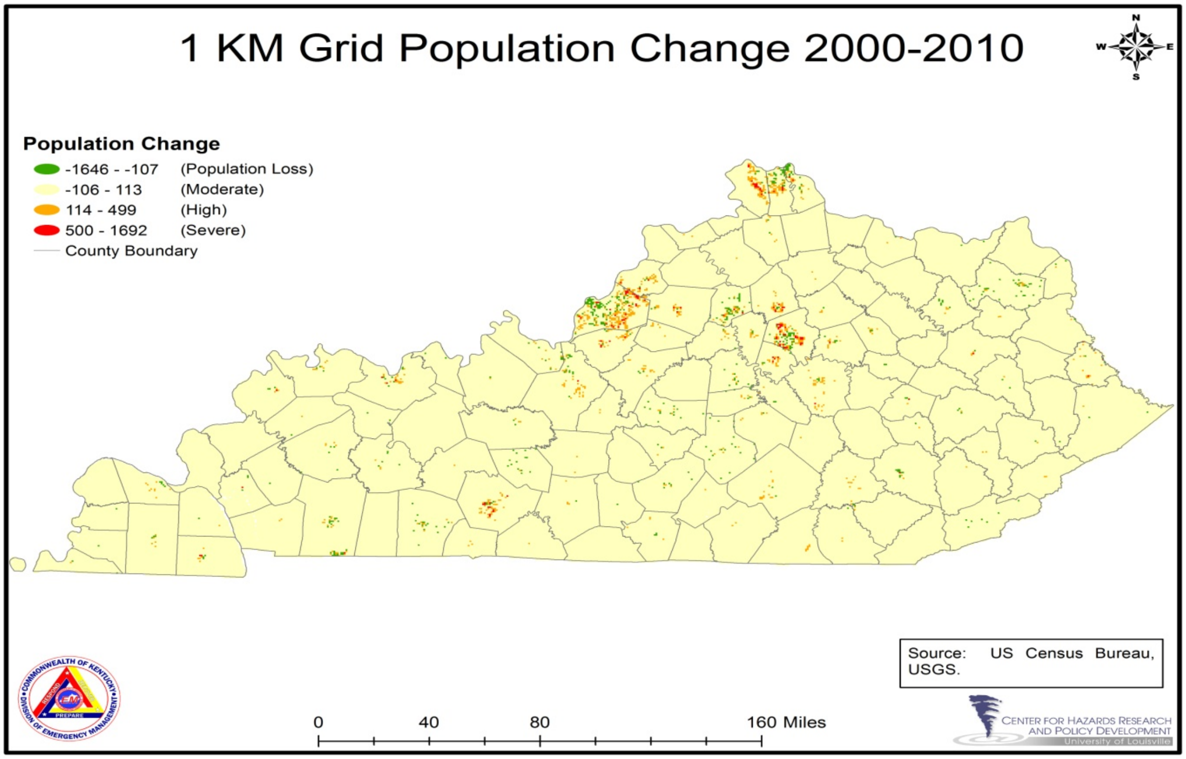
Using the “Severe Hazard Score” hazard boundary layer from the Hazard Score grid, vulnerability assessments and loss estimates were performed on the state facilities. The Severe Hazard Score 1 KM MGRS grids were used as the hazard boundary that was used to overlay on the geo-referenced state facility GIS file. The state facilities that were located within the severe hazard zones were then identified and assumed to be vulnerable and estimated to be damaged during an event. To identify State Facilities that are vulnerable per county throughout the Commonwealth, CHR created a table that displays the total number of facilities and the potential losses to those facilities identified within a “Severe” hazard area (1 KM grid Hazard Score) (See ***Appendix 3-4*** “Hazard Facility Vulnerability and Loss Estimations”). These estimates should be used to assess State Facilities’ vulnerability and potential loss from hazard events. In addition to the County Summary data, Hazard Facility Vulnerability and Loss Estimations By Building Type tables are included in Appendix 3-4. Appendix 3-4 is designed to show a county level loss estimation by the type of state owned facility. Each state facility was broken into its appropriate Building Class/Type. The following is the listing and definition of the Division of State Risk and Insurance Building Types.

Building Type	Definition
RESIDENCE	A facility used as living quarters.
STORAGE	A facility used to store objects or goods.
PUBLIC SAFETY	A facility devoted to law enforcement or other public safety activities.
RECREATION & SPORT	A facility devoted to recreation or sport activities such as parks, game lands, etc.
FOOD SERVICE	A facility devoted to the preparation and service of food.
OFFICE	A facility devoted to any kind of administrative or office functions.
FARMING	A facility concerned with the raising of crops, plants or animals.
EXHIBITION	A facility devoted to the presentation of indoor and outdoor exhibits and shows.
MEDICAL	A facility devoted to delivering public health services such as medical, psychiatric treatment, nursing or other health care.
CORRECTIONS	A facility concerned with the imprisonment and treatment of public offenders.
GENERAL MAINTENANCE	A facility devoted to general repair, clean-up or maintenance of Commonwealth property.
TRAVEL	A facility devoted to travel activities such as an airport.
PARKING	A facility devoted to the parking of motor vehicles.
VEHICLE MAINTENANCE	A facility devoted to the maintenance or repair of Commonwealth motor vehicles.
HANGAR	A facility used for storage of airplanes.
EDUCATION	A facility devoted to instruction, educational and teaching activities.
MECHANICAL	A facility providing electricity, gas, water, etc. for power, heat and other services.
DEFENSE	A facility concerned with the various functions of the Department of Military Affairs.
RESEARCH	A facility devoted to research, experimentation or analysis.
MANUFACTURING	A facility devoted to the assembly or manufacture of objects.

Changes in Development

An important step in developing solid mitigation policy that influences changes in potential loss from hazard events is to identify areas that are displaying substantial growth. Areas with high growth are increasing their exposure to hazards and these changes will increase the risk to future hazard events. The state hazard mitigation plan and local hazard mitigation plans should be used to identify high-risk areas to each hazard and evaluate the development patterns within the high hazard zones to ensure that any development is done in a way that minimizes risk. To identify these particular high growth areas, CHR decided to identify counties and 1KM grids with significant growth. Using 2010 and 2000 Census data (which is the best available data to show population trends at this time), CHR developed maps which depict areas showing high development based on population change from 2000-2010. Furthermore, the grid level population changeassessment was completed using the most current development data. It used 2010 Census population data, 2012 ACS property value data, and 2012 ESRI business data to ensure the most up-to-date picture of Kentucky was given.


Population Change 2000-2010
N
W
E
S
Population Change
-3924 - 1421 (Low)
1422 - 6846 (Moderate)
6847 - 21270 (High)
21271 - 47492 (Severe)
County Boundary
Source: US Census Bureau.
0
40
80
160 Miles
Commonwealth of Kentucky
Division of Emergency Management
Center for Hazards Research and Policy Development
University of Louisville


1 KM Grid Population Change 2000-2010
N
W
E
S
Population Change
-1646 - -107 (Population Loss)
-106 - 113 (Moderate)
114 - 499 (High)
500 - 1692 (Severe)
County Boundary
Source: US Census Bureau, USGS.
0
40
80
160 Miles
Commonwealth of Kentucky
Division of Emergency Management
Center for Hazards Research and Policy Development
University of Louisville

Hazard Category: FLOOD

Flood

Identifying Hazards: Flood

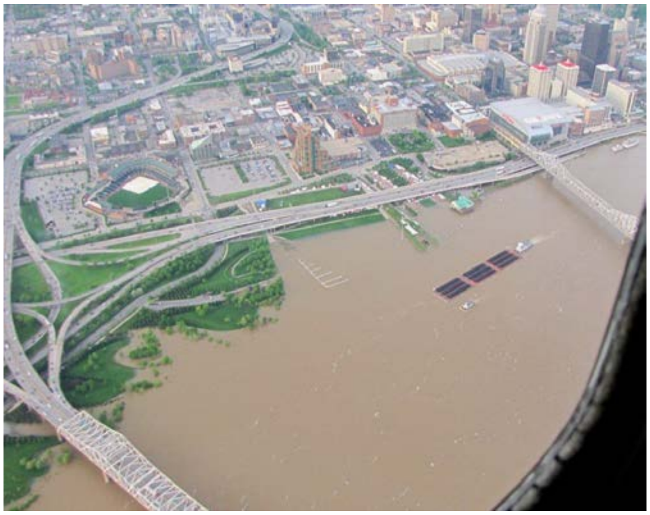
Description

As defined by USGS, flooding is *a relatively high stream flow that overflows the natural or artificial banks of a stream or that submerges land not normally below water level*, and, as a natural event, is caused in a variety of ways. Winter or spring rains, coupled with melting snows, can fill river basins too quickly. Torrential rains from decaying hurricanes or other tropical systems can also produce flooding. The excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto lowlands, adjacent to rivers, lakes, and oceans which are subject to recurring floods; most commonly referred to as floodplains. Currently, floodplains in the U.S. encompass over nine (9) million households.

Factors determining the severity of floods include:

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

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



Kentucky Flooding 2011

Types

There are a multitude of reasons that floods may occur, with each type of flooding having a variety of environmental effects post-flood, and are generally grouped into seven (7) types; regional, river or riverine, flash, ice-jam, storm surge, dam and levee failure, and debris, landslide, and mudflow flooding.

1. *Regional Flooding* can occur seasonally when winter or spring rains, coupled with melting snow, fill river basins with too much water too quickly. The ground may be frozen, reducing infiltration into the soil and thereby increasing runoff. Extended wet periods during any part of the year can create saturated soil conditions, after which any additional rain runs off into streams and rivers, until river capacities are exceeded. Regional floods are many times associated with slow-moving, low-pressure or frontal storm systems including decaying hurricanes or tropical storms.

2. *River or Riverine Flooding* is a high flow or overflow of water from a river or similar body of water, occurring over a period of time too long to be considered a flash flood.

3. *Flash Floods* are quick-rising floods that usually occur as the result of heavy rains over a short period of time, often only several hours or even less. Flash floods can occur within several seconds to several hours and with little warning. They can be deadly due to the rapid rises in water levels and devastating flow velocities produced.

4. *Ice-Jam Flooding* occurs on rivers that are totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile 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. Backwater upstream from the ice dam can rise rapidly and overflow the channel banks. Flooding moves downstream when the ice dam fails, and the water stored behind the dam is released. At this time the flood takes 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. An added danger of being caught in an ice-jam flood is hypothermia, which can quickly kill.

5. *Storm-surge flooding* is water which is pushed up onto otherwise dry land by onshore winds. Friction between the water and the moving air creates drag which, depending upon the distance of water (fetch) and the velocity of the wind, can pile water up to depths greater than 20 feet. Intense, low-pressure systems and hurricanes can create storm-surge flooding. The storm surge is unquestionably the most dangerous part of a hurricane as pounding waves create very hazardous flood currents.

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

7. *Debris, Landslide, and Mudflow Flooding* is created by the accumulation of debris, mud, rocks, and 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. Mudflow floods can occur when volcanic activity rapidly melts mountain snow and glaciers, and the water mixed with mud and debris moves rapidly down slope.

Facts

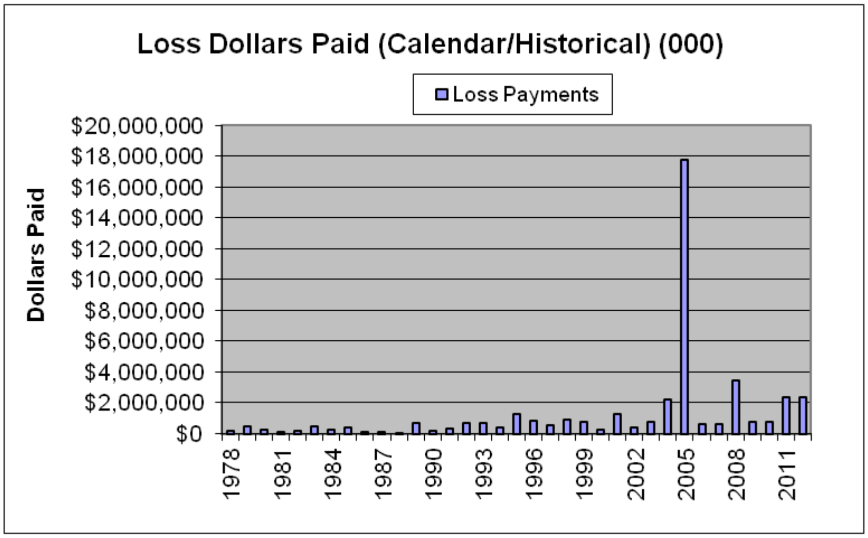
- Floods caused by Hurricane Katrina resulted in over $200 billion in losses, resulting in the most costly natural disaster in U.S. history.
- Annually, average losses from 30-year floods in the U.S. are over $8 billion in damages and 95 deaths.
- Flooding is the most common natural disaster in the United States.
- More than 2,200 lives were lost in the Johnstown, Pennsylvania flood of 1889, a flood that was caused by a dam failure.
- Most flood-related deaths are due to flash floods.
- 50% of all flash-flood fatalities are vehicle related.
- 90% of those who die in hurricanes drown in flood waters.

Impacts

Though fatalities associated with all types of flooding have steadily declined in the U.S. over the last half century, the average annual death toll is still over 200. Advanced warning systems are now commonplace and give residents time to plan, but an increase in urban and coastal development has caused the monetary losses associated with flooding to increase drastically.

Most homeowners' insurance policies do not cover floodwater damage, so homeowners without flood insurance are at a high risk for loss. Since 1978, over $47 billion in flood loss payments have been made nationwide by the National Flood Insurance Program. 2005, had by far the most loss dollars paid (almost $18 billion), as a result of Hurricane Katrina. The next largest yearly paid loss dollars amount was in 2008 at almost $3.5 billion, largely as a result of Hurricane Ike. New Jersey had the highest total flood loss payments in 2011 in the United States, followed by New York, Pennsylvania, North Carolina, North Dakota, Connecticut, Vermont, Mississippi, Missouri and Louisiana.

Hurricane Sandy is the most recent example of the devastation flooding can cause in urban areas. In October 2012, Hurricane Snadyhit the coast of New York and New Jersey, affecting the largest and one of the most densely populated cities in the United States, New York City. Over 63,500 flood insurance claims were paid, second only to Hurricane Katrina, for a total of $2,649,099,182. The event also resulted in over 100 deaths, most of who drowned in the storm surge.



Source: FEMA, http://www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13/loss

According to the NWS, water year 2011 was a year of record-breaking, prolonged floods along some of the nation’s largest rivers, the Missouri, Ohio and Mississippi. Direct flood damages during this water year totaled $8.41 billion. Over 100 people died as a result of this flooding, over half of which were attributed to flash flood events. These flood events were largely due to spring snowmelt flooding that resulted from heavy precipitation the preceding fall and summer.

Profiling Hazards: Flood

FLOOD PROFILE RISK TABLE	
Period of occurrence:	For river flooding - January through May For flash flooding - Anytime, but primarily during summer rains
Number of events: (1960-2013)	5,934*
Annual Rate of Occurrence:	112
Warning time:	River flooding - 3-5 days Flash flooding - minutes to several hours Out-of-bank flooding - several hours/days
Potential impacts:	Impacts human life, health, and public safety. Utility damages 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.
Recorded losses:	$2,301,445,697*
Annualized Loss:	$43,423,504
Extent (Historical)[25]:	Date: March 1997 Damage: $400 M Location: 100 counties/statewide

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)

Flooding, which is one of the most significant natural hazards in Kentucky, occurs within the state every year, with several substantial floods occurring annually. Since 2010, four (4) Presidential disaster declarations have been made for the Commonwealth of Kentucky, all of which have included flooding. Kentucky's topography contains 13 major drainage basins to accommodate 40-50 inches of average rainfall (maximum during winter and spring, minimum during late summer and fall), The state contains 89,431 miles of rivers and streams, 637,000 acres of wetlands, 18 reservoirs over 1,000 acres in size, and 228,382 acres of publicly-owned lakes and reservoirs.

It is no surprise, given the above statistics, approximately 300 communities statewide have identified flood-prone areas; and for many of the communities the economic, social, and physical damage caused by flooding can be severe. SHELDUS data indicates there have been 670 deaths and 154 injuries since 1960 due to flooding. And, flood loss payments totaling $283,207,948 have been made to Kentuckians since 1978. According to NOAA NCDC data, from 2010 to 2012 there were 94 days with a flood event affecting 102 out of the 120 counties in Kentucky. These flood events resulted in

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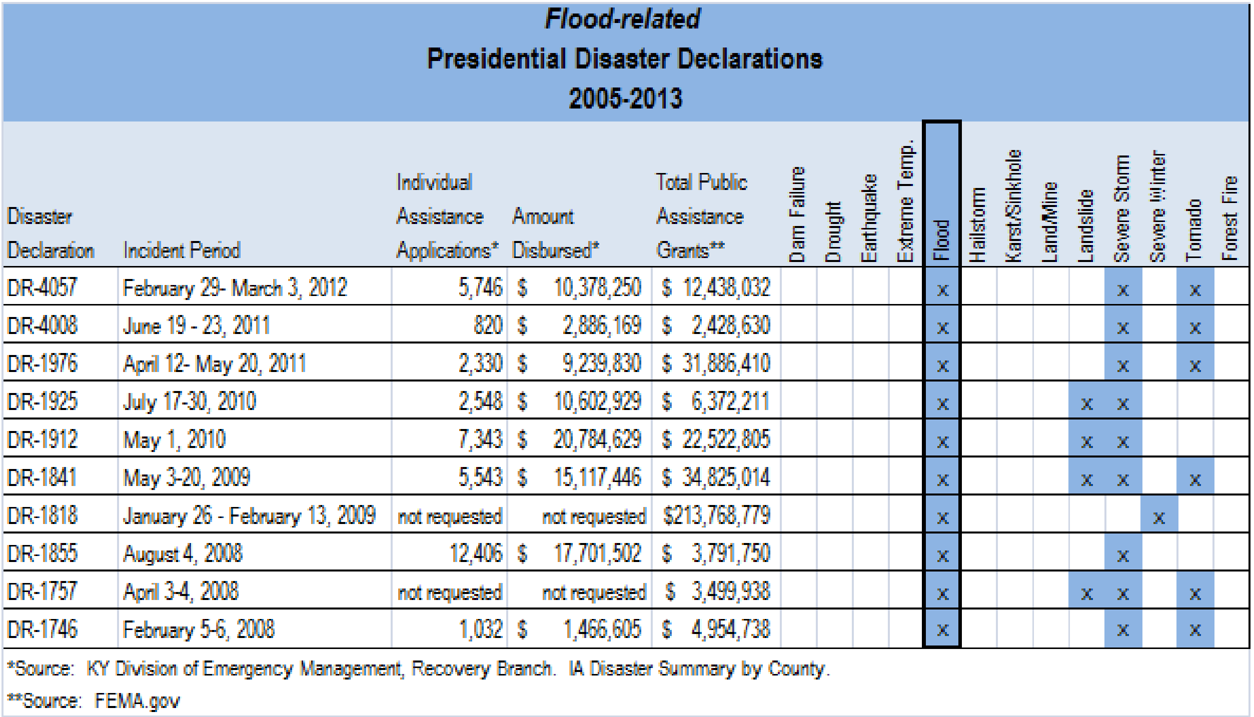
[25] See below descriptions/historical accounts for further examples that serve as "extent," i.e. these are all accounts by which one can compare how bad flooding can become in the Commonwealth of Kentucky.

one (1) death, four (4) injuries, and $62 million worth of combined property and crop damages.

The following is a list of flood-related Presidential Declarations in Kentucky from 1970 to the present. Because only major disasters are included, a number of isolated, smaller events are not listed.

Kentucky Presidential Flood Disaster Declarations		
Disaster Number	Declaration Date	Counties Affected
282	February 2, 1970	12
288	June 5, 1970	13
332	May 15, 1972	10
461	March 29, 1975	17
529	April 6, 1977	15
568	December 12, 1978	37
705	May 15, 1984	28
821	February 24, 1989	67
834	June 30, 1989	12
846	October 30, 1989	11
893	January 29, 1991	19
1163	March 3, 1997	101
1388	August 15, 2001	20
1407	April 4, 2002	37
1414	May 7, 2002	29
1471	June3, 2003	44
1475	July 2, 2003	23
1523	June 6, 2004	77
1537	August 6, 2004	27
1703	May 25, 2007	9
1746	February 21, 2008	23
1757	May 19, 2008	15
1818	February 5, 2009	102
1841	May 29, 2009	24
1855	August 14, 2009	2
1912	May 11, 2010	83
1925	July 23, 2010	7
4008	July 25, 2011	7
4057	March 6, 2012	23

Source: Kentucky Division of Emergency Management,
FEMA www.fema.gov/disaster



Flood-related

Presidential Disaster Declarations

2005-2013

Disaster Declaration	Incident Period	Individual Assistance Applications*	Amount Disbursed*	Total Public Assistance Grants**	Dam Failure	Drought	Earthquake	Extreme Temp.	Flood	Hailstorm	Karst/Sinkhole	Land/Mine	Landslide	Severe Storm	Severe Winter	Tornado	Forest Fire
DR-4057	February 29- March 3, 2012	5,746	$ 10,378,250	$ 12,438,032					x					x		x	
DR-4008	June 19 - 23, 2011	820	$ 2,886,169	$ 2,428,630					x					x		x	
DR-1976	April 12- May 20, 2011	2,330	$ 9,239,830	$ 31,886,410					x					x		x	
DR-1925	July 17-30, 2010	2,548	$ 10,602,929	$ 6,372,211					x				x	x			
DR-1912	May 1, 2010	7,343	$ 20,784,629	$ 22,522,805					x				x	x			
DR-1841	May 3-20, 2009	5,543	$ 15,117,446	$ 34,825,014					x				x	x		x	
DR-1818	January 26 - February 13, 2009	not requested	not requested	$213,768,779					x						x		
DR-1855	August 4, 2008	12,406	$ 17,701,502	$ 3,791,750					x					x			
DR-1757	April 3-4, 2008	not requested	not requested	$ 3,499,938					x				x	x		x	
DR-1746	February 5-6, 2008	1,032	$ 1,466,605	$ 4,954,738					x					x		x	

*Source: KY Division of Emergency Management, Recovery Branch. IA Disaster Summary by County.

**Source: FEMA.gov

A number of significant flooding incidences occurred in late 19th and early 20th centuries within the state, including an event in February 1884, lasting almost two (2) weeks. On February 14, 1884, the Ohio River crested at 48 feet in Louisville; 24 feet above the base flood stage. Towns as far away as Paducah were also inundated for long periods of time.

In January of 1913, unseasonably high amounts of rain in Kentucky, Indiana, and Ohio caused almost every major river and stream in the state to flood, leading to what U.S. Weather Bureau officials referred to as “vast inland seas”. In the Louisville area alone, property damages were estimated at over $200,000 and crop losses totaling over $50,000.

The flood of 1937, is one of the most devastating floods in Kentucky history. In the month of January the state incurred four (4) times the normal amount of precipitation. With the river cresting at over 57 feet in Louisville, 75% percent of the city was underwater and over 175,000 residents were evacuated. Further downstream in Paducah, where the river crested at over 60 feet, residents were evacuated as well. The damages incurred by the entire state were estimated at $250 million, an extremely large sum for the economic climate of the 1930s.

On March 1, 1997, Louisville set a record for the highest amount of precipitation to fall in a single day at 10.48 inches. That March was also the wettest March on record for Louisville, with 17.52 inches of rain for the month. This was part of more widespread rain in central Kentucky and the surrounding areas that led to massive flooding of the Ohio River unlike any in many decades. The crest of the river reached 70.47 feet in Louisville, causing about $200 million in damages with 50,000 homes affected and the closing of Interstates 64 and 65. Ninety-two counties in Kentucky were declared disaster areas with approximately $400 million in damages, tens of thousands of people evacuated from their homes, and seven deaths occurred. Record flood stages were reached at numerous streams throughout the state.

In August 2009, a record high rainfall for a single day in August occurred in the Louisville area; a record unbroken since 1879. During this event 4.53 inches of rain fell at Louisville International Airport, with 3 inches falling within one hour. The Louisville Free Public library sustained $1 million dollars in damages and the University of Louisville alone sustained upward of $20 million in damages.

Beginning on Derby Day May 1, 2010, the entire state was inundated with a torrential rain event. A similar deluge in Tennessee impacted rivers flowing into Kentucky. In all, 84 Kentucky counties were impacted by this event and a Presidential declaration was issued on May 11, 2010. Three (3) weeks after the storm, the far western areas of the Commonwealth were still submerged. FEMA resources were deployed to implement both the Public Assistance Program and the Individuals and Households Assistance Program. Estimated Public Assistance projects exceed $60 million.

The Commonwealth has identified numerous Severe Repetitive Loss (SRL) and Repetitive Loss (RL) properties which both KYEM and KDOW considered to be of high priority for mitigation measures. See ***Appendix 3-5*** for RL/SRL by county.

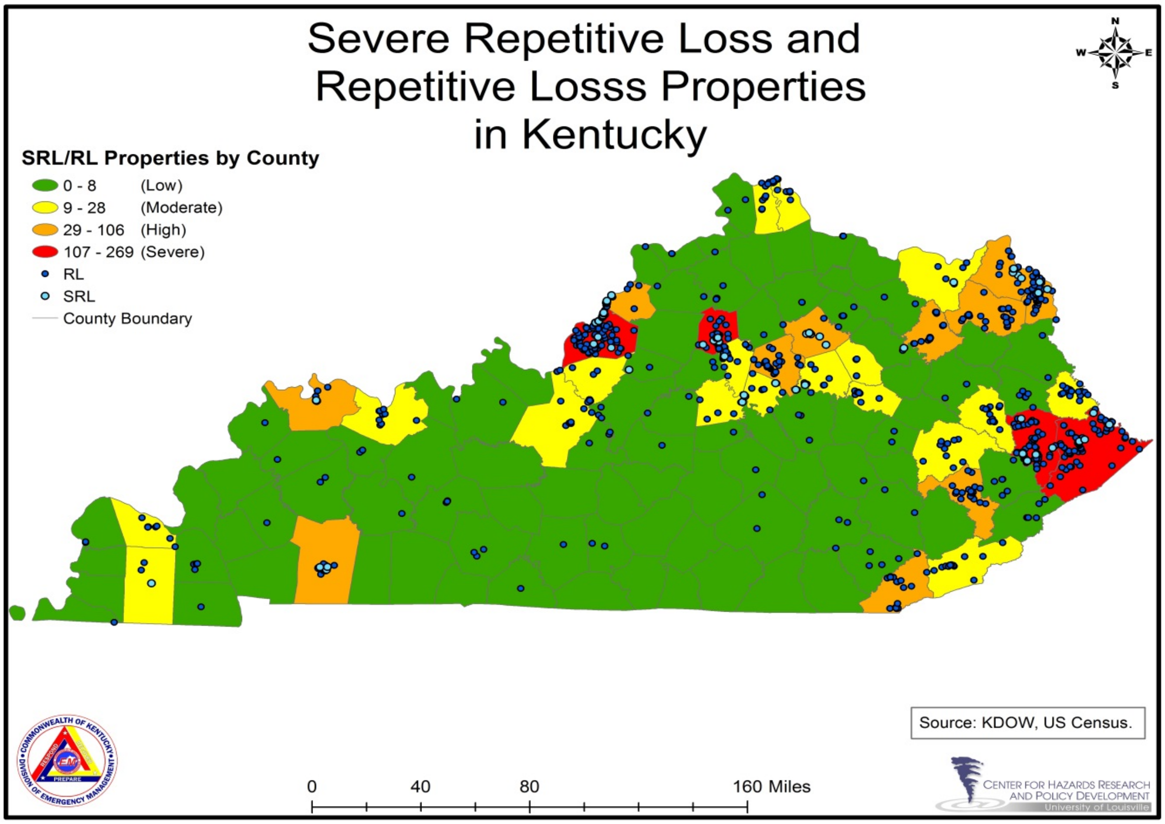
REQUIREMENT
§201.4 (C) (3) (V):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

BEGINNING HERE

C. Addressing Repetitive Loss Properties in the Commonwealth of Kentucky's Risk Assessment

Western Kentucky Flooding 2011



Source: KDOW, US Census.

Assessing Vulnerability by Jurisdiction: Flood

Grid-Level Risk Assessment Model

Flood Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to flood was determined through first calculating the Flood Hazard Score. The Flood Hazard Score was calculated by studying three (3) sources of data. Each of the datasets was provided by the Kentucky Division of Water (KDOW) and FEMA. The first data layer used to create the Flood Hazard Score was the Digital Flood Insurance Rate Map (DFIRM). The DFIRM displays a geo-referenced data layer that depicts where flooding could occur. To analyze Kentucky's risk to flood according to the DFIRM data, the DFIRM layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the DFIRM covered within each grid. This percentage of area affected by the mapped flood potential area (DFIRM) was then calculated and scored 0-1 to develop 50% of the Flood Hazard Score.

The next step determined the total number of Severe Repetitive Loss (SRL) and Repetitive Loss (RL) properties within each 1 KM MGRS grid. This data displayed where concentrations of flood events have occurred, thus producing areas of risk. Once all the SRL and RL property points were aggregated to their appropriate grid, each grid was giving a score 0-1 to create the other 50% of the Flood Hazard Score.

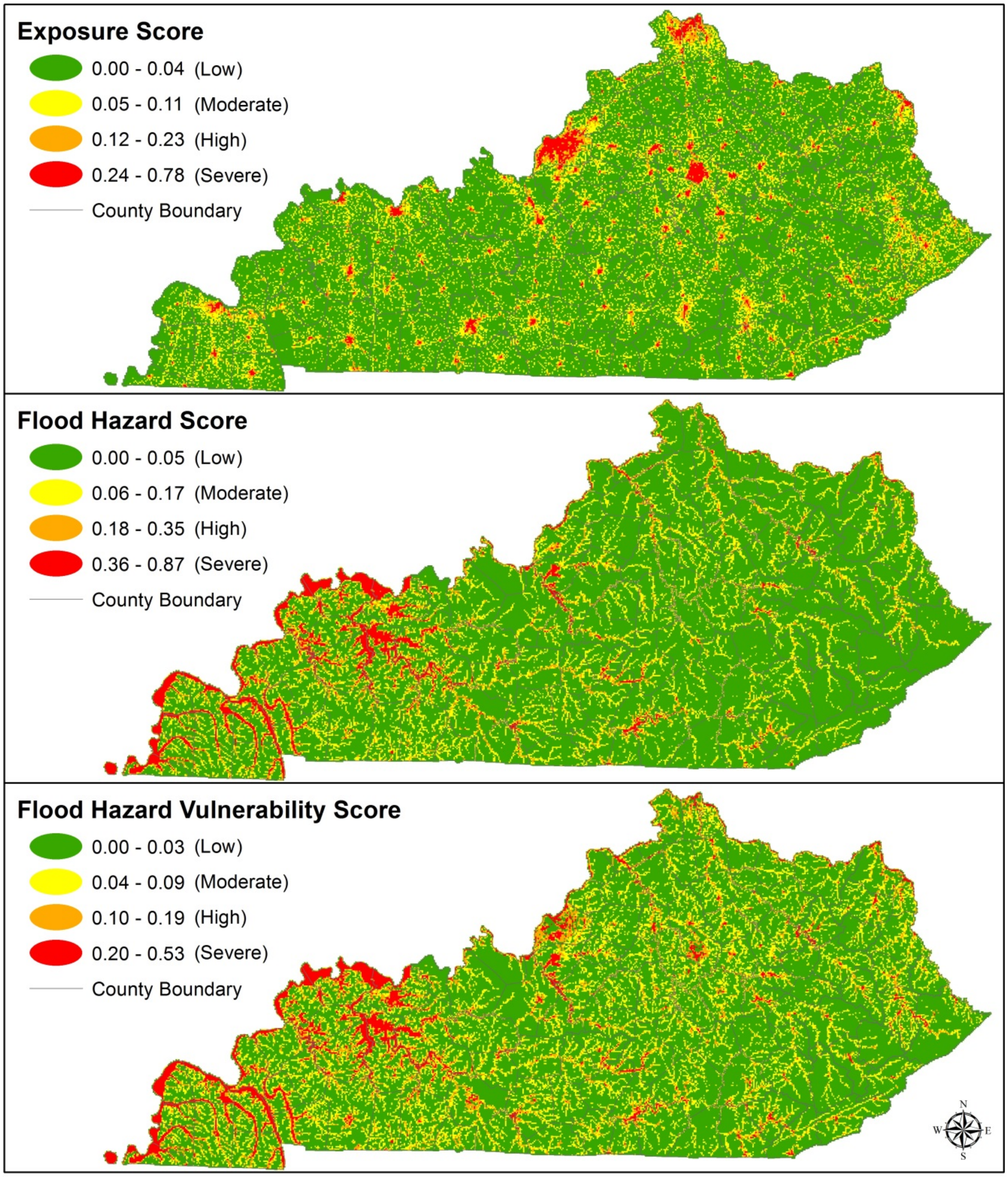
The Flood Hazard Score was then calculated by adding the two (2) scores together and scored 0-1. It is important to note if the Flood Hazard Score inputs equaled 0, then the Flood Hazard Vulnerability Score equaled 0.

Finally, the Flood Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Flood Hazard Score and then scored 0-1. Once the final Flood Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

Western Kentucky Flooding 2011

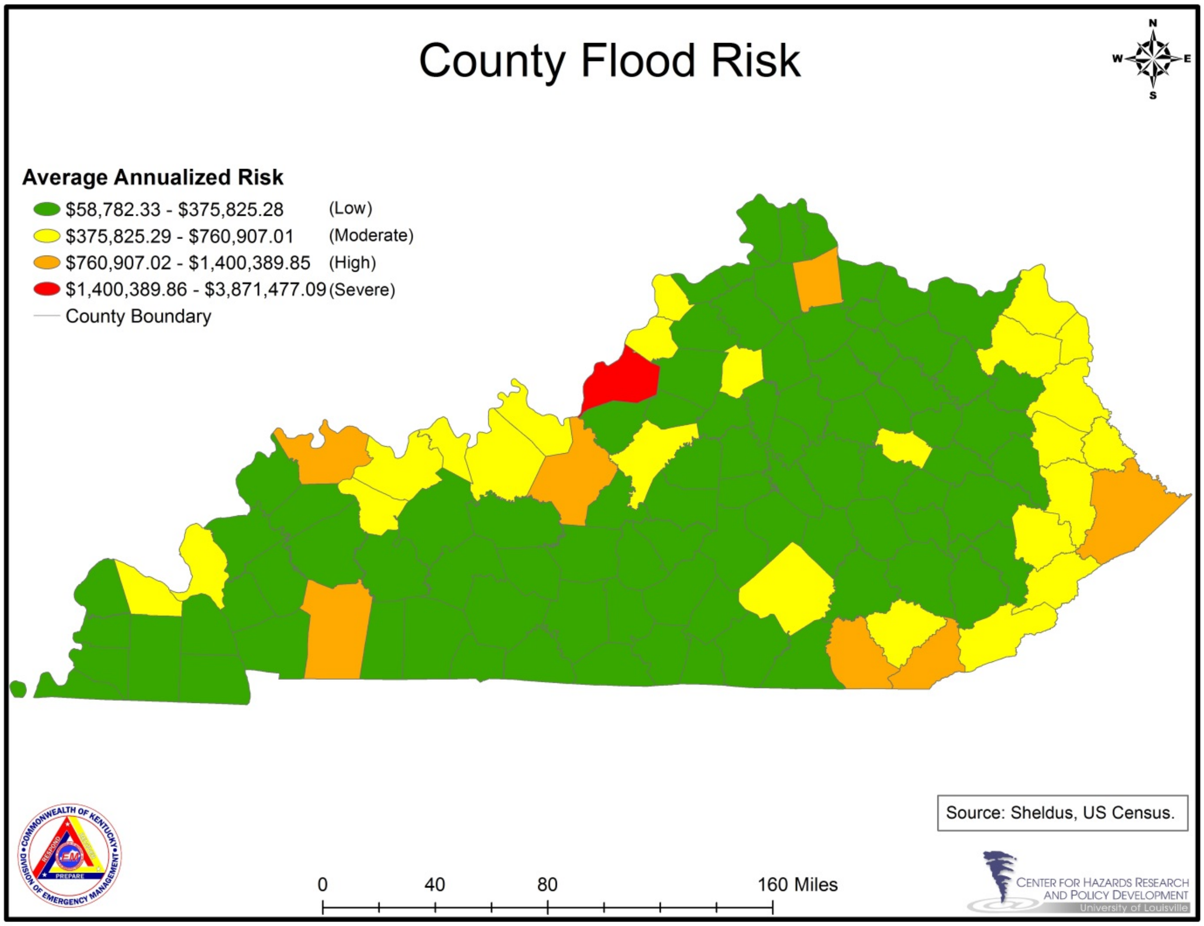
The following map displays the maps and components of the Flood Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: FEMA, Kentucky Division of Water.

County-Level Risk Assessment Model

The Flood County Risk Assessment Model was created using the Flood Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by their average losses (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



Source: Sheldus, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences and losses from flooding comparatively across Kentucky.

Hazard Category: GEOLOGIC/EARTHQUAKE

Earthquake

Identifying Hazards: Earthquake

Description

According to the U.S. Geological Survey, an earthquake is *a shaking of the ground caused by the sudden release of accumulated strain by an abrupt shift of rock along a fracture in the Earth or by volcanic or magmatic activity, or other sudden stress changes in the Earth*. For hundreds of millions of years, the forces of plate tectonics - massive, irregularly-shaped slabs of rock - have shaped the Earth as these huge plates that form the Earth's surface move slowly over time.

When a substantial amount of energy has accumulated during these tectonic interactions, the plates move in a way which releases stored energy and produce the seismic waves which generate earthquakes. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. However, some earthquakes do occur in the middle of plates for various reasons.

The movement of the earth‘s surface during earthquakes (or explosions) is the catalyst for most of the damage during an earthquake. Produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source, ground motion travels both through the earth and along its surface, amplified by soft soils overlying hard bedrock; a phenomenon referred to as ground motion amplification. Ground motion amplification can cause a great deal of damage during an earthquake, even to sites very far from the epicenter; the epicenter being the point on the Earth’s surface that is directly above the area where rock has broken on the tectonic plate below. Earthquakes strike suddenly and without warning and can occur at any time of the year, any time of the day or night. Worldwide, 70 to 75 damaging earthquakes occur annually.

The Northridge (Los Angeles), 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 over $30 billion. Exactly one (1) year later, Kobe, Japan, a densely populated community less prepared for earthquakes than Northridge, was devastated by the most costly earthquake ever to occur. Property losses were projected at over $100 billion, and at least 5,530 people were killed. These two (2) earthquakes tested building codes and construction practices, as well as emergency preparedness and response procedures.

One of the most destructive earthquakes to date occurred in Haiti in 2010, which resulted in 316,000 deaths, hundreds of thousands of injuries, and millions of people displaced from their homes. The disaster also led to a widespread cholera epidemic and untold economic damages.

Over 75 million Americans in 39 states face a significant risk of experiencing the effects of a substantial earthquake. California experiences the greatest amount of damaging earthquakes in terms of effected infrastructure and damage to private property. However, Alaska experiences the greatest actual number of large earthquakes, most of which occur in uninhabited areas of the state. The largest earthquake felt in the contiguous United States was along a 600 mile stretch of the Cascadia Subduction Zone between Vancouver, British Columbia and Northern California in the year 1700, where the oceanic Juan de Fuca plate is sliding beneath the North American plate. The earthquake leveled entire villages, collapsed structures in many others, and caused landslides, tsunamis, and devastating swells down much of the Northwest coast of North America. A tsunami produced by this earthquake travelled across the Pacific Ocean, also causing significant levels of devastation on coastal areas of Japan.

Types

Plate boundaries are characterized into four (4) distinct types:

1) Divergent boundaries – a new crust is created as two plates move away from another
2) Convergent boundaries – areas where tow plates are coming together and thus losing crust as one plate slides under another
3) Transform boundaries –two plates slide horizontally past one another without creating or destroying boundaries
4) Plate boundary zones – broad belts without well defined boundaries or plate interaction

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

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

The Modified Mercalli Scale measures the effect of an earthquake on the Earth‘s surface. Composed of 12 increasing levels of intensity that range from unnoticeable shaking to catastrophic destruction, the scale is designated by Roman numerals.

There is no mathematical basis to the scale; rather, it is an arbitrary ranking based on observed events. The lower values of the scale detail the manner in which the earthquake is felt by people, while the increasing values are based on observed structural damage. The intensity values are assigned after gathering responses to questionnaires administered to postmasters in affected areas in the aftermath of the earthquake.

Modified Mercalli Intensity Scale with Corresponding Richter Scale

Intensity	Verbal Description	Witness Observations	Maximum Acceleration (cm/sec^2)	Corresponding Richter Scale
I	Instrumental	Detectable on seismographs	<1	<3.5
II	Feeble	Felt by some people	<2.5	3.5
III	Slight	Felt by people resting	<5	4.2
IV	Moderate	Felt by people walking	<10	4.5
V	Slightly Strong	Sleepers awake; church bells ring	<25	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<50	5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls	<100	6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures; poorly constructed buildings damaged	<250	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<500	6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<750	7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards	<980	8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>980	>8.1

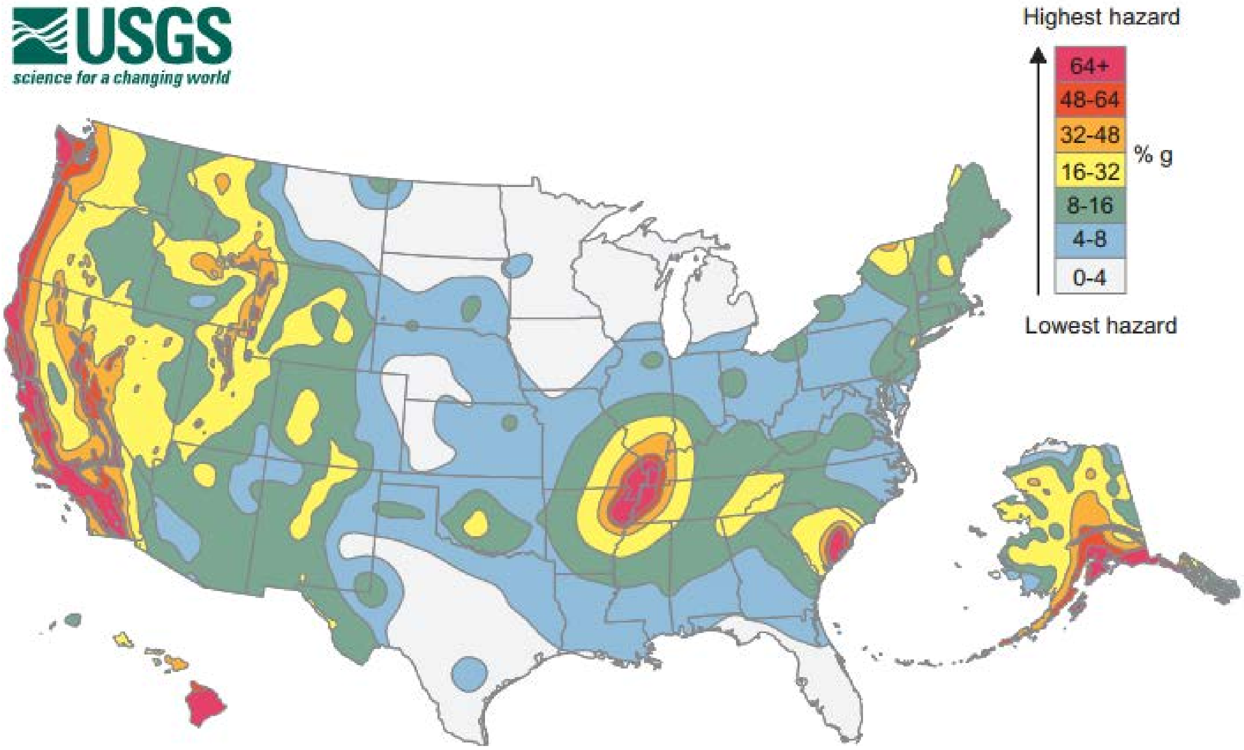
Source: US Geological Survey

10 Largest Earthquakes in the Contiguous United States		
Richter Scale Magnitude	Date	Location
~9.0	January 26, 1700	Cascadia Subduction Zone
7.9	January 9, 1857	Fort Tejon, CA
7.8	April 18, 1906	San Francisco, CA
7.8	February 24, 1892	Imperial Valley, CA
7.7	December 16, 1811	New Madrid, MO
7.7	February 7, 1812	New Madrid, MO
7.5	January 23, 1812	New Madrid, MO
7.4	March 26, 1872	Owens Valley, CA
7.3	June 28, 1992	Landers, CA
7.3	August 18, 1959	Hebgen Lake, MT

Source: U.S. Geological Survey. 2010. http://earthquake.usgs.gov/earthquakes/states/10_largest_us.php

Facts

- Earthquakes in the central or eastern United States affect much larger areas than earthquakes of similar magnitude in the western United States. For example, the San Francisco, California earthquake of 1906 (magnitude 7.8) was felt 560 miles away in the middle of Nevada, whereas the New Madrid earthquake of December 1811 (magnitude 7.7) rang church bells in Boston, Massachusetts, 1,600 miles away. Geology differences east and west of the Rocky Mountains account for this strong contrast.
- Earthquakes similar to the New Madrid earthquake series of 1811 -1812 and the San Francisco earthquake of 1906 could cause over $500 billion in damage.
- Annually, there are an average of six (6) earthquakes with a 6 or greater magnitude and fifty-seven earthquakes with magnitudes of 5 or greater in the United States.
- Currently, twenty-six urban and metropolitan areas in the U.S. are at risk of being affected by significant seismic activity.
- The largest earthquake ever recorded in the U.S. was a magnitude 9.2 in Prince William Sound, Alaska in March of 1964.
- Almost 6,000 earthquakes occurred on average each year from 2010-2012 in the United States.
- Over 20,000 earthquakes occurred on average each year from 2010-2012 worldwide.



The USGS National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States. Based on peak ground acceleration (PGA) the following map shows high risk areas to earthquake effects.

Impacts

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

Between 2000 and 2012, an average of 62,600 people worldwide died annually due to earthquakes. Small tremors that occur after the initial earthquake has dissipated often make it difficult for those participating in rescue and rebuilding efforts to aid the populations most affected. These delays cause further loss of life and prolong the displacement of families and individuals. The January 1994 earthquake in Northridge, California, for example, killed 60, injured 9,000, and displaced over 20,000 people.

FEMA has estimated future losses due to earthquakes in the United States at $5.6 billion each year, with more earthquakes occurring on the West coast than the East coast, though the Central and Eastern portions of the country remain at a high risk of damage due to geologic factors, magnified by the lack of structures built to withstand such disasters. Thus, the USGS has named earthquakes the natural disaster most likely to cause catastrophic casualties, property damage, and economic disruption.

Profiling Hazards: Earthquake

EARTHQUAKE PROFILE RISK TABLE	
Period of occurrence:	Earthquakes can occur year-round, at any time of the day or the night
Number of events: (1960-2013)	1*
Annual Rate of Occurrence:	Currently there are no probability ratios determined for earthquakes because of its unpredictable nature.
Warning time:	Warning time is essentially non-existent, as geologic activity at fault lines in the earth's crust happen sporadically.
Potential impacts:	Earthquakes can heavily impact human life, health, and public safety. Large events can cause infrastructure damage, utility damage, and critical facilities damage. Secondary events often trigger landslides, dam failure/flooding, and may facilitate the release of hazardous materials from containment structures.
Recorded losses:	$2,763,158*
Annualized Loss:	$52,135
Extent (Historical & Scale)[26]:	Year: 1980 Scale: 5.2 Location: Bath County

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)

Fault lines run through much of Kentucky, with each of the fifteen area development districts (ADDs) 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 some are overdue for a surge in activity.

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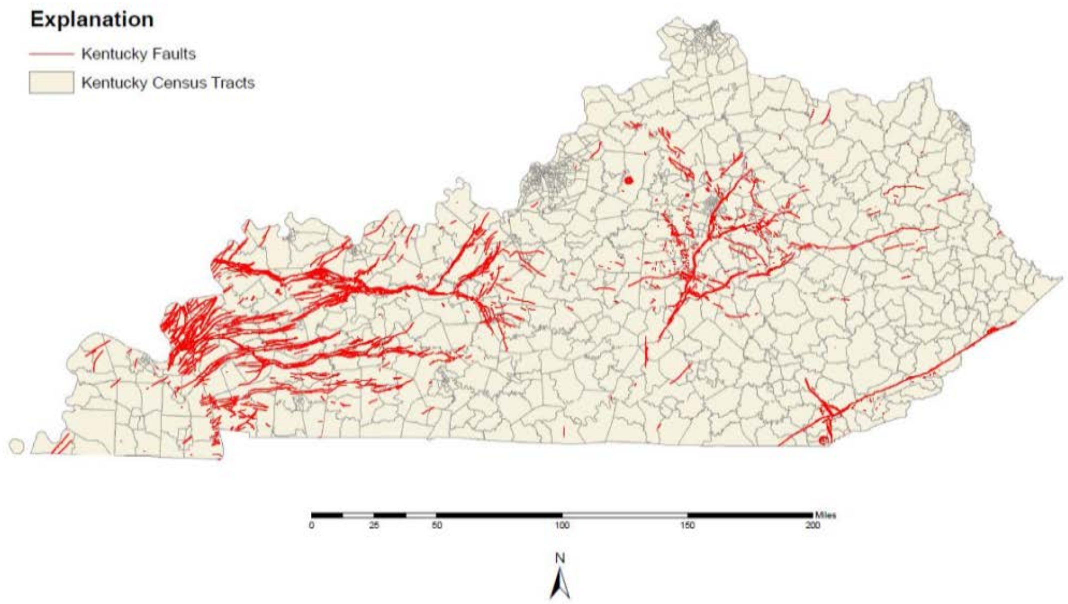
[26] The extent to which an earthquake can possibly wreak havoc to the Commonwealth of Kentucky is implicit in the citation of Modified Mercalli Intensity Scale. However, this plan also reports an historical account by which to judge extent: In 1980, Bath County experienced a particularly destructive earthquake that measured a 5.2 on the Modified Mercalli Intensity Scale.

Kentucky Fault Lines



Source: U.S. Geological Survey. 2008 http://earthquake.usgs.gov/research/hazmaps/products_data/2008/maps/

The three (3) seismic zones most likely to put Kentucky at risk are centered outside of the state, but pose a very real threat to the Commonwealth’s citizens.

1. *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 within the upper to middle crust.
2. *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 (3) times.

3. *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 which 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.

The most notable earthquake or series of earthquakes in Kentucky occurred along the New Madrid Seismic Zone from December 1811 to March 1812. Three (3) of the largest earthquakes in the contiguous United States occurred along this zone during this period. An engineer in Louisville recorded approximately 1,850 quakes throughout the four-month timeframe. The shocks from these earthquakes could be easily felt as far away as Michigan and South Carolina. An area between the St. Francois River and Mississippi River running from New Madrid, Missouri to Marked Tree, Arkansas showed numerous sand-blows (a place where liquefacted alluvial soil has geysered through the surface).

Earthquake Occurrences (1834-2003)			
Date	Location	Richter/Mercalli Value	Description
Nov. 20, 1834	Northern KY		Houses shook and plaster cracked
Dec. 27, 1841	Hickman, KY		Houses shook and Mississippi River was agitated, though no wind was blowing
January 4, 1843	Mississippi Valley		Small earthquakes were reported, but no damages or first-hand accounts of intensity were reported
Feb. 16, 1843	Mississippi Valley		Small earthquakes were reported, but no damages or first-hand accounts of intensity were reported.
March 12, 1878	Columbus, KY		A severe shock caused sections of bluff line along the Mississippi River to cave in
Dec. 7, 1915	Western Kentucky	Intensity V, VI	Buildings were strongly shaken, windows and dishes rattled, and loose objects were thrown to the floor
Oct. 26, 1916	Mayfield, KY	Intensity V	Pictures were shaken from walls
Dec. 18, 1916	Hickman, KY	Intensity VI, VII	Houses shook and chimneys partially toppled
March 2, 1924	Western Kentucky		No significant damages were reported
Sept. 2, 1925	Henderson, KY		Caused landslides and damage to a number of properties, including a chimney that was toppled in Louisville, over 100 miles away from the epicenter. Illinois, Indiana, and Tennessee were also affected.
Jan. 1, 1954	Middlesboro, KY	Intensity VI	Slight damages were reported. The tremor was felt in Tennessee, North Carolina, and Virginia.
Nov. 9, 1958	Henderson, KY	Intensity VII	Substantial masonry damage was sustained in Henderson. Significant damage was also reported in Poole, Smith Mills, and Uniontown, as well as part of southern Illinois, Indiana, and Missouri.
Nov. 9, 1968	Statewide		Strongest earthquake reported in Kentucky since 1895; affected 23 states

Earthquake Occurrences (1834-2003)			
Date	Location	Richter/Mercalli Value	Description
1977	Statewide		Originating at the Wabash Valley Fault, at least one chimney in Louisville was destroyed. earthquake, was felt by most of the Midwest.
1980	Bath County	5.2	The earthquake was recorded near Sharpsburg and was felt over all or parts of 15 State and in Ontario, Canada. Damage occurred in Indiana, Kentucky, and Ohio.
2003	Western Kentucky	4.0	Slight damage (VI) at Bardwell. Felt (V) at Arlington; (IV) at Clinton, Fulton and Wickliffe; (III) at Cunningham, Kevil, Paducah, and West Paducah. Felt in western Kentucky and in parts of Arkansas, Illinois, Indiana, Missouri, and Tennessee.

During the 1811-1812 earthquakes, notable geologic changes occurred on the landscape. Land masses along the Mississippi River were uplifted, while others subsided. Opposite New Madrid, Missouri for example, in the area around Tiptonville, Tennessee, a dome was formed that uplifted several yards. Immediately adjacent to the Tiptonville Dome, an area subsided to form a lake eighteen miles long and five miles wide, now known as Reelfoot Lake and used as a tourist and recreation area.

Ground failure and landslides were apparent throughout the Chickasaw Bluffs alongside the Mississippi River in Kentucky and Tennessee, with many fissures created throughout the region. One local observer reported that while watching the fissures form, the earth seemed to be rolling in waves several feet in height.

The damage to the area was so severe, Congress passed and President James Madison signed into law, the first disaster relief act which gave citizens in the affected area the option to obtain government lands in other territories due to the devastation that disaster had caused.

The strongest earthquake in the history of Kentucky was recorded on July 27, 1980, near Sharpsburg in Bath County, Kentucky. It registered at a magnitude of 5.2 on the Richter Scale and an Intensity VII on the Mercalli Scale. This earthquake was felt over all or parts of 15 States and in Ontario, Canada. Damage occurred in Indiana, Kentucky, and Ohio.

Property damage was estimated at $1 million at Maysville, Kentucky which is in Mason County about 50 kilometers north of the epicenter, where 37 commercial structures and 269 private residences were damaged to some extent. Multistory all-brick structures in the downtown area, many of which were built in the mid-1800s, were affected the most. Broken chimneys represented the most common type of damage observed: several toppled or were broken at or near the roofline, some had bricks loosened or broken off their tops, and others sustained cracks of varying lengths and widths. This type of damage was a community-wide effect only in Maysville.

Cracks formed in the ground about 12 kilometers from the epicenter. East of the epicenter, at Owingsville, ground cracks were estimated to be 6 to 10 centimeters deep and 30 meters long. West of the epicenter, near Little Rock, ground cracks extending toward a cistern were observed on Stoner Road.

Assessing Vulnerability by Jurisdiction: Earthquake

Grid-Level Risk Assessment Model

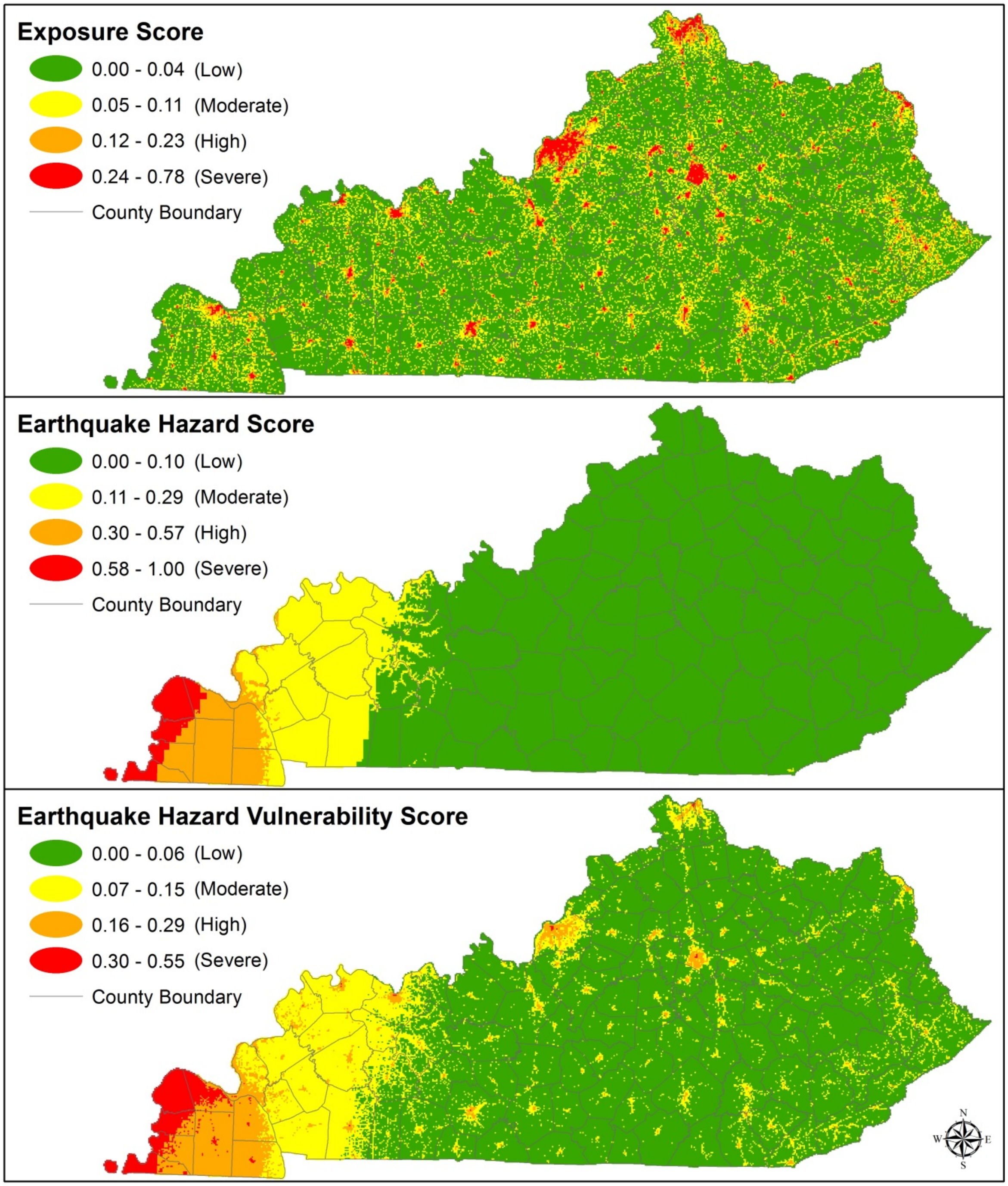
Earthquake Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to earthquake was determined through first calculating the Earthquake Hazard Score. The Earthquake Hazard Score was calculated by studying two (2) sources of data. The two (2) layers used were the USGS 2% chance in 50 years peak ground acceleration (PGA) data modified by the NEHERP soil amplification data provided by the Kentucky Geological Survey (KGS). Using FEMA's HAZUS technical manual methodology CHR modified USGS 2% chance in 50 years PGA data using NEHERP soil classification to modify PGA values based on Kentucky soil types. Combining these layers provided enhanced soil classifications for Kentucky which were used to compute soil amplifications. Next, a calculation was computed based on the average modified PGA value located within each grid. This average PGA value for each 1KM MGRS grid was then calculated and scored 0-1 to develop the Earthquake Hazard Score.

Finally, the Earthquake Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Earthquake Hazard Score and then scored 0-1. Once the final Earthquake Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

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

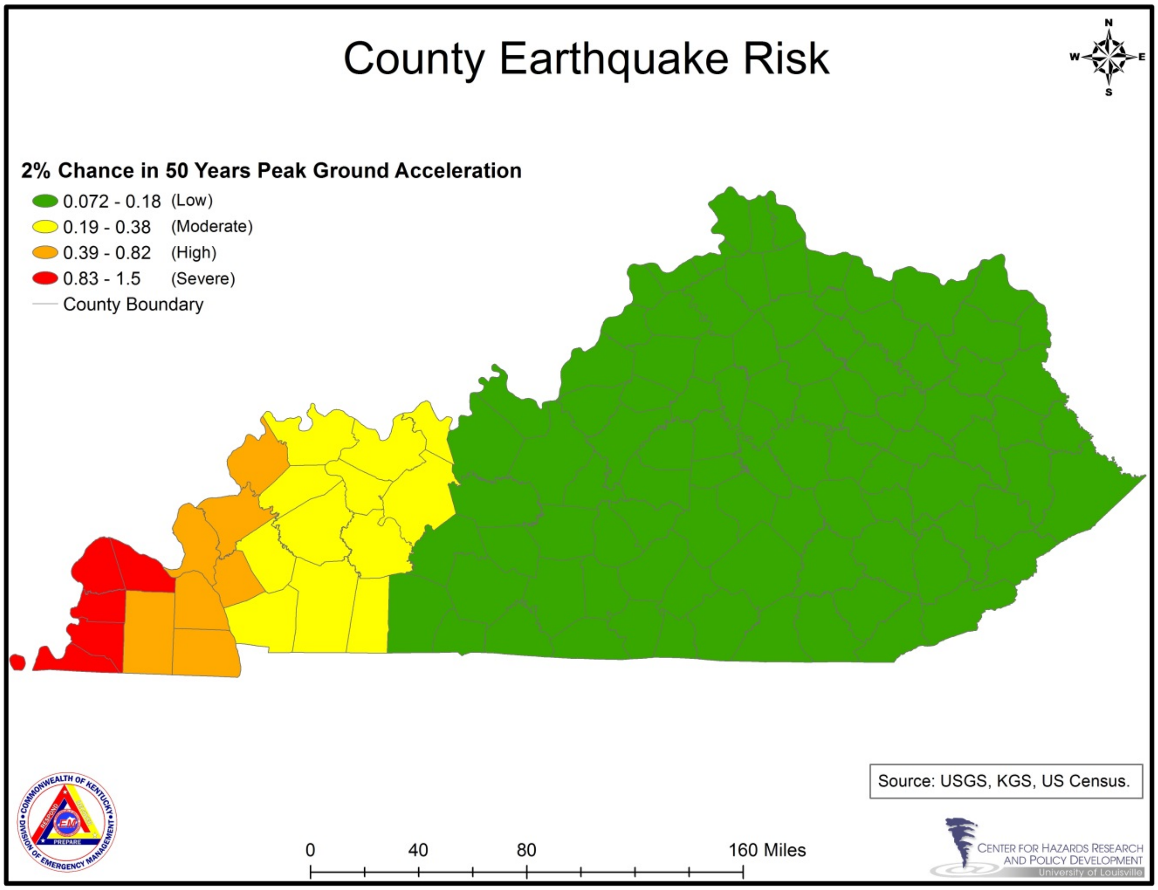


Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: Kentucky Geological Survey, USGS.

CENTER FOR HAZARDS RESEARCH AND POLICY DEVELOPMENT
University of Louisville

County-Level Risk Assessment Model

The Earthquake County Risk Assessment Model was created using the modified earthquake NEHERP soil PGA. The average PGA was calculated for each county and then joined to a county map for display as seen below.



Source: USGS, KGS, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are most likely to experience damaging earthquakes.

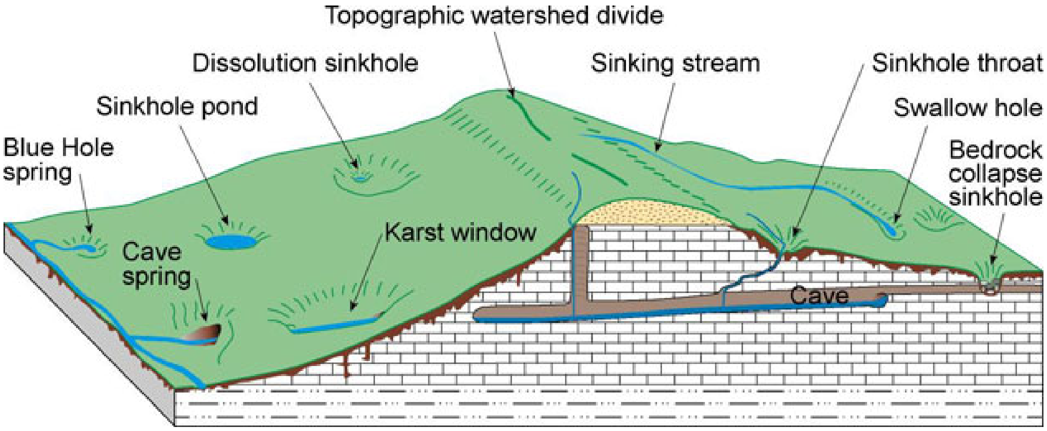
Karst/Sinkhole

Identifying Hazards: Karst/Sinkhole

Description

A term stemming from a Slavic word meaning “barren, stony ground”, Karst refers to *a terrain with distinctive landforms and hydrology created from the dissolution of soluble rock—such as limestone and other carbonate rocks—and is characterized by springs, caves, sinkholes, and a unique hydrology*.

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



(Source: Kentucky Geological Survey (KGS), http://www.uky.edu/KGS/water/general/karst/index.htm)

Most commonly seen in karst landscapes, sinkholes are defined as *concentrated areas of depressed landscape due to spaces and caverns that have developed underground in soluble rocks by the groundwater running through them*. Sinkholes may vary in area from a just a few square feet to over 100 acres and may vary in depth from just under one (1) foot to over 100 feet deep; though they typically average ten to thirty feet in depth. Most often sinkholes develop slowly over very long periods of time, but occasionally the collapse of large sinkholes cause substantial changes to the landscape and pose a threat to human populations and structures in the immediate area. The presence of karst topography and sinkholes poses a threat not only to populations and built structures, but poses a significant threat to groundwater supplies as well. For the purposes of this document, however, the focus will remain on the potential risk caused by the development of karst topography and sinkholes in terms of potential damage sustained by structures and harm posed to human populations.

Due to unique geological composition, Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania are the most at-risk states in the U.S. in terms of experiencing karst/sinkhole related events. But, approximately 20 percent of the land surface in the U.S. is classified as karst.

Because sinkholes are often very large in size, many are improperly classified as other geologic phenomena and structures are built on them. Agencies in some states are working jointly to assess the geologic composition of the terrain in conjunction with zoning laws in regions where karst/sinkholes appears to be a problem.

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

Good indicators of the development of sinkholes include; circular and linear cracks in soil, asphalt, and concrete paving and floors; depressions in soil or pavement which commonly result in ponds of water; slumping, sagging, or tilting of trees, roads, rails, fences, pipes, poles, sign boards, and other vertical or horizontal structures; downward movement of small-diameter vertical or horizontal structures; fractures in foundations and walls, often accompanied by jammed doors and windows; small conical holes that appear in the ground over a relatively short period of time; sudden muddying of water in a well which has been producing clear water; and sudden draining of a pond or creek.

Types

Sinkholes develop in a number of ways and can be categorized into five types.

1. *Collapse sinkholes* occur when the bridging material over a subsurface cavern cannot support the overlying material. The cover collapses into the cavern and a large, funnel-shaped depression forms.

2. *Solution sinkholes* result from increased groundwater flow into higher porosity zones within the rock, typically through fractures or joints within the rock. An increase of slightly acidic surface water into the subsurface continues the slow dissolution of the rock matrix, resulting in slow subsidence as surface materials fill the voids.

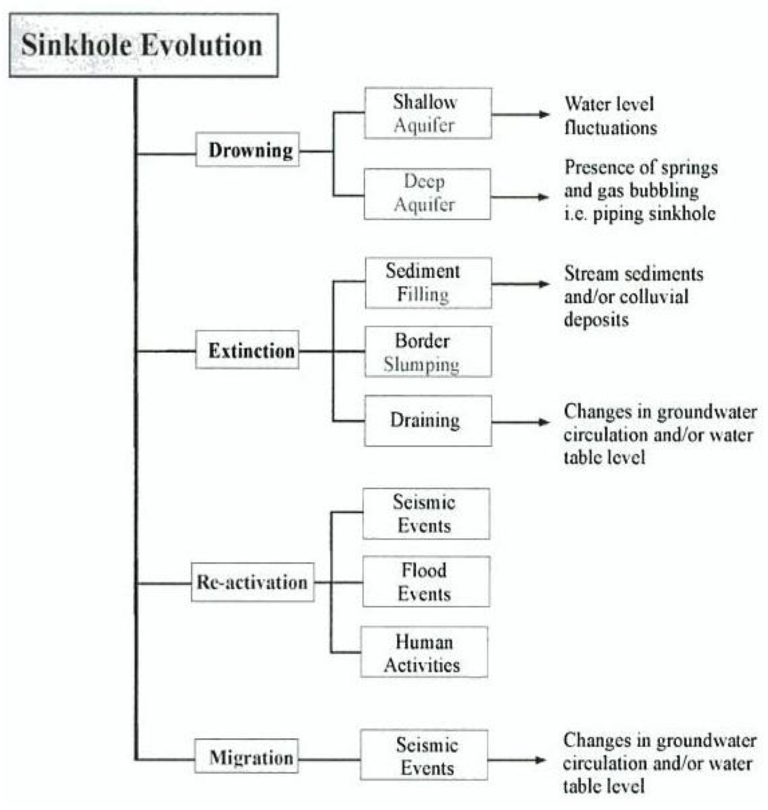
3. *Alluvial sinkholes* are older sinkholes which have been partially filled with marine, wetland, or soil sediments. These features are common in places like Florida, where the water table is shallow, and typically appear as shallow lakes, cypress domes, and wetlands.

4. *Raveling sinkholes* form when a thick overburden of sediment over a deep cavern caves into the void and pipes upward toward the surface. As the overlying material or plug erodes into the cavern, the void migrates upward until the cover can no longer be supported and then subsidence begin

5. *Cover-Collapse sinkholes* occur in the soil or other loose material overlying soluble bedrock. Sinkholes that suddenly appear form in two ways. In the first way, the bedrock roof of a cave becomes too thin to support the weight of the bedrock and the soil material above it. The cave roof then collapses, forming a bedrock-collapse sinkhole. Bedrock collapse is rare and the least likely way a sinkhole can form, although it is commonly incorrectly assumed to be the way all sinkholes form. The second way sinkholes can form is much more common and much less dramatic. The sinkhole begins to form when a fracture in the limestone bedrock is enlarged by water dissolving the limestone. As the bedrock is dissolved and carried away underground, the soil gently slumps or erodes into the developing sinkhole. Once the underlying conduits become large enough, insoluble soil and rock particles are carried away too. Cover-collapse sinkholes can vary in size from 1 or 2 feet deep and wide, to tens of feet deep and wide. The thickness and cohesiveness of the soil cover determine the size of a cover-collapse sinkhole.

Facts

- A karst landscape most commonly develops on limestone, but can develop on several other types of rocks, such as dolostone, gypsum, and salt.
- Evaporite rocks (the most soluble of common rocks), which includes gypsum and salt, underlie 35% to 40% of the U.S., though sometimes they are buried deep below the surface.
- Karst landscapes make up one-fifth of the world's land surface. The American Southeast has a proportion almost doubling that of other karstic regions of the world.
- Sixty times more fresh water lies beneath the Earth's surface than on it, so karst landscapes and their underground streams, springs, and aquifers have played a key role in supplying water to various populations for thousands of years.
- A few famous karst areas in the United States include Carlsbad Caverns in New Mexico, the many springs of Florida, and the Mammoth Cave system in Kentucky.
- Some geologists believe that sinkhole activity increases after periods of prolonged drought.
- The evolution of a sinkhole is proposed as looking like:



Impacts

The effects of sinkholes and other features typically present in karst terrain vary from the mild to the extreme and can no doubt wreak havoc on infrastructure in urban areas. Storm-water drainage is of major concern in urban areas underlain by karst geology, as the ground surface area necessary for the even infiltration of rainwater into the groundwater supply system is covered with impervious substances such as blacktop and cement. This imbalance can often have serious consequences, leading to movement of the ground which may rupture sewer lines, natural gas lines, or effect underground utility lines.

For example, in 2009, a fire truck in a Los Angeles suburb was pulled into a sinkhole that was caused by a series of pipe ruptures that stemmed from geologic phenomena. And, in 1994, an area underlain by karst produced a sinkhole the size of a small house that jeopardized Allentown, Pennsylvania's newest office building and thoroughfare. Allentown filled the sinkhole using over 700 cubic yards of concrete. The most recent national sinkhole news was about a man who was swallowed by a sinkhole that suddenly opened under his bedroom in Sefner, Florida on February 28, 2013. The depression formed by the collapse was 30 feet wide and 20 feet deep.

Groundwater contamination is also more prevalent in areas of karst geology, as percolation occurs more quickly. Contaminants such as oil from automobiles in parking lots, pesticides and herbicides from lawns, and urine and feces from cattle feed lots end up in water supplies used by surrounding communities. This type of contamination is particularly dangerous in areas where private wells are used instead of water that comes from public works. If allowed to filter naturally, an underground water source will take up to 100 human generations to filter its impurities.

Some states now have enacted insurance legislation which provides property owners affected by sinkholes some piece of mind, but most states have yet to specifically address the issue.

Profiling Hazards: Karst/Sinkhole

KARST/SINKHOLE PROFILE RISK TABLE	
Period of occurrence:	At any time
Number of events: (Unknown)	101,632 Identified Sinkholes*
Annual Rate of Occurrence:	Unknown due to lack of start and end dates
Warning time:	Weeks to months, depending on monitoring and maintenance
Potential impacts:	Economic losses such as decreased property value and agribusiness losses, and may cause minimal to severe property damage and destruction, may cause geological movement, causing infrastructure damages.
Recorded losses:	Unknown
Annualized Loss:	Unknown due to lack loss data captured on Karst/Sinkhole events
Extent (Statistical)[27]:	Location: 55% of State with rocks susceptible to developing karst terrain Size: On average 7 ft. in diameter[28]

*Data captured from Kentucky Geological Survey

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[27] The fact that sinkhole events are so common throughout Kentucky that seldom are events reported to central authorities: "Most noticeable are sinkhole flooding and cover collapse. Damage to infrastructure from these two causes is so common in Kentucky that it is typically dealt with by local authorities as a routine matter. Seldom are collapses reported to any central agency."

- □□*Source:* Cobb, Jim and James C. Currens. [May 2001]. "Karst: The Stealthy Hazard." *Geotimes*. American Geological Institute: http://www.geotimes.org/may01/feature2.html [Last accessed: 2/22/2013]

Still: "Some sinkholes [in Kentucky] are up to several hundred feet in diameter and more than 100 feet (30m) deep…Sinkholes are so numerous in…Pennyroyal that rainwater disappears underground before it has a chance to form surface streams [Palmer 1981, p. 38]."

- □□*Source:* Palmer, Arthur N. [1981]. *A Geological Guide to Mammoth Cave National Park*. Teaneck, NJ: Zephyrus Press.

And Bowling Green, Kentucky houses one of the largest sinkholes…in the world! The ***Trimodal TransPark*** sinkhole is ***200 feet wide,*** and ***35 feet deep***! It is ranked one of the "5 Giant Holes That Devoured Everything Around Them" by *Environmental Graffiti*, which is an environmental news-aggregating website.

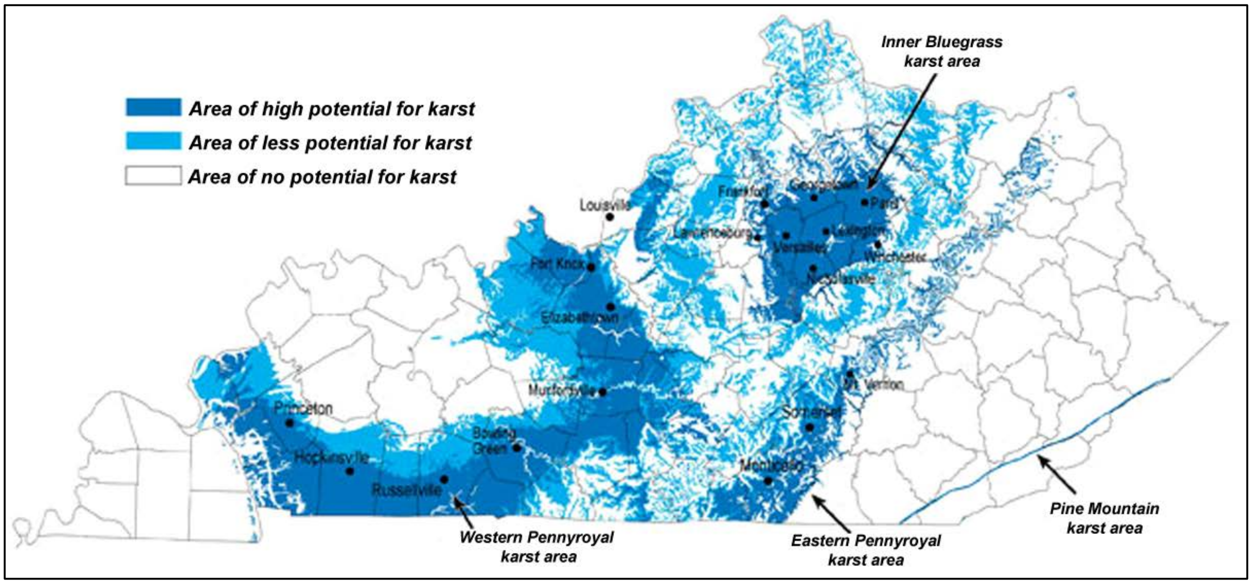
- § *Source:* Anonymous. [Date Unspecified]. "5 Giant Holes That Devoured Everything Around Them." *Environmental Graffiti*. *Can be accessed:* http://www.environmentalgraffiti.com/offbeat-news/5-giant-holes-devoured-everything-around-them/1196?image=6. [Last accessed: 2/22/2013].

The ***Trimodal TransPark*** sinkhole also is ranked by *WebEcoist* as one of the 13 "Biggest, Strangest, Most Devastating Sinkholes on Earth."

- § *Source:* Ecoist. [2012]. "13 of the Biggest, Strangest, Most Devastating Sinkholes on Earth." *WebEcoist*. Evolve Media: AtomicOnline, LLC. *Can be accessed:* http://webecoist.momtastic.com/2008/08/26/incredible-strange-amazing-sinkholes/ [Last accessed: 2/22/2013].

[28] As karst more describes terrain and the *eventual* or *probabilistic cause* of hazards, a statistical average has been used to describe "extent." In the spirit of "extent" and like using a scale or an historical extreme, the statistical average diameter of karst terrain acts a standard by which to compare individual "karst hazard events."

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 also some dolostone. The areas where those rocks are near the surface closely approximate where karst topography will form. The following map 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 them is hundreds of thousands of years old. In humid climates such as Kentucky's it is assumed that all limestone has karst development, although that development may not be visible at the surface.



Source: KGS, http://www.uky.edu/KGS/water/general/karst/where_karst.htm

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 cities located on karst include (in the Inner Bluegrass) Frankfort, Louisville, Lexington, Lawrenceburg, Georgetown, Winchester, Paris, Versailles, and Nicholasville; (in the Western Pennyroyal) the communities of Fort Knox, Bowling Green, Elizabethtown, Munfordville, Russellville, Hopkinsville, and Princeton; (in the Eastern Pennyroyal) Somerset, Monticello, and Mount Vernon.

Springs and wells in karst areas supply water to tens of thousands of homes. Much of Kentucky‘s prime farmland is underlain by karst, as is a substantial amount of the Daniel Boone National Forest with its important recreational and timber resources. Caves are also important karst features, providing recreation and unique ecosystems. Mammoth Cave is the longest surveyed cave in the world, with more than 400 miles of passages. Two (2) other caves in the state stretch more than 30 miles, and nine (9) Kentucky caves are among the 50 longest caves in the United States.

Because of these formations, Kentucky is ranked fifth in the nation of states affected by sinkholes. The most noticeable hazards in Kentucky in regards to sinkholes are sinkhole flooding and cover collapse. Damage to infrastructure from these two (2) causes is so common in Kentucky, in fact, that it is typically dealt with by local authorities as a routine matter and collapses are seldom reported to any central agency.

Previous Occurrences

In Kentucky, infrastructure damage from karst is common, as a number of dams are built in karst areas. For example, Wolf Creek Dam, located on the Cumberland River in the Western part of Russell County, Kentucky in southeastern Kentucky, was constructed in the 1940s on permeable Lower Mississippian calcareous siltstones interbedded with reef carbonates, Devonian black shale, and Upper Ordovician dolomites. Although karst conduits and caves were encountered and remediated, the extent of karst development at the site was not fully recognized during construction. In the late 1960s, sinkholes developed near the downstream toe of the dam where reservoir water was passing beneath the cutoff trench. The problem was solved with a diaphragm cutoff wall nearly 4,500 feet long and up to 278 feet deep. The repairs cost millions of dollars and could have been avoided if the original builders had obtained better on-site geological data.

Throughout the state, many other reservoirs of all sizes have leaking dams or leakage through carbonate bedrock around the dam, including leakage through caves passing under the dam of Shanty Hollow Lake in Warren County and leakage through bedrock that forms the abutment bank of Spa Lake in Logan County.

Highways are also vulnerable. In the mid-1990s, a cover-collapse sinkhole appeared overnight in the northbound lane of Interstate 65 near Elizabethtown. Fortunately, no one drove into it, but it did require extensive repairs. Exceptional costs for highway construction projects and repairs to existing roadways since 1995 are estimated to exceed a half million dollars a year.

The Kentucky Department of Emergency Services estimates that a March 1997 sinkhole flood cost more than $1 million in mitigation costs alone -- including buyouts and construction of storm water detention basins for a few counties in the central and western Kentucky karst areas. The Kentucky Geological Survey has been part of efforts to address karst-related flooding problems in several cities in the Inner Bluegrass and Western Pennyroyal since 1990. Sinkhole flooding in Bowling Green (Warren County) is well known and has prompted the county to enact strict zoning regulations and building codes. The city of Versailles has spent over $500,000 to purchase flood-damaged property in order to take remedial action. These sites suggest the average annual loss statewide exceeds $1 million from flood damage alone.

In 2008, Louisville Metro Government introduced local karst regulations which were adopted by Louisville Metro Government Council. These regulations are now part of the Louisville Development Code. The new regulations assigns responsibility to the Louisville Metro Government Planning and Design Services for the receipt and reporting of information regarding karst/sinkhole locations indicated on development plans.

Assessing Vulnerability by Jurisdiction: Karst/Sinkhole

Grid-Level Risk Assessment Model

Karst/Sinkhole Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to karst/sinkhole was determined through first calculating the Karst/Sinkhole Hazard Score. The Karst/Sinkhole Hazard Score was calculated by studying two (2) sources of data. Each of the datasets was provided by the Kentucky Geological Survey (KGS). The first layer used to create the Karst/Sinkhole Hazard Score was the KGS developed Minor and Major karst GIS layer. The KGS karst layer displays a geo-referenced data layer that depicts where karst is located. To analyze Kentucky's risk to karst/sinkhole, the karst layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the karst layer covered within each grid. This percentage of area affected by the mapped karst potential area was then calculated and scored 0-1 to develop 50% of the Karst/Sinkhole Hazard Score.

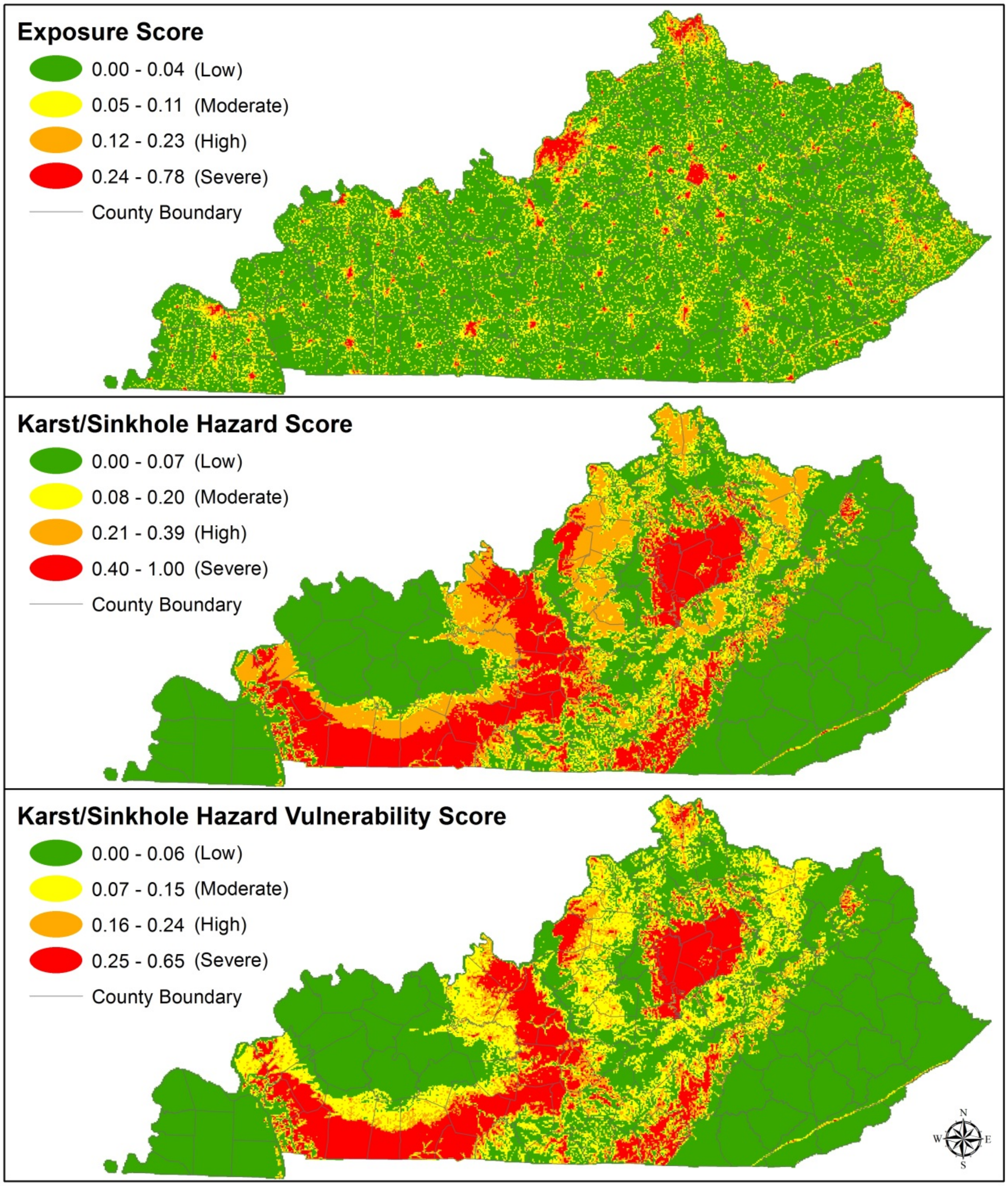
The next step was determined by calculating the percent area affected by a sinkhole polygon GIS layer provided by KGS. This data displayed where concentrations of sinkhole events have occurred, thus producing areas of risk. The KGS sinkhole layer displays a geo-referenced data layer that depicts where sinkholes have occurred. To analyze Kentucky's risk to karst/sinkhole, the sinkhole layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the sinkhole layer covered within each grid. This percentage of area affected by the mapped sinkhole areas was then calculated and scored 0-1 to develop 50% of the Karst/Sinkhole Hazard Score.

The Karst/Sinkhole Hazard Score was then calculated by adding the two (2) scores together and scored 0-1. It is important to note if the Karst/Sinkhole Hazard Score inputs equaled 0, then the Karst/Sinkhole Hazard Vulnerability Score equaled 0.

Finally, the Karst/Sinkhole Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Karst/Sinkhole Hazard Score and then scored 0-1. Once the final Karst/Sinkhole Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, and 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

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

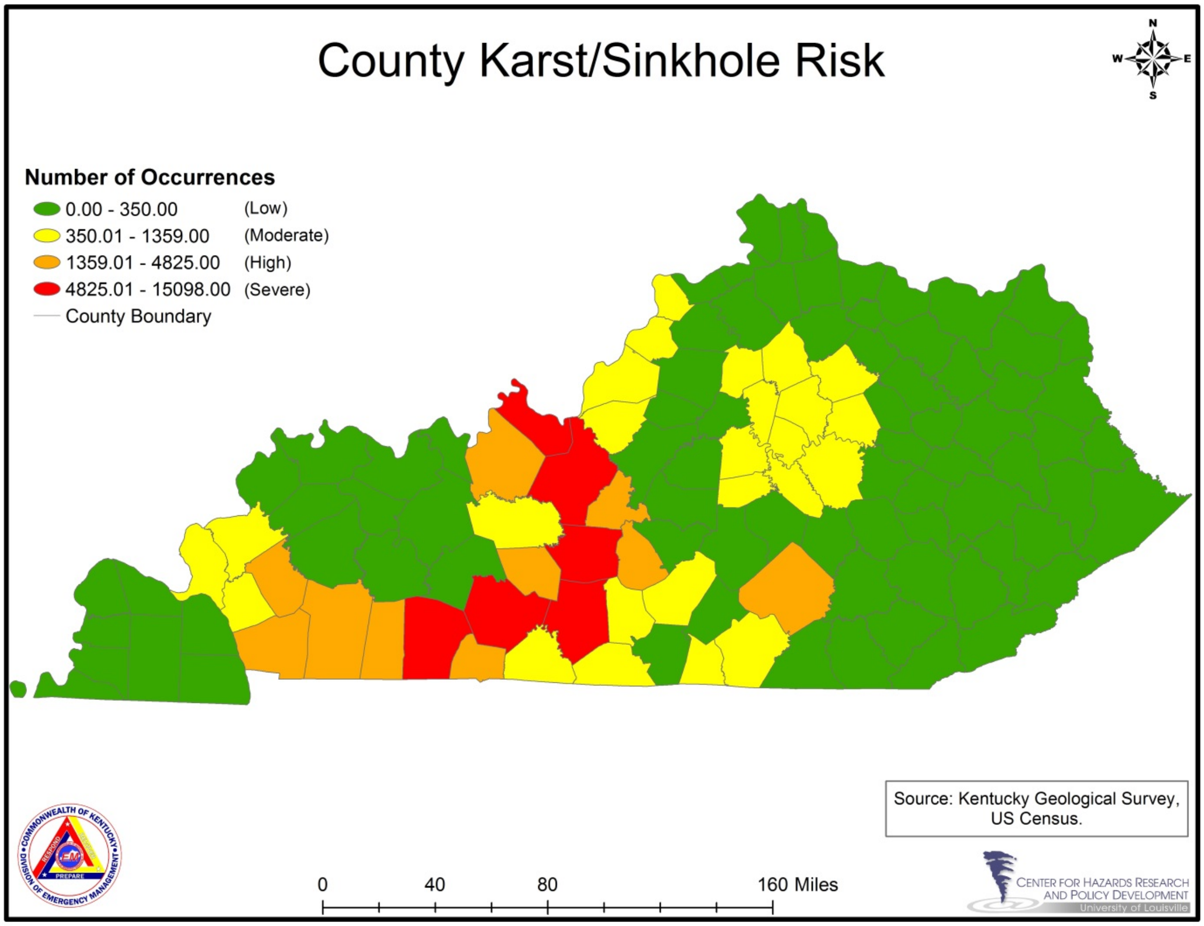


Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: Kentucky Geological Survey

Center for Hazards Research and Policy Development
University of Louisville

County-Level Risk Assessment Model

The Karst/Sinkhole County Risk Assessment Model was created computing a count of the number of sinkholes per county. This data was then joined to a county map for display as seen below.



Source: Kentucky Geological Survey, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences of sinkholes comparatively across Kentucky.

Mine/Land Subsidence

Identifying Hazards: Mine/Land Subsidence

Description

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials. Subsidence is a global problem and, in the United States, more than 17,000 square miles in 45 States, an area roughly the size of New Hampshire and Vermont combined, have been directly affected by subsidence. The principal causes are aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost. Three distinct processes account for most of the water-related subsidence--compaction of aquifer systems, drainage and subsequent oxidation of organic soils, and dissolution and collapse of susceptible rocks.

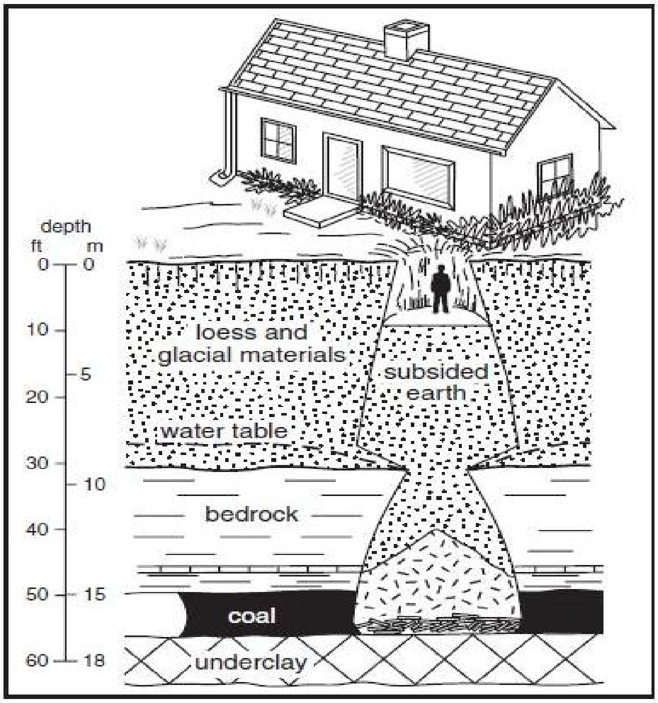
General forms of land subsidence most often occur when large amounts of ground water have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts as voids form in place of the water. As more water is withdrawn, the rock falls in on itself. The occurrence of land subsidence may easily go unnoticed because it generally covers large areas and develops gradually.

Mine subsidence, a more specific type of land subsidence, can be defined as *movement of the ground surface as a result of readjustments of the overburden due to collapse or failure of underground mine workings*. Surface subsidence features usually take the form of either very large sinkholes referred to as pits or troughs.

Mine subsidence is most often associated with coal mines, but can also be attributed to the mining of other minerals such as lead and zinc. Subsidence caused by these prior operations can wreak havoc on structures, causing large cracks in foundations, walls, and ceilings, separation of chimneys, porches, and steps from the structure, and the breakage of water, sewer, and gas lines. Popping and cracking can be heard as the structure settles and often, windows will break as well while settlement occurs. Many of the problems may occur simultaneously.

Types

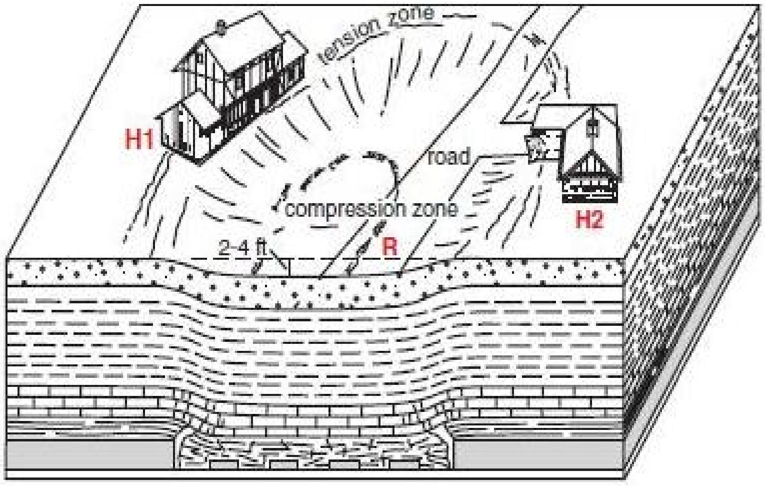
As depicted in the following drawing, pit subsidence occurs most commonly over mines that are considered fairly shallow, at less than 100 feet deep. Collapse of a mine roof causes a pit on the surface that generally ranges in depth from six (6) to eight (8) feet and in diameter from two (2) to 40 feet, although on average, a pit will reach less than 16 feet across. Just as with new sinkholes, new pits have steep sidewalls that present an added danger to humans and wildlife in the area. Pit subsidence usually occurs more rapidly than trough subsidence.



PIT SUBSIDENCE

(Source: Wildanger et al, 1980)

As shown below, trough subsidence forms gentle, more linear depressions over a broad area and most often is caused by the disintegration or collapse of coal pillars, resulting in depressions that sometime span the entire length of a whole mine panel which may be up to several hundred feet long and a few hundred feet wide.

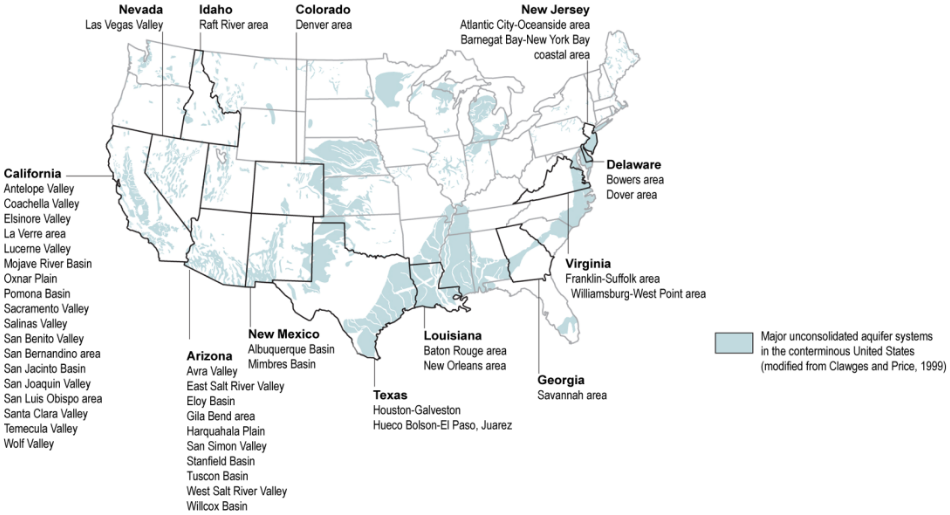


TROUGH SUBSIDENCE

(Source: Illinois State Geological Survey (ISGS), 2006.)

Facts

- Nationwide, the most common cause of land subsidence (over 80%) is the extraction of water from underground aquifers.



(Areas where subsidence has been attributed to the compaction of aquifer systems caused by ground-water pumpage. Source: USGS, http://water.usgs.gov/ogw/pubs/fs00165/)

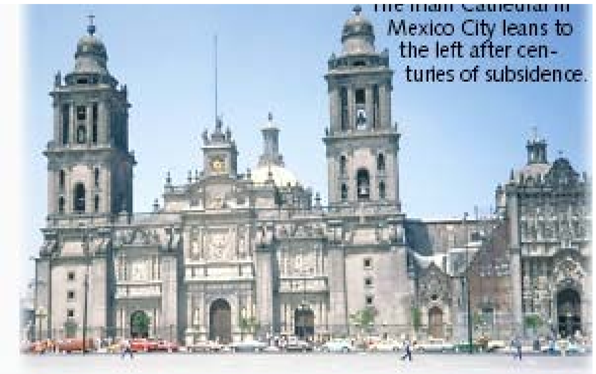
- Mine subsidence is controlled by a number of factors, including:
  - Height of mined-out area
  - Width of unsupported mine roof
  - Thickness of overburden
  - Competency of bedrock
  - Pillar dimensions
  - Hydrology
  - Fractures and joints
  - Time
- Between 1995 and 2001, the Ohio Department of Transportation spent $26.6 million to repair mine subsidence damage on eight (8) highway projects.
- An estimated 320,000 housing units in the state of Illinois are built over or adjacent to underground mines.
- In the state of Kentucky, the room-and-pillar mining technique responsible for most trough subsidence is still the most commonly used practice for underground mining.

Impacts

In areas where mining occurs, it is strongly suggested that homeowners acquire insurance coverage which specifically addresses mine subsidence. In some states property owners are required by law to possess such policies. It is for these reasons, annual out-of-pocket expenses for private landowners is much lower than that of other natural disasters, such as landslides.


Early longwall mine. Source: ISGS, 2006

Land subsidence, in general, is experienced throughout the country and the world each year, even in areas where mining isn't prevalent. The Jefferson Memorial in Washington, DC has been a sight of significant subsidence, as has the main Cathedral in Mexico City and the 15th century Inca settlement of Machu Picchu, in the Peruvian Andes.



Source: USGS, 2009

In terms of loss of human life, the potential risk associated with Mine/Land Subsidence is substantially lower than it is for other disasters such as tornadoes, earthquakes, and landslides, but it is important to keep in mind that the ground at the bottom of a pit or trough is often times not as stable as it appears. It is also important to ensure that the public is aware of the risks associated with inappropriate accessing of mine shafts, particularly those that have been abandoned for a number of years.

Profiling Hazards: Mine/Land Subsidence

MINE/LAND SUBSIDENCE PROFILE RISK TABLE	
Period of occurrence:	At any time. Chance of occurrence increases after heavy rainfall, snow melt, or construction and mining activity.
Number of events: (1981-2013)	133*
Annual Rate of Occurrence:	4.16
Warning time:	Warning times vary greatly and are often dependent upon inspection for weaknesses in rock and soil. Most subsidence problems move slowly and cause damage gradually; however some events can move very quickly.
Potential impacts:	Economic losses such as decreased land values, agribusiness losses, disruption of utility and transportation systems, and costs for any litigation. May cause geological movement, causing infrastructure damages ranging from minimal to severe. May cause injury or death and shut down critical facilities for days or weeks.
Recorded losses:	$5,550,000*
Annualized Loss:	$173,438
Extent[29]:	Deaths: Multiple per year Damage/Reclamation Costs: $13.5-14 M in mine reclamation grant dollars over a 3 year period: Some go up into the millions of dollars

*Data captured the Division of Abandoned Mine Lands (AML)

In Kentucky, land subsidence is often used interchangeably with mine subsidence, as abandoned subterranean mining operations are the most common cause of subsidence events. For this reason, subsidence is most likely to occur in the Eastern and Western coalfield regions of the state.

Kentucky coal mining has suffered more roof fall accidents and production loss due to roof collapse problems than any other coal-producing state. The geologic factors related to roof collapse commonly include faults, fractures, weak and disturbed roof strata, and rider coals (thin coals separated from the main coal seam, often by a weak shale-ridden zone).

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[29] Mine/Land Subsidence presents a tricky interpretation of “extent”: It is arbitrary to compare a mine/land subsidence event to some “standard,” whether scale-based or historically-based. The danger, the extent to how severe the havoc wrought from a mine/land subsidence event is based upon the individual and mutually exclusive characteristics of abandoned the mine/land. It is arbitrary to compare events across mines as one would compare, say, tornadoes across a certain geographical area. An abandoned mine could be 164 feet (50 meters) or over two (2) miles (approximately 12,801 feet or 3,902 meters – the Anglo Gold Ashanti’s Tautona mine) down; the extent, the absolute severity of the physical havoc to be wrought from any mine/land subsidence event is death to those experiencing the event. Otherwise, a small abandoned mine will produce a proportional “extent” in terms of physical characteristics of the damage. A large abandoned mine will produce similar proportional “extent” in terms of physical characteristics of the damage.

Although the greatest number of abandoned mines runs in a belt through western Pennsylvania, eastern Kentucky, and central West Virginia, data on past occurrences isn't maintained in any single database for the Commonwealth of Kentucky.

Dozens of people of all ages die each year in accidents that occur in and around abandoned mines, with many of these deaths occurring in Kentucky. Victims of such accidents have encountered deadly odorless gasses, fallen down holes that open under their weight, drowned in near-freezing pools of water at the bottom of shafts, and have been buried in unpredictable cave-ins.

Each year Kentucky receives an Annual Abandoned Mine Land (AML) Grant with a three year lifespan that totals approximately $13.5 - 14 million. With this funding an average of 25 to 35 reclamation projects are performed each year and costs for the projects vary from a few thousand to several million dollars.

The goal of these AML grants is to mitigate the hazards associated with subsidence and abandoned mines including landslides, dangerous highwalls, mine drainage, sedimentation and flooding, dangerous impoundments, open portals and shafts, open pits, dangerous piles and embankments, refuse piles, refuse fires, mine fires, hazardous facilities and equipment, and polluted water including surface and ground water pollution.

Assessing Vulnerability by Jurisdiction: Mine/Land Subsidence

Grid-Level Risk Assessment Model

Mine/Land Subsidence Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Mine/Land Subsidence was determined through first calculating the Mine/Land Subsidence Hazard Score. The Mine/Land Subsidence Hazard Score was calculated by studying two (2) sources of data. The first layer used to create the Mine/Land Subsidence Hazard Score was derived from a GIS mined out layer from KGS. The mined out layer displays a geo-referenced data layer that depicts where mining operations have been. To analyze Kentucky's risk to Mine/Land Subsidence, the mined out layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the mined out layer covered within each grid. This percentage of area affected by the mapped mined out areas was then calculated and scored 0-1 to develop 50% of the Mine/Land Subsidence Hazard Score.

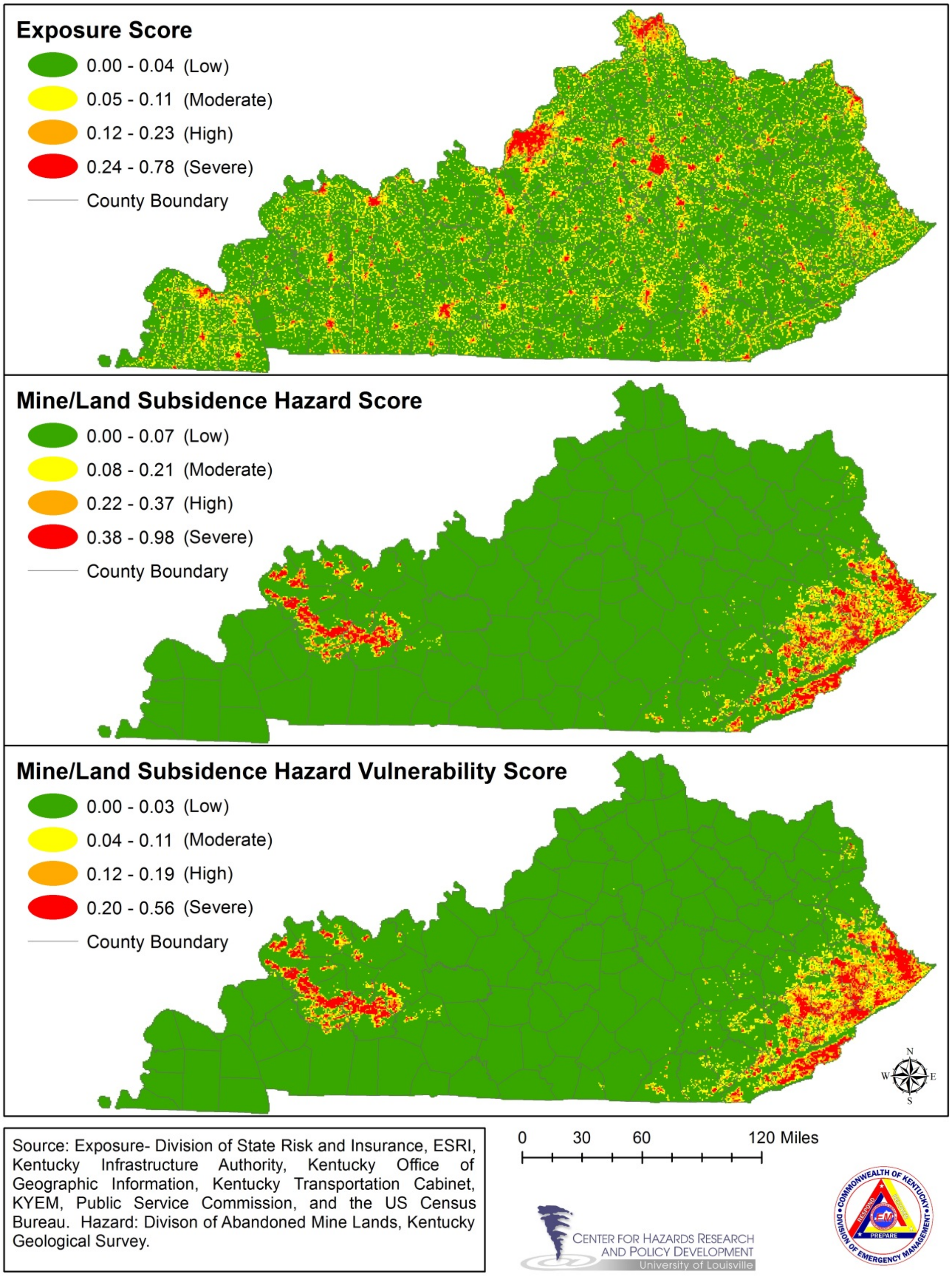
The next step was determined by calculating the number of areas AML has mitigated. This data displayed where concentrations of mine subsidence have occurred, thus producing areas of risk. The AML mitigation layer displays a geo-referenced data layer that depicts where mine subsidence has been mitigated. To analyze Kentucky's risk to Mine/Land Subsidence, the mine subsidence layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based the total number of projects that have occurred within each grid. The total number was then calculated for each grid and scored 0-1 to develop 50% of the Mine/Land Subsidence Hazard Score.

The Mine/Land Subsidence Hazard Score was then calculated by adding the two (2) scores together and scored 0-1. It is important to note if the Mine/Land Subsidence Hazard Score inputs equaled 0, then the Mine/Land Subsidence Hazard Vulnerability Score equaled 0.

Finally, the Mine/Land Subsidence Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Mine/Land Subsidence Hazard Score and then scored 0-1. Once the final Mine/Land Subsidence Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

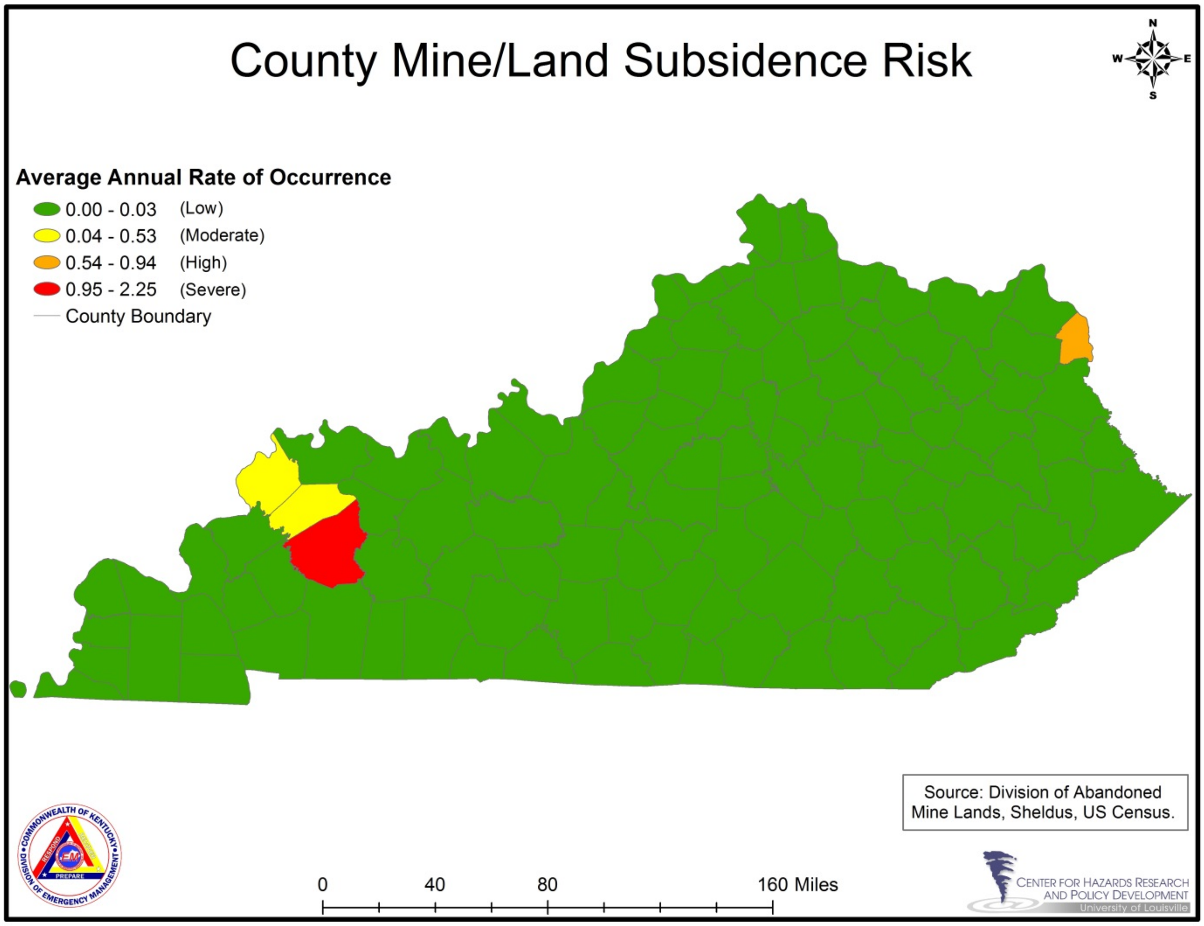
The following map displays the maps and components of the Mine/Land Subsidence Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: Divison of Abandoned Mine Lands, Kentucky Geological Survey.

County-Level Risk Assessment Model

The Mine/Land Subsidence County Risk Assessment Model was created using the Mine/Land Subsidence Annual Rate of Occurrence data for each county. The annual rate of occurrence is calculated by dividing the range of years the data has been captured by each county’s total number of occurrences (See ***Appendix 3-2*** “Hazard Average Annualized Loss”). This data was then joined to a county map for display as seen below.



Source: Division of Abandoned Mine Lands, Sheldus, US Census.

The County-Level Risk Assessment Model should be used to compare county level risk. This data depicts which counties are experiencing the most occurrences of mine subsidence comparatively across Kentucky.

Landslide

Identifying Hazards: Landslide

Description

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

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

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

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

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

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

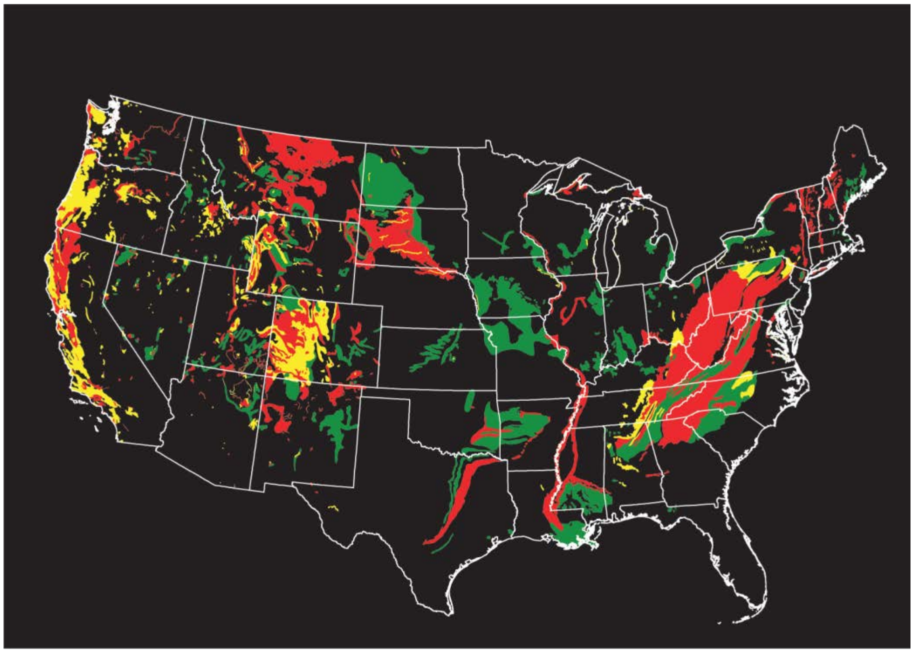
Types

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

Facts

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

USGS United States Landslide Susceptibility Map



Source: U.S. Geological Survey. 2005. http://pubs.usgs.gov/fs/2005/3156/2005-3156.pdf

Profiling Hazards: Landslide

LANDSLIDE PROFILE RISK TABLE	
Period of occurrence:	At any time. Chance of occurrence increases after heavy rainfall, snow melt, or construction and mining activities.
Number of events: (1975-2013)	1,393*
Annual Rate of Occurrence:	36.66
Warning time:	Days to months, depends on inspection for weakness in rock and soil.
Potential impacts:	Economic losses such as decreased land values, infrastructure damage, and agro-business losses. May cause minimal to severe property damage and destruction.
Recorded losses:	$28,365,706*
Annualized Loss:	$746,466
Extent:	Damage: $2 million to repair annually Location: Statewide Data Currently Unavailable related to a physical standard by which to compare landslide hazard events[30]

*Data captured from the Kentucky Geological Survey

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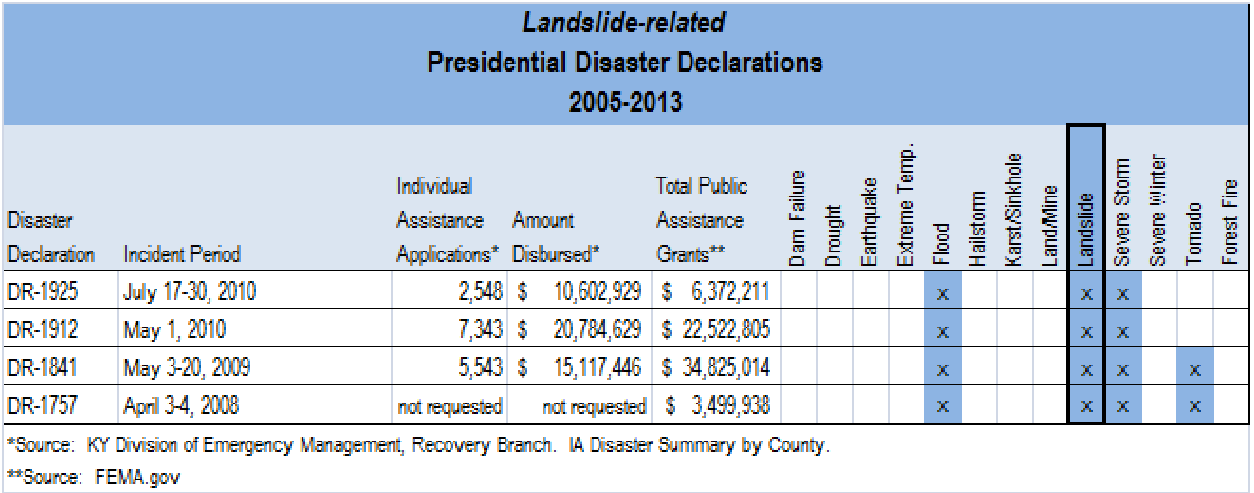
[30] The 2010 Update of the Commonwealth of Kentucky's hazard mitigation plan makes no mention of and thusly provides no data or historical context from which the "extent" of landslides within Kentucky can be compared. Further, a thorough review of literature provides ample data regarding damages resulting from landslides, but scant concerning physical descriptions of landslides within Kentucky. However, within Kentucky, we do know this: The massive 1811-1812 New Madrid Earthquake series (which remains the most powerful set of earthquakes to strike the eastern United States in recorded history) struck within Kentucky. Some oft-cited reports written in the late 19th, early 20th century allude to equally massive landslides being the result of the 1811-1812 New Madrid Earthquakes. Some of these reports even describe the physical characteristics of the resulting landslides with rather pastoral prose [e.g. Fuller 1912]. That the 1811-1812 New Madrid Earthquakes caused these landslides described so poetically has been confirmed by Jibson [1985] (and Jibson, Keefer 1988). Thus, for inexact descriptions of how bad (with what magnitude) a landslide in Kentucky can become, see the following:

- Jibson, R.W. and D.K. Keefer. [1988]. "Landslides Triggered by Earthquakes in the Central Mississippi Valley, Tennessee and Kentucky." *United States Geological Survery (USGS) Professional Paper 1336-C*. DC: United States Government Printing Office.
- Jibson, R.W. [1985]. "Landslides Caused by the 1811-1812 New Madrid Earthquakes." *Unpublished Doctoral Dissertation for Stanford University Department of Geology*.
- Penick, J.L. [1981]. *The New Madrid Earthquakes (Revised Edition)*. Columbia, MO: University of Missouri Press.
- Fuller, M.L. [1912]. "The New Madrid Earthquake." *United States Geological Survey (USGS) Bulletin 494*.
- Safford, J.M. [1869]. *Geology of Tennessee*. Nashville, TN: S.C. Mercer.
- Owen, D.D. [1856]. *Report of the Geological Survey in Kentucky, Made During the Years 1854 and 1855*. Frankfort, KY: A.G. Hodges State Printer.



Landslide-related
Presidential Disaster Declarations
2005-2013

Disaster Declaration	Incident Period	Individual Assistance Applications*	Amount Disbursed*	Total Public Assistance Grants**	Dam Failure	Drought	Earthquake	Extreme Temp.	Flood	Hailstorm	Karst/Sinkhole	Land/Mine	Landslide	Severe Storm	Severe Winter	Tornado	Forest Fire
DR-1925	July 17-30, 2010	2,548	$ 10,602,929	$ 6,372,211					x				x	x			
DR-1912	May 1, 2010	7,343	$ 20,784,629	$ 22,522,805					x				x	x			
DR-1841	May 3-20, 2009	5,543	$ 15,117,446	$ 34,825,014					x				x	x		x	
DR-1757	April 3-4, 2008	not requested	not requested	$ 3,499,938					x				x	x		x	

*Source: KY Division of Emergency Management, Recovery Branch. IA Disaster Summary by County.
**Source: FEMA.gov

Kentucky's landslides have occurred in all regions of the state, mostly in the Ohio River Valley, the Knobs, the Outer Bluegrass, and the Eastern Kentucky Coal Field. Since the early 1970's the Kentucky Transportation Cabinet and the Kentucky Transportation Center has received reports of approximately 3,000 landslides. Costs for repair of landslides exceed $2 million annually. Thousands of slides are unrelated to transportation, however, and many are unreported. These also pose significant hazards to people and infrastructure. The chart below demonstrates that landslide has been recorded in association with four presidentially declared disasters from 2008 to 2010.

Pike County, Kentucky 2010

Landslide problems in Kentucky are usually related to certain rock formations on yield soils which are unstable on moderate to steep slopes. Often, slopes are cut into or over-steeped to create additional level land for development. For example, a landslide which occurred on a connector road from Alexandria to Ashland Highway in northern Kentucky cost the state millions of dollars to repair; and an effort to create several acres of level land for a shopping complex in Laurel County triggered a landslide which created damage to a subdivision upslope from the complex and threatened a major highway below.

Landslide problems can be compounded when unrecognized ancient slides are excavated during construction. The most spectacular and well-documented reactivation of an ancient landslide in Kentucky occurred during construction of U.S. Highway 119 between Pineville and Harlan. When the contractor inadvertently excavated through an ancient landslide in this area, several slope failures were triggered. The problems caused by these failures delayed completion of the highway, significantly increased costs, and caused time-consuming and expensive ongoing maintenance for the Kentucky Transportation Cabinet.

Similarly, part of the business district of Hickman was destroyed when a contractor for the U.S. Army Corps of Engineers, in an attempt to construct a ground water cutoff wall in front of the existing floodwall, cut through an old landslide which was a resulted of the 1811-1812 earthquakes. Many homes have also been damaged or destroyed in eastern and southeastern Kentucky because they were constructed on unstable geologic formations, or because of a combination of unstable soil and rock and the subsidence of abandoned underground mines.

Below is a description of landslide events resulting from the four previously listed presidentially declared disasters:

- **July 17-30, 2010 (DR-1925):** Over the period of July 17-30 severe storms caused widespread tree and power damage, flooding and mudslides, particularly in Pike County. Up to 8 inches of rain fell in a short period of time, prompting emergency evacuations and rescues. Approximately 200 homes were damaged or destroyed by the flooding and mudslides.

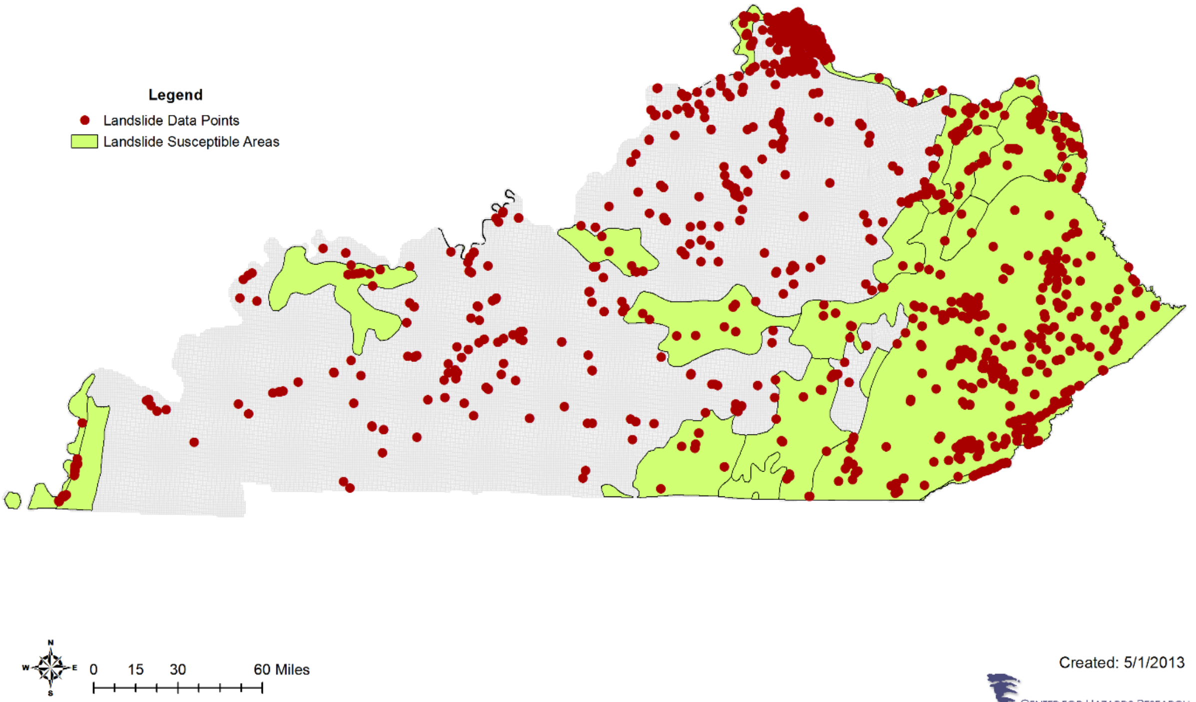
- **May 1, 2010 (DR-1912):** Multiple lines and clusters of intense showers and strong to severe thunderstorms brought a variety of severe weather to eastern Kentucky. During the overnight hours a large area of intense showers and thunderstorms dumped anywhere from 2 to over 7 inches of rainfall.
    - Estill County. Heavy rain caused a mudslide in the Hargett area on Route 89. Brown Ridge Road and Highway 89 north of Estill High School were closed due to mudslides.
    - Powell County. A report was received of a hillside collapsing into the back of a house on Skinner Branch Road in Clay City.

- **May 3-20, 2009 (DR-1841):** This major disaster declaration was due to severe storms, heavy rain, flooding, high winds, tornadoes, and mudslides in 22 counties. Starting on May 3, 2009, strong storms moved across the central and eastern parts of the Commonwealth resulting in the loss of life and private property and road closures. There were over half a million citizens impacted by this event.

- **April 3-4, 2008 (DR-1757):** Kentucky was impacted by severe thunderstorms which produced tornadoes, floods, flash flood, hail, mudslides, and landslides. This line of severe weather resulted in loss of life and personal injury, power outages, downed trees, road closures, and widespread damage. Records show that four to six inches of rain fell in a 24-hour period, with some locally higher observations exceeding eight inches.

In addition to the above mudslide occurrences resulting from four disaster declarations, the Kentucky Geological Survey (KGS) has recorded data points of landslide hazards and areas susceptible to landslides. Landslide locations come from KGS research, published maps, state and local government agencies, the public, and the media. The purpose is to provide and overall view of landslide hazards across the state. Below is a map that demonstrates landslide data points and susceptibility:

KY Landslide Inventory and Susceptibility
Source: Kentucky Geological Survey



Source: Kentucky Geological Survey

Created: 5/1/2013

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Assessing Vulnerability by Jurisdiction: Landslide

Grid-Level Risk Assessment Model

Landslide Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky’s vulnerability to Landslide was determined through first calculating the Landslide Hazard Score. The Landslide Hazard Score was calculated by studying two (2) sources of data. The first layer used to create the Landslide Hazard Score was derived from the USGS Landslide Overview GIS map layer. The landslide layer displays a geo-referenced data layer that depicts where landslide susceptibility is located throughout United States. To analyze Kentucky’s risk to Landslide, the landslide layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the landslide layer covered within each grid. This percentage of area affected by the landslide potential areas was then calculated and scored 0-1 to develop 50% of the Landslide Hazard Score.

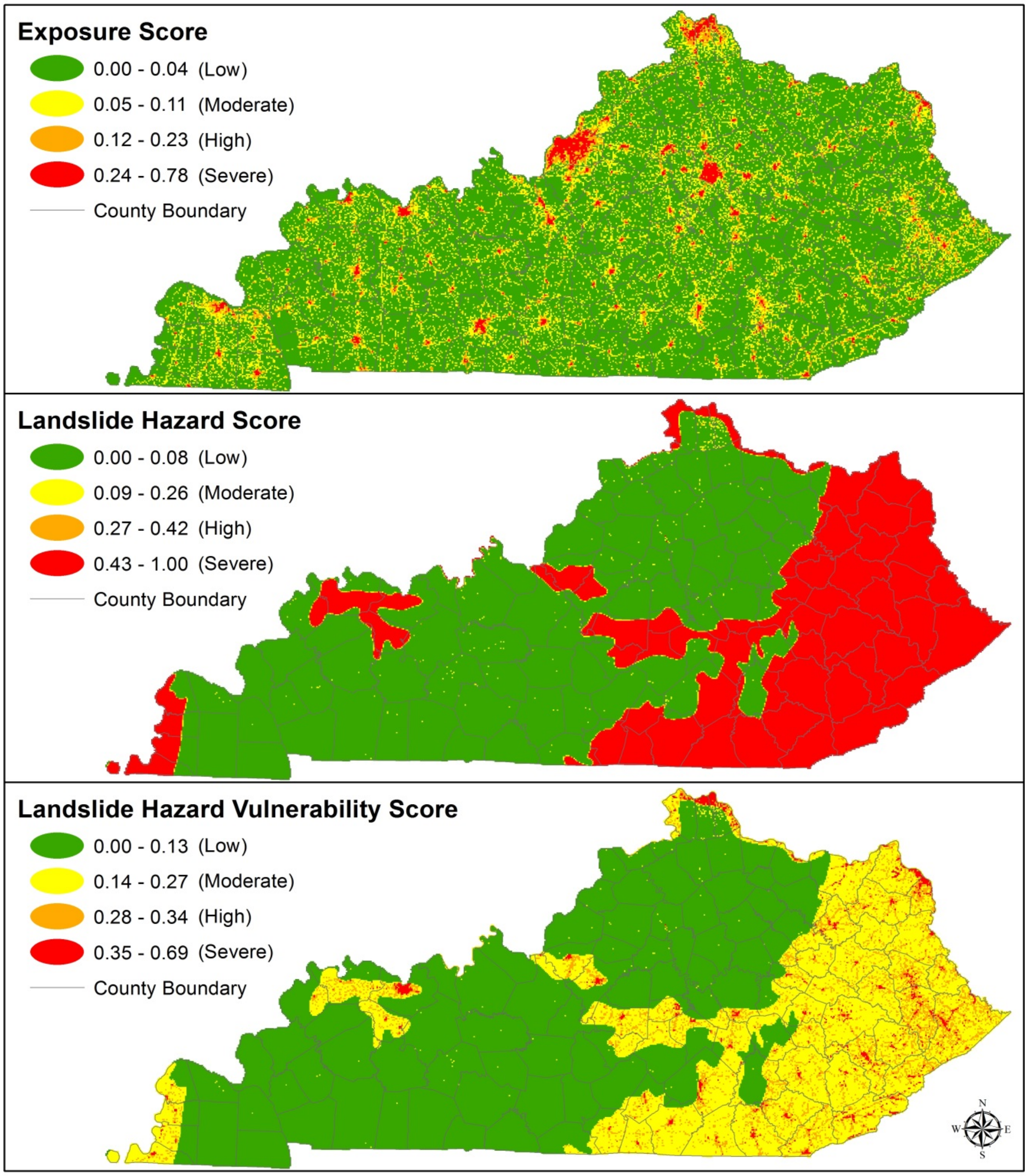
The next step was determined by calculating the number of landslide points. This point data acquired from KGS, displayed where concentrations of landslides have occurred, thus producing areas of risk. The KGS landslide point layer displays a geo-referenced data layer that depicts where landslides have been identified by KGS through a multitude of methods. To analyze Kentucky’s risk to landslide, the KGS landslide point layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based the total number of landslides that have occurred within each grid. The total number was then calculated for each grid and scored 0-1 to develop 50% of the Landslide Hazard Score.

The Landslide Hazard Score was then calculated by adding the two (2) scores together and scored 0-1. It is important to note if the Landslide Hazard Score inputs equaled 0, then the Landslide Hazard Vulnerability Score equaled 0.

Finally, the Landslide Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid’s Exposure Score by its Landslide Hazard Score and then scored 0-1. Once the final Landslide Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, and 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

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



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: Kentucky Geological Survey, USGS.

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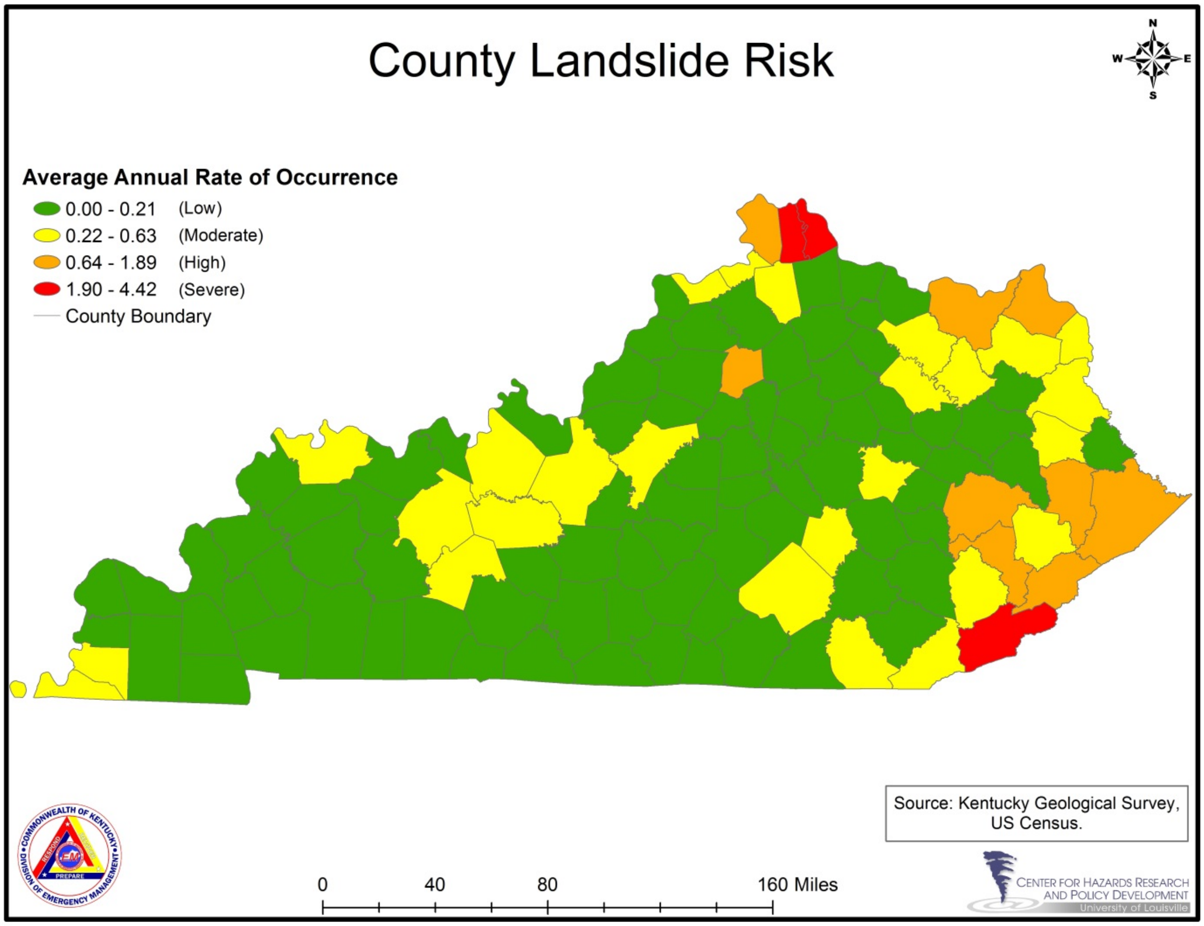
County-Level Risk Assessment Model

The Landslide County Risk Assessment Model was created using the Landslide Annual Rate of Occurrence data for each county. The annual rate of occurrence is calculated by dividing the range of years the data has been captured by each county's total number of occurrences (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



Source: Kentucky Geological Survey, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences of landslides comparatively across Kentucky.

Hazard Category: NON-SEVERE WEATHER

Forest Fire

Identifying Hazards: Forest Fire

Description

A forest fire is any non-structural fire, other than a prescribed fire, that occurs in the wildland. The term encompasses fires previously called wildland fire, wildfires and prescribed natural fires. Though often a beneficial occurrence, fires are frequently suppressed by various agencies to prevent structural loss. Forest fire suppression is a management response that results in curtailment of fire spread and eliminates all identified threats from a particular fire. This suppression, however, eventually leads to more severe fires, as vegetation becomes denser.

Types

There are three different classes of forest fires:

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

The average forest fire kills most trees up to 3-4 inches in diameter, in the area burned. These trees represent approximately 20 years of growth. In the case of up-slope burning, under severe conditions, almost every tree is killed regardless of size or type. When the trees are burned and everything is killed, then the forest is slow to reestablish itself, because of the loss of these young seedlings, saplings, pole, and sawtimber trees.

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

Other consequences of forest fires are the death of and loss of habitat for the forest's wildlife. Even when the adult animals escape, the young are left behind to perish. The heaviest wildlife lost is felt by game birds since they have ground nesting habits. Fish life also suffers as a result of the removal of stream shade and the loss of insect and plant food is destroyed by silt and lye from wood ashes washed down from burned hillsides.

Forest Fire Fuel Categories

- *Light* fuels such as shrubs, grasses, leaves, and pine needles (any fuel having a diameter of one-half inch or less) burn rapidly and are quickly ignited because they are surrounded by plenty of oxygen. Fires in light fuels spread rapidly but burn out quickly, are easily extinguished, and fuel moisture changes more rapidly than in heavier fuels.
- *Heavy* fuels such as limbs, logs, and tree trunks (any fuel one-half inch or larger in diameter) warm more slowly than light fuels, and the interiors are exposed to oxygen only after the outer portion is burned.
- *Uniform* fuels include all of the fuels distributed continuously over an area. Areas containing a network of fuels that connect with each other to provide a continuous path for a fire to spread are included in this category.
- *Patchy* fuels include all fuels distributed unevenly over an area, or as areas of fuel with definite breaks or barriers present, such as patches of rock outcroppings, bare ground, swamps, or areas where the dominant type of fuel is much less combustible.
- *Ground* fuels are all of the combustible materials lying beneath the surface including deep duff, tree roots, rotten buried logs, and other organic material.
- *Surface* fuels are all of the combustible materials lying on or immediately above the ground, including needles or leaves, duff, grass, small deadwood, downed logs, stumps, large limbs, and low shrubs.
- *Aerial* fuels are all of the green and dead materials located in the upper canopy, including tree branches and crowns, snags, hanging moss, and tall shrubs.

Fuel Types

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

Fuel Characteristics

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

Facts

- Homeowners can do much to help save their homes from forest fires, such as constructing the roof and exterior structure of a dwelling with non-combustible or fire resistant materials such as tile, slate, sheet iron, aluminum, brick or stone.
- While it was U.S. policy for most of the 20th century to suppress forest fires, fires actually benefit the ecosystem. The effects of fire can retard or accelerate the natural development of plant communities, alter species diversity and change nutrient flows.
- More than 100 years of suppressing fires, combined with past land-use practices, have resulted in a heavy buildup of dead vegetation, dense stands of trees, a shift to species that have not evolved and adapted to fire, and occasionally an increase in non-native, fire-prone plants. Because of these conditions, today's fires tend to be larger, burn hotter, and spread farther and faster, making them more severe.
- Government scientists have also concluded that "fire severity has generally increased and fire frequency has generally decreased over the last 200 years. The primary causative factors behind fire regime changes are effective fire prevention and suppression strategies, selection and regeneration cutting, domestic livestock grazing, and the introduction of exotic plants."
- Scientific analysis of the 2000 fire season revealed that the vast majority of burned acres were located in previously logged and roaded areas, not in road-less or wilderness areas.
- The Endangered Species Act permits federal officials to take actions that might impact endangered species or their habitat during times of emergency, including forest fire emergencies. Water can be taken from a river without permission from wildlife agencies during emergencies.
- There is consensus in the scientific literature dealing with fire and forest management that forests in un-roaded, un-logged areas have the most fire resiliency and present a lower fire risk compared to other areas.

- The Congressional Research Service, in an August 2000 report analyzing the impact of the fires in 2000, concluded, "Timber harvesting removes the relatively large diameter wood that can be converted into wood products, but leaves behind the small material, especially twigs and needles. The concentration of these ‘fine fuels’ on the forest floor increases the rate of spread of wildfires."
- Fire ecologists and most forest scientists agree that long-term ecological restoration with careful fire reintroduction (not increased resource extraction or aggressive fire suppression) holds the best hope of preventing future large-scale severe forest fires in fire-dependent ecosystems of the interior West.
- Many species depend on fires to improve habitat, recycle nutrients and maintain diverse habitats.
- Humans, either through negligence, accident, or intentional arson, have caused approximately 90% of all forest fires 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.

Profiling Hazards: Forest Fire

FOREST FIRE PROFILE RISK TABLE	
Period of occurrence:	Spring Forest Fire Hazard Season: Feb. 15 through April 30 Fall Forest Fire Hazard Season: Oct. 1 through Dec. 15
Number of events: (1997-2012)	22,467*
Annual Rate of Occurrence:	898.68
Warning time:	None, unless associated with drought
Potential impacts:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases.
Recorded losses:	$41,250**
Annualized Loss:	$1,650
Extent (Scale):	Year: 2010 Scale: 54,577 acres burned

*Data captured from the Kentucky Division of Forestry**Data captured from SHELDUS 10.1

“Forests cover approximately 12 million acres of land in Kentucky, representing 47 percent of the state’s land cover. The Cumberland Plateau and the Appalachians in the eastern part of the state account for 50 percent of the state’s forest cover, with 25 contiguous counties having a forest cover percentage of greater than 75 percent.

There are two defined wildfire seasons in Kentucky: February 15-April 30 and October 1-December 15. These spring and fall seasons are separated by periods of higher moisture and colder, less conducive fire weather. Leaf drop in the fall from deciduous hardwood trees produces a thick litter layer in forested areas which rapidly carries expanding wildfires. Tall grasses across the state become very flammable in the fall and during periods of drought. Wildfire occurrence is possible outside of these defined fire seasons during any prolonged periods of drought. During these wildfire seasons, specific outdoor burning laws have been established to lessen the occurrence of damaging wildfires.

Kentucky Revised Statute 149.400 prohibits outdoor burning during these fire seasons between 6 am and 6 pm unless at a distance of at least 150 feet from woodlands or brushland. Kentucky averages 1,484 wildfires a year that burn 38,000 acres of private lands. During the past ten years, these wildfires have destroyed 270 homes, structures, and improvements valued at $4,145,216.00. However, during the same time frame, 7,129 homes and structures have been saved by wildland firefighters for a value of $332,018,580.00. In the past five years wildfires in Kentucky have also been attributed to the deaths of at least five citizens including one Kentucky Division of Forestry firefighter. Based on a recent study conducted by the University of Kentucky and the Kentucky Division of Forestry (KDF), the loss in timber value over this ten year period exceeds $139,450,000.00 [Reeves and Stringer 2010[31]]. With such a clear threat to life, and property, identifying successful wildfire mitigation projects has become a priority for the state.

Kentucky's wildfire risks are compounded by the state's extremely high arson rate. Kentucky has the highest arson rate of all the 13 southern states. In fact, 62 percent of all wildfires in Kentucky are deliberately set by arsonists. Over 90 percent are human caused. These high numbers also represent a high potential for prevention efforts.

The area of Kentucky generally referred to as Appalachia poses the greatest wildfire risk within the state due to the mountainous terrain, limited access roads, and high arson occurrence. This area is the most heavily forested area of the state and heavier fuel loading increases the risks of wildfire [KDF 2013[32], *See* ***Appendix 4-2***]."

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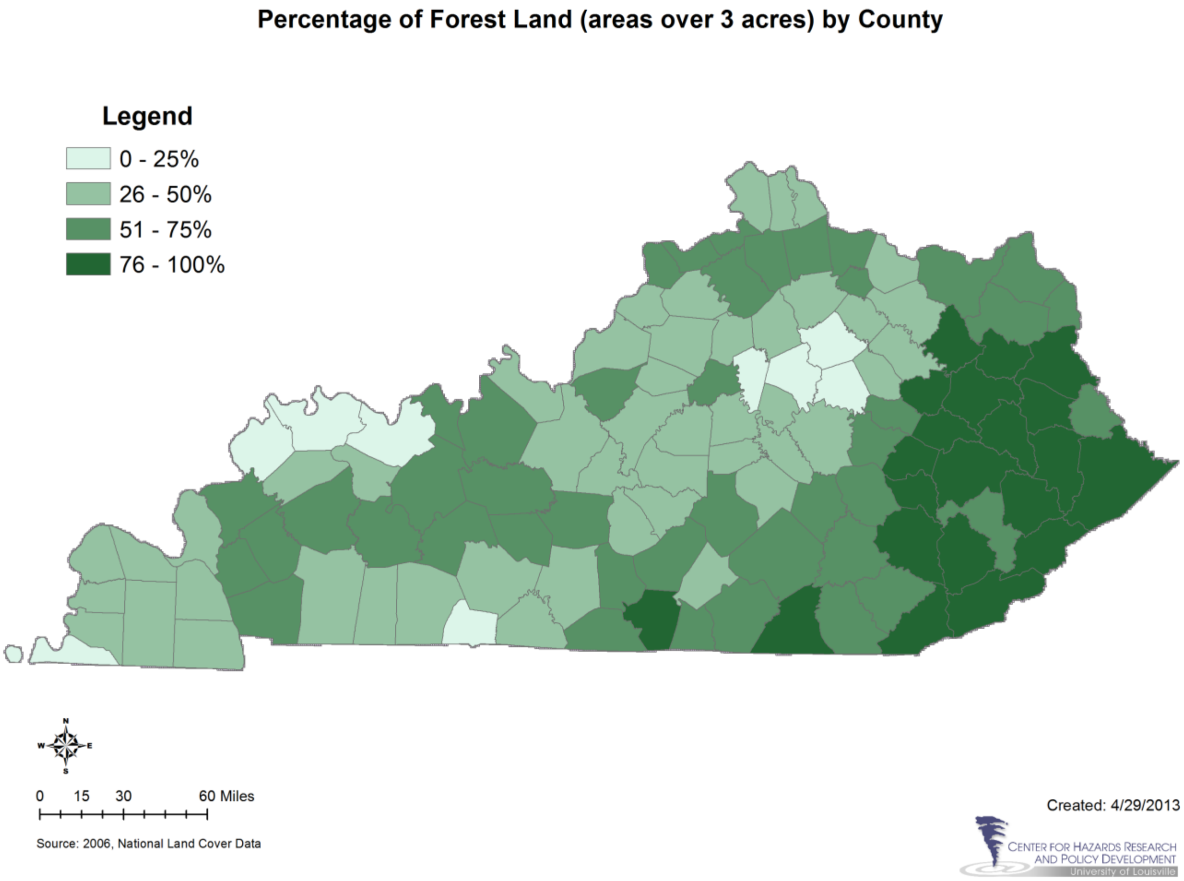
[31] Reeves, Christopher D. and Jeffrey W. Stringer. [2010]. "Economic Impact on Forest Product Values in the Appalachian Region of Kentucky and Tennessee." Lexington, KY: University of Kentucky College of Agriculture Cooperative Extension Service. *Cited within:* Division of Forestry (KDF). [2013]. "Hazard Identification: Wildfire." Unpublished Report. Frankfort, KY: Kentucky Energy and Environment Cabinet - Department for Natural Resources: Division of Forestry.

[32] Division of Forestry (KDF). [2013]. "Hazard Identification: Wildfire." Unpublished Report. Frankfort, KY: Kentucky Energy and Environment Cabinet – Department for Natural Resources: Division of Forestry. *[A copy of this report has been appended to this plan:* ***Appendix 4-2****].*



Percentage of Forest Land (areas over 3 acres) by County

Source: 2006, National Land Cover Data

Created: 4/29/2013

Oak-hickory is the dominant forest cover and covers 8.4 million acres, or 72 percent of the state's forested land. Oak-pine forests make up 9 percent, maple-beech-birch and aspen-birch make up 7 percent, oak-gum-cypress and elm-ash-cottonwood make up 6 percent, softwood makes up 5 percent, and non-stocked, 1 percent.

Intentionally setting a fire on a land owned by another is illegal in Kentucky Revised Statute (KRS 149.380). The penalties include a fine of no less than $1,000 or more than $10,000, imprisonment for not more than five (5) years, or both fine and imprisonment.

The Kentucky Division of Forestry is responsible for fighting forest fires on private lands and enforcing forest first

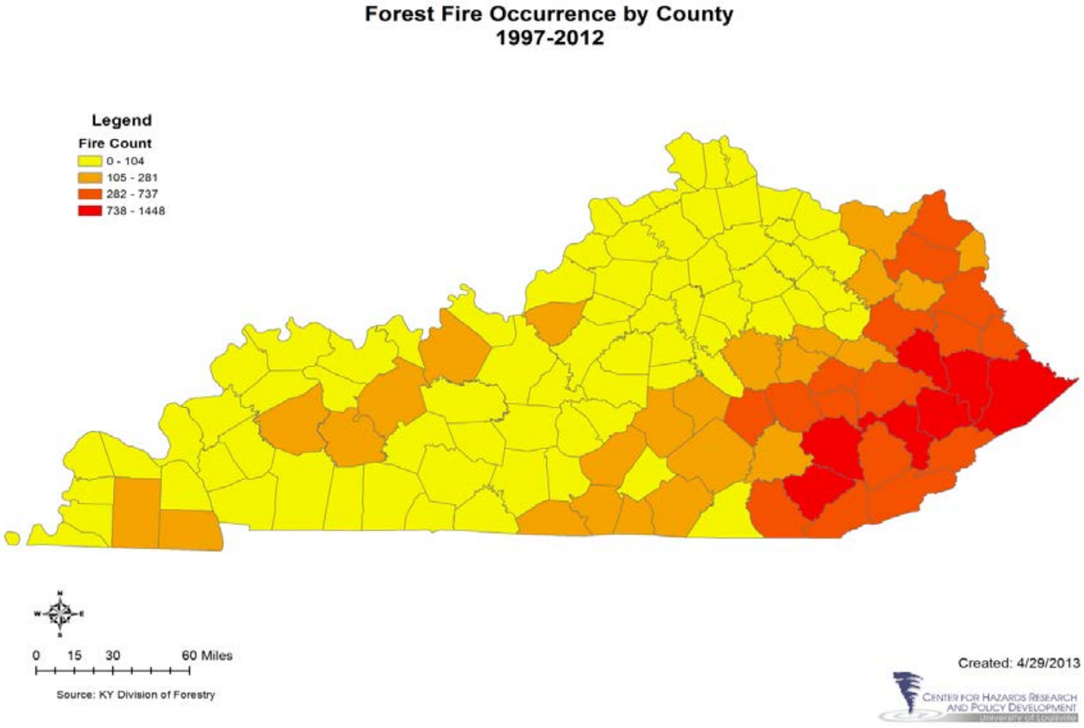
Kentucky Fire and Acres Burned 2003-2012

Year	No. of Fires	Acres Burned
2003	927	19,699
2004	1,470	26,916
2005	1,710	51,587
2006	1,857	49,759
2007	1,956	52,506
2008	1,480	34,381
2009	1,369	40,934
2010	1,830	54,577
2011	1,002	23,090
2012	1,234	32,855
TOTALS	14,835	386,305

Source: KY Division of Forestry Wildland Fire Management. Retrieved on: April 29, 2013 at http://forestry.ky.gov/wildlandfiremanagement/Pages/default.aspx hazard seasons and other outdoor burning regulations. Although the lead agency, there is no one agency that can fight all the forest fires in Kentucky.

“The Kentucky Division of Forestry protects nearly 12 million acres of privately owned forest acres across the state. The mission statement for the Division is to protect, conserve and enhance the forest resources of the Commonwealth through a public informed of the environmental, social, and economic importance of these resources. The Division currently has 146 full time employees, made up of foresters, county rangers, and tree nursery workers. In 2013 KDF restructured its nine district offices into five regional offices, concentrating resources and personnel to more efficiently meet the state’s fire suppression and forest stewardship challenges [KDF 2013[33], *See **Appendix 4-2***].”

For data used to develop the forest fire profile, reports and statistics from Wildland Fire Management Branch provide updated information daily throughout the fire hazard season and periodically throughout the year.


Forest Fire Occurrence by County
1997-2012

Source: KY Division of Forestry

Created: 4/29/2013

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[33] Division of Forestry (KDF). [2013]. “Hazard Identification: Wildfire.” Unpublished Report. Frankfort, KY: Kentucky Energy and Environment Cabinet – Department for Natural Resources: Division of Forestry. *[A copy of this report has been appended to this plan: **Appendix 4-2**].*

Assessing Vulnerability by Jurisdiction: Forest Fire

Grid-Level Risk Assessment Model

Forest Fire Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Forest Fire was determined through first calculating the Forest Fire Hazard Score. The Forest Fire Hazard Score was calculated by studying two (2) sources of data. The first layer used to create the Forest Fire Hazard Score was derived from the USGS NLCD land cover GIS map layer. This layer was used to calculate three (3) acre or higher forested areas to display forest fire potential. The NLCD land cover layer displays a geo-referenced data layer that depicts where forest fire potential could be based on three (3) acre forest coverage. To analyze Kentucky's risk to forest fire, the forest fire layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the forest fire layer covered within each grid. This percentage of area affected by the forest fire potential areas was then calculated and scored 0-1 to develop 50% of the Forest Fire Hazard Score.

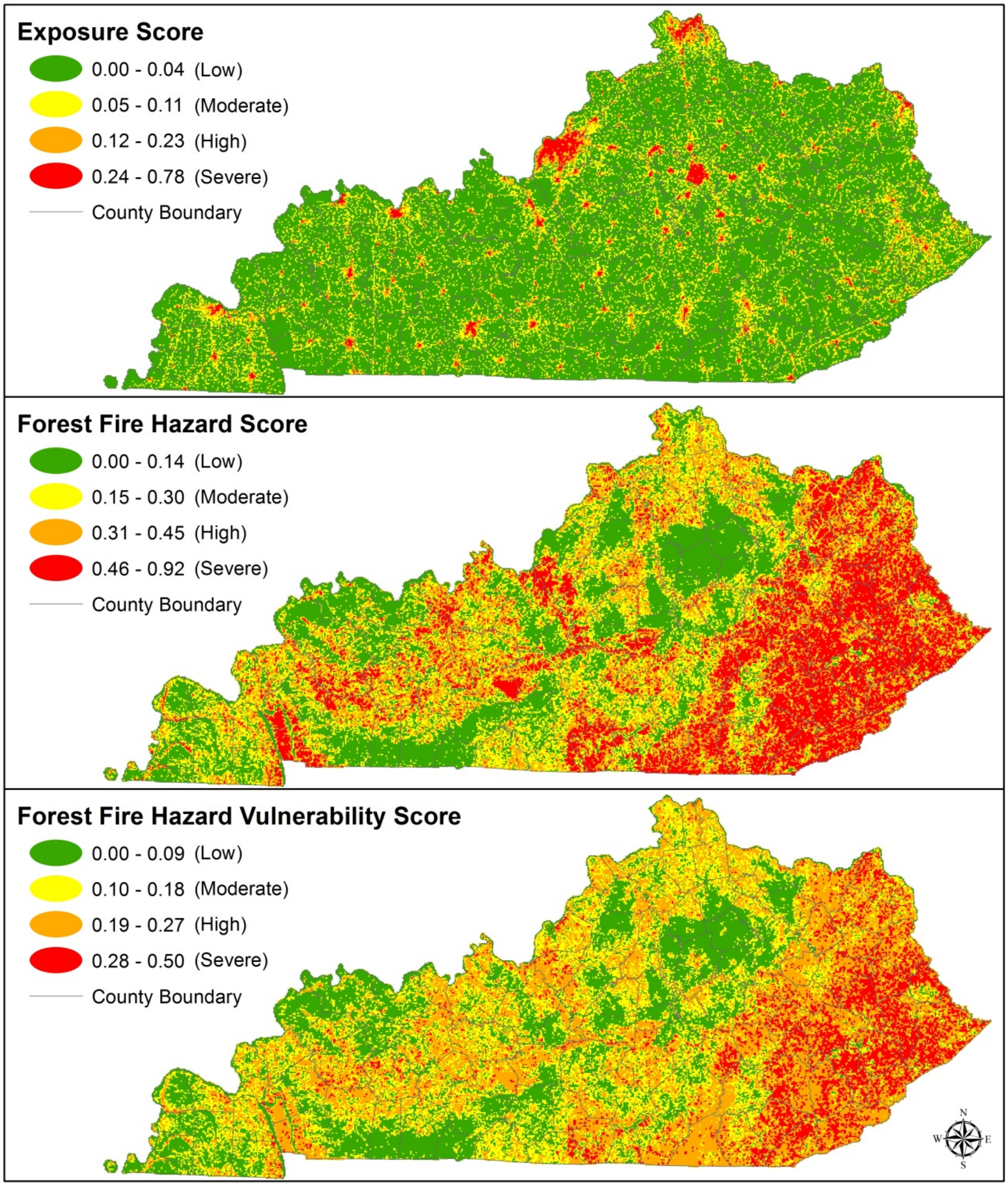
The next step was determined by calculating the number of forest fire points. This point data acquired from Kentucky Division of Forestry (KDF), displayed where concentrations of forest fires have occurred, thus producing areas of risk. The KDF forest fire point layer displays a geo-referenced data layer that depicts where forest fires have been identified. To analyze Kentucky's risk to forest fire, the KDF forest fire point layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based the total number of forest fires that have occurred within each grid. The total number was then calculated for each grid and scored 0-1 to develop 50% of the Forest Fire Hazard Score.

The Forest Fire Hazard Score was then calculated by adding the two (2) scores together and scored 0-1. It is important to note if the Forest Fire Hazard Score inputs equaled 0, then the Forest Fire Hazard Vulnerability Score equaled 0.

Finally, the Forest Fire Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Forest Fire Hazard Score and then scored 0-1. Once the final Forest Fire Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

The following map displays the maps and components of the Forest Fire Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: Kentucky Division of Forestry, USGS

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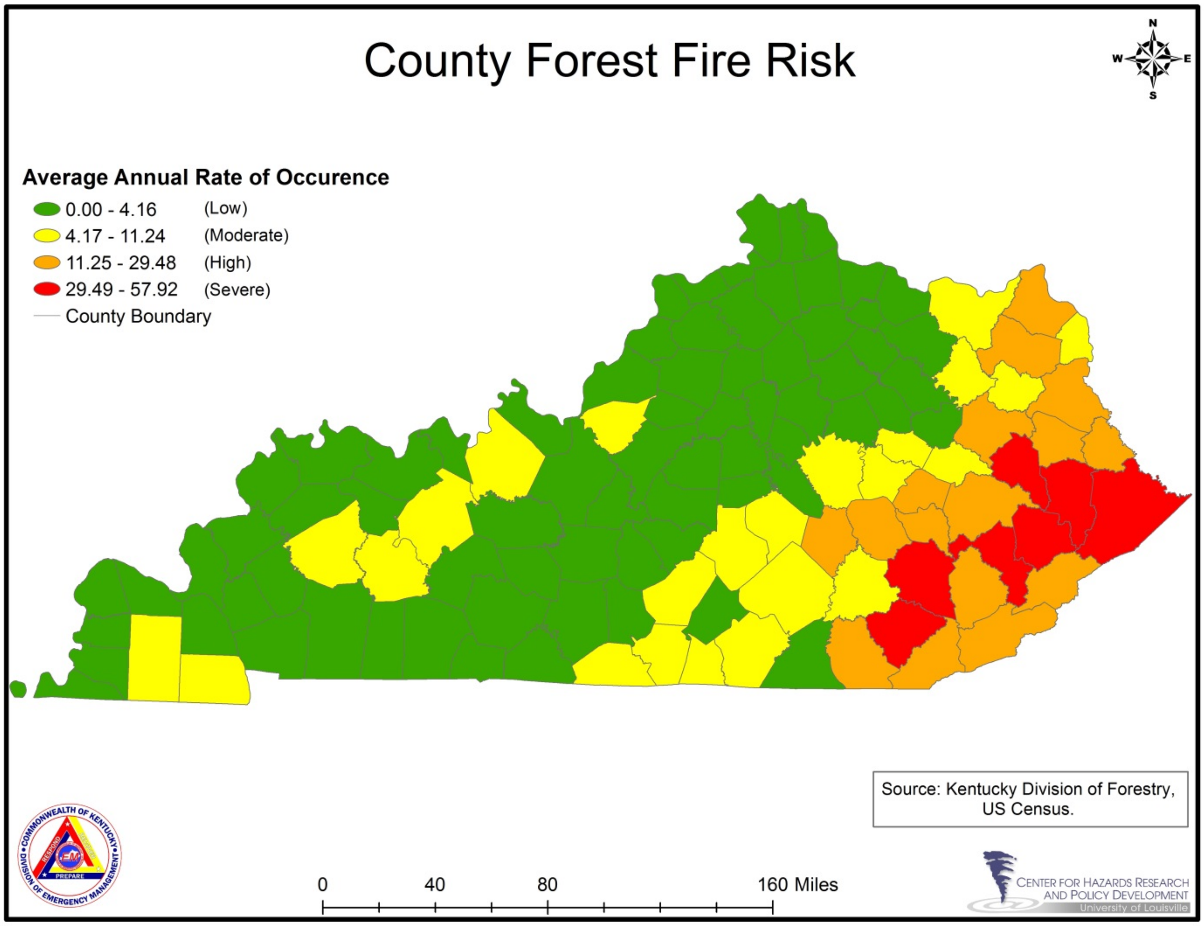
University of Louisville

County-Level Risk Assessment Model

The Forest Fire County Risk Assessment Model was created using the Forrest Fire Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by their average losses (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



Source: Kentucky Division of Forestry, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences of forest fire comparatively across Kentucky.

Hazard Category: SEVERE WEATHER

Drought

Identifying Hazards: Drought

Description

Drought is a natural and recurring feature of Kentucky’s climate that can be considered a “severe" weather event much like a tornado, a flood, or a hurricane. However, there are few key differences which distinguish drought from other weather events, making it difficult to detect and track.

Part of the difficulty in detecting drought is in the lack of an obvious onset of drought conditions. A drought develops slowly and can appear to mimic a normal spell of dry weather in the summer, a time of the year when dry weather is accepted and expected. Short-term rainfall shortages create problems for agricultural crops, livestock, urban landscapes, and other activities that depend on stored soil moisture between rainfall events.

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, thus making definitions of drought specific to particular situations.

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

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 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 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.

Types

There are many different indices for measuring drought. Although none are superior to the others, some indices are better for certain situations. The Palmer Drought Severity Index (PDSI) is currently used by the U.S. Department of Agriculture to help determine when grant assistance is needed. This index is also helpful for areas of widely similar topography. As Kentucky has relatively similar topography (with exceptions in the eastern portion of the state) and also has a great deal of agriculture, the PDSI will be used in the state plan. The index measures the level of recorded precipitation against the average, or normal, amount of precipitation for a region.

Palmer Classifications System (PDSI)	
+4.0 in. or more	extremely wet
3.0 in to 3.99 in	very wet
2.0 in to 2.99 in	moderately wet
1.0 in to 1.99 in	slightly wet
0.5 in to 0.99 in	incipient wet spell
0.49 in to -0.49 in	near normal
-0.5 in to -0.99 in	incipient dry spell
-1.9 in to -1.99 in	mild drought
-2.0 in to -2.99 in	moderate drought
-3.0 in to -3.99 in	severe drought
-4.0 in or less	extreme drought

Source: National Oceanic and Atmospheric Association (NOAA)

Facts

- High temperatures, prolonged high winds, and low relative humidity can aggravate drought conditions.
- Droughts can lead to economic losses such as unemployment, decreased land values, and agribusiness losses.
- In 2011, in Texas alone, almost 2.5 billion dollars in property and crop damages were attributed to drought.

Primary Impacts

- Crop failure is the most crucial effect of drought. Drought has a direct impact on the economy and in many cases the health of the population that is affected. Due to a lack of water and moisture in the soil, many crops will not produce normally or efficiently and in many cases, may be lost entirely.
- Water shortage is a very serious effect of drought. The availability of potable water is severely decreased when drought conditions persist. Springs, wells, streams, and reservoirs have been known to run dry due to the decrease in ground water, and, in extreme cases, rivers have become unsafe for navigation as a result of drought.

Secondary Impacts

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

Tertiary Impacts

- Environmental degradation via erosion and ecological damage can be additional results of drought. As moisture in topsoil dissipates and the ground becomes dryer, the susceptibility to windblown erosion increases. In prolonged drought situations loss of habitat for certain species native to that particular environment is possible. Prolonged drought conditions may also result in loss of food sources for certain species.
- In prolonged drought situations the soil surrounding structures subsides, sometimes creating cracks in foundations and separation of foundations from above ground portions of the structure. Forest root systems may be damaged or destroyed through a similar process.

Profiling Hazards: Drought

FOREST FIRE PROFILE RISK TABLE	
Period of occurrence:	Drought can occur at any time of the year in any part of Kentucky
Number of events: (1960-2013)	121*
Annual Rate of Occurrence:	2.28
Warning time:	Warning times for drought are not applicable as they are for severe storms or winter weather. Drought is onset by a period of similar weather and precipitation conditions. Predictability and preparedness is based mostly on the awareness of populations drought conditions are affecting.
Potential impacts:	Impacts to human life, health, and public safety are possible. Utility damage and failure, infrastructure damage (transportation and communication systems), structural damage, potential increase in risk of wild fire, and the possibility of damaged or destroyed critical facilities are additional impacts. Most impacts result from wildfire, extreme dry conditions, or dust storms.
Recorded losses:	$301,317,375*
Annualized Loss:	$2,490,226
Extent (Historical & Scale):	Year: 1996 Scale: 1.5 inches of rain measured between July and September Damages: $155 M in crop losses

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)

Kentucky Drought Action Levels

Drought Advisories

Drought Level I: "Official" recognition of drought

Drought Level II: Serious impacts to human and environment

Drought Level III: Substantial impacts to human and environment

A Level 1 drought indicates moderate drought conditions have developed primarily affecting soil moisture and vegetative health. Serious impacts to agricultural water needs, an increased wildfire risk, water supply shortages with systems on small lakes and reservoirs, and other water-sensitive sectors can be expected in the designated areas.

A Drought Level I declaration will be considered when at least three (3) of the five (5) indicators meet the trigger threshold. At this stage of drought it is expected that some level of drought impact will be observed in one or more drought management regions.

A Level 2 drought indicates that the Level 1 risks are becoming an actuality. Low stream flows and lower-than-normal lake levels could lead to water conservation advisories and/or mandatory restrictions on water use.

A Drought Level II declaration will be considered when at least three (3) of the five (5) indicators meet the trigger threshold. At this stage of drought it is expected that drought impacts, some severe, will be observed in all of the affected drought management regions including:

- Moderate to severe impacts to water-sensitive enterprises
- Unusually high demands placed on water treatment facilities
- Depletion of water supplies in shallow wells, springs and small ponds
- Reports of water conservation advisories from communities with drought-vulnerable sources of supply
- Increased incidence wildland and residential fires

A Drought Level III declaration will be considered when at least three (3) of the five (5) indicators meet the trigger threshold. During this stage of drought it is expected that drought impacts will be widespread and severe and develop into emergencies if drought conditions are not abated, including:

- Severe to extreme impacts to water-sensitive enterprises
- Loss of water supplies in shallow wells, springs and small ponds
- Multiple occurrences of water utilities requiring mandatory water-use restrictions or declaring local water shortage emergencies

- Critical low streamflows impacting water quality and aquatic habitat
- Frequent reports of water utilities having difficulties with adequate treatment for iron or manganese, or with taste and odor problems
- Critically low flows in some major rivers that provide drinking water to large population centers in the drought management regions
- Increased incidence of conflicts between users of diminishing water resources
- Increased incidence wildland and residential fires

Although bits and pieces of data on drought occurrence exist, most of the information is in the form of news reports and historical records. As referenced in Drought's description above, the Palmer Drought Severity Index (PDSI) is the most widely used measurement of drought severity. Unfortunately, significant figures and information regarding these periods of drought are difficult to find, if they even exist at all.

For example, NOAA NCDC data indicated 32 state-wide drought events, where SHELDUS showed only two (2) state-wide significant events since 1999. 2007 was recorded as being one of the driest years since the 1940's and 2012 was the worst drought year since the 1950s for the entire country as well as Kentucky yet no in depth data has been found on the effects of this particular drought.

According to NOAA, there have been 16 recorded drought occurrences in Kentucky since 1996. Only three (3) of those droughts caused serious damage to agricultural yields. The 1996 drought affected 20 counties in western Kentucky with crop damages assessed around $154 million. In 2002, 22 counties in Kentucky were affected with losses assessed at $70 million. Drought in 2007 again affected 22 counties in western Kentucky, resulting in a loss of over $48 million in crop damages. There were no injuries or deaths reported as a result of these droughts.

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

The severe summer drought of 1996 took a major toll on crops and plants across the state. Rainfall at Paducah, Kentucky was only one and a half inches from July through September of that year. Paducah usually receives around ten inches of rain for that period. Soybean crops sustained the greatest losses, estimated near $70 million. Additionally, tobacco losses amounted to $50 million and corn losses approached $35 million. Total crop losses in western Kentucky alone were near $155 million, which prompted an agricultural disaster declaration by state and federal governments. The root systems of many shrubs and young trees were damaged. Many died as a result of the drought.

Other, large-scale effects of the 1996 drought can be seen in fire damage and water shortages. During the drought, the danger of wild fire reached extreme levels. The largest fire occurred east of Central City in Muhlenberg County. It eventually covered close to 1,000 acres, prompting the closure of the Western Kentucky Parkway for several hours. Another large fire, estimated as having a burn area of around 500 acres, ignited in Hickman County. This fire, which may have been sparked by a passing train, burned numerous corn and soybean fields. Finally, a 100-acre cornfield fire near Henderson Kentucky closed the Pennyrile Parkway for about an hour and forced the brief evacuation of a local nursing home. The Kentucky Division of Water declared a water shortage warning for the Pennyrile area, which includes the cities of Owensboro and Hopkinsville. No mandatory water conservation measures were imposed however.

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

During this event, 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 sixteen 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.

In October of 2010, a drought declaration was issued for 50 counties in seven DMAs under a Level 2 declaration and 35 counties in eight DMAs under a Level 1 declaration with agricultural disasters and wildfires becoming a major concern. As of October 12, 38 Kentucky counties were under burn bans.

Assessing Vulnerability by Jurisdiction: Drought

Grid-Level Risk Assessment Model

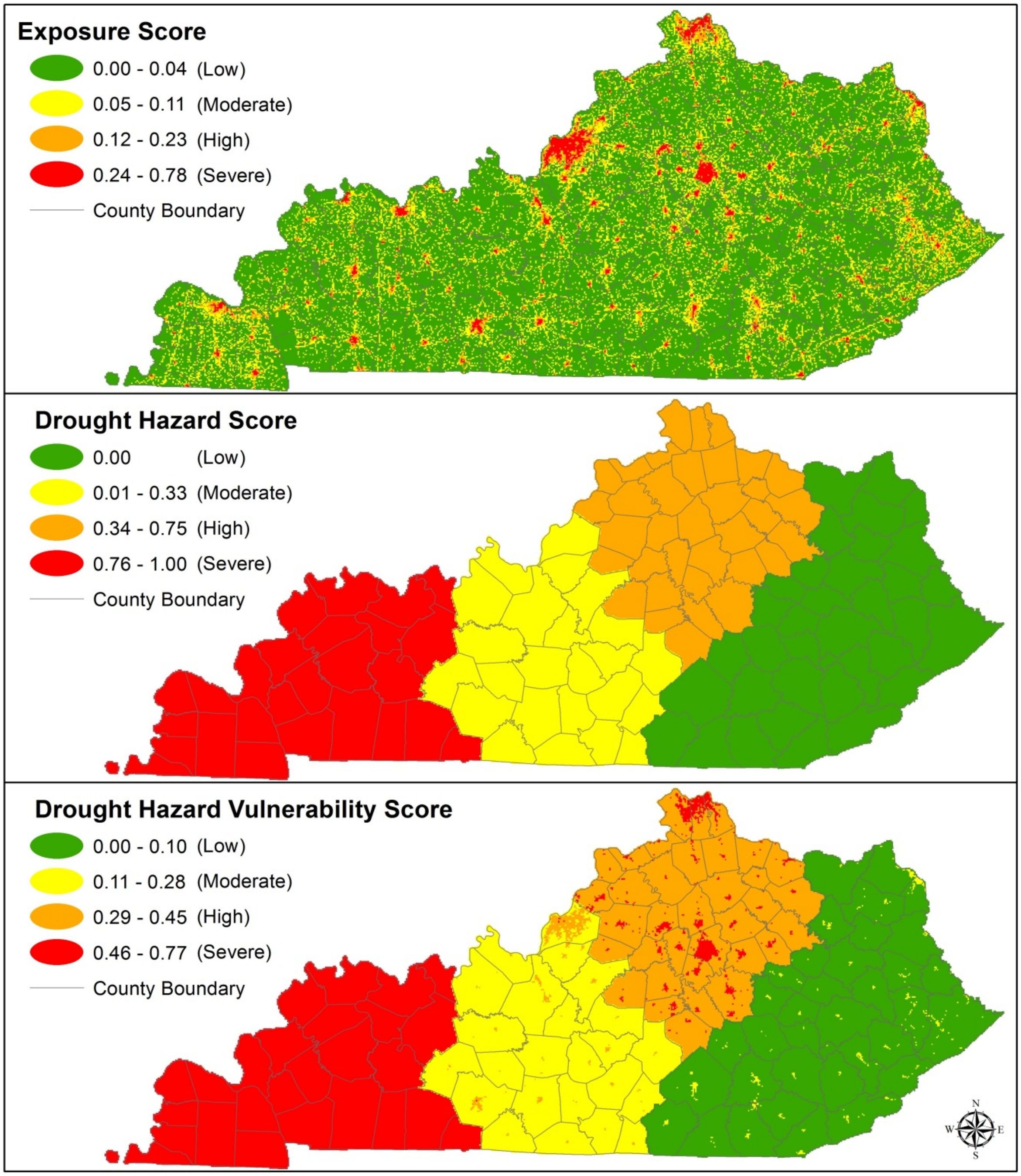
Drought Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Drought was determined through first calculating the Drought Hazard Score. The Drought Hazard Score was calculated by studying one (1) specific source of data. The data layer used to create the Drought Hazard Score was data collected from the Palmer Drought Severity Index (PDSI) from 1895-2013. In order to use this data for the Drought Hazard Score an average PDSI was calculated for each of the four (4) PDSI regions in Kentucky using the annual PDSI from 1895-2013. This created four (4) specific hazard areas to score from. To analyze Kentucky's risk to Drought, the PDSI layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the PDSI layer covered within each grid. This percentage of area affected by the mapped PDSI areas (4) was then calculated and scored 0-1 to develop the Drought Hazard Score.

The Drought Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Drought Hazard Score and then scored 0-1. Once the final Drought Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe) which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

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

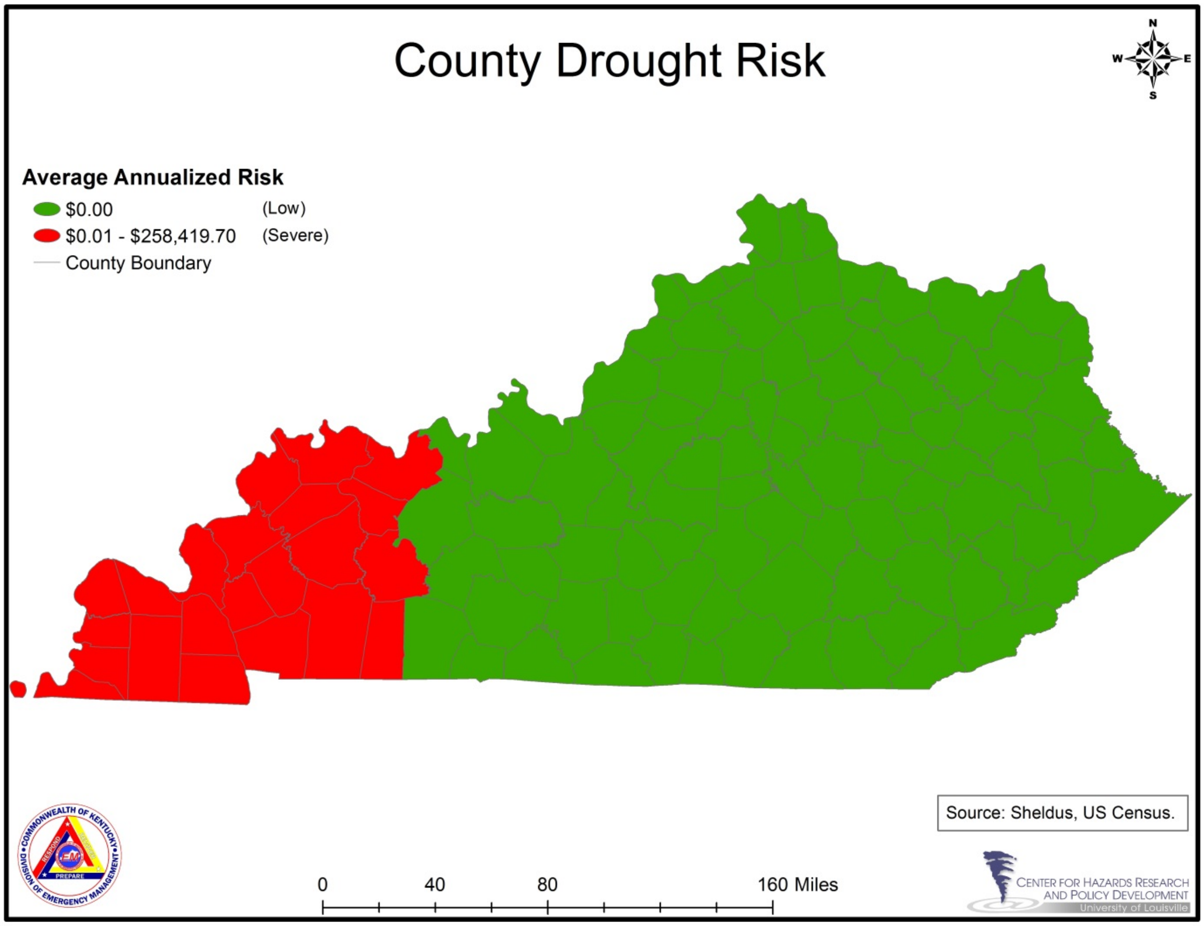


Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: NOAA

Center for Hazards Research and Policy Development
University of Louisville

County-Level Risk Assessment Model

The Drought County Risk Assessment Model was created using the Drought Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county’s annual rate of occurrence by their average losses (See ***Appendix 3-2*** “Hazard Average Annualized Loss”). This data was then joined to a county map for display as seen below.



The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences and losses from drought comparatively across Kentucky.

Extreme Temperature

Identifying Hazards: Extreme Temperature

Description

Extreme Heat

Conditions of extreme heat are defined as temperatures that are substantially hotter and/or more humid than average for a location during a particular (usually summer) time of year. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground.

Wildfires and droughts are aggravated and sometimes caused by periods of extreme heat. As drought and wildfires have their own profiles, heat-related illness is the main focus of this hazard identification.

Heat-related illness most often occurs when the body's temperature control system is overloaded. The body normally cools itself by sweating, but sometimes lacks the capacity to keep the body cooled to a safe temperature. When the natural cooling process fails, a person's body temperature rises rapidly. Very high body temperatures may damage the brain or other vital organs. Several factors affect the body's ability to cool itself during extremely hot weather. When humidity is high, sweat will not evaporate as quickly, preventing the body from releasing heat quickly. This is a major concern in Kentucky as significant humidity levels are common year round.

Impacts
(Listed in order of greatest to least severity)

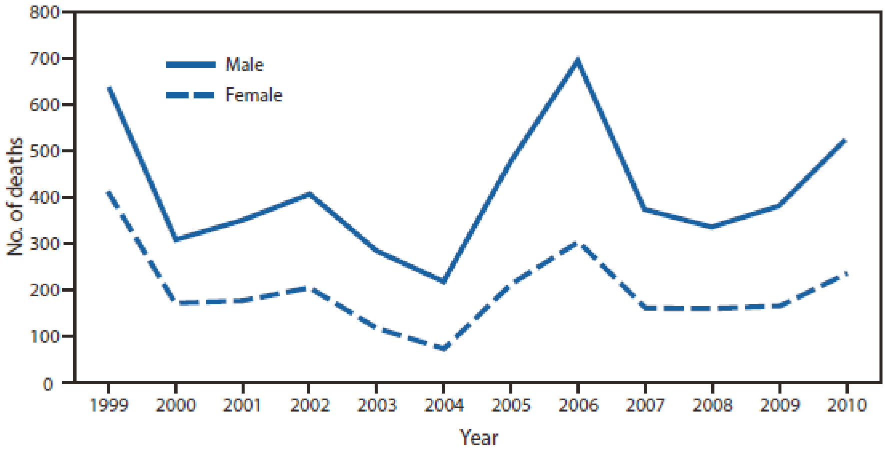
- *Heat Stroke:* Heat stroke occurs when the body is unable to regulate its temperature. The body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. Body temperature may rise to 106°F or higher within 10 to 15 minutes. Heat stroke can cause death or permanent disability if emergency treatment is not provided.
- *Heat Exhaustion:* Heat exhaustion is a milder form of heat-related illness that can develop after several days of exposure to high temperatures and inadequate or unbalanced replacement of fluids. It is the body's response to an excessive loss of the water and salt contained in sweat. Those most prone to heat exhaustion are elderly people, people with high blood pressure, and people working or exercising in a hot environment.
- *Heat Cramps:* Heat cramps usually affect people who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture. The low salt level in the muscles may be the cause of heat cramps. Heat cramps may also be a symptom of heat exhaustion.

- *Sunburn:* Sunburn should be avoided because it damages the skin. Although the discomfort is usually minor and healing often occurs in about a week, more severe sunburns may require medical attention.
- *Heat Rash:* Heat rash is a skin irritation caused by excessive sweating during hot, humid weather. It can occur at any age but is most common in young children.

Facts

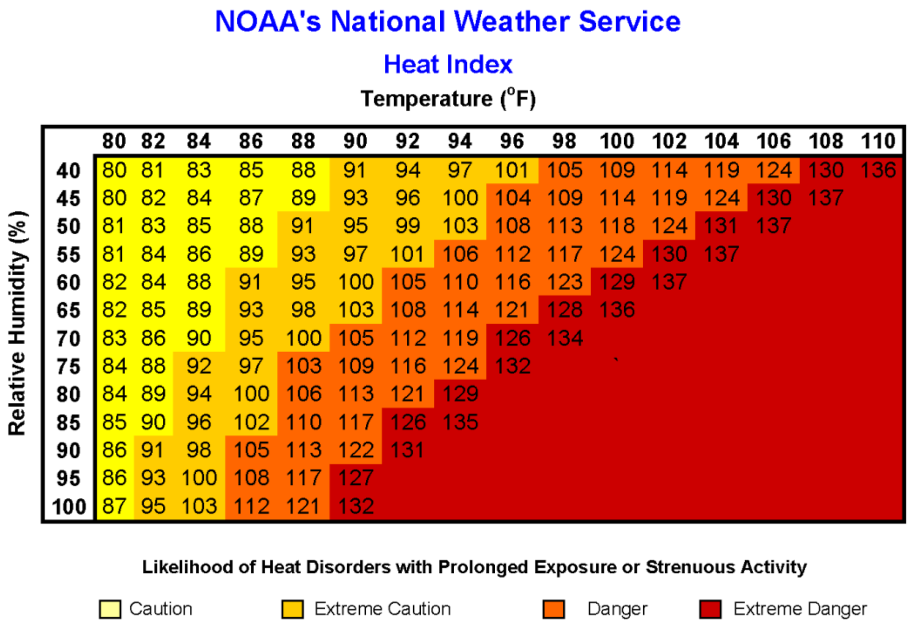
- Heat is the number one weather-related killer in the United States and claims more lives each than floods, lightning, tornadoes, and hurricanes combined.
- In a normal year, hundreds of Americans die from extreme heat. Young children, elderly people, and those who are sick or overweight are more likely to become victims.
- Sunburn can significantly slow the skin's ability to release excess heat.
- Because men sweat more than women, men are more susceptible to heat illness because they become dehydrated more quickly.
- Between 1936 and 1975, nearly 20,000 people died as a result of heat and solar radiation.
- In the disastrous heat wave of 1980, more than 1,250 people died nationwide.
- In the heat wave of 1995, more than 700 people died in the Chicago area.
- The record heat wave in August 2003 claimed an estimated 50,000 lives in Europe.
- From 1999 to 2010, a total of 7,415 deaths in the United States, an average of 618 per year, were associated with exposure to excessive heat.

Number of Heat-Related Deaths, United States, 1999-2010



(Source: CDC, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6136a6.htm)

The following graphic depicts the National Weather Services' "Heat Index". The Heat Index is the temperature the body feels when heat and humidity are combined. Although extreme heat can be either extremely humid or extremely dry, there are several types of heat-related illness that result due to exposure to this hazard. Potential impacts are also assumed to only involve the human factor (an individual's health) as additional information on drought and wildfires are found in their respective identification sections.



NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

☐ Caution 🟨 Extreme Caution 🟧 Danger 🟥 Extreme Danger

(Source: http://www.nws.noaa.gov/om/heat/index.shtml)

Extreme Cold

What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In the north, below zero temperatures may be considered as "extreme cold." Extreme cold often accompanies a winter storm or is left in its wake.

Whenever temperatures drop decidedly below normal and as wind speed increases, heat can leave your body more rapidly. These weather related conditions may lead to serious health problems. Extreme cold is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible.

Freezing temperatures can also cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Long cold spells can cause rivers to freeze, disrupting shipping. Ice jams may form and lead to flooding.

Impacts

- *Frostbite:* Frostbite is an injury to the body that is caused by freezing. Frostbite causes a loss of feeling and color in affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes. Frostbite can permanently damage the body, and severe cases can lead to amputation. The risk of frostbite is increased in people with reduced blood circulation and among people who are not dressed properly for extremely cold temperatures.
- *Hypothermia:* When exposed to cold temperatures, your body begins to lose heat faster than it can be produced. Prolonged exposure to cold will eventually use up your body's stored energy. The result is hypothermia, or abnormally low body temperature. Body temperature that is too low affects the brain, making the victim unable to think clearly or move well. This makes hypothermia particularly dangerous because a person may not know it is happening and won't be able to do anything about it. Hypothermia is most likely at very cold temperatures, but it can occur even at cool temperatures (above 40°F) if a person becomes chilled from rain, sweat, or submersion in cold water.

Facts

- The National Weather Service refers to winter storms as the "Deceptive Killers" because most deaths are indirectly related to the storm. Instead, people die in traffic accidents on icy roads and of hypothermia from prolonged exposure to cold.
- Infants lose body heat more easily than adults and unlike adults, infants can't make enough body heat by shivering.
- Older adults often make less body heat because of a slower metabolism and less physical activity.
- During 1979-2002, a total of 16,555 deaths in the United States, an average of 689 per year, were attributed to exposure to excessive natural cold (hypothermia).

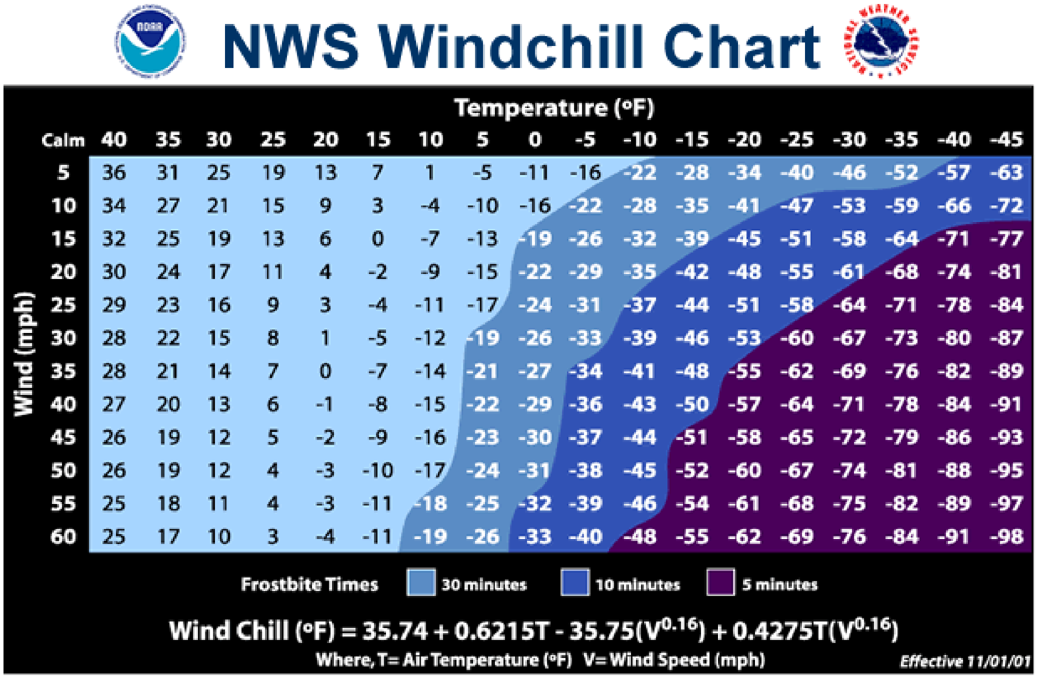
During the winter, a breeze can make a cold day feel more uncomfortable. That's because wind drives heat away from exposed skin faster than calm air. High winds combined with very low temperatures create dangerously cold conditions. To help people understand the risk, NOAA's National Weather Service provides wind chill temperatures in reports of current conditions and in forecasts. While dangerous wind chills occur regularly in the northern plains, they can also affect almost any region in the United States. As temperatures drop below freezing, exposed skin is at risk of frostbite and you become more susceptible to hypothermia. The lower the wind chill temperature, the faster frostbite or hypothermia can occur.

NOAA's National Weather Service wind chill chart shows the increasing dangers as temperature drops and wind speed increases. In cold winter months, National Weather

Service weather forecast offices routinely issue two types of alerts to warn people about dangerously low wind chill temperatures.

- A *Wind Chill Advisory* is issued when wind chill temperatures are potentially hazardous.
- A *Wind Chill Warning* is issued when wind chill temperatures are life threatening.

However, temperature criteria for an advisory or warning can vary from state to state to reflect regional climate differences.



NWS Windchill Chart

Temperature (°F)

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

Frostbite Times ▨ 30 minutes ▨ 10 minutes ▨ 5 minutes

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

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

Effective 11/01/01

(Source: NOAA/NWS, http://www.nws.noaa.gov/om/windchill/)

Profiling Hazards: Extreme Temperature

EXTREME TEMPERATURE PROFILE RISK TABLE	
Period of occurrence:	Extreme heat is most likely to occur in the months of July, August, or September. Extreme heat has been known to occur in May, June, and October. The likelihood of extreme heat occurring outside of these months is extremely small and unheard of December through March. Extreme cold is most likely to occur in the months of December, January or February.
Number of events: (1960-2013)	1,175*
Annual Rate of Occurrence:	22.17
Warning time:	The National Weather Service will initiate alert procedures when the Heat Index is expected to exceed 105°- 110°F (depending on local climate) for at least two consecutive days. Currently, there are no officially warnings for extreme cold. This was tested in 2012 but later dropped.
Potential impacts:	Extreme heat, impacts human life, health, and public safety. Fires due to extremely dry conditions are possible. Can lead to economic losses such as decreased land values and agribusiness losses. Extreme cold, impacts human life, health, and public safety. Rivers and lakes freeze causing transportation issues. Energy consumption goes up and depending on the time of year extreme cold can have large impacts on agriculture. Cold temperatures can also cause ruptured pipes and stressed on engines and motors.
Recorded losses:	$1,141,306*
Annualized Loss:	$21,534
Extent (Historical):	Date: 2012 Temperature: 94 degrees Impact: 1 death

*Data captured from SHELDUS 10.1 and NCDC. The number of events and recorded losses is a combination of both heat and cold events.

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

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

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

During the last two weeks of July 1999, the Midwest experienced a lengthy series of days with temperatures higher than 90 degrees F. While 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 9-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 urban heat island 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, that 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 the 29th and 30th, lived in large cities with aging and old infrastructure consisting of non-air-conditioned brick buildings.

In August 2007, nearly 30 temperature records were set in central Kentucky. The average temperature for August in Kentucky is around 77 degrees, give or take a few degrees per location. In 2007, the average was 85 degrees. August 2007 became the hottest month ever recorded at Louisville and Bowling Green, and the 3rd hottest on record at Lexington. A federal disaster designation by the U.S. Department of Agriculture was declared allowing farmers in the state's $4 billion-a-year industry to seek emergency assistance, including low-interest loans to help pay for essential farm and living expenses.

The summer of 2010 was one of the hottest on record across Kentucky. This is true with respect to both average temperature and minimum daily temperature. The summer was the 2nd warmest on record with maximum daily temperature (1952 had higher maximum temps).

According to NOAA, 2012 was the hottest year on record for the continental United States. Every year from 2010 to 2012 was in the top four (4) warmest summers recorded in Kentucky. 2010 had the most days over ninety degrees (85 days) and 2012 had 10 days over one hundred degrees.

Although these events cover a broad time span, it is still important to note what accompanies extreme heat. Kentucky is always at risk for extreme heat during peak occurrence months. Extreme heat not only causes droughts and crop damage, but also the loss of human life. Several accounts of heat-related deaths populate headlines throughout warmer months for Kentucky. There was a case in Louisville, August 20, 2008, where a young man died due to heat-related complications resulting from football practice in 94 degree weather. As stated in the description section of the state plan, elderly people, young people, and persons who are of unhealthy weights are all at constant risk from the dangers of extreme heat.

Extreme Cold

As many incidents of extremely cold temperatures in Kentucky have accompanied other severe winter weather events and those events are discussed in their respective sections throughout this document, this section will focus only on the temperature element, of which there is little information available to report.

Along with the record snowfall in January 1994, Kentucky also set low temperature records across the state. The heavy snow set the stage for incredibly low temperatures, as behind the storm an intensely cold air mass dumped south out of Canada, sending temperatures plunging well below zero by Wednesday, January 19th. Not only did Louisville record an all-time low of -22 degrees, but Shelbyville set a new record low temperature for the entire state of Kentucky with a reading of -37 degrees. Lexington came within one degree of its all-time record low.

The great ice storm of 1951 also was accompanied by extremely low temperatures. From January 29-February 2, 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. This was the perfect set up for the development and occurrence of freezing rain and sleet along with freezing temperatures. Bowling Green recorded a temperature of -20 degrees, the coldest official temperature ever recorded in February up to that time. 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 the snow.

In 2007, an example of an out of the ordinary extremely cold weather event and the potential devastation it can cause occurred throughout Kentucky. After an unusually warm streak the lasted 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 on April 3. 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. Bowling Green spent a total of 47 non-consecutive hours below freezing, with their lowest temperatures of 22 degrees Fahrenheit on the 8th of the month. Louisville and Lexington both recorded impressive lows as well, 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 million dollars’ worth of losses. The same was true for the area’s corn crop, which reported 5 million dollars in losses. 16 million was reported in damages for a 20 million dollar fruit industry, nearly crippling it.

The massive ice storm of 2009 that swept destruction throughout the state was also coupled with extremely cold weather. Most areas of the state saw temperatures fall to below freezing and wind chills below zero. This exacerbated the challenge of recovering from the storm by allowing the ice to linger even longer and making it even more difficult for work crews to clean up the debris and restore power to peoples' homes.

Assessing Vulnerability by Jurisdiction: Extreme Temperature

Grid-Level Risk Assessment Model

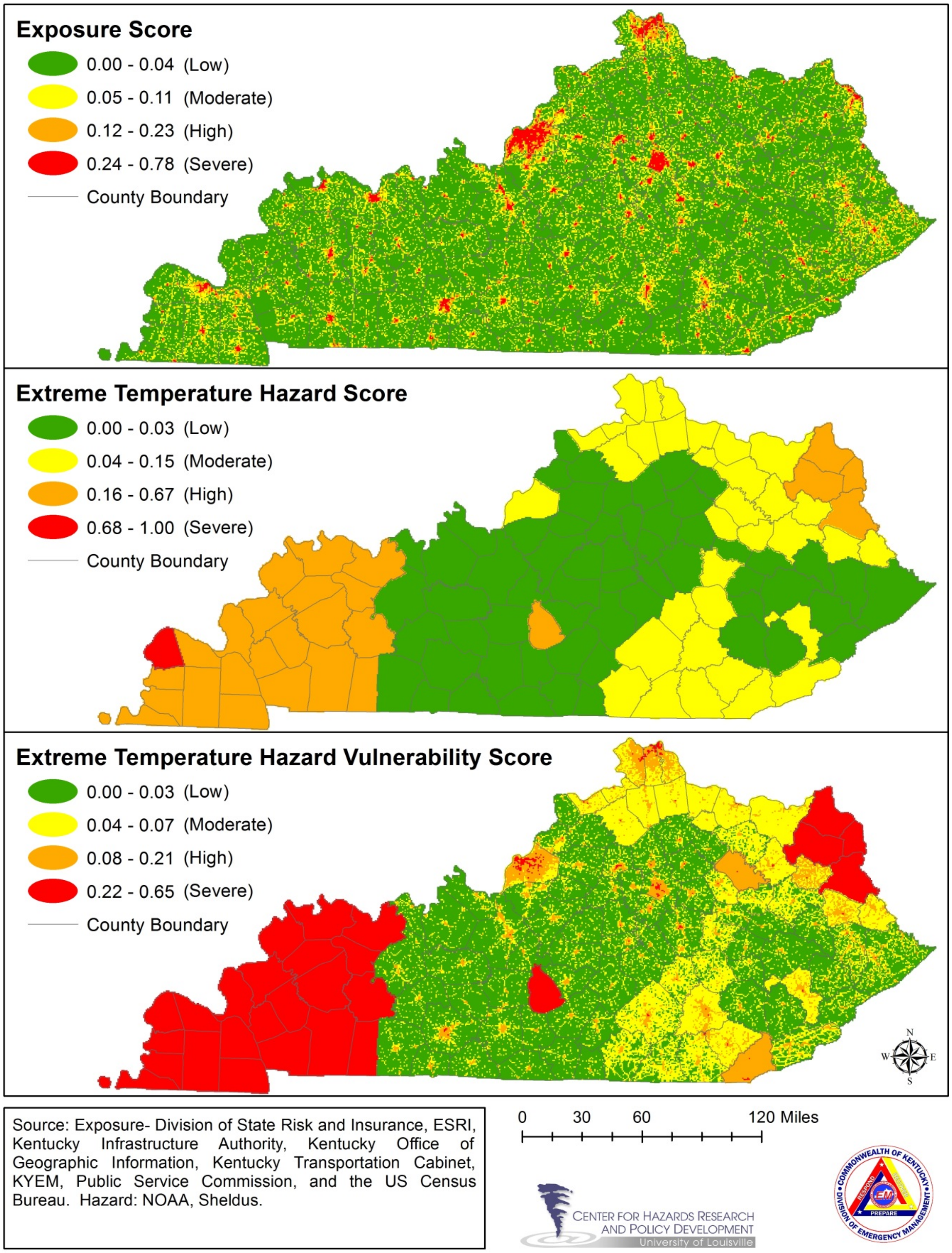
Extreme Temperature Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Extreme Temperature was determined through first calculating the Extreme Temperature Hazard Score. The Extreme Temperature Hazard Score was calculated by studying one (1) specific source of data. The data layer used to create the Extreme Temperature Hazard Score was data collected from the capturing county-level extreme temperature events. In order to use this data for the Extreme Temperature Hazard Score each county was assigned their maximum number of events and that data was aggregated to each grid within that county. To analyze Kentucky's risk to extreme temperature, the county extreme temperature layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the extreme temperature layer covered within each grid. This percentage of area affected by the extreme temperature layer was then calculated and scored 0-1 to develop the Extreme Temperature Hazard Score.

The Extreme Temperature Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Extreme Temperature Hazard Score and then scored 0-1. Once the final Extreme Temperature Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe), which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

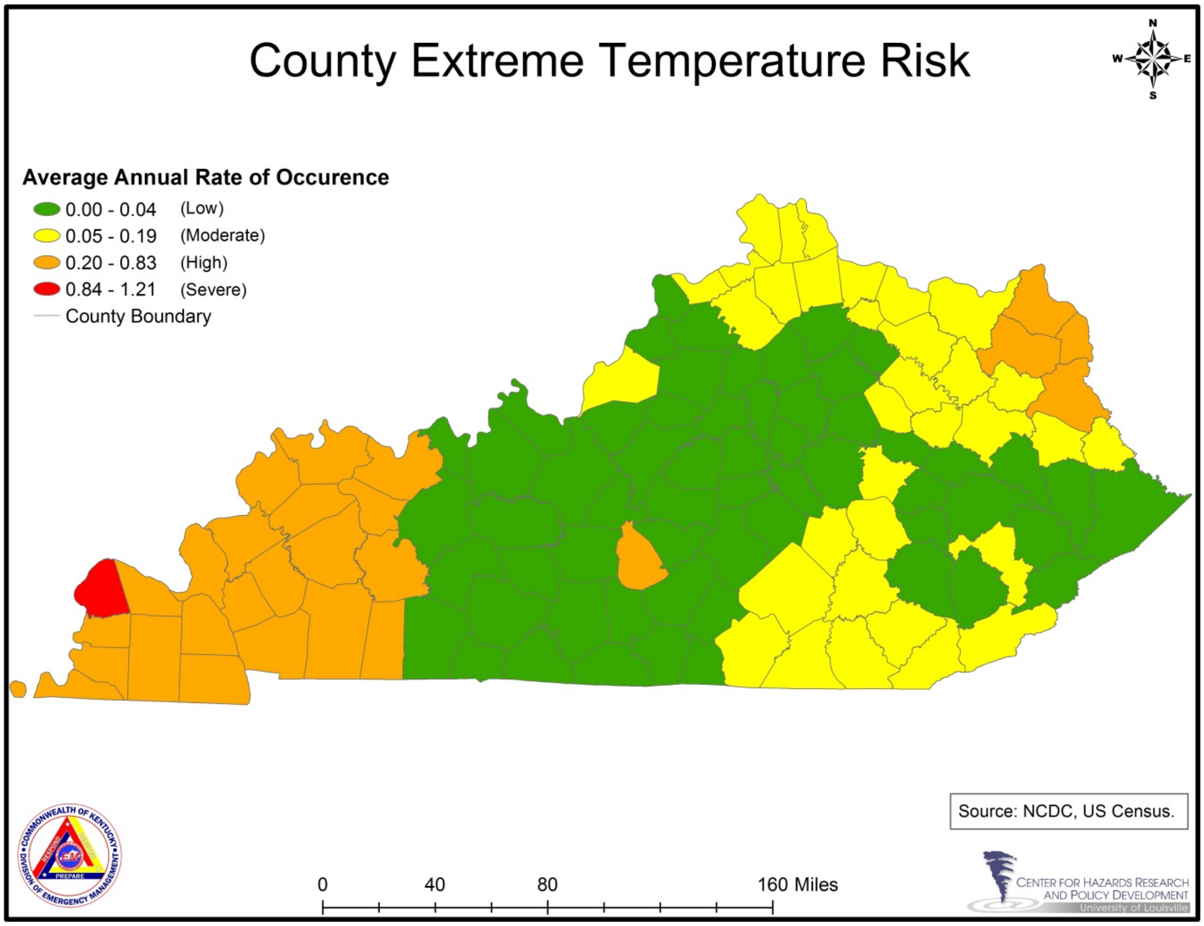
The following map displays the maps and components of the Extreme Temperature Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: NOAA, Sheldus.

County-Level Risk Assessment Model

The Extreme Temperature County Risk Assessment Model was created using the Extreme Temperature Annual Rate of Occurrence data for each county. The annual rate of occurrence is calculated by dividing the range of years the data has been captured by each county's total number of occurrences (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences of extreme temperature comparatively across Kentucky.

Hail Storm

Identifying Hazards: Hail

Description

Hail is a type precipitation which is formed when updrafts in thunderstorms carry raindrops into extremely cold areas of the atmosphere and freezes them. These frozen raindrops grow by colliding with super-cooled water drops creating 'hailstones'. Thunderstorms which have a strong updraft keep lifting the hailstones up to the top of the cloud, increasing the amount of moisture they collect. The hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft, the larger the hailstone can grow.

Though Florida has the most thunderstorms, Nebraska, Colorado, and Wyoming usually have the most hail storms. The area where these three states meet – "hail alley," averages seven to nine hail days per year. The reason why this area gets so much hail is that the freezing levels (the area of the atmosphere at 32 degrees or less) in the high plains are much closer to the ground than they are at sea level, where hail has plenty of time to melt before reaching the ground. Other parts of the world that experience damaging hailstorms include China, Russia, India and northern Italy.

When viewed from the air, it is evident that hail falls in paths known as hail swaths. They can range in size from a few acres to an area 10 miles wide and 100 miles long. Piles of hail in hail swaths can be so deep, that snow plows are need to clear roadways, and occasionally, hail drifts have been reported.

Types

Hail is commonly associated with severe storms. While severe storms and super cell storms usually produce the most damaging hail occurrences, many non-super cell storms have produced golf ball size hail. Storms which produce hail are more frequent during the late spring and early summer months.

Although there is no scientific classification of hail, NOAA provides the following comparisons to identify hail sizes with common items.

NOAA Hail Size Comparison	
Non-Severe Sizes	
Pea	¼ inch diameter
Marble	½ inch diameter
Severe Sizes	
Dime/Penny	¾ inch diameter
Nickel	7/8 inch diameter
Quarter	1 inch diameter
Ping-Pong Ball	1 ½ inch diameter
Golf Ball	1 ¾ inch diameter
Tennis Ball	2 ½ inch diameter
Baseball	2 ¾ inch diameter
Tea Cup	3 inch diameter
Grapefruit	4 inch diameter
Softball	4 ½ inch diameter

It is important to note that the severe designation for hail is based on a 1952 study of the "smallest size of hailstones which cause significant damage at airplane speeds between 200 and 300 mph”.

Facts

- The largest and heaviest hailstone recovered in the U.S. fell on July 23, 2010 in Vivian, South Dakota and had a diameter of 8 inches, a circumference of 18.62 inches, and weighed 1 lb 15 oz (1.93 pounds).
- Hailstones can fall at speeds of up to 120 miles an hour.
- In the United States, hail is responsible for nearly $1 billion in damage to crops and property each year.

Impacts

The primary impacts of hail are mainly property and infrastructure damages, including crop damages, and personal injuries. Although extensive damage occurs as a result of hail, the event by itself causes few, if any, additional hazards.

Profiling Hazards: Hail

HAIL STORM PROFILE RISK TABLE	
Period of occurrence:	Frequented with severe storms which are most prevalent in Kentucky from April to June. Severe storms can occur whenever conditions are favorable however. As such, hail can occur at any time of the year, although it is a rarity in off season months.
Number of events: (1960-2013)	4,882*
Annual Rate of Occurrence:	92.11
Warning time:	Prediction of hail as a contained event is very difficult. Providing any warning in advance for a threat of hail relies mostly on tracking storm systems which are capable of producing hail. Assuming hail is a possibility, when severe storms are approaching the best warning for hail is this point in time.
Potential impacts:	Impacts to human life, health, and public safety are possible. Utility damage and failure, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases are additional impacts.
Recorded losses:	$983,340,017
Annualized Loss:	$18,553,585
Extent (Historical):	Date: April 16, 1998 Size: 2.75 inches Damage: $714 M

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)

SIGNIFICANT RECENT HAIL EVENTS IN KENTUCKY				
Date	Location (County)	Magnitude	Property Damage	Crop Damage
5/3/1996	Jefferson	2.75 in	$30 M	0
4/16/1998	Warren	2.75 in	$714 M	0
5/01/2002	Laurel	4.5 in	$38 M	$2.5 M
5/01/2002	Pulaski	4.5 in	$6.3 M	$1.3 M
5/01/2002	Rockcastle	2.75 in	$5.7 M	$1.3 M
5/04/2003	McCracken	2.5 in	$25 M	0
5/04/2003	Marshall	2.75 in	$12.5 M	0
3/2/2012	Wolfe	3.0 in	$2 M	0
3/2/2012	Adair	1.75 in	$1.5 M	0
4/28/2012	Jefferson	2.0 in	N/A	N/A

Data obtained from SHELDUS and NOAA NCDC; adjusted for 2012 inflation

The effects of hailstorms range from minimal to severe damage to anything from personal property to community infrastructure. According to SHELDUS and NOAA NCDC data, there have been no documented deaths or injuries over the past three (3) years from hailstorms in the state of Kentucky. However, there has been over $5.5 million in property damages and over $3,000 in crop damages in the state during that time. As can be seen in the previous table, there were only two (2) hail events that resulted in significant damages of over one million dollars in the past three (3) years.

Hail events occur in all regions of the state and the amount of large hail events (hail with a diameter of 0.75 inches or greater, as specified by the NOAA/NWS Storm Prediction Center) varies greatly by county across the state. Reporting also varies greatly across the state with more populated counties reporting higher numbers of events. This is due to the fact hail events in a more populated county will not only be more noticed, but will also likely cause more damage than a less populated county. The result of this is slightly skewed data, which is also the case with other severe storm events.

There have been numerous instances in Kentucky that demonstrate the destructive capacity of hailstorms. On April 16, 1998 a severe line of storms passed through Adair, Warren, Barren, and Metcalfe counties in Kentucky. This storm system created hail in some areas which was recorded as baseball-size. The city of Bowling Green was devastated by the massive amounts of hail falling from the line of storms. There were 8,300 homes, 900 mobile homes, 4,000 vehicles, 37 businesses, and 14 apartments that sustained major damage. Minor damage was reported for 1,300 homes, 6,000 vehicles, 42 business, and 4 churches. The total damage in the Micropolitan Statistical Area was estimated at $510 million. Additionally, several people received minor injuries after being struck by falling hail.

On May 1, 2002, another severe thunderstorm system that produced at least baseball-sized hail moved across central Kentucky impacting ten counties. Three (3) injuries were reported in Washington County as a result of the hail and softball-size hail was reported in Nelson, Marion, Lincoln, and Pulaski counties, which caused considerable damage to many homes and vehicles. The entire event resulted in approximately $40 million in property damages and $4 million in crop damages across Kentucky.

One of the most devastating hailstorms in Kentucky history occurred on April 28, 2012 in the Louisville metropolitan area. A cluster of severe storms produced one predominate storm that grew into a high precipitation supercell. Hailstones baseball-size and smaller devastated the roofs of residential and commercial properties, and automobiles, both personal and dealerships, were severely impacted. Over five thousand residences also lost power during the deluge. Total damages were estimated at over $175 million dollars in insured losses.

Assessing Vulnerability by Jurisdiction: Hail Storm

Grid-Level Risk Assessment Model

Hail Storm Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Hail Storm was determined through first calculating the Hail Storm Hazard Score. The Hail Storm Hazard Score was calculated by studying one (1) specific source of data. The data layer used to create the Hail Storm Hazard Score was collected from the National Weather Service NEXRAD Level-III Radar data. The radar data provided a new and improved capture of hail occurrences using radar to capture when and where hail events were occurring from 2000-2012. As with all new technologies this data does come across with some caveats. Currently the radar is not 100% accurate when capturing images so the data comes with probabilities assigned to each data point captured. For this process CHR used anything with a 50% or greater probability as a counted hail occurrence.

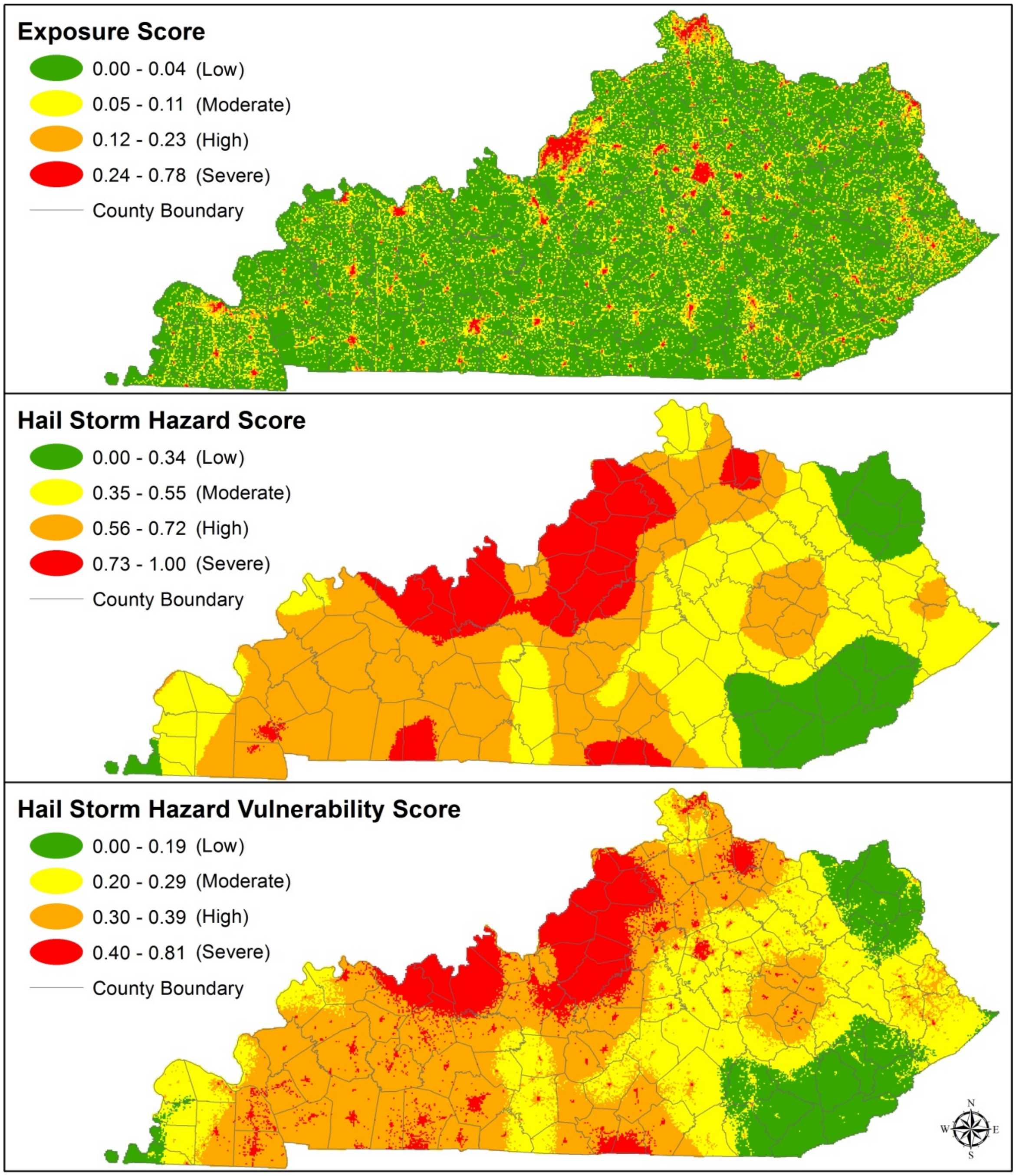
For analyzing this data CHR used a 25 mile radius to calculate each 1 KM MGRS grids geographic risk from a hail event. The 25-mile radius was selected because that is the distance that the National Weather Service uses when producing severe weather alerts and probability maps. Basically, the 25 mile radius reduces the white noise and randomness present in atmospheric event data, which enables a meaningful picture of the risk to each grid, built based on historic rates of occurrence in the area. These 25 mile radiuses create map layers that were used as the base map layer for Hail Storm Hazard Score.

To analyze Kentucky's risk to Hail Storm, the county 25 mile radius Hail Storm layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the total number of hail events that occurred within a 25 mile radius of each grid. Each grid was then calculated and scored 0-1 to develop the Hail Storm Hazard Score.

The Hail Storm Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Hail Storm Hazard Score and then scored 0-1. Once the final Hail Storm Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe), which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

The following map displays the maps and components of the Hail Storm Vulnerability Score.

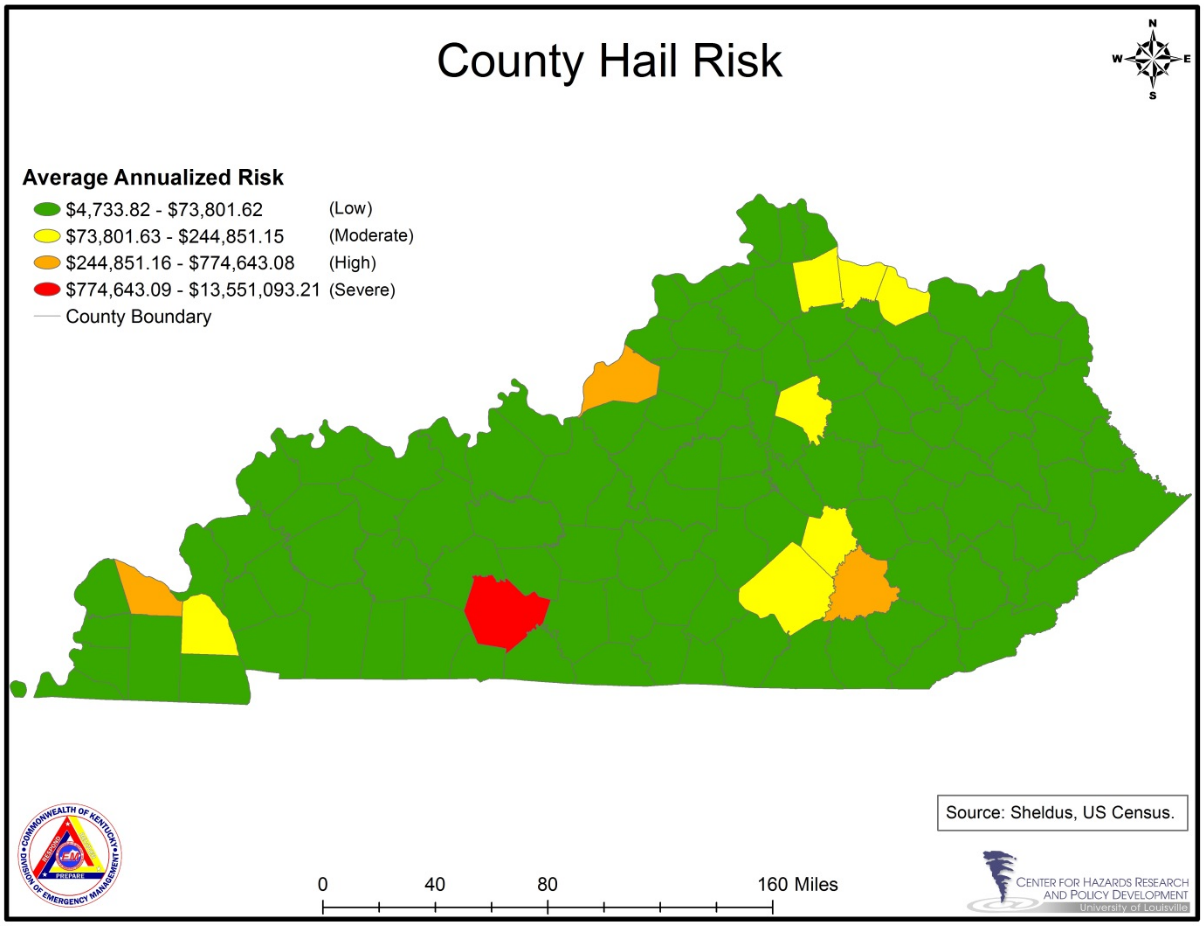


Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: NOAA

Center for Hazards Research and Policy Development
University of Louisville

County-Level Risk Assessment Model

The Hail Storm County Risk Assessment Model was created using the Hail Storm Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by their average losses (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



Source: Sheldus, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences and losses from hail storms comparatively across Kentucky.

Severe Storm

Identifying Hazards: Severe Storm

Description

A thunderstorm is formed from a combination of moisture, rapidly rising warm air, and a force capable of lifting air such as a warm or cold front, a sea breeze, or a mountain. All thunderstorms contain lightning and may occur singly, in clusters, or in lines. Thus, it is possible for several thunderstorms to affect one location in the course of a few hours. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended period time.

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

Types of Thunderstorms

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

Tornadic supercell near Owensboro, KY, October 18, 2007.
Source: Accuweather.com. Retrieved: May 1, 2013.

- *Supercell*. Even though it is the rarest of storm types, the supercell is the most dangerous because of the extreme weather generated. Defined as a thunderstorm with a rotating updraft, these storms can produce strong downbursts, large hail, occasional flash floods, and weak to violent tornadoes. This storm is extremely dangerous to the public and aviation.
- *Storms with Straight-line Winds.* Straight-line winds are convective wind gusts, outflow and downbursts that are produced by the downward momentum in the downdraft of a thunderstorm. An environment conducive to strong straight-line wind is one in which the updrafts and thus downdrafts are strong, the air is dry in the middle troposphere and the storm has a fast forward motion If these winds meet or exceed 58 miles per hours then the storm is classified as severe by the National Weather Service.

Types of Lightning

Overall, there are four different types of lightning:

1. *Cloud to Air.* Lightning that occurs when the air around a positively charged cloud top reaches to the negatively charged air around it.
2. *Cloud to ground.* Lightning that occurs between the cloud and the ground.
    - *Bolt from the blue.* A positive lightning bolt which originates within the updraft of the storm, typically 2/3rds of the way up, travels horizontally for many miles, then strikes the ground.
    - *Anvil Lightning.* A positive lightning bolt which develops in the anvil, or top of the thunderstorm cloud, and travels generally straight down to strike the ground.
3. *Intra-cloud.* The most common type of lightning which happens completely inside the cloud, jumping between different charge regions in the cloud. This is sometimes called sheet lightning because it lights up the sky with a 'sheet' of light.
4. *Inter-cloud.* Lightning that occurs between two or more separate clouds.

Lightning flashes can have more than one ground point. Roughly, there are five to ten times as many cloud flashes, or flashes that do not strike the surface, than cloud to ground flashes. They may be inside a cloud, travel from one part of a cloud to another, or from cloud to air.

Thunderstorm and Lightning Facts

- The NWS estimates more than 100,000 thunderstorms worldwide each year.
- 1,800 to 2,000 thunderstorms occur worldwide in a given second.
- In the last 25 years, severe storms have been associated with over 300 federal disaster declarations
- Lightning is the second most frequent killer in the U.S. with nearly 100 deaths and 500 injuries each year.
- Lightning is a component of all thunderstorms.
- In the continental U.S. there are more than 40 million cloud to ground lightning flashes each year.
- The longest bolt, seen to date, was 118 miles long in the Dallas-Ft. Worth, TX area.
- The peak temperature of lightning is around 60,000 degree Fahrenheit, or about 5 times hotter than the surface of the Sun.
- Lightning most commonly occurs in thunderstorms, but it can also occur in snowstorms, sandstorms, and in the ejected material over volcanoes.
- Cloud to ground lightning can injure or kill people and destroy objects by direct or indirect means. Objects can either absorb or transmit energy. The absorbed energy can cause the object to explode, burn, or totally destruct. The various forms of transfer are:
    - Tall object transferred to person
    - Tall object to ground to person
    - Object (telephone line, plumbing pipes) to a person in contact with the appliance

Dangers Associated with Thunderstorms

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

Effects of Lightning

- Fires may occur in structures such as storage and processing units, aircraft, and electrical infrastructure and components.
- Forest fires may be initiated by lightning. Half the wildfires in the western U.S. are caused by lightning.
- Injury and death to people
- 85% of lightning victims are children and young men ages 10 to 35.
- 25% of victims die and 70% of survivors suffer long term effects

Profiling Hazards: Severe Storm

SEVERE STORM PROFILE RISK TABLE	
Period of occurrence:	Spring, Summer, and Fall
Number of events: (1960-2013)	21,481*
Annual Rate of Occurrence:	405.30
Warning time:	Minutes to hours
Potential impacts:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Impacts human life, health, and public safety.
Recorded losses:	$898,499,257*
Annualized Loss:	$16,952,816
Extent (Historical):	Date: September 14, 2008 Scale: 68 knots (kts.) Damages: $168 M property, $69 M crop, 1 death, 46 injuries

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)

Kentucky is affected every year by severe thunderstorm systems which move across the region. As the above chart demonstrates, Kentucky has experienced 12 presidentially declared disaster events since 2005. Most recently, the March 2, 2012 tornado outbreak resulting from supercells that swept eastward across the Ohio and Tennessee Valleys, were accompanied by strong straight-line winds that, according to the NCDC Storm Events Database, caused an estimated $834,000 in property damage. Five years prior, in September 2008, Kentucky experienced a rare weather event which was of hurricane origin. This system, along with an upper level trough and a surface cold front approaching the region, combined to bring very strong surface wind gusts to the area. Widespread damage occurred with measured wind gusts up to 75 mph, along with seven (7) known injuries and two (2) fatalities across parts of central Kentucky. Seventy-five percent of all Louisville Metro electrical customers - more than 300,000 homes and businesses - lost power for up to a week due to the storm, leaving many businesses and schools closed during the week. Statewide, nearly 600,000 customers lost power due to the storm. Cost estimates were reported as approximately $10 million across the Commonwealth, including $4.2 million in the Louisville Metro area alone. In Kentucky, 33 counties were declared major disaster areas by President Bush.

Severe Storm-related
Presidential Disaster Declarations
2005-2013

Disaster Declaration	Incident Period	Individual Assistance Applications*	Amount Disbursed*	Total Public Assistance Grants**	Dam Failure	Drought	Earthquake	Extreme Temp.	Flood	Hailstorm	Karst/Sinkhole	Land/Mine	Landslide	Severe Storm	Severe Winter	Tornado	Forest Fire
DR-4057	February 29- March 3, 2012	5,746	$ 10,378,250	$ 12,438,032					x					x		x	
DR-4008	June 19 - 23, 2011	820	$ 2,886,169	$ 2,428,630					x					x		x	
DR-1976	April 12- May 20, 2011	2,330	$ 9,239,830	$ 31,886,410					x					x		x	
DR-1925	July 17-30, 2010	2,548	$ 10,602,929	$ 6,372,211					x				x	x			
DR-1912	May 1, 2010	7,343	$ 20,784,629	$ 22,522,805					x				x	x			
DR-1841	May 3-20, 2009	5,543	$ 15,117,446	$ 34,825,014					x				x	x		x	
DR-1802	September 14-15, 2008	not requested	not requested	$ 18,821,452										x			
DR-1855	August 4, 2008	12,406	$ 17,701,502	$ 3,791,750					x					x			
DR-1757	April 3-4, 2008	not requested	not requested	$ 3,499,938					x				x	x		x	
DR-1746	February 5-6, 2008	1,032	$ 1,466,605	$ 4,954,738					x					x		x	
DR-1617	December 1, 2005	399	$ 459,715	not requested										x		x	

*Source: KY Division of Emergency Management, Recovery Branch. IA Disaster Summary by County.
**Source: FEMA.gov

The following narrative provides more detailed information on severe storms that resulted in Presidential Declarations in Kentucky:

- **November 15, 2005 (DR-1617):** A line of powerful storms moved across the western half of Kentucky and southern Indiana during the afternoon. The line of storms was responsible for damaging winds and a few tornadoes along and west of Interstate 65.

- **February 5-6, 2008 (DR-1746)**: More than $4.5 million in federal disaster public assistance was approved in association with tornadoes and severe storms. The intense thunderstorms and tornadoes resulted in seven (7) fatalities, widespread damages to public and private property, power outages, and road closures. This line of severe weather ran from southwest to northeast spawning 22 tornadoes in 17 counties across western and central Kentucky. In addition to the public assistance grants made available to governmental units and qualifying non-profit entities, this declaration provided assistance to individuals and households in the amount of $1.4 million dollars.

- **April 3-4, 2008 (DR-1757):** During this event the Commonwealth was impacted by severe thunderstorms which produced tornadoes, floods, flash floods, hail, mudslides, and landslides. This line of severe weather resulted in the loss of life and personal injury, power outages, downed trees, road closures, and widespread damage to public and private property. Records show that four (4) to six (6) inches of rain fell in a 24-hour period, with some locally higher observations exceeding eight (8) inches. The heavy rains caused widespread flash flooding, road closures, evacuations, stranded motorists, vehicle-related water rescues, and mudslides. Power outages were reported throughout the Commonwealth for several days due to damages or power being shut off as a safety measure. Waters remained high along rivers through mid-April. A number of communities resorted to sandbagging to protect homes and schools from flooding and the continuing rising waters.

- **September 14, 2008 (DR-1802):** On this date the remnants of Hurricane Ike, strengthened by a cold front crossing the Ohio Valley, caused extremely strong surface winds to blow across the Commonwealth resulting in widespread damage to public and private property and affecting 1.8 million residents. Hurricane-force wind gusts caused an immense number of trees to fall and power outages in numerous counties of the Commonwealth, leaving citizens in the dark and without essential services for weeks after the storm. A total of $168 M in property damage was recorded, $69 M in crop damage, and 1 death and 46 injuries were recorded.

- **May 3 - 20, 2009 (DR-1841):** Starting on May 3, 2009, strong storms producing tornadoes, severe thunderstorms, heavy rainfall, flash flooding, and generalized flooding moved across the central and eastern parts of the Commonwealth resulting loss of live and private property and road closures and these conditions endangered public health and safety and threatened public and private property. There were over half a million citizens impacted by this event.

- **August 14, 2009 (DR-1855):** On August 14, 2009, the counties of Jefferson and Trimble experienced a severe storm which contained straight-line winds and flooding. The flooding in Louisville was centralized in the downtown resulting in significant damages to the University of Louisville, the Louisville Public Library, several hospitals, and over a thousand private residences. Public Assistance is estimated to exceed $27 million dollars and over $17 million has been distributed in individual and household assistance.

- **May 11, 2010 (DR-1912):** Beginning on Derby Day, May 1, 2010, the Commonwealth was inundated with a severe rain event as was also Tennessee. Flooding which occurred across Kentucky was exacerbated by massive flooding in Tennessee rivers (the Cumberland and Tennessee) which flow into Kentucky. Eighty-four Kentucky counties were impacted by this disaster which was declared by President Obama on May 11, 2010.

- **July 17-30, 2010 (DR-1925):** On the night of July 18, an isolated severe thunderstorm caused widespread tree and power damage across southeastern Kentucky. The major damage resulted from flash flooding beginning on July 17. See the "Flood" profile section for additional information on this event.

- **April 12-May 20, 2011 (DR-1976):** During an incident period of over one month, NCDC recorded $4.183 million in property damage across 94 County/Zone affected areas. One of the most costly of severe storm events recorded, occurred on April 25th in Calloway County where wind gusts were measured at 101 mph a number of buildings were damaged and an industrial warehouse was destroyed. There was extensive damage to trees and power lines in the city of Murray. Property damage in this county totaled $2 million. On this same day, an EF3 tornado hit Christian County caused $1 million in damage.

- **June 19-23, 2011 (DR-4008):** The June 18-22 tornado outbreak lasted five (5) days and produced widespread tornado activity; five tornadoes of which struck the Louisville metropolitan area, along with widespread damaging winds. While tornado and flood damage was substantial (see "Tornado" and "Flood" profile section for additional information on this event) trees and utilities were reported down, along with widespread damage to buildings in Bell, Breathitt, Knott, Knox, Lee, Magoffin, and Perry Counties.

- **March 2, 2012 (DR-4057):** A deadly tornado outbreak occurred over a large section of the southern U.S. into the Ohio Valley region. Between 1:38 p.m. and 7:25 p.m. 27 Kentucky counties experienced $33.489 million in damage with 23 deaths and 207 injuries. These tornado outbreaks resulting from supercells that swept eastward across the Ohio and Tennessee Valleys were accompanied by strong straight-line winds that, according to the NCDC Storm Events Database, caused an estimated $834,000 in property damage. For more information about this disaster view "Tornado" profile.

Assessing Vulnerability by Jurisdiction: Severe Storm

Grid-Level Risk Assessment Model

Severe Storm Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Severe Storm was determined through first calculating the Severe Storm Hazard Score. The Severe Storm Hazard Score was calculated by studying two (2) specific sources of data. The two (2) data layers used to create the Severe Storm Hazard Score were collected from the National Weather Service SVRGIS wind point (1955-2012) and wind swath (2006-2012) GIS data layers. This GIS point data was combined to create the baseline for the Severe Storm Hazard Score.

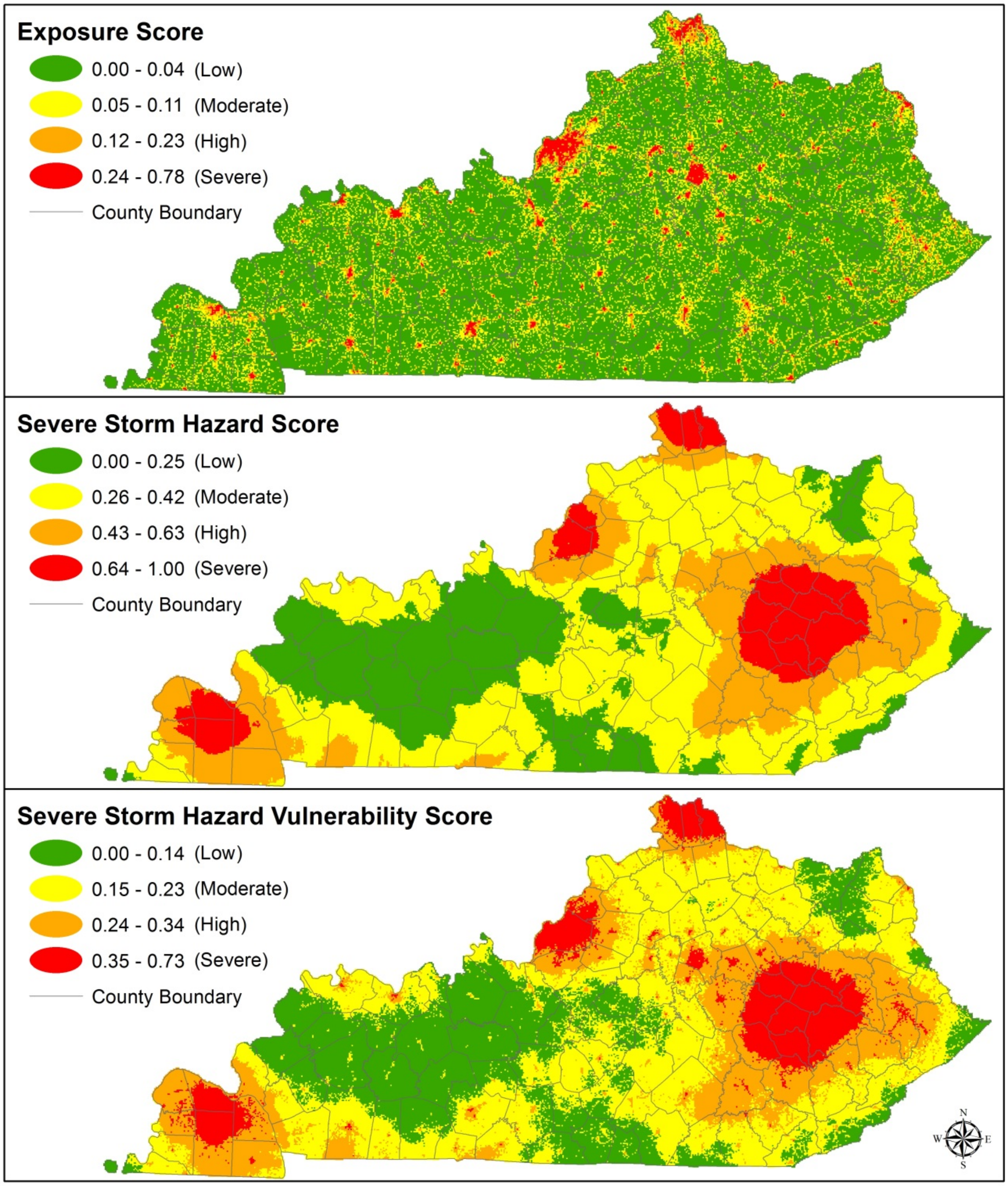
For analyzing this data CHR used a 25 mile radius to calculate each 1 KM MGRS grids geographic risk from a severe storm event. The 25-mile radius was selected because that is the distance that the National Weather Service uses when producing severe weather alerts and probability maps. Basically, the 25 mile radius reduces the white noise and randomness present in atmospheric event data, which enables a meaningful picture of the risk to each grid, built based on historic rates of occurrence in the area. These 25 mile radiuses create map layers that were used as the base map layer for Severe Storm Hazard Score.

To analyze Kentucky's risk to Severe Storm, the county 25 mile radius Severe Storm layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the total number of severe storm events that occurred within a 25 mile radius of each grid. Each grid was then calculated and scored 0-1 to develop the Severe Storm Hazard Score.

The Severe Storm Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Severe Storm Hazard Score and then scored 0-1. Once the final Severe Storm Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe), which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

The following map displays the maps and components of the Severe Storm Vulnerability Score.

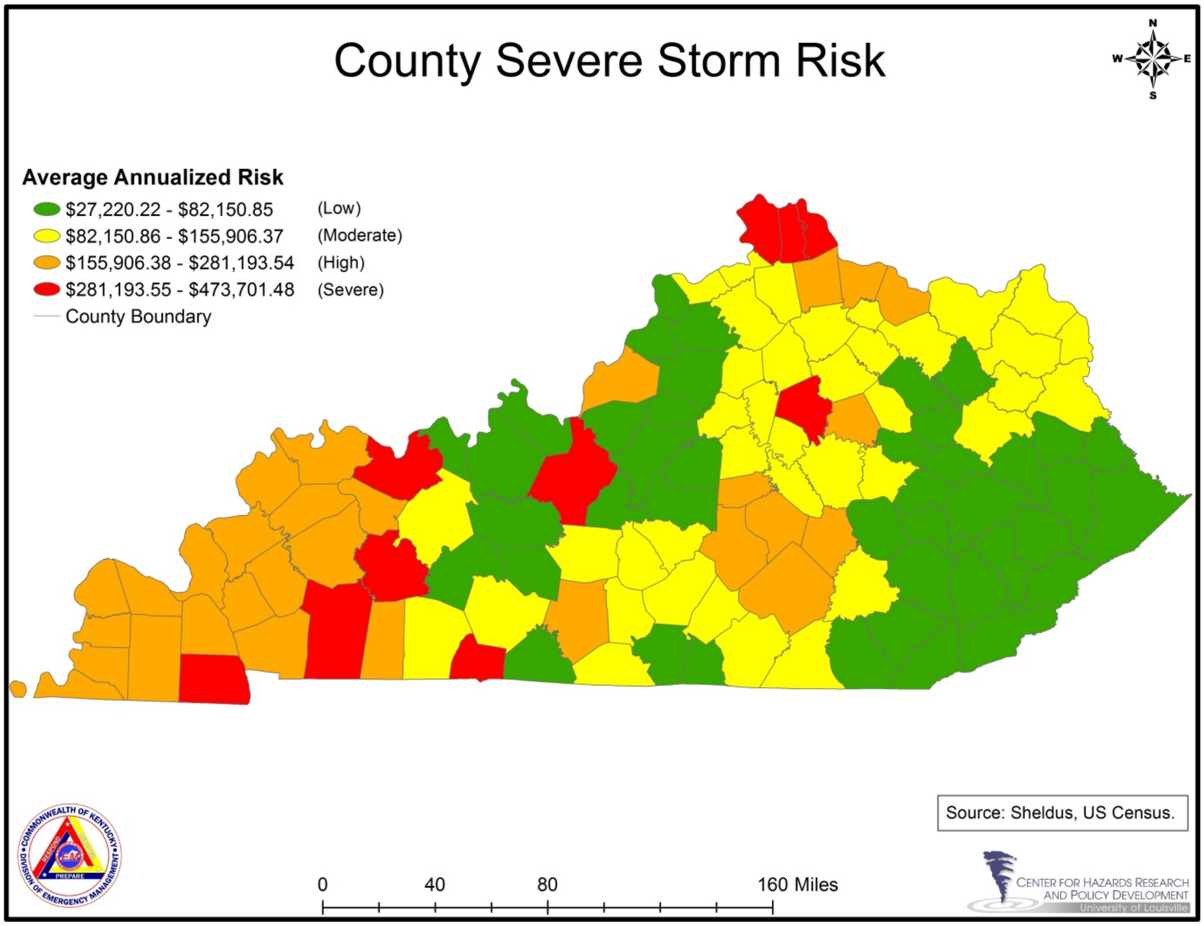


Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: NOAA

Center for Hazards Research and Policy Development
University of Louisville

County-Level Risk Assessment Model

The Severe Storm County Risk Assessment Model was created using the Severe Storm Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by their average losses (See Appendix 2X "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



Source: Sheldus, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences and losses from severe storms comparatively across Kentucky.

Severe Winter Storm

Identifying Hazards: Severe Winter Storm

Description

A winter storm can range from moderate snow over a few hours to blizzard conditions with blinding wind-driven snow, sleet and/or ice that lasts several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by low temperatures and blowing snow, which can severely reduce visibility. A severe winter storm is defined as an event that drops four (4) or more inches of snow during a 12-hour period or six (6) or more inches during a 24 hour span. All winter storms make driving and walking extremely hazardous. The aftermath of a winter storm can impact a community or region for days, weeks, or months.

Types

- *Blizzards* are by far the most dangerous of all winter storms. They are characterized by temperatures below twenty degrees Fahrenheit and winds of at least 35 miles per hour. In addition to the temperatures and winds, a blizzard must have a sufficient amount of falling or blowing snow. The snow must reduce visibility to one-quarter mile or less for at least three (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. In Mid-March of 1993, a major blizzard struck the Eastern U.S., including parts of Kentucky.
- *Ice storms* occur when freezing rain falls from clouds and freezes immediately on impact. Ice storms occur when cold air at the surface is overridden by warm, moist air at higher altitudes. As the warm air advances and is lifted over the cold air, precipitation begins falling as rain at high altitudes then becomes super cooled as it passes through the cold air mass below, and, in turn, freezes upon contact with chilled surfaces at temperatures of 32º F or below. In extreme cases, ice may accumulate several inches thick, though just a thin coating is often enough to do severe damage. In January 2009, a massive ice storm impacted the center U,S. including Kentucky.

Facts

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

- *Power outages* can result when snow and ice accumulation on trees cause branches and trunks to break and fall onto vulnerable power lines. Blackouts vary in size from one street to an entire city.
- *Extreme cold temperatures* may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold resulting in frostbite.
- *Flooding* may occur after precipitation has accumulated and then temperatures rise once again which melts snow and ice. In turn, as more snow and ice accumulate, the threat of flooding increases.
- *Snow and ice accumulation on roadways* can cause severe transportation problems in the form of extremely hazardous roadway conditions with vehicles losing control, collisions, and road closures.


© Reuters

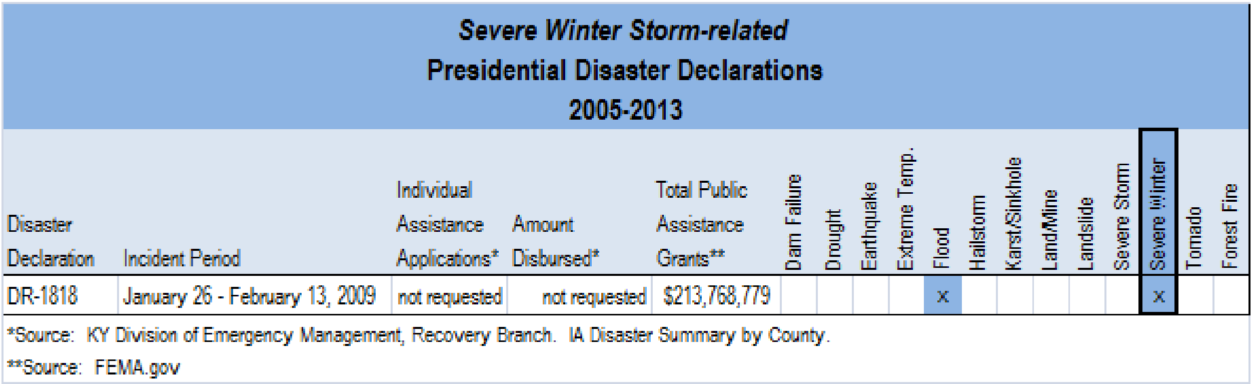
Typical winter storm, Louisville, Kentucky

Profiling Hazards: Severe Winter Storm

SEVERE WINTER STORM PROFILE RISK TABLE	
Period of occurrence:	Winter
Number of events: (1960-2013)	3,951*
Annual Rate of Occurrence:	74.55
Warning time:	Days for Snow Minutes to hours for ice
Potential impacts:	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
Recorded losses:	$435,706,556*
Annualized Loss:	$8,220,878
Extent (Historical):	Date: January 26 – February 13, 2009 Damages: $307 M, multiple injuries and 36 fatalities Scale: 1.5 inches of ice

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)

Kentucky's location makes it vulnerable to heavy snowfall. Its proximity to the Gulf of Mexico provides a necessary moisture source for precipitation all year. Kentucky is also north enough to be influenced by polar air masses. Depending on atmospheric conditions during the winter, Kentucky can have cool, wet winter or suffer the ill effects of heavy snow fall and ice accumulation.



Severe Winter Storm-related
Presidential Disaster Declarations
2005-2013

Disaster Declaration	Incident Period	Individual Assistance Applications*	Amount Disbursed*	Total Public Assistance Grants**	Dam Failure	Drought	Earthquake	Extreme Temp.	Flood	Hailstorm	Karst/Sinkhole	Land/Mine	Landslide	Severe Storm	Severe Winter	Tornado	Forest Fire
DR-1818	January 26 - February 13, 2009	not requested	not requested	$213,768,779					x						x		

*Source: KY Division of Emergency Management, Recovery Branch. IA Disaster Summary by County.
**Source: FEMA.gov

As the above chart demonstrates, in early 2009, Kentucky's worst modern day, natural disaster occurred in the form of a severe winter storm. A storm system moving across the Midwest dropped a devastating amount of ice on the state. As rain continued and temperatures fluctuated above and below freezing temperatures, ice formed on all surfaces, several inches thick in some places. Eventually the weight of the ice was too much for trees and utility lines which broke under the tremendous strain.

President Barack Obama declared Kentucky in a state of emergency on January 28, 2009, through Emergency Declaration 3302 and declared disaster DR-1818 on February 5, 2009. After the freezing rain ended, trees and utility lines continued to fall causing extensive damage and power outages. The situation was so severe that 4,600 members of the National Guard were called to Kentucky. They helped to clear debris, deliver food to those without power, as well as tend to people stranded or in need of help. Five thousand utility workers, some from as far away as Texas, worked around the clock to restore power. There were more than 769,000 power outages reported. Many of these outages lasted as long as four weeks in areas which remained difficult to reach because of debris and heavy ice accumulation. As a result of power loss and ineffective preparedness in some areas, 36 deaths were recorded and several injuries occurred due to falling debris and extreme temperatures. Around $616 million worth of damage and loss resulted because of this severe winter storm. As a result of this event, federal assistance was available for 104 of the state's 120 counties.

- **December 18-19, 2009:** A large and intense area of low pressure moved across the Tennessee valley and eventually up to the east coast on December 18th and 19th. The highest snowfall totals for this event were 16 inches on Black Mountain, 13 inches on Flatwood Mountain in Pike County, and 11 inches at the Jackson weather office. Numerous trees and power lines were downed by the heavy wet snow with widespread and long lasting power outages reported across the area.
    - McCreary County ($250,000 in property damage) reported that 37,000 customers were without power as of 2 p.m. on the 19th.
    - Perry County ($50,000 in property damage) reported trees down in the Vicco area and power outages reported in the Woodland section of Hazard.
    - Leslie County ($350,000 in property damage) reported that trees and power lines were down across the county with many secondary roads impassable due to the heavy wet snow.
    - Pike County ($100,000 in property damage) reported that numerous trees and power lines were down across the county.

- **January 26, 2009 – February 13, 2009 (DR-1818):** Ice, snow, and rain paralyzed the Commonwealth. Fallen trees, debris, and power outages left extremely large groups of people, including the elderly and medically fragile, without essential services. Fatalities occurred in multiple counties as a result of this event. Communication services failed cutting off contact with numerous communities. The National Guard was activated and along with emergency workers and law enforcement, thousands of house-to-house checks were performed to identify and rescue those citizens at medical risk. Downed trees necessitated extensive road closures and created power outages that, in some areas, exceeded four (4) weeks. This event represents the largest Commonwealth disaster in modern history.

- **February 3-6, 1998:** A major snowstorm affected 33 counties in eastern Kentucky. Snowfall totals for the storm ranged from around four (4) inches in valley locations near the Virginia border to as much as two (2) feet in other areas. Power outages were widespread as falling trees brought down by the weight of an unusually wet snow disabled utility lines. Nine thousand customers of various utility companies were still without power on February 9, 1998, and some areas were without power for two (2) weeks.

  Numerous roads were blocked by debris. Bulldozers had to be used to reach people who were stranded. Numerous buildings, including trailer homes, houses, barns, and commercial buildings collapsed under the weight of the snow. Many people remained in unheated homes during the extended power outages. A woman in McCreary County died in her home as a result of a hypothermia-induced heart attack. A man in Wolfe County died from similar circumstances.

- **January 8, 1996:** The notorious “Blizzard of 96’” brought a significant amount of snowfall to the Greater Cincinnati/Northern Kentucky area and was the largest 24-hour snowfall on record. Total snowfall from the storm accumulated to 14.3 inches, over half the amount the area receives in an entire season (23 inches). Many homes and businesses experienced partial or total roof collapses due to the weight of the snow. Road conditions remained hazardous in some locations for many days.

- **March 3, 1993:** One of the strongest winter storms ever (it is sometimes referred to as “the storm of the century”) dumped 30 inches of snow in some areas of eastern and southeastern Kentucky. The snow accompanied high winds, produced snow drifts from six (6) to 10 feet high. For two days Interstate 75 was closed from Lexington, Kentucky to the Tennessee border. Interstate 64 was closed from Lexington to the West Virginia border. Between 3,000 and 4,000 motorists were stranded along the highways. Some of the heavier snow amounts with respective locations were: 30 inches in Perry County, 24 inches in Pikeville, 22 inches in Ashland, and 22 inches in London.

Assessing Vulnerability by Jurisdiction: Severe Winter Storm

Grid-Level Risk Assessment Model

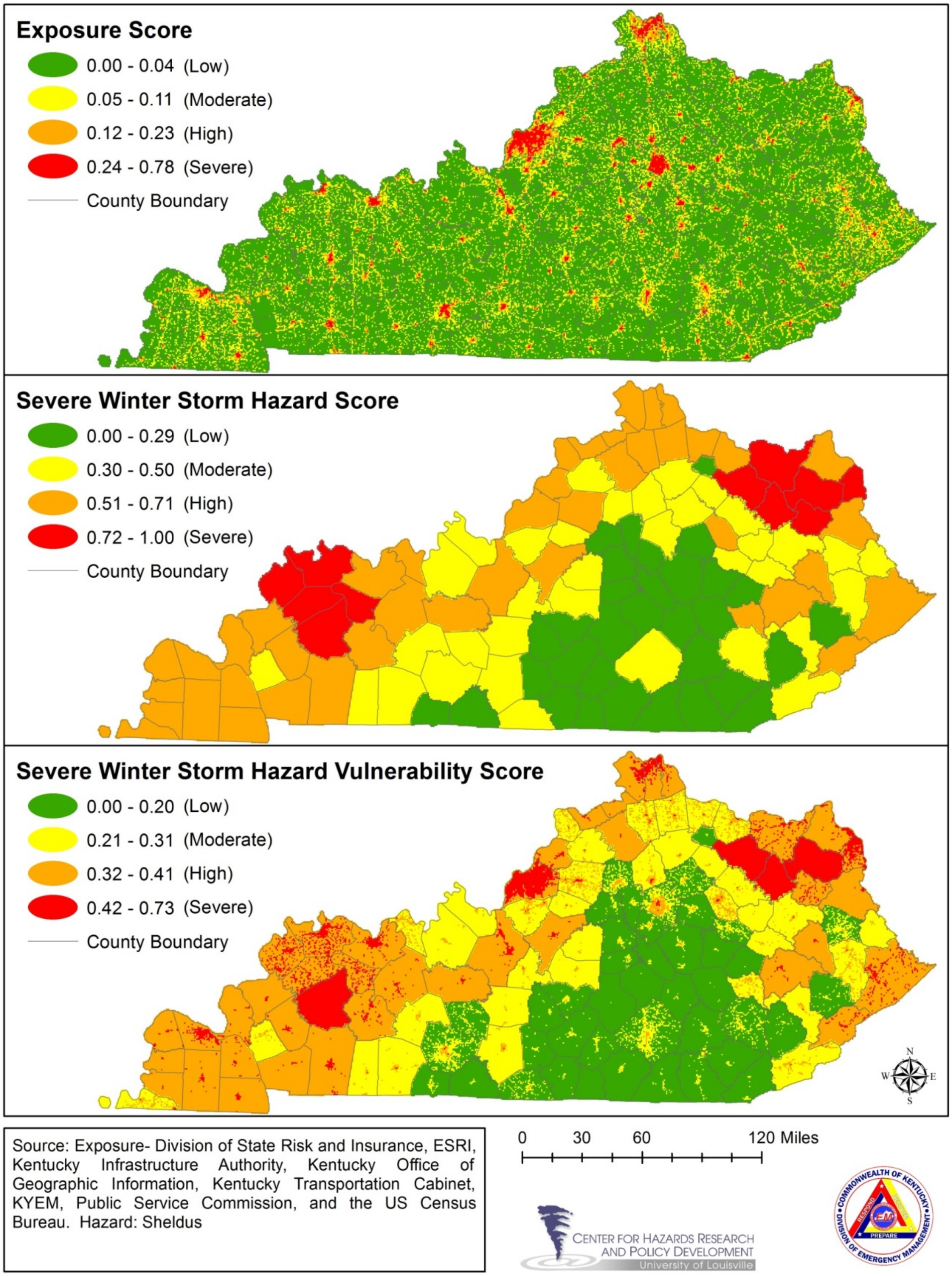
Severe Winter Storm Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Severe Winter Storm was determined through first calculating the Severe Winter Storm Hazard Score. The Severe Winter Storm Hazard Score was calculated by studying one (1) specific source of data. The data layer used to create the Severe Winter Storm Hazard Score was data collected from the capturing county-level Severe Winter Storm events. In order to use this data for the Severe Winter Storm Hazard Score each county was assigned their maximum number of events and that data was aggregated to each grid within that county. To analyze Kentucky's risk to Severe Winter Storm, the county Severe Winter Storm layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the Severe Winter Storm layer covered within each grid. This percentage of area affected by the Severe Winter Storm layer was then calculated and scored 0-1 to develop the Severe Winter Storm Hazard Score.

The Severe Winter Storm Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Severe Winter Storm Hazard Score and then scored 0-1. Once the final Severe Winter Storm Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe), which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

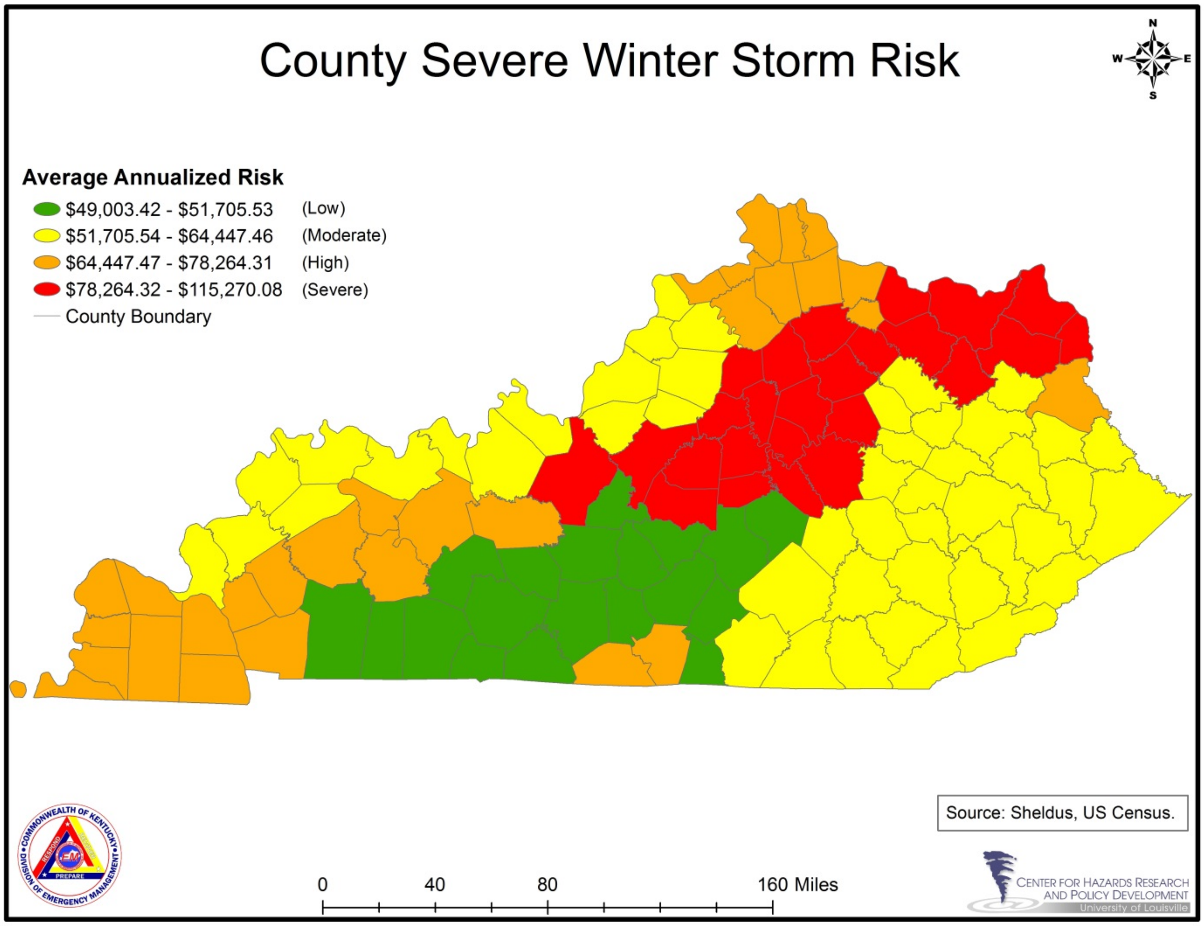
The following map displays the maps and components of the Severe Winter Storm Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: Sheldus

County-Level Risk Assessment Model

The Severe Winter Storm County Risk Assessment Model was created using the Severe Winter Storm Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by their average losses (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences and losses from severe winter storms comparatively across Kentucky.

Tornado

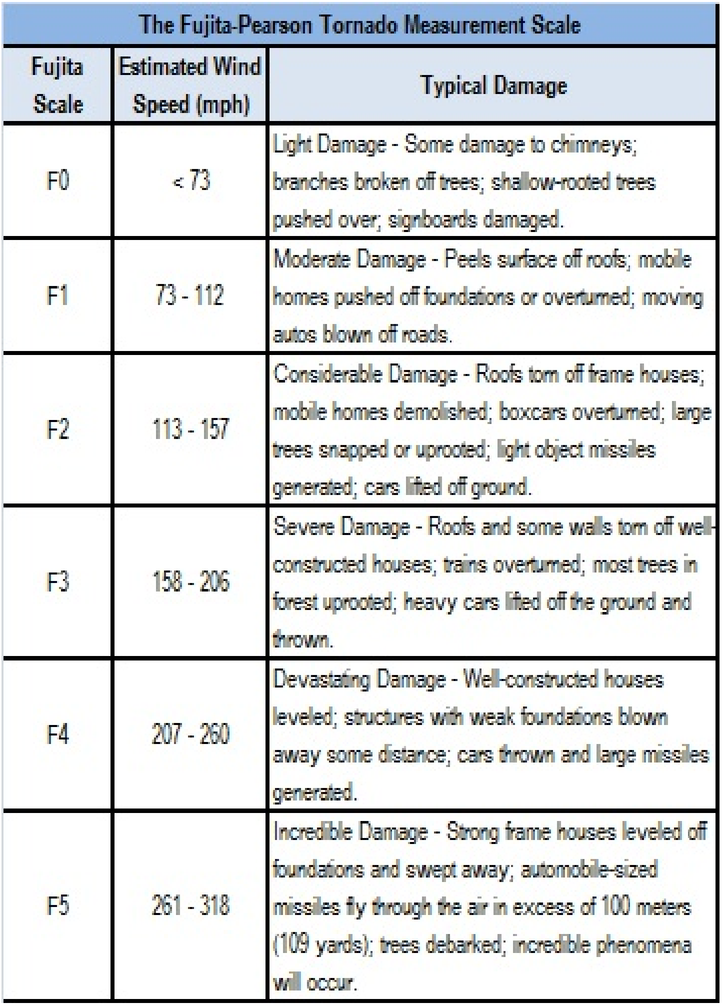
Identifying Hazards: Tornado

Description

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

Types

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



The Fujita-Pearson Tornado Measurement Scale

Fujita Scale	Estimated Wind Speed (mph)	Typical Damage
F0	< 73	Light Damage - Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
F1	73 - 112	Moderate Damage - Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113 - 157	Considerable Damage - Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
F3	158 - 206	Severe Damage - Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207 - 260	Devastating Damage - Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261 - 318	Incredible Damage - Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Facts

- World-wide, approximately 1,000 tornadoes are generated by severe thunderstorms each year.
- Earthquake-induced fires and wildfires may also produce tornadoes.
- A tornado can move as fast as 125 mph with internal winds speeds exceeding 300 mph.
- Powerful tornadoes have lifted and moved objects weighing more than 300 tons a distance of thirty feet and have tossed homes greater than 300 feet away from their foundations.
- During an outbreak from May 4-10 of 2003, 334 tornadoes were recorded.
- In the entire month of May 2003, 559 tornadoes were reported.
- On April 3, 1974, 148 tornadoes in 13 states killed 315 people.
- The path of a tornado can be many miles long, but tornadoes rarely last longer than 30 minutes.
- Tornadoes may cause crop and property damage, power outages, environmental degradation, injury, and death.

Impacts

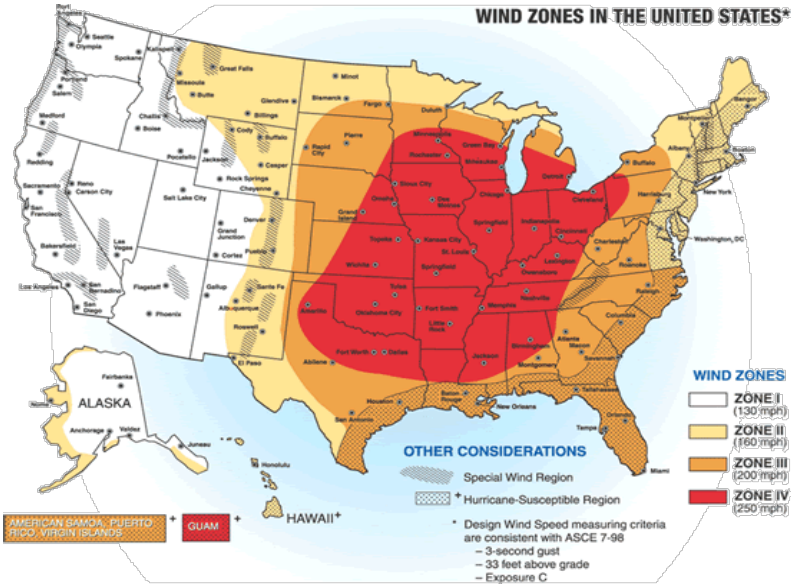
- The primary impacts of tornado outbreaks affect infrastructure and human life most directly. Catastrophic damage may result from tornadoes leaving houses, businesses, and even streets destroyed.
- The secondary impacts of loss of critical infrastructure may result in hazards and additional problems well after a tornado has passed. Citizens may be without shelter, power, or running water for several days, depending on the severity of the tornado.
- Loss of critical infrastructure may also impact local or regional economies by inhibiting transportation of goods and the availability of certain services.

West Liberty, Kentucky, 2012

Profiling Hazards: Tornado

TORNADO PROFILE RISK TABLE	
Period of occurrence:	Spring, Summer, and Fall
Number of events: (1960-2013)	1,136*
Annual Rate of Occurrence:	21.43
Warning time:	Minutes to hours
Potential impacts:	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Impacts human life, health, and public safety.
Recorded losses:	$1,020,237,467*
Annualized Loss:	$19,249,764
Extent (Scale):	Date: March 2-3, 2012 Scale: EF4 Damages: $33.5 M, 23 deaths, 207 injuries

*Data captured from SHELDUS 10.1 (occurrence data captures county-level events across the state)



Tornadoes are common throughout Kentucky and historically have occurred in every month of the year. Unfortunately, the occurrence of a tornado is highly unpredictable. Forecasting the exact time and location a tornado will touch down and the path it will take is nearly impossible.

It is possible however to create a valuable risk assessment based on historic occurrences of tornados and the damage resulting from such events. Also, it is important to consider the majority of Kentucky is located in the most severe wind zone (ZONE IV 250 mph) in the country. The state is historically highly vulnerable to tornado-related weather.

Tornado-related Presidential Disaster Declarations 2005-2013

Disaster Declaration	Incident Period	Individual Assistance Applications*	Amount Disbursed*	Total Public Assistance Grants**	Dam Failure	Drought	Earthquake	Extreme Temp.	Flood	Hailstorm	Karst/Sinkhole	Land/Mine	Landslide	Severe Storm	Severe Winter	Tornado	Forest Fire
DR-4057	February 29- March 3, 2012	5,746	$ 10,378,250	$ 12,438,032					x					x		x	
DR-4008	June 19 - 23, 2011	820	$ 2,886,169	$ 2,428,630					x					x		x	
DR-1976	April 12- May 20, 2011	2,330	$ 9,239,830	$ 31,886,410					x					x		x	
DR-1841	May 3-20, 2009	5,543	$ 15,117,446	$ 34,825,014					x				x	x		x	
DR-1757	April 3-4, 2008	not requested	not requested	$ 3,499,938					x				x	x		x	
DR-1746	February 5-6, 2008	1,032	$ 1,466,605	$ 4,954,738					x					x		x	
DR-1617	December 1, 2005	399	$ 459,715	not requested										x		x	

*Source: KY Division of Emergency Management, Recovery Branch. IA Disaster Summary by County.
**Source: FEMA.gov

West Liberty, Kentucky 2012

As the previous chart demonstrates, since 2005, Kentucky has received Presidential Major Disaster Declarations for seven (7) events that included widespread damage from tornado. To gain a better understanding of the magnitude of tornado impacts on the state, information regarding these and additional tornadic events in Kentucky follows:

March 2, 2012 Tornado Outbreak by County

County	Magnitude	Deaths	Injuries	Property Damage
Kenton	EF4	4	8	$ 20,000,000.00
Lawrence	EF3	2	8	$ 2,350,000.00
Pendleton	EF3	0	0	$ 2,000,000.00
Magoffin	EF3	0	30	$ 1,800,000.00
Morgan	EF3	6	80	$ 1,600,000.00
Johnson	EF1-3	2	7	$ 1,005,000.00
Campbell	EF3	0	0	$ 1,000,000.00
Laurel	EF2	6	40	$ 815,000.00
Trimble	EF0-3	0	0	$ 625,000.00
Martin	EF2	0	0	$ 547,000.00
Menifee	EF3	2	30	$ 530,000.00
Grant	EF3	0	0	$ 500,000.00
Owen	EF2	0	3	$ 320,000.00
Breckinridge	EF2	0	0	$ 150,000.00
Bracken	EF0	0	0	$ 70,000.00
Henderson	EF0	0	0	$ 50,000.00
Warren	EF1	0	0	$ 50,000.00
Hancock	EF1	0	0	$ 40,000.00
Bath	EF1	0	0	$ 35,000.00
Meade	EF0	0	0	$ 2,000.00
Union	EF2	1	1	$ -
Webster	EF0	0	0	$ -
Daviess	EF0	0	0	$ -
Henry	EF1	0	0	$ -
Wolfe	EF1	0	0	$ -

Source: National Climatic Data Center, Storm Events Database. Retrieved: April 30, 2013.

- **March 2-3, 2012 (DR-4057):** A deadly tornado outbreak occurred over a large section of the southern U.S. into the Ohio Valley region. Between 1:38 p.m. and 7:25 p.m. 27 KY counties experienced $33.5 million in damage with 23 deaths and 207 injuries. The accompanying table shows the amount of damage as recorded by the National Climatic Data Center.

- **February 29, 2012 (DR-4057):** Tornadoes ranging from EF0 to EF2 touched down affecting 13 counties: Ballard ($100,000), McCracken ($150,000, 5 injuries), Henderson ($80,000, 2 injuries), Hopkins ($10,000), Muhlenberg ($130,000, 1 injury), Grayson ($50,000, 1 injury), Hardin ($200,000), Larue ($220,000), Metcalfe ($10,000), Russell ($200,000), Morgan ($100,000), Casey ($10,000), and Pulaski ($50,000).

- **January 17, 2012:** Tornadoes ranging from EF0 to EF2 touched down causing damage in Jefferson ($350,000, 1 injury), Scott ($30,000), Simpson ($75,000), and Allen ($10,000) counties.

- **September 25, 2011:** Isolated tornadoes ranging from EF1 to EF2 touched down causing damage in Hopkins ($80,000) and Christian ($40,000) counties.

- **June 19-23, 2011 (DR-4008):** Tornadoes ranging from EF1 to EF2 touched down in Jefferson county, causing $800,000 in property damage.

- **May 23, 2011:** An EF2 touched down in Lafayette of Christian County, causing $350,000 in property damage and 1 injury.

- **April 23, 2011 (DR-1976):** Tornadoes ranging from EF0 to EF2 affected seven (7) counties: Harrison, Ballard ($100,000), Carlisle ($2 million, 2 injuries), Grant ($55,000), Pendleton ($5,000), and Kenton ($15,000). The brunt of the damage occurred in the downtown area of Bardwell, with several of the damaged buildings deemed a total loss and they had to be demolished. Peak winds were estimated near 120 mph.

- **April 22, 2011 (DR-1976):** Tornadoes ranging from EF0 to EF2 affected four (4) counties: Union ($300,000), Webster ($500,000, 2 injuries), Henderson ($80,000), and Daviess ($3,000).

- **April 4, 2011:** From western to eastern KY, isolated tornadoes ranging from EF0 to EF2 affected 10 counties: Ballard ($740,000, 1 injury), McCracken ($30,000), Muhlenberg ($100,000), Christian ($2 million, 7 injuries), Butler, Grayson, Monroe, Clinton, Whitley ($200,000), and Floyd ($10,000).

- **February 28, 2011:** A NWS storm survey confirmed an EF3 tornado with winds of up to 140 mph in Henry County. Of the largest amount of damage, Henry County rang in at $500,000 and one injury was recorded. Three (3) other counties were affected: Jefferson ($1,000), Lincoln ($100,000), and Wolfe ($75,000).

- **February 24, 2011:** Storms moving across the Lower Ohio Valley produced scattered wind damage and a few tornadoes ranging from EF0 to EF2, affecting four (4) counties: Fulton ($30,000), Hickman ($60,000), Graves ($20,000), and Christian ($600,000).

- **October 26, 2010:** A squall line developed ahead of a cold front that produced widespread damaging wind gusts and a few tornadoes ranging from EF0 to EF1 and affecting seven (7) counties. The most property damage was recorded in Bell County ($250,000) and Christian County ($104,000).

- **May 2, 2010:** A broken cluster of severe thunderstorms with embedded supercells and small bow echoes moved east-northeastward across western KY. The two (7) primary supercells of the night followed similar paths across southern parts of the Purchase area, the Lakes region, and the southern Pennyrile region. Multiple tornados ranging from EF0 to EF2, affecting seven(7) counties: Fulton, Hickman, Graves, Christian, Hopkins, Monroe and Wayne. The highest recorded damage was recorded in Hickman ($300,000) and Christian County ($300,000).

- **May 8, 2009 (DR-1841):** A tornado touched down in eastern Garrard County south of Nina on Bethel Road. The first damage observed was of EF1 intensity and the tornado grew to EF2 before reaching the Madison County line. The tornado peaked EFE intensity in Madison County where a mobile home was picked up, thrown, and disintegrated. Two (2) adults were killed and thrown into a nearby pond. Five (5) other occupants of the mobile home were injured. On May 29, 2009, Federal Disaster DR-1841 was declared.

- **February 5, 2008 (DR-1746):** On this date a prolific tornado outbreak took place. There were at least 16 tornados which crossed central Kentucky. The outbreak included two EF3 tornadoes in three (3) counties. There were four (4) deaths in Allen County near Amos. The storm also included straight-line winds and gust which exceeded 100 mph in Nicholas County. On February 21, 2008 Presidential Disaster Declaration1746 was issued.

- **November 6, 2005 (DR-1617)**: On this date a long-track F3 tornado killed over 20 people in the Evansville, IN area**.** Two (2) more deadly tornadoes occurred later that month, each of which killed one (1) person. They were in Marshall County (KY) on **November 15, 2005**, and Ripley County (MO) on **November 27, 2005.** The most recent killer tornado in the Paducah County Warning Area was in Perry County, Missouri on **March 11, 2006.** Two persons were killed in this tornado. All the 2005-06 killer tornadoes were rated F2 or F3.

- **January 3, 2000:** F3 tornadoes struck Owensboro, Kentucky and Crittenden County, Kentucky on this date. These tornadoes demonstrate just how vulnerable this region is during the winter. These two (2) tornadoes caused about 70 million dollars in damage, along with a couple dozen injuries. **January 1999** was another active winter month, with tornadoes on **January 21, 1999** and destructive severe thunderstorms on **January 17, 1999**.

- **March 18, 1925:** One of the most infamous tornadoes in U.S. history occurred in northern parts of the Paducah Warning Area. The Great Tri-state Tornado of March 18, 1925, was perhaps the deadliest and longest-lived in American history. This F5 tornado tracked an estimated 219 miles, killing 695 persons in its path. The tornado began near Ellington, Missouri and finally dissipated near Petersburg, Indiana. Jackson and Franklin Counties in southern Illinois suffered some of the most concentrated damage. Along a path from Gorham to West Frankfort, IL, 541 people were killed and 1,423 seriously injured in just 40 minutes. Despite the fact there was a continuous damage track, it is possible the Tri-state Tornado could have been a series of tornadoes instead of a single tornado.

Kentucky National Guard responds to tornado in West Liberty, Kentucky - 2012

Assessing Vulnerability by Jurisdiction: Tornado

Grid-Level Risk Assessment Model

Tornado Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Tornado was determined through first calculating the Tornado Hazard Score. The Tornado Hazard Score was calculated by studying one (1) specific data source. The data layer used to create the Tornado Hazard Score was collected from the National Weather Service SVRGIS tornado path (1950-2012) GIS data layer.

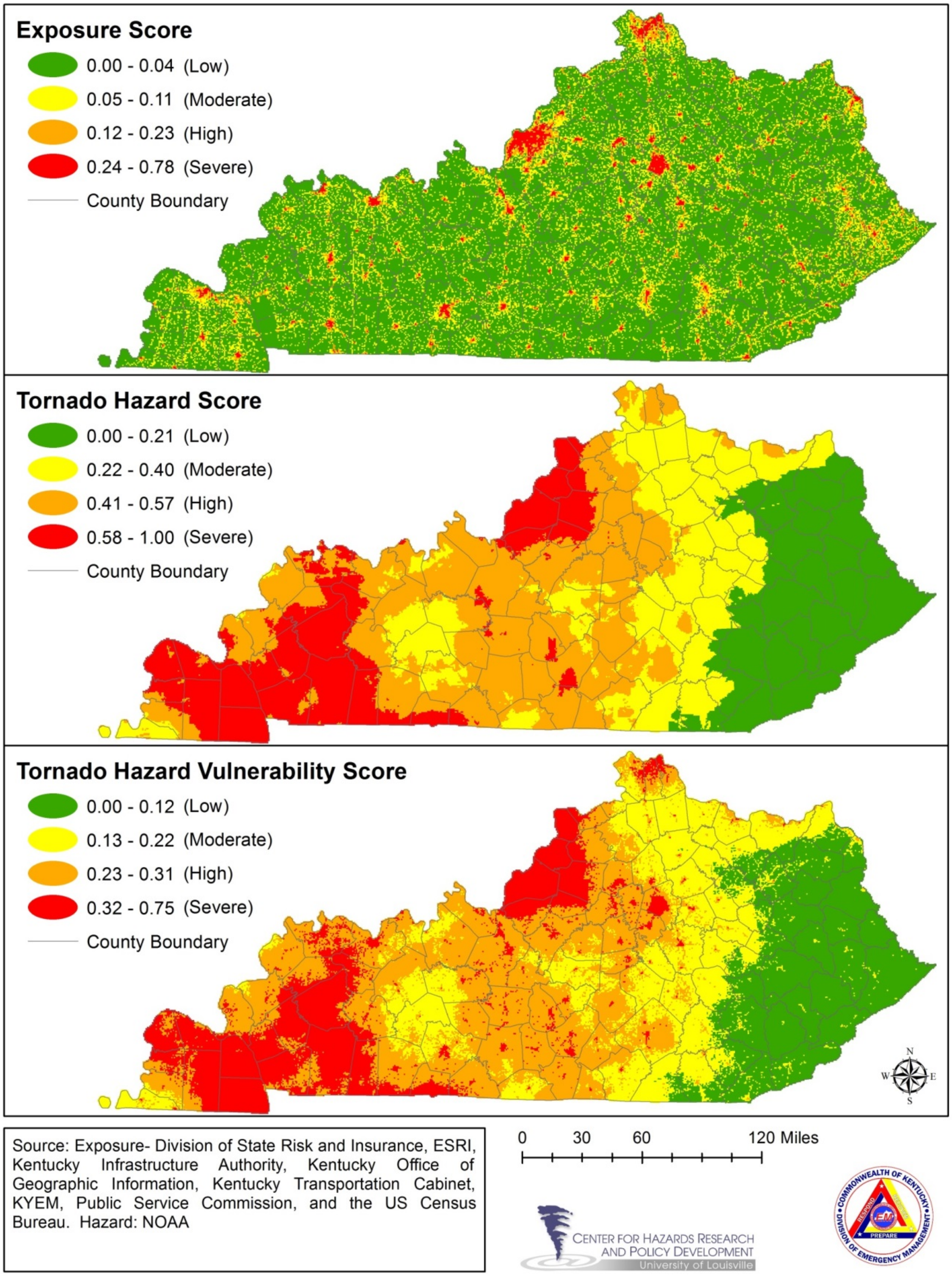
For analyzing this data CHR used a 25 mile radius to calculate each 1 KM MGRS grids geographic risk from a tornado event. The 25-mile radius was selected because that is the distance that the National Weather Service uses when producing severe weather alerts and probability maps. Basically, the 25 mile radius reduces the white noise and randomness present in atmospheric event data, which enables a meaningful picture of the risk to each grid, built based on historic rates of occurrence in the area. These 25 mile radiuses create map layers that were used as the base map layer for Tornado Hazard Score.

To analyze Kentucky's risk to Tornado, the 25 mile radius tornado path layer was overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the total number of tornado events that occurred within a 25 mile radius of each grid. Each grid was then calculated and scored 0-1 to develop the Tornado Hazard Score.

The Tornado Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Tornado Hazard Score and then scored 0-1. Once the final Tornado Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe), which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

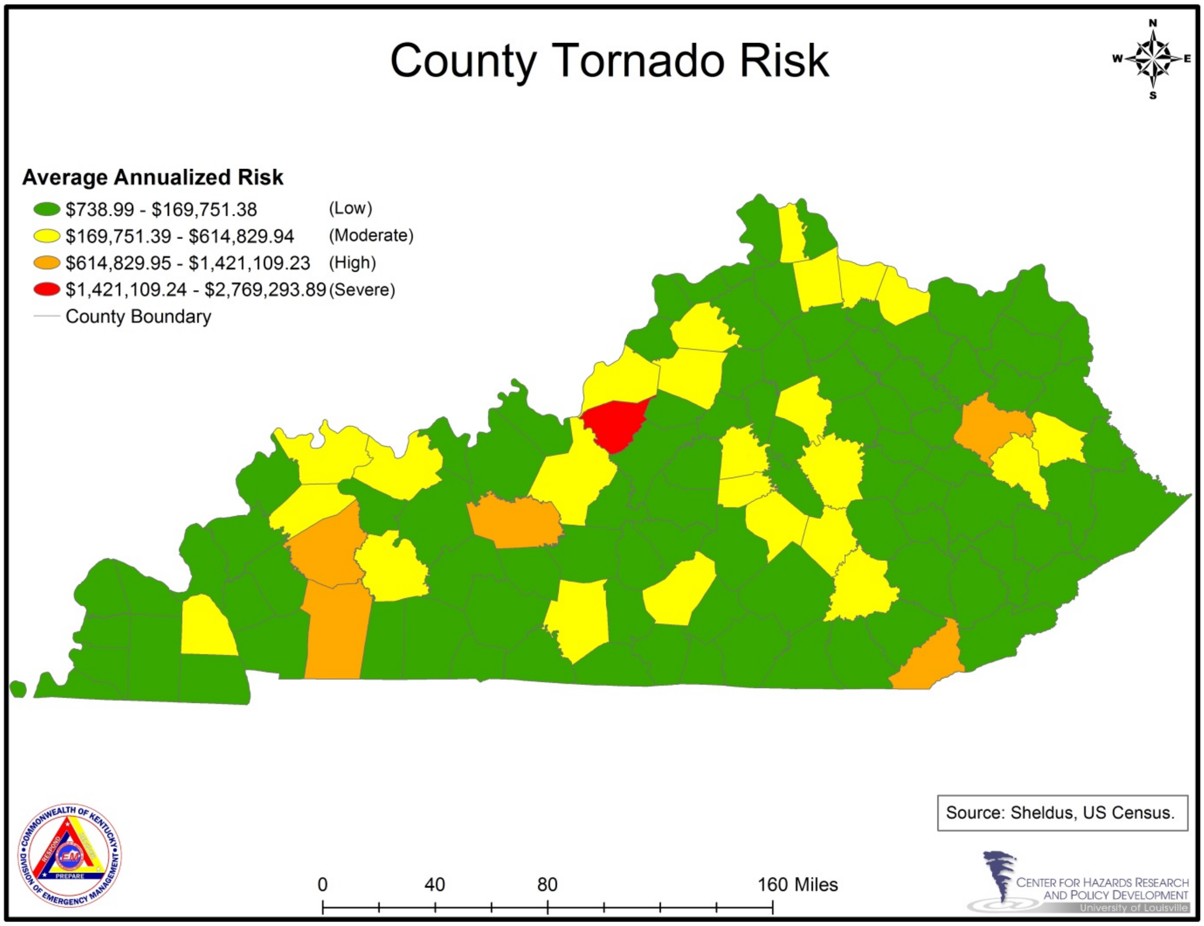
The following map displays the maps and components of the Tornado Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: NOAA

County-Level Risk Assessment Model

The Tornado County Risk Assessment Model was created using the Tornado Average Annual Loss data for each county. The average annual loss is calculated by multiplying each county's annual rate of occurrence by their average losses (See ***Appendix 3-2*** "Hazard Average Annualized Loss"). This data was then joined to a county map for display as seen below.



Source: Sheldus, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties are experiencing the most occurrences and losses from tornados comparatively across Kentucky.

Hazard Category: HUMAN-MADE

Dam Failure

Identifying Hazards: Dam Failure

Description

There are more than 80,000 dams in the United States, the majority of which are privately owned. Other owners are state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous; providing water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power and create lakes for fishing and recreation. Most importantly, dams are important mitigation effort that save lives by preventing or reducing floods.

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

Types

Manmade dams may be classified by: 1) the type of materials used; 2) the methods used in construction; 3) the slope or cross-section of the dam; 4) the way the dam resists water pressure forces; 5) the means for controlling seepage; and 6) the purpose of the dam. Materials used for dams may include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, and miscellaneous materials such as plastic or rubber.

- *Embankment dams,* the most common type of dam in use today, are made from materials which include natural soil or rock, or waste materials obtained from mining or milling operations. An embankment dam is termed an “earth-fill” or “rock-fill” dam depending on whether it is comprised of compacted earth or of dumped rock. The ability of an embankment dam to resist the reservoir water pressure is primarily a result of the mass weight and the type and strength of the materials from which the dam is made.

- *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 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.

- *Concrete arch dams* are typically thin in cross-section. The reservoir water forces acting on an arch dam are carried laterally into the abutments. The shape of the arch may resemble a segment of a circle or an ellipse, and the arch may be curved in the vertical plane as well. Such dams are usually constructed of a series of thin vertical blocks that are keyed together with barriers to stop water from flowing between the blocks.

- *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 20 feet high or capable of impounding 20 acre feet of water. Coal impoundments store coal slurry comprised of wastewater and impurities that result from coal washing and processing. A bulkhead or embankment is made of coarse coal refuse and acts as a dam. Behind it lies a pond of coal slurry. Sediment settles out of this turbid mixture, filling the pond, while wastewater is recycled back into the coal washing process. The sizes of the ponds and bulkheads vary, but pond basins are often hundreds of feet deep and hold millions of gallons of slurry. Coal impoundment failures have resulted in property damage, environmental contamination and, in one case, loss of life.

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

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

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

Facts

- There are 84,134 dams listed in the National Inventory of Dams (2010 database).
- Only 3.8% of the dams are owned by the federal government.
- 87% of the dams in the inventory are earthen dams.
- 1,595 significant hazard dams are within one mile of a downstream city.
- The average age of a dam is 55 years.

Signs of Potential Dam Failure

- *Seepage.* The appearance of seepage on the downstream slope, abutments, or downstream area is cause for concern. If the water is muddy and is coming from a well-defined hole, material is probably being eroded from inside the embankment and a potentially dangerous situation can develop.

- *Erosion.* Erosion on the dam and spillway is one of the most evident signs of danger. The size of erosion channels and gullies can increase greatly with slight amounts of rainfall.

- *Cracks.* Cracks are of two types: traverse and longitudinal. Traverse cracks appear perpendicular to the axis of the dam and indicate settlement of the dam. Longitudinal cracks run parallel to the axis of the dam and may be the signal for a slide, or slump, on either face of the dam.

- *Slides and Slumps.* A massive slide can mean catastrophic failure of the dam. Slides occur for many reasons and their occurrence can mean a major reconstruction effort.

- *Subsidence.* Subsidence is the vertical movement of the foundation materials due to failure of consolidation. Rate of subsidence may be so slow that it can go unnoticed without proper inspection. Foundation settlement is the result of placing the dam and reservoir on an area lacking suitable strength, or over collapsed caves or mines.

- *Structural.* Conduit separations or ruptures can result in water leaking into the embankment and subsequent weakening of the dam. Pipe collapse can result in hydraulic failures due to diminished capacity.

- *Vegetation.* A prominent danger signal is the appearance of "wet environment" types of vegetation such as cattails, reeds, mosses and other wet area vegetation. These types of vegetation can be a sign of seepage.

- *Boils.* Boils indicate seepage water exiting under some pressure and typically occur in areas downstream of the dam.

- *Animal Burrows.* Animal burrows are a potential danger since such activity can undermine the structural integrity of the dam.

- *Debris.* Debris on dams and spillways can reduce the function of spillways, damage structures and valves, and destroy vegetative cover.

Types of Failures

- *Hydraulic Failure.* Hydraulic failures result from the uncontrolled flow of water over the dam, around the dam and adjacent to the dam, and the erosive action of water on the dam and its foundation. Earth dams are particularly vulnerable to hydraulic failure since earth erodes at relatively small velocities.

- *Seepage Failure.* All dams exhibit some seepage that must be controlled in velocity and amount. Seepage occurs both through the dam and the foundation. If uncontrolled, seepage can erode material from the foundation of an earth dam to form a conduit through which water can pass. This passing of water often leads to a complete failure of the structure, known as piping.

- *Structural Failure.* Structural failures involve the rupture of the dam or its foundation. This is particularly a hazard for large dams and for dams built of low strength materials such as silts, slag, fly ash, etc. Dam failures generally result from a complex interrelationship of several failure modes. Uncontrolled seepage may weaken the soils and lead to a structural failure. Structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may lead to structural or piping failures.

Impacts

Dam failures cause flooding much different from natural flooding. A flood from a dam failure may arrive before any warning or evacuation can occur and the resulting wall-of-water makes evacuation based on limited environmental cues very problematic. The failure of large dams results in flooding with enough energy to damage or destroy residences and other structures

Profiling Hazards: Dam Failure

DAM FAILURE PROFILE RISK TABLE	
Period of occurrence:	Failure can occur at any time, but is often spurred by other events such as heavy flooding or seismic activity
Number of events: (1973-2013)	13*
Annual Rate of Occurrence:	0.43
Warning time:	Warning time is minimal and can often be directly related to frequency and thoroughness of inspections
Potential impacts:	Impacts on human life and public safety. Economic loss, environmental damage, and disruption of lifeline facilities.
Recorded losses:	Unknown based on lack of data capture
Annualized Loss:	Unknown based on lack of recorded losses
Extent (Date, Damages, Scale/Size):	Years: 1981, 2000 Damage: 1 fatality, 250 million gallons of slurry release.

*Data captured from National Performance Dam Program and Dam Safety.org

The state of Kentucky has over 1,000 dams, with almost 300 dams being identified by FEMA as High Hazard - or Class C - dams. According to the National Performance of Dams Program's database, eleven (11) dam malfunctions have been reported in the state of Kentucky since 1973, with seven of those being complete dam failures.

Dam malfunctions and failures can occur at any time during the year, day or night and certain types of damages can be prevented with regular inspection and maintenance.

Coal impoundments also pose a severe threat to the human populations and the environment in the event of failure. According to the MSHA, of the 713 impoundments nationwide, 121 are found in Kentucky and 60 of those are high risk impoundments in terms of retaining failure.

Listed in the following table are the historical dam malfunction events for the state of Kentucky, as well as information on impoundment failure and current dam projects occurring in the state.

Kentucky Dam Malfunctions, 1973-Present				
NPDP ID	Dam Name	Incident Date	Incident Type	Dam Failure
KY00137	Caulk Lake Dam	12/16/1973	Seepage	Yes
KY00003	Camp Ernst Dam	9/15/1978	Embankment Slide	Yes
KYS00007	East Fork Pond River FRS No. 4.1	12/8/1978	Foundation Failure	Yes
KYS00004	Samsel	2/2/1979	Seepage	No
KYS00006	Eastover Mining Company Dam	12/18/1981	Sabotage - Other	Yes
KY00014	Indian Lake Dam	1983	Piping	Yes
KYS00005	Unnamed Dam	1989	Inflow Flood - Hydrologic Event	Yes
N/A	Treasure Lake (Boone Co)	02/1993	Overtopping – 32' Hugh damn, 15 acre lake.	No
KY00036	Kincaid Creek Dam	3/1/1997	Inflow Flood - Hydrologic Event	No
KY00345	Mud River Mps #6a	3/1/1997	Inflow Flood - Hydrologic Event	No
KY00040	Guist Creek Lake Dam	3/1/1997	Inflow Flood - Hydrologic Event	No
KY00174	Hematite	6/11/1998	Not Known;Seepage;Piping	Yes
N/A	Inez (Martin Co)	10/11/2000	Tailings dam failure from collapse of an underground mine beneath the slurry impoundment. 250 million gallons (950,000 m3) of coal waste slurry released into local streams	Not a damn failure but a failure of the floor of the reservoir into the mine

http://npdp.stanford.edu/index.html
http://www.damsafety.org/media/Documents/PRESS/US_FailuresIncidents.pdf
http://www.wise-uranium.org/mdaf.html

On October 11, 2000, the Big Sandy River in Inez, Kentucky ran black with thick coal sludge. An abandoned mine below the coal impoundment near Inez collapsed, freeing 250 million gallons of refuse coal slurry from the impoundment pond. It flooded the mineshaft and spilled out into local rivers and streams, overflowing riverbanks and swamping backyards and roads with tar-like black muck.

Inez schools and businesses closed and some Kentucky towns advised residents to boil their water. Nearby communities in West Virginia rerouted drinking water pipelines to avoid slurry contamination.

The Environmental Protection Agency (EPA) calls the aftermath of the Inez impoundment collapse one of the worst environmental disasters to have ever occurred in the South.

Alternatives to coal impoundments include injecting the slurry underground, designing power plants to use impure coal, and cleaning coal using magnets and electrostatic forces, not water. With less coal slurry and fewer coal impoundments, the risk of dangerous impoundment failure is lessened.

The Wolf Creek Dam is on the Cumberland River in the Western part of Russell County, Kentucky. It was constructed to generate hydroelectricity and prevent flooding but is better known for creating Lake Cumberland, which has become a popular tourist attraction and is also the largest man-made lake, by volume, east of the Mississippi River. Lake Cumberland, along with Dale Hollow Dam, Center Hill Dam and J. Percy Priest Dam, provide an adequate supply of water to enhance navigation on the mainstream the Cumberland River from Celina, Tennessee, to the Ohio River. The lake is a source of recreation which has attracted more visitors (4.89 million) than Yellowstone National Park (2.87 million). Designed and constructed during the period 1938-1951, the 5,736 foot-long dam is a combination of rolled earth fill and concrete gravity structure.

From 1968 through 1979, efforts were made to respond to technical issues affecting the dam with water undercutting the dam at its base. By the end of 1979 the Corps of Engineers had conducted a "grout" campaign as well as constructed a concrete dam in front of the earthen dam to assist in maintaining water in the Lake. In 2005, the dam was discovered to have developed leaks under the earthen part of the dam. The center of the earthen dam is filled with a concrete slab which has already been extended. Minor repairs were scheduled in 2006 with major repairs beginning in 2007. As of April 2013, the U.S. Army Corps of Engineers announced the $594 million project would be finished ahead of schedule sometime in the spring of 2013.

KYEM has been directly involved since 2005 with the development of a joint dam planning group, consisting of the Corps of Engineer, Federal Emergency Management Agency, and emergency management Representatives from Clint, Cumberland, Monroe, and Russell Counties. Evacuation and sheltering plans were developed in coordination with the Wolf Creek Dam Emergency Action Plan. The plans are reviewed and updated as required and will be in effect until such time as the rehabilitation projects managed by the Corps of Engineers is finished.

Assessing Vulnerability by Jurisdiction: Dam Failure

Grid-Level Risk Assessment Model

Dam Failure Vulnerability Score = Exposure Score + Hazard Score

Assessing Kentucky's vulnerability to Dam Failure was determined through first calculating the Dam Failure Hazard Score. The Dam Failure Hazard Score was calculated by studying three (3) sources of data. The first layer used to create the Dam Failure Hazard Score was the newly created KDOW dam inundation maps along with the DFIRM mapped X zones that displayed areas protected by levees. These two (2) layers display a geo-referenced data that depicts where dam and levee failures could occur. To analyze Kentucky's risk to Dam Failure according to these data layers, they were overlaid onto a map of 1 KM MGRS grids in Kentucky. Next, a calculation was computed based on the percent of the area the dam inundation and mapped levee areas covered within each grid. This percentage of area affected by the mapped layers was then calculated and scored 0-1 to develop 50% of the Dam Failure Hazard Score.

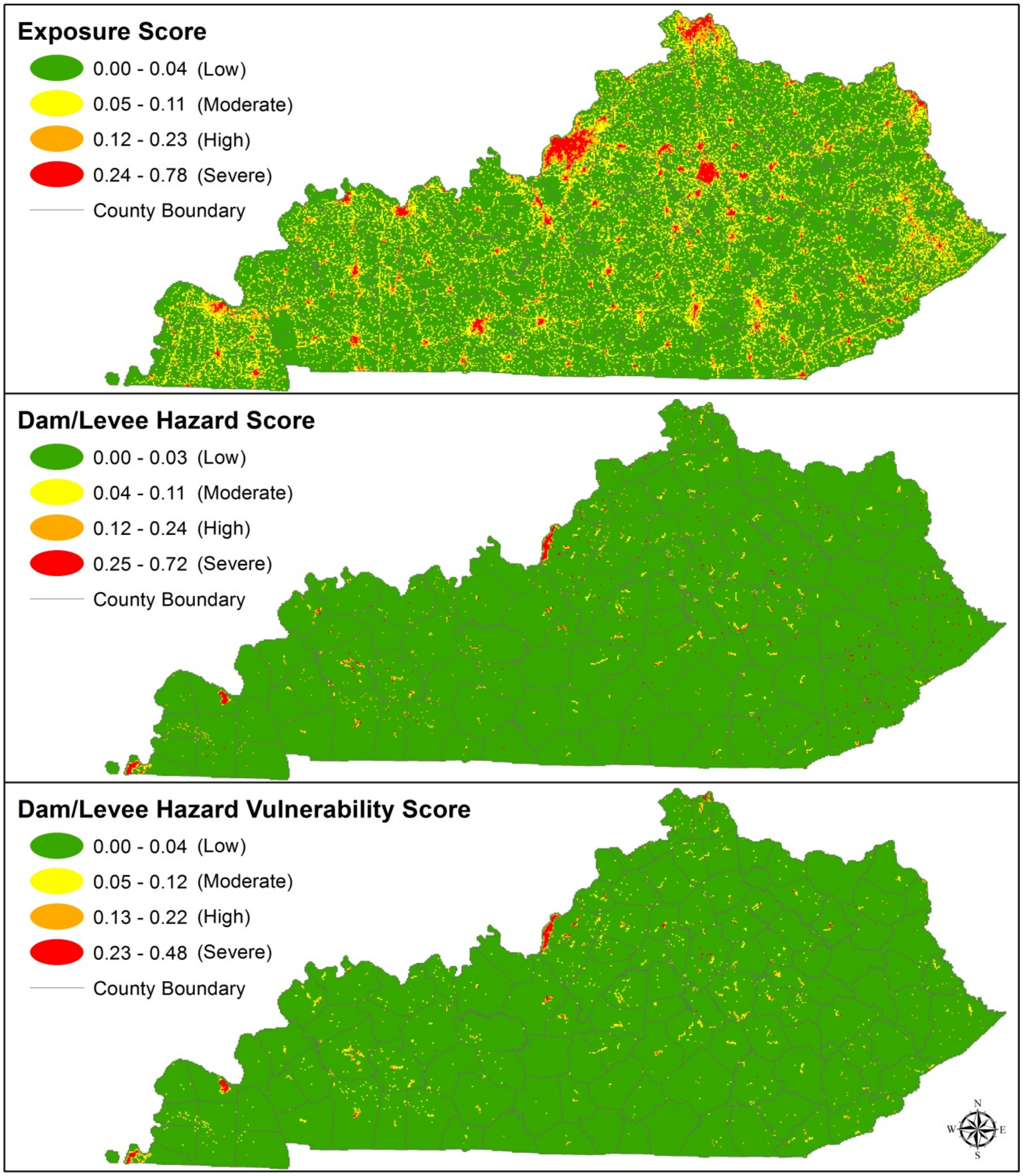
The next step was determined by counting the total number of dams located within each 1 KM MGRS grid. This data displayed where concentrations of Dam Failure events have occurred, thus producing areas of risk. In order to calculate different severities of risk based on dam risk classifications each dam was rated as high, medium, and low hazard dams according to Federal Guidelines for Dam Safety Classifications (2004). A high hazard dam was given a score of 3, medium a score of 2, and low a score of 1. Once all the scored dam location points were aggregated to their appropriate grid, each grid was giving a score 0-1 to create the other 50% of the Dam Failure Hazard Score.

The Dam Failure Hazard Score was then calculated by adding the two (2) scores together and scored 0-1. It is important to note if the Dam Failure Hazard Score inputs equaled 0, then the Dam Failure Hazard Vulnerability Score equaled 0.

Finally, the Dam Failure Vulnerability Score was calculated for each 1 KM MGRS grid by adding each grid's Exposure Score by its Dam Failure Hazard Score and then scored 0-1. Once the final Dam Failure Vulnerability Scores were calculated the composite scores were broken into four (4) categories, using the Natural Breaks classification system (1. Low, 2. Moderate, 3. High, 4. Severe), which demonstrates different levels of vulnerability displayed on the map.

The Grid-Level Risk Assessment Model should be used to identify specific areas of vulnerability located throughout Kentucky. This model provides 106,178 equal areas of comparison for the end users to assess hazard vulnerability. The best way to view and use this data is through a GIS viewer.

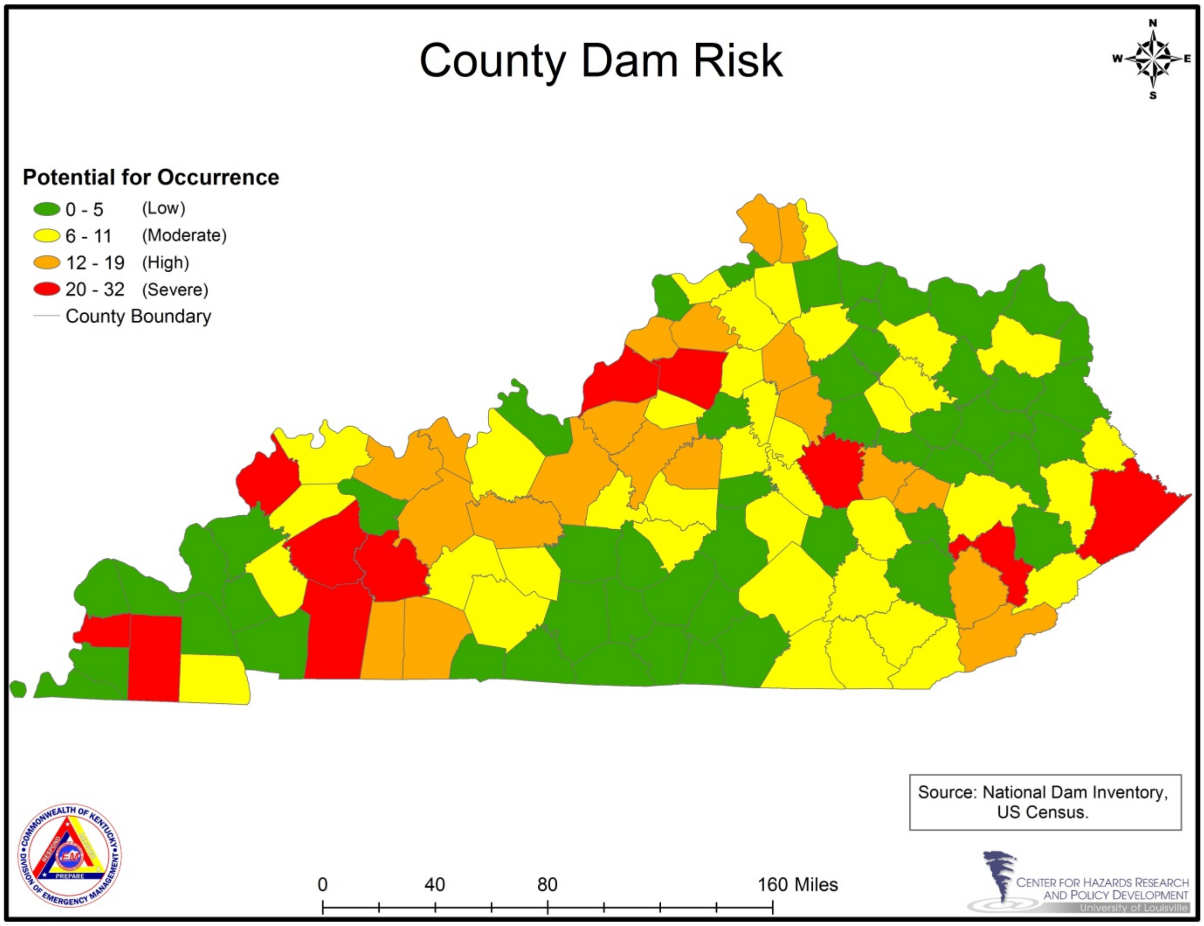
The following map displays the maps and components of the Dam Failure Vulnerability Score.



Source: Exposure- Division of State Risk and Insurance, ESRI, Kentucky Infrastructure Authority, Kentucky Office of Geographic Information, Kentucky Transportation Cabinet, KYEM, Public Service Commission, and the US Census Bureau. Hazard: FEMA, Kentucky Division of Water, National Dam Inventory, National Performance of Dams Program.

County-Level Risk Assessment Model

The Dam Failure County Risk Assessment Model was created based on the total number of dams per county. Each dam was assigned to their appropriate county and was then calculated to provide a total number of dams per county layer. This data was then joined to a county map for display as seen below.



Source: National Dam Inventory, US Census.

The County-Level Risk Assessment Model should be used to compare county-level risk. This data depicts which counties have the most dams comparatively across Kentucky.

A Note on Other Types of Human-Made Hazards

Kentucky Revised Statute (KRS) 39A.010 ultimately lists the following “threats to public safety and health” that, using Threat and Hazard Identification and Risk Assessment (THIRA) criteria, have been categorized by Kentucky as “human-made[34]”:

- Enemy Attack
- Nuclear Weapons
- Chemical Weapons
- Biological Agents
- Sabotage
- Riot
- Civil Disorder
- Terrorism
- National Security Emergencies
- Explosions
- Power Failure and/or Energy Shortages
- Major Utility System Failure
- Building Collapse
- Infrastructure Failure
- Transportation-Related Failures
- Hazardous Materials (HAZMAT)
- Mass Casualties/Fatalities
- Technological Emergencies Related to Cyber Technology
- Technological Emergencies *Not* Related to Cyber Technology

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[34] “Dam Failure” falls within this “human-made” category, as well. It has been excluded from the list as it is an area formally addressed and analyzed above.

In the statute (KRS 39A.010), the above list is collapsed into categories as follows:

1) **Enemy Attack**
2) **Threats to Public Safety and Health Involving Nuclear, Chemical, and/or Biological Agents or Weapons**
3) **Acts of Terrorism**, Including: Sabotage, Rioting, Civil Disorder, Terrorism, Other National Security Emergencies
4) **Infrastructure Failure**, Including: Explosions, Power Failure and/or Energy Shortages, Major Utility System Failure, Building Collapse, Other Infrastructure Failure
5) **Transportation-Related Failures**
6) **Emergencies Caused by the Spill of Hazardous Materials (HAZMAT)**
7) **Mass Casualty/Mass Fatality Emergencies**
8) **Other**, Including: Technological Emergencies Related to Cyber Technology and Technological Emergencies *Not* Related to Cyber Technology (Biological, Etiological, Radiological, Environmental, Industrial, Agricultural Emergencies)

This 2013 Update of the Commonwealth of Kentucky's Hazard Mitigation Plan does not seek any substantial analysis of these abovementioned "human-made" threats. This is an area of emergency management and hazard mitigation in its infancy both within the state of Kentucky and nationally.

However, this is also an area of emergency management and hazard mitigation that currently is being pursued by the Commonwealth of Kentucky and toward which future planning will be required and subsequently directed.

To this point, the 2013 update of Kentucky's hazard mitigation plan has addressed such prefatory actions by the Commonwealth in its *Planning Process* section and has prepared mitigation actions that provide a basis upon which future planning for human-made hazards can be based. The latter is discussed in the *Mitigation Strategy* section of this plan and will be discussed below.

Consequently, a general discussion of vulnerability and of risk assessment related to human-made hazards is relevant here. The Federal Emergency Management Agency (FEMA) has provided considerable guidance regarding how the Commonwealth of Kentucky can begin its future pursuit to mitigate human-made hazards. The following discussion then will rely upon FEMA resources, namely its *Enhanced Threat and Risk Assessment* guidance,[35] that, when used is cited as FEMA [2009].

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[35] Federal Emergency Management Agency (FEMA). [2009]. *Enhanced Threat and Risk Assessment: MGT-315: Participant Guide*. Washington, D.C.: U.S. Department of Homeland Security National Training Program.

The first general idea to address is clarifying the list of human-made hazards (i.e. “threats to public safety and health”) deriving from the Kentucky Revised Statute (39A.010) mentioned above. The individual categories in the list do not necessarily carry equal weight and worth in analysis. There is an underlying framework by which to organize the human-made hazards identified so that a systematic and useful analysis eventually can be performed.

Kentucky Revised Statute 39A.010 arguably juxtaposes both causes with their effects and ends with their means.

Addressing the former, within the KRS 39A.010 list, “enemy attack” and “acts of terrorism” should be prioritized: “Enemy attack” and “acts of terrorism” are causes. From the KRS 39A.010 list, its effects possibly include: “explosions,” “power failures,” “major utility system failure,” “building collapse,” “infrastructure failure,” “transportation-related failures,” “technological emergencies,” and “mass casualties/fatalities.”

Addressing the argument that KRS 39A.010 juxtaposes ends with their means, again “acts of terrorism” is the highlight: “nuclear weapons,” “chemical weapons,” “biological agents,” “sabotage (as a mean instead of an effect),” and “technological emergencies” are all means by which terrorists (rioters, disobedient civilians, saboteurs et al.) would achieve their ends.

This is, of course, not to say that those items on the KRS 39A.010 list that are likely to be *effects* from causes and *means* to ends should not be addressed separately: Effects can, of course be causes and means can, of course, be ends given change in context. A “major utility system failure” does not have to be an effect. It can certainly be a cause for “infrastructure failure,” “building collapse,” “transportation-related failures,” “civil disorder,” and “mass casualties and fatalities.” “Acts of terrorism” do not need to “cause” “major utility system failure.” Similarly, “acts of terrorism” do not have to be the end for there to exist danger from “nuclear weapons,” “chemical weapons,” and “biological agents.” Protecting populations from the harmful effects of nuclear/chemical/biological weaponry need not consider a calculated motive or spontaneous uprising as the hazards’ catalyst. These items are dangerous all on their own.

However, when it comes to mitigation measures and strategy, “enemy attack” and “acts of terrorism” do provide a tie that binds or a framework that underlies most of the human-made hazards listed in KRS 39A.010. “Enemy attack” and “acts of terrorism” ultimately describe a motive (even in the case of spontaneous rioting and civil disobedience). Granted, while a motive is not necessary, (i.e. whether the metempsychosis of premillennial caliphs animates the act of terrorism or whether Homer Simpson falls into a sugar coma at the control switch means little to the effects resulting from a “HAZMAT” leak), focusing planning and mitigation strategies on enemy attacks and acts of terrorism do imply mitigating *the effects from enemy attacks and acts of terrorism* so that terrorism does not *need* to be the cause of the danger: The Commonwealth of Kentucky protects against “major utility system failure” by assuming it is, with motive, being attacked even if it is, in fact, not being attacked and is simply failing due to poor maintenance.

In other words, using the hazards identified in KRS 39A.010 and categorized as "human-made" using THIRA criteria, focusing planning and mitigation activity on terrorism acts as planning for a "worst-case scenario." Power failures and HAZMAT issues do not have to come about as the result of malign intent via attack; but, planning as if attack was the cause provides the most comprehensive planning for those hazards.

Anchoring human-made hazard risk analysis (of those hazards identified in KRS 39A.010) to terrorism, or, more generally, to an attack, sets one immediate priority onto which the Commonwealth of Kentucky can focus its risk assessment and planning activities: The Commonwealth-wide identification of critical facilities.

Such identification would likely involve at least three (3) "phases[36]":

- ***Phase 1:*** *Commonwealth-wide identification and compilation of local jurisdictions' critical facilities.* This will literally be a count; the identification of individual data points.

- ***Phase 2:*** *The identification of the relationship/connection between individual critical facilities:* Critical facilities are rarely stand-alone edifices and functions. By their very nature and definition (i.e. they are *critical*), such facilities will be tied to or "nested" within networks of other likely critical facilities or to some larger system. For example, a power plant toward which the Commonwealth would want to mitigate the effects of "power failure" or "energy shortage" is connected to a distribution system that includes substations connected to transformers connected to individual houses, schools, and commercial structures. Many of these facilities within the power plant's distribution network also would be "critical." Such distribution system identification, or networking, especially apply if the Commonwealth of Kentucky includes "technological emergencies" as either means (to cause) or effects resulting in human-made hazards: Technology, again by nature, is imbedded ("nested") into larger systems.

- ***Phase 3:*** *The individual identification of vulnerabilities within the now-identified critical facilities nested with systems of critical facilities*. By this phase, the Commonwealth of Kentucky ideally will have a full list of individual critical facilities accompanied by further spatial data regarding with which, within which, or amidst which facilities the items on this list are linked, nested, and/or related. Knowing *which* of Kentucky's facilities is "critical" and *how* these facilities are related to other critical facilities finally allows a vulnerability assessment from *within* the individual critical facilities themselves.

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[36] These "phases" have been identified as some of the Commonwealth of Kentucky's mitigation actions, as well.

A Brief Discussion of Vulnerability to Human-Made Hazards

Enemy attacks and acts of terrorism and the subsequent potential for threats to public safety and health involving nuclear, chemical, and/or biological agents or weapons; emergencies caused by the spill of hazardous materials; and/or mass casualties/mass fatalities that they would cause imply a mitigation strategy founded in assessing vulnerability in structures, especially “critical facilities.” Transportation infrastructure, security infrastructure, and structures that provide a vital need for a community or population, et al. will be targeted by enemy attacks and acts of terrorism and will be the confines in or onto which nuclear/chemical/biological agents/weapons, HAZMAT, and mass casualties/mass fatalities are released, spilt, and occur.

When the Commonwealth of Kentucky becomes able to begin identifying the vulnerabilities within its individual critical facilities (i.e. after the abovementioned *Phase 1* and *Phase 2* are complete), the following general, universal concerns likely will be apparent:

1) That there may be a lack of sufficient security
2) That there may be a lack of organizational culture that would play a substantial role in ensuring sufficient security
3) That there may be a lack of or irregular maintenance
4) That there may be deficiencies, inconsistencies, etc. in whom has access to a facility or how the facility is accessed

Beyond these vulnerabilities common to any type of critical facility nested within any network, one might identify the following relevant vulnerabilities specific to the targets of enemy attack and acts of terrorism and/or susceptible to threats to public safety and health involving nuclear, chemical, and/or biological agents and/or weapons; hazardous materials emergencies; and/or mass casualties/mass fatalities:

Assessing Vulnerability: Infrastructure Failure

The vulnerability of infrastructure generally looks similar to the abovementioned universal vulnerability concerns:

VULNERABILITY	ELABORATION
Lack of sufficient security to protect assets	The critical facility may be deficient in maintaining adequate security over the resources/assets/people it houses. The level of security may not match the criticality of the assets protected.
Lack of organizational culture supporting security; lack of employee security awareness	Those working within the critical facility and are not a member of the security team likely will pay less attention to and report less incidents and situations that expose or exploit vulnerabilities.
Lack of, irregular maintenance, especially around secure areas	Even if security measures are implemented, they must be maintained. A frequent vulnerability surrounds such security measures not being maintained: Broken locks, holes in security fencing, and lack of or burnt-out lighting around secure areas are common examples.
Deficiencies, inconsistencies, etc. in whom has access to a facility or how the facility is accessed; access control	Unauthorized access to restricted or controlled areas is an all-too-common vulnerability to critical facilities. This vulnerability is especially egregious to personnel not directly employed by the critical facility, i.e. external personnel.

Source: FEMA [2009]

However, specific types of infrastructure and their vulnerability to failure require additional consideration:

Waterfront/Port Infrastructure Vulnerabilities

Waterfront/Port Infrastructure

VULNERABILITY	ELABORATION
Act of terrorism/Attack deriving from ground, from air, from water	Ports necessarily are accessible from multiple transportation systems.
High cost and limited capability of sub-surface surveillance and response tools	Tools such as sonar, floating barriers, etc. that are frequently used by the United States Navy and United States Coast Guard are far more cost-prohibitive than grounded security tools and equipment.
Minimal resources and training necessary to attack from water	Those who seek to attack critical facilities have an advantage if the facility is on a waterfront or is a port or is in water: SCUBA gear is commercially available and is affordable; SCUB A dive-training is relatively inexpensive. Meanwhile, the attacks that SCUBA gear and training would allow are especially showy and destructive.
Difficulty in restricting access to waterfront facilities	Waterfront facilities and areas generally are open to the public. This has as much to do with futility as it does demand for and purpose of waterfront facilities: The public may as well be allowed in many places near water because it is highly cost-prohibitive to exclude. However, this also means that attacks using watercraft and SCUBA gear can “hide in plain sight” and operate unrestricted near critical assets.

Source: FEMA [2009]

Distribution System Infrastructure Vulnerabilities

"Distribution systems are vast and complex and require computer-based control systems to keep them operating at peak efficiency. They are used in many industries to monitor and control sensitive processes and physical functions. Control systems perform important functions in many of our nation's critical infrastructures… [FEMA 2009[37], p. 4-26]."

Basically, there exist two (2) types of control system: *distributed control systems* and *Supervisory Control and Data Acquisition (SCADA) systems*. The former generally are used over small geographic areas or in a single generating or processing-type plant. SCADA systems, meanwhile, are implemented over large geographic areas and toward dispersed function and operation.

Technological innovation and gains in efficiency guarantee, then, that SCADA systems are now widespread. Still, they are expensive both to implement and to maintain. Further, if disrupted in any way, such system failure creates considerable consequence for public safety. In protecting them, the following describes their general vulnerability:

VULNERABILITY	ELABORATION
Connectivity requirements to the internet and to other control systems	This is an inherent weakness in all control systems: Control systems – especially SCADA—automatically regulate the distribution of critical resources. In order to do so requires constant internet and intra-net activity. Major connectivity disruptions can lead to one part of the distribution system not communicating with another and, thus, regulation of distribution faltering or failing.
Inability to implement traditional network security protocols	SCADAs present significant technical challenges: They are real-time operations with limited processing capability and inherent system-design constraints that hinder the ability to implement what would be very typical network security protocols, e.g. "patches" and strong authentication passwords.

Source: FEMA [2009]

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[37] Federal Emergency Management Agency (FEMA). [2009]. *Enhanced Threat and Risk Assessment: MGT-315: Participant Guide*. Washington, D.C.: U.S. Department of Homeland Security National Training Program.

However, there are additional vulnerabilities to consider regarding specific types of distribution infrastructure that use SCADA:

Electrical Distribution Infrastructure

VULNERABILITY	ELABORATION
Location of sub-stations	Sub-stations are usually located in isolated areas with subsequent minimal security around its critical components (i.e. the switches, circuit-breakers, transformers, ceramic insulators).
Substantial length of transmission lines	According to FEMA, the typical high-voltage transmission line (i.e. 155-765 kV) spans about 300 miles, end-to-end. Obviously, securing this 300-mile expanse is highly cost-prohibitive. These lines are vulnerable anywhere along their 300+ mile length.
Excessive power requirements leading overburdened electrical grid	Seasons of peak usage imply that high demand for power increases the likelihood that an electrical grid will shut down, causing a blackout. Blackouts are an especial vulnerability for those areas that heavily regulate the supply of electric power (e.g. politics slows the process of building new plants) and/or significantly subsidize the cost of electric power (thus artificially increasing demand for it).

Source: FEMA [2009]

Petroleum Distribution Infrastructure

VULNERABILITY	ELABORATION
Refineries	Refineries, as a consequence of design and purpose, are vulnerable to all manner of hazard, particularly natural hazard and hazards as a result of industrial accident. Further, as a consequence of their importance, refineries are target for attack, either intentional or spontaneous.
Pipelines	The United States houses thousands of miles of petroleum-carrying pipeline. For the most part and due mainly to the cost-prohibitive nature of it, these pipelines are unprotected.
Oil spills	Petroleum distribution infrastructure is always vulnerable to oil spills. This is a consequence of the nature of the product being distributed and of probability. Just as probability ensures that a Wal-Mart distribution chain will lose small portions of its products, so probability ensures that petroleum distribution chains will lose some of its product, as well. Lossless distribution does not exist.

Source: FEMA [2009]

Water Distribution Infrastructure

VULNERABILITY	ELABORATION
Access to points-of-origin	Water to be distributed originates from lakes, rivers, etc. It is highly cost-prohibitive and likely impossible to provide security around the shorelines of the large bodies of water supplying the distribution chain.
Access to points-of-distribution	The water distributed to fire hydrants and meters is likely entirely unprotected.
Systems dependent on water	A source of water distribution makes for a tempting target for attack as other hazard-prevention/mitigating systems are dependent on that water supply, e.g. cooling systems, the tools for fire suppression, et al.

Source: FEMA [2009]

Telecommunications Distribution Infrastructure

VULNERABILITY	ELABORATION
Simplicity of attack	Telecommunications refers to both cellular and wired networks. Attacks on these networks can be as simple as destroying one of the many and unguarded distribution paths governing a cellular or wired network, thus denying service
Simplicity of cell-phone network attack	More a sub-category of how simple it may be to attack telecommunications networks generally, cellular networks tend to have at least two (2) vulnerabilities related to "simplicity of attack": 1) They are easily hacked and 2) signals easily can be broadcast at cellular frequencies aimed toward cell towers.
Access to points-of-distribution	Related to cellular networks, cell towers and Mobile Telephone Switching Offices are critical to the network, are easily noticed, an usually lacking in any substantial security. Related to telecommunications networks generally, there are multiple points-of-distribution that are noticeable, easily accessed, and typically lightly secured. Examples of such points-of-distribution include: the Video-Ready Access Device (VRAD), which distributes television and internet services; the Cross-Connect Box (X-Box), which is a "telephone cabinet" primarily used by AT&T to distribute general communication services to its designated areas; and the Controlled-Environment Vault (CEV), which acts like AT&T's X-Box, but distributes telephony services more generally. CEV's are especially vulnerable as they frequently are placed in heavily-populated areas and provide distribution to critical facilities.

Source: FEMA [2009]

Building System Infrastructure Vulnerabilities

The “building system infrastructure” of most consequence to a critical facility is its Heating, Ventilation, and Air-Conditioning (HVAC) system. HVAC systems are the means by which a facility is able to bring in air from outside and mix it with air inside the facility while filtering out contaminants to create a pleasant environment within the facility. Comfort can be further manipulated through features like humidity-control, heating, and cooling that are controlled from some central access point(s).

HVAC systems typically are comprised of the following parts:

- Intakes that “take in” air from the outside;
- Ductwork;
- Air-handling Units (i.e., air filters, mixing chambers, supply fans, inputs);
- Heating and cooling systems;
- Humidity-control systems;
- Chillers, Boilers, and Cooling Towers;
- Return Air Systems;
- Exhaust Fans and Air Outlets; and
- Central Controls and Terminal Devices for the System

Consequently, HVAC systems are notoriously tempting targets for attack or for accident: They are central to the infrastructure of a facility. HVAC systems are connected to all parts of a facility via the facility’s ductwork. Further, HVAC systems have multiple access points into which contaminants can be entered into a facility’s duct system or that simply can be attacked.

Heading, Ventilation, and Air-Conditioning (HVAC) Infrastructure

VULNERABILITY	ELABORATION
Centrality to a Facility	In its function of bringing air from the outside of a facility and mixing with air on the inside and with its connection to all parts of facility via ducts, boilers, chillers, cooling towers, fans, and return air systems, an HVAC system makes for an ideal target.
Access points	Related to its centrality to a facility, the HVAC system's many parts that all have some connection to the duct-work within a facility and thus to the facility as a whole reveals another factor as to why they are ideal targets.
Duct Leakage/Irregular Maintenance	An HVAC system must be maintained regularly. One consequence and vulnerability resulting from irregular maintenance involves leakage in ductwork. Ducts must be sealed with less than 3% leakage. Otherwise, contaminants introduced into the HVAC system through its ductwork may spread to areas outside of the HVAC system's area.
Security layer	Again, related to an HVAC system's centrality within a facility, protecting the system may require multiple "layers" of security. For example, depending upon the sensitivity and criticality of a facility, it may detrimental to have HVAC systems connected thoroughly throughout the facility. Mailrooms, lobbies, mechanical rooms, and loading zones/docks may want to operate within different and segmented zones than the rest of the facility. Return-air systems or ceiling plenums may similarly want to be sequestered and not shared with other parts of the facility.

Source: FEMA [2009]

Information Technology (IT) System Infrastructure Vulnerabilities

The information technology (IT) system is the ultimate SCADA (Supervisory Control and Data Access) system: It is not exaggeration to claim that critical facilities themselves and critical facilities as nested in networks of facilities are utterly dependent upon IT systems.

Information Technology (IT) Infrastructure

VULNERABILITY	ELABORATION
Type of information to be targeted	IT systems oft maintain a facility's security system schematics; access codes and controls; facility emergency plans and site plans; the feeds from remote video-camera monitoring; employee/personnel personal information and work schedules; and digital controls for security systems, elevators, fire alarms, and HVAC systems. If IT systems can successfully be accessed, then they are ideal targets.
External internet connection: Lack of sufficient security	The IT system's primary vulnerability is through its external internet connection. Related to the general infrastructure failure vulnerability that there can be a lack of sufficient security, the external internet connection needs vigilantly maintained and updated firewalls, virus protections, and anti-spyware/anti-malware programs
External internet connection: Lack of organizational culture supporting security	The IT system's primary vulnerability is through its external internet connection. Related to the general infrastructure failure vulnerability that there can be a lack of organizational culture that supports/enforces security, the external internet connection needs to be protected through constantly updated security documentation, enforced computer usage and password policies, and the support of management.

Source: FEMA [2009]

Assessing Vulnerability: Transportation-Related Failure

“Transportation” is generally comprised of the following units and systems:

	By Air	By Land	By Water
Cargo-Bearing	• Hazardous Materials • Non-Hazardous Materials/Goods	• Hazardous Materials • Non-Hazardous Materials/Goods	• Hazardous Materials • Non-Hazardous Materials/Goods
People-Bearing	• Private Pilots, Passengers • Airline Pilots, Passengers, Crew • Emergency Responders	• Individual Drivers/Riders • Mass Transit Users/Drivers • Cargo Drivers • Emergency Responders	• Recreational Boaters, Boat Passengers • Commercial Mariners • Emergency Responders
Transport Sites	• Airports • Air Traffic Control Centers	• Roadways, Bridges • Bus, Rail Stations • Rail Yards, Rail Lines	• Public Waterways • Marinas, Ports • Cargo Terminals • Offshore Oil Platforms[38]
Vehicles	• Airplanes • Helicopters	• Cars, Motorcycles, Trucks • Buses, Trains, Subways	• Boats, Ships, Ferries • Container Ships, Tankers

Source: FEMA [2009]

The general vulnerability for most of the above units of transportation involves predictability: Predictable time schedules, predictable destinations, and predictable routes to arrive at destinations. Related, further vulnerability is a consequence of dependency upon these modes of transportation.

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[38] Not relevant to Kentucky

The following is a more specific consideration of vulnerability for transportation-related infrastructure:

Transportation-Related Infrastructure

VULNERABILITY	ELABORATION
Attractive Targets	Transportation units are tempting targets for attack because of the likely potential for: - Mass casualties/mass fatalities - Far-reaching economic impact - Related, the disruption of national and international commerce/trade - Impacts to traffic flow - The inability/shutdown of emergency responses - The loss of confidence felt by the public toward public officials to protect them.
Major interstate or highway to enemy attack/act of terrorism	Specific to the general attractiveness of transportation systems as targets, a major interstate or highway is especially attractive as all of the effects listed above can be achieved logistically simply by an attack to an overpass or major artery.
Mass transit to enemy attack/act of terrorism	Again, specific to the general attractiveness of transportation systems as targets, mass transit is pointed out to clarify that while not as devastating or as effective a target to most areas of Kentucky, Kentucky does maintain some mass transit systems that would impact many individuals and disrupt economic activity if attacked.
Age/Reliability of existing infrastructure	According to FEMA, a majority of bridges, overpasses, and roadways have been identified as below-standard and, thus, subject to structural failure due simply to irregular maintenance and/or age.
Toxic materials	Daily, toxic materials travel the roadways and rail lines of Kentucky. An accident or an attack on just one of these modes of transport (e.g. one tanker-truck) carrying something as common as chlorine could lead to the deaths and/or injuries of hundreds of people.
Dependence on SCADA	Air and rail transport typically are operated by archaic computerized systems

Source: FEMA [2009]

Summarizing, then, considering the above general and hazard-specific vulnerabilities requires first an identification of all of the Commonwealth of Kentucky's critical facilities, and, second, an identification of the systems and networks within which individual critical facilities operate and/or are nested. Such a massive campaign is justified by assuming that of all of the human-made hazards identified in KRS 39A.010, enemy attack and acts of terrorism are the cause from which the Commonwealth of Kentucky should seek to protect its denizens. Enemy attack and acts of terrorism being the fulcrum used to turn the lever of mitigation activity aimed toward human-made hazard ensures a "worst-case scenario" mitigation strategy that is focused on Commonwealth-wide and system-wide identification of critical facilities and assets that otherwise might not take precedence outside attack ranked low in priority and if facilities were considered mutually exclusively.

While any or all of the abovementioned specific vulnerabilities can exist within any corresponding critical facility, we do not know which of the facility-specific vulnerabilities or to what extent each of the facility-specific vulnerabilities is affecting any one critical facility without knowing (a) that the "critical facility" is indeed critical and (b) within which system/network it is operating or is nested.

A (Very) Brief Discussion of Risk Assessment of Human-Made Hazards

Using enemy attack and acts of terrorism as the foundation for a discussion on vulnerabilities and risk assessment, the vulnerabilities to the Commonwealth of Kentucky from human-made hazards (at least as listed in KRS 39A.010) involves its infrastructure, especially related to transportation-related infrastructure and critical facilities.

Of the remaining human-made hazards that comprise the KRS 39A.010 list of categories[39], "vulnerability" is not at issue. Rather, "risk" is at issue. Human-made hazards such as "emergencies caused by the spill of hazardous materials (HAZMAT)" are not vulnerable in and of themselves. Rather, such hazards are the *source* of vulnerability mainly to infrastructure generally and both to transportation-related and critical, specifically.

"Risk," then, ultimately is a function of two variables: probability and magnitude of effect. Even after the source of a threat has been identified (e.g. we know specifically who will attack us) and even after the vulnerability of potential targets has been assessed, we cannot conceive of risk until we can assess the likelihood that an identified threat will strike and until we can assess how much damage (both monetarily and socially) will be wrought in the event of the identified threat whose likelihood of occurrence has been assessed.

The latter variable involved in "risk" (i.e. magnitude of effect) can be conceptualized: There is always enough information available validly to estimate to what degree of devastation an identified threat will call forth.

The immediate dilemma facing human-made hazards and the "risk" they present to vulnerable infrastructure and critical facilities involves "probability."

Probability, by its nature, is relative. What that means is that the likelihood of an event occurring cannot be claimed without that likelihood being in relation to some other event or variable. One cannot walk outside one's house on June 1st and simply claim that there is 85% chance of rain today. To justify such a probabilistic statement requires that that statement be related to some event or variable. It may look like an 85% chance of rain *in relation to* the dark and ominous nature of the sky upon walking out of the house. Similarly, the 85% statement can be justified if you know that, say, for 85 of the past 100 continuous years, June 1st has seen rain. There are, of course, problems with the above justifications; but, the point to be made is that probability requires relativity.

The caveat for the statement that "probability requires relativity" is that "relativity" or "relative-ness" can be defined and assumed as "random" and/or "independence." Here, the likelihood of an event occurring is still in relation to some other event or variable; only the relation is hypothetical: The likelihood of an event occurring in relation to the assumption that nothing external influences that likelihood.

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[39] Namely, "enemy attack;" "acts of terrorism;" "threats to public safety and health involving nuclear, chemical, and/or biological agents/weapons;" "emergencies caused by the spill of hazardous materials (HAZMAT);" "mass casualties/fatalities;" and "other," which includes technological emergencies both related and *un*related to cyber technology

Herein lies the dilemma and the source of future opportunity for the pursuance of assessing the risk of an event being caused by a human-made hazard: These causes are *not* random and are *not* independent; yet, they likely are "conditional[40]" upon an almost infinitesimal array of environmental, social, and political events and variables that (most importantly here) do not have to be historical in nature.

To this previous point, the relationship by which probability is deciphered when dealing with *natural* hazards is grounded in history as much as it is grounded in general environment and geography specifically[41]: A flood of some degree of magnitude is some percentage likely to occur in an area largely because floods of similar degrees of magnitude have occurred in this area repeatedly in the past, i.e. historically.

Human-made hazards do not give us such historical predictability. The variables upon which probability will be based are social, are political, are economic, and are psychological. In other words, the variables upon which probability for human-made hazards is based are infinite and dynamic. To add further complication, what historical points-of-relation do exist are rare and not connected necessarily: The bombing of a federal building in Oklahoma City in 1995 does not really say anything about the future likelihood of a bombing of a federal building in Louisville, Kentucky in 2014.

The point to be taken here is that risk assessment of human-made hazards is in its infancy. It is an area of emergency management and hazard mitigation that will be and is currently actively being pursued. Kentucky's immediate goals related to human-made hazards involves the prefatory data and variables that will later inform the probability underlying "risk" of a human-made hazard occurring: Kentucky seeks first to identify its critical facilities, to identify within which networks such critical facilities are nested, and then to use this information to assess how and where and to what magnitude individual critical facilities are vulnerable given what we know about their network and their purpose to a community or society generally. Until then and simultaneously, research will focus on how to conceptualize probability of human-made hazard events.

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[40] Essentially, a human-made hazard occurs given the occurrence of some other cause or hazard.

[41] Even if it most likely true that geography *determines* the history of natural hazards, e.g. the flat plains characterizing the American West certainly determine the American West's history of tornado events.

MITIGATION STRATEGY

PART I:
Hazard Mitigation Goals I

REQUIREMENT §201.4(C)(3)

The Commonwealth of Kentucky's mitigation strategy shall include a description of the Commonwealth's goals to guide the selection of activities to mitigate and reduce potential losses

B. *Assessing Previous Mitigation Goals; Acknowledgment of Validity and Revision*

For the 2010 update of its hazard mitigation plan, the Commonwealth of Kentucky articulated the following six (6) goals:

Goal 1: Reduce or eliminate injuries or risks to people from natural hazard events.

Goal 2: Reduce or eliminate damages or risks to property from natural hazard events.

Goal 3: Promote sustainable communities.

Goal 4: Enhance state capability to implement a statewide comprehensive hazard mitigation strategy.

Goal 5: Increase public and private sector awareness of and support for hazard mitigation education practices as a means of developing a culture of hazard mitigation in Kentucky.

Goal 6: Conduct scientific research to promote hazard mitigation [2010 Kentucky State Hazard Mitigation Plan, p. 202].

The 2010 update of the Commonwealth hazard mitigation plan sought to achieve the aforementioned goals by meeting the following objectives:

Regarding Goal 1, *The Reduction (or Elimination) of Injuries or Risks to People Resulting from Natural Hazard Events by:*

- Promoting the use of early alert systems to warn people of all natural hazard events [***Objective 1.1***].
- Reducing the impacts of hazards on vulnerable populations [***Objective 1.2***].
- Training public officials in natural hazard preparedness [***Objective 1.3***].
- Promoting the installation or construction of tornado safe-rooms within homes or amongst communities [***Objective 1.4***].

Regarding Goal 2, *The Reduction (or Elimination) of Damages or Risks to Property Resulting From Natural Hazard Events by:*

- Reducing property losses resulting from flooding [***Objective 2.1***].
- Reducing severe repetitive losses and the number of “repetitive loss properties” under the presumption that doing so would reduce the amount of money being paid from the National Flood Insurance Program (NFIP) fund [***Objective 2.2***].
- Increasing the number of communities participating in the National Flood Insurance Program (NFIP) while promoting compliance with the NFIP for those communities already participating [***Objective 2.3***].
- Promoting local government involvement in the Community Rating System (CRS) program in order to promote better floodplain management [***Objective 2.4***].
- Reducing the vulnerability of state-owned facilities and infrastructure to natural hazards [***Objective 2.5***].
- Reducing the vulnerability of Kentucky’s structures and infrastructures to the effects of geologic hazards (which include landslides, earthquakes, sinkhole collapse, subsidence caused by coal mining, et al.) [***Objective 2.6***].
- Encouraging the enforcement of Kentucky’s building codes related to the construction of engineered and residential structures [***Objective 2.7***].
- Making existing manufactured housing more resistant to movement from their sites by high winds and swift floodwaters [***Objective 2.8***].
- Improving the safety of high-hazard dams to minimize the threats associated with dam failure [***Objective 2.9***].

Regarding Goal 3, *The Promotion of Sustainable Communities by:*

- Providing incentives for mitigation planning and actions [***Objective 3.1***].
- Forming partnerships in order to leverage and share resources [***Objective 3.2***].
- Supporting efforts which will assist with the continuity of critical and business operations [***Objective 3.3***].

Regarding Goal 4, *The Enhancement of the Commonwealth's Capability to Implement a Statewide Comprehensive Hazard Mitigation Strategy by:*

- Determining if existing state agency programs, plans, and policies are efficient to reduce risk to and vulnerability from natural hazards [***Objective 4.1***].
- Establishing and supporting on-going intra-governmental and intergovernmental coordination amongst the private sector, the public sector, and the general public and between federal, state, regional, and local governments, respectively [***Objective 4.2***].
- Integrating the pre- and post-disaster mitigation functions of the Commonwealth with its response and recovery functions [***Objective 4.3***].
- Reviewing and updating the Commonwealth's risk and vulnerability assessment at least every three (3) years [***Objective 4.4***].
- Coordinating funding resources and opportunities among the Commonwealth's agencies in order to assist both state and local sub-grantees to meet the non-federal match requirements for federal mitigation-related funding sources [***Objective 4.5***].
- Supporting the development and use of building codes and standards designed to reduce vulnerability and risk to all hazards [***Objective 4.6***].
- Supporting the development and enhancement of local capability to mitigate hazards [***Objective 4.7***].
- Promoting new policies to enhance hazard mitigation initiatives [***Objective 4.8***].

Regarding Goal 5, *The Increase in Public and Private Sector Awareness of and Support For Hazard Mitigation Education Practices by:*

- Developing a tool for dissemination of information related to hazard mitigation [***Objective 5.1***].
- Developing and promoting outreach strategies designed to educate about the Commonwealth's hazards, risks, and vulnerabilities, and mitigation actions applicable to addressing them [***Objective 5.2***].
- Identifying and encouraging the incorporation of available hazard mitigation education and outreach programs/products [***Objective 5.3***].
- Improving public knowledge of hazards and the protective measures against them so that individuals can appropriately respond during hazard events [***Objective 5.4***].

Regarding Goal 6, *The Conducting of Scientific Research In Order to Promote Hazard Mitigation by:*

- Leveraging the existing relationship between KYEM, UK-HMGP, and CHR; continuing to establish partnerships with public and private research universities throughout Kentucky (in order to enhance and support the securing of funding, contracts, and mitigation opportunities); enhancing research infrastructure; and assessing Kentucky’s vulnerability to natural hazards [***Objective 6.1***].
- Collaborating with FEMA’s Emergency Management Institute (EMI) and Kentucky’s public and private universities 1) to develop higher education curriculums (multiple single curriculum) designed primarily to educate professionals in emergency management, and 2) to integrate hazard mitigation curricula into existing tertiary-level career programs [***Objective 6.2***].
- Fostering the continued development and improvement of existing research centers and laboratories within Kentucky’s public research universities by aiding and supporting efforts to secure funding and research contract opportunities that will enhance in-state capabilities to conduct hazard mitigation-related research [***Objective 6.3***].
- Improving information concerning hazards, especially database development/maintenance and map production [***Objective 6.4***].

Kentucky’s 2010 hazard mitigation plan update sought to address these goals-cum-objectives with the following mitigation action items that were intended to address the tabulated hazards from which Kentucky was vulnerable:

Table 4-1: Kentucky's 2010 Update Mitigation Actions

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Use eligible funds from the HMGP and other sources to assist communities in the purchase and installation of indoor and outdoor warning systems, including, but not limited to, weather-alert radios, telephone "ring-down" systems and outdoor warning sirens.	1.1.1	Long Term	Severe Storm, Dam Failure, Earthquake, Hail, Tornado
Identify vulnerable populations through the risk assessment.	1.2.1	Short Term	All Hazards
When funding permits target FEMA mitigation funds for projects that benefit vulnerable populations.	1.2.2	Long Term	All Hazards
Assist where possible to include mitigation activity in emergency management training.	1.3.1	Mid Term	All Hazards
Provide information to the general public and the housing industry through publications and electronic resources about the value of residential and non-residential safe rooms, as well as guidelines and criteria for their construction.	1.4.1	Long Term	Tornado, Severe Storm, Hail
Where resources permit and eligibility criteria can be met, make FEMA mitigation funds and other funding sources available for grants to communities interested in construction of residential and non-residential safe rooms.	1.4.2	Long Term	Tornado, Severe Storm, Hail
Promote the purchase of flood insurance for structures vulnerable to flooding.	2.1.1	Long Term	Flood, Dam Failure
Where communities and citizens express a desire to participate, and as funding resources permit, prevent or reduce damages to structures through elevation, acquisition/demolition or other flood protection means, using available FEMA and other mitigation funds.	2.1.2	Long Term	Flood

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Where communities express a desire to participate and as funding resources permit, prevent or reduce flood prone property though the design and construction of minor engineered water management projects, using available FEMA and other mitigation funds.	2.1.3	Long Term	Flood
Improve the information on the repetitive-loss list by visiting the sites of these properties to verify and correct the data on the list.	2.2.1	Long Term	Flood
Provide information through outreach to floodplain managers and local officials about the repetitive losses suffered at these locations.	2.2.2	Long Term	Flood
Improve the information on the severe repetitive-loss list by visiting the sites of these properties to verify and correct the data on the list.	2.2.3	Long Term	Flood
Provide information through outreach to floodplain managers and local officials about the repetitive losses suffered at these locations.	2.2.4	Long Term	Flood
Educate community leaders and floodplain managers about the program, its value to a community, and how to manage and enforce it.	2.3.1	Mid Term	Flood
Conduct community assessment visits and floodplain audits on a regular basis, including after major flooding events to promote the value of quality participation in the programs.	2.3.2	Mid Term	Flood
Increase inter-agency communication to create better understanding among state and federal agencies about the impact of the NFIP and floodplain management and to tap the expert resources of other agencies for these efforts.	2.3.3	Long Term	Flood
Prioritize communities with a greater flood hazard, more flood insurance policies and population growth, as well as enforcement and program management capabilities.	2.4.1	Long Term	Flood

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Continue a partnership with University of Louisville and the CHR to provide outreach, development of floodplain management publications, and promotional materials.	2.4.2	Short Term	Flood
Increase inter-agency communication to create better understanding among state and federal agencies about the impact of the CRS and to tap the expert resources of other agencies for these efforts.	2.4.3	Mid Term	Flood
Establish hazard mitigation priorities for retrofitting of existing state critical facilities and infrastructure based upon risk and vulnerability assessment.	2.5.1	Short Term	Earthquake, Flood, Hail, Karst/Sinkhole, Mine Subsidence, Landslide, Severe Storm, Severe Winter Storm, Tornados, Extreme Heat
Ensure that state facilities and infrastructure are located, designed and constructed to complement / support local priorities as defined in the Local Mitigation Strategies.	2.5.2	Long Term	All Hazards
Visit sites of interest, such as landslide location after heavy rains, when requested by individuals or agencies affected by geologic hazards in order to gather information on the hazard and disseminate it to other agencies with regulatory or programmatic interests in mitigating the effects of these hazards.	2.6.1	Long Term	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide
Part I. - Use funds available through HMGP, the Pre-Disaster Mitigation Program and any other available funding source for the following types projects: The voluntary acquisition and demolition of geologically-threatened structures which meet the required benefit and cost analysis, and other requirements of the funding agency, and the restriction of future development on the land. Such projects permanently eliminate damages in the areas of the project.	2.6.2 PART I	Long Term	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
PART II. - The retrofitting of existing structures, which meet any required benefit / cost analysis and other requirements of the funding agency, against structural or non-structural damages from geologic hazards, particularly earthquakes.	2.6.2 PART II	Long Term	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide
Promote land use planning for geologically high risk areas.	2.6.3	Long Term	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide
Where funding permits, conduct outreach activities with local jurisdictions to provide technical assistance in the proper enforcement of building codes.	2.7.1	Mid Term	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire
Where funding permits, conduct training seminars and workshops for local building enforcement officials.	2.7.2	Mid Term	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire
Through outreach and education, encourage the creation of local building enforcement capabilities in communities that currently do not have them.	2.7.3	Mid Term	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire
Explore the possibilities of a state-required builder-licensing program to include continuing education, insurance or builders and mediation of disputes over the quality of construction.	2.7.4	Short Term	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire
Explore possible opportunities for financial incentives for owners of manufactured housing to secure their homes to their sites.	2.8.1	Mid Term	Flood, Severe Storm, Severe Winter Storms, Tornado
Examine and evaluate the need for emergency action plans, including impact area / inundation maps, for KY's high hazard dams.	2.9.1	Long Term	Dam Failure, Flood
Examine the issues related to how unregulated development below a dam can change its designation form low or moderate to high hazard, thus necessitating an improvement to the dam or its removal.	2.9.2	Long Term	Dam Failure, Flood

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Investigate the use of tax incentives to promote smart development in hazard-prone locations.	3.1.1	Long Term	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence, Wildfire
Provide FEMA mitigation grant opportunities for communities who develop, maintain, and update their hazard mitigation plans.	3.1.2	Long Term	All Hazards
Establish a working system in which local governments can work together to promote and encourage smart development.	3.2.1	Mid Term	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence, Wildfire
As funding permits; provide grants to communities for utility protection measure projects including electrical, water, and sanitary sewer.	3.3.1	Long Term	Dam Failure, Drought, Earthquake, Flood, Hail, Karst/Sinkhole, Land, Dam Failure, Drought, Earthquake, Flood, Hail, Karst/Sinkhole, Landslide, Mine Subsidence, Severe Storm, Severe Winter Storm, Tornado, Wildfire
As funding permits, provide grants to communities for mitigation activities involving transportation systems.	3.3.2	Long Term	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence
As funding permits; provide grants to communities for the purchase of generators and generator hook ups for critical facilities.	3.3.3	Long Term	Dam Failure, Earthquake, Flood, Hail, Severe Storm, Severe Winter Storm, Tornado
Review the existing state agency programs, plans and policies every three years.	4.1.1	Long Term	All Hazards

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Incorporate State policies into the State Hazard Mitigation Plan.	4.1.2	Long Term	All Hazards
Invite interested or needed agencies to join the State Hazard Mitigation Team.	4.2.1	Long Term	All Hazards
Hold bi annual meetings of the State Mitigation Team or in post disaster setting as necessary.	4.2.2	Long Term	All Hazards
Promote the gathering and archiving of data by local governments on the types and amount of damages after a natural hazard event.	4.3.1	Long Term	All Hazards
Establish criteria for risk and vulnerability assessment of state-owned critical facilities and infrastructure.	4.5.1	Short Term	All Hazards
Update the inventory of state-owned facilities.	4.5.2	Long Term	All Hazards
Inventory critical facilities and infrastructure that are leased.	4.5.3	Mid Term	All Hazards
Inventory identified vulnerable structures from the ADD's structure point data sets when complete.	4.5.4	Mid Term	All Hazards
Continue the state's cost-share on the Hazard Mitigation Grant Program.	4.6.1	Long Term	All Hazards
Develop guidelines for enhancing local community risk and vulnerability assessments.	4.8.1	Long Term	All Hazards

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Where resources permit, provide technical assistance to local governments in establishing, enhancing, standardizing, and implementing local mitigation strategies.	4.8.2	Long Term	All Hazards
Identify effective local regulatory approaches to hazard mitigation.	4.8.3	Long Term	All Hazards
Identify pre and post disaster mitigation related funding opportunities for local communities throughout the state.	4.8.4	Long Term	All Hazards
Identify mitigation best practices for pre and post disaster hazards mitigation activities.	4.8.5	Long Term	All Hazards
Encourage the integration of applicable hazards mitigation objectives from the local mitigation strategies into local comprehensive plans.	4.8.6	Long Term	All Hazards
Review and update local hazard mitigation plans at a minimum of every five (5) years.	4.8.7	Long Term	All Hazards
Build a website for KyEM and local planners to use during plan updates that could be used for data transfer, public outreach, and project management.	5.1.1	Long Term	All Hazards
Develop brochures defining hazards and mitigation funding opportunities.	5.2.1	Long Term	All Hazards
As resources permit, develop a public awareness campaign on the benefits of pre and post disaster mitigation through the dissemination of mitigation success stories or best practices.	5.2.2	Long Term	All Hazards
Develop a strategy for working with the print, electronic and broadcast media to disseminate mitigation education and outreach material.	5.2.3	Long Term	All Hazards

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
As requested hazard mitigation staff will conduct workshops, training, and seminars on hazard mitigation techniques, grant program funding, planning, and benefit cost analysis.	5.2.4	Long Term	All Hazards
As resources allow, maintain an ongoing education and outreach effort to educate public and private schools about the importance of hazard mitigation.	5.3.1	Long Term	All Hazards
As resources allow, maintain an ongoing education and outreach effort to educate elected officials about the importance of hazard mitigation to include in an annual report to the legislature and other appropriate officials.	5.3.2	Long Term	All Hazards
As resources allow, maintain an ongoing education and outreach effort to educate the general public about the importance of hazard mitigation.	5.3.3	Long Term	All Hazards
Promote the design of a functional statewide emergency responders communication system.	5.4.1	Long Term	All Hazards
Promote NIMS compliancy so that local governments communicate more efficiently during large scale, multi-jurisdictional events.	5.4.2	Long Term	All Hazards
Establish a catalog of KY's hazards and mitigation research studies.	6.1.1	Long Term	All Hazards
Establish access and / or interchange privileges with pertinent resource centers throughout the country and internationally.	6.1.2	Long Term	All Hazards
Recommend the creation of a memorandum of collaboration with FEMA and Ky public and private universities for designing higher ed. Curriculum for EM professionals, including the hazard mitigation and related fields.	6.2.1	Mid Term	All Hazards
Participate in education program course development.	6.2.2	Mid Term	All Hazards

Action	Action Number	Short, Middle, or Long Term	Hazard(s) Addressed
Update and modernize KY's flood maps and flood insurance studies in order to improve the information on current maps and studies, and to provide mapping where there currently is none.	6.4.1	Long Term	Dam Failure. Flood
Continue to work with FEMA to prioritize communities for new mapping based on population growth and number of flood insurance policies.	6.4.2	Long Term	Dam Failure, Flood
Continuously update the database of information and knowledge of KY's geologic hazards through research work such as that done by KGS, the University of KY, Dept. of Geological Sciences and USGS.	6.4.3	Long Term	Earthquake, Karst/Sinkhole, Landslide, Mine Subsidence
Monitor, update, and maintain seismic activity using the KY Seismic and Strong Motion Network.	6.4.4	Long Term	Earthquake

It should be emphasized that many of the abovementioned goals, their objectives, and the actions intended to meet the goals-cum-objectives are administrative in focus and would normally not be implemented with hazard mitigation projects (even if some of the above objectives could be pursued with requests for federal assistance from other sources).

The following table summarizes which of the Commonwealth of Kentucky's non-planning mitigation projects and projects currently *pending review* aligned with which 2010 mitigation *goal* via a specified *objective*. While the table below represents a summary, the individual projects comprising the aggregate numbers displayed below are detailed in ***Appendix 4-1***, which also includes in which county and city and under which Area Development District (ADD) each either "closed-out" or "withdrawn" project or project "pending review" was completed/is awaiting the ability to be completed was placed. From the summary, however, a criticism and assessment of the 2010 update of the Commonwealth of Kentucky's hazard mitigation plan (and of state-wide planning generally) will be obvious. The obvious criticism, thusly, will be the motivation for the revision of Kentucky's hazard mitigation goals, subsequent actions, and how those actions are to be developed, prioritized, and implemented. The criticism/assessment will center on the concept of *deductive planning* introduced earlier in this hazard mitigation plan.

For reminder, *deductive planning* refers, essentially, to the act of planning *for*, in this case, Kentucky's local jurisdictions. Using "deductive" as it describes reasoning, *deductive planning* describes the creation of a general plan whose components, conclusions, mechanisms, products, et al. will be specified downward toward Kentucky's local jurisdictions. *Deductive planning* is defined in contrast to *inductive planning*: That the individual plans (and components, conclusions, mechanisms, products of other plans) are aggregated to create a general plan. Also, it should be noted that effective planning requires **both** *deductive* and *inductive* planning. But, the distinction is drawn through these neologisms for this 2013 update of Kentucky's hazard mitigation plan in order to posit and articulate *when* deductive vis-à-vis inductive planning should occur. And, again, this need to distinguish between types of planning results from effective assessment of Kentucky hazard mitigation goals and objectives.

REMEMBER:

Deductive Planning

VS.

Inductive Planning

Table 4-2: Of 32 Objectives, 5 Objectives Were Evaluable Using Mitigation Projects

GOAL	**OBJECTIVE**	**PROJECT TYPE**	**# OF PROJECT[42] TYPE**
Goal 1: Reduce or Eliminate Injuries or Risks to People from Natural Hazard Events.	*1.1:* Promoting the Use of Early Alert Systems	Ringdown System	3
		Weather Radio	2
		Siren	24
	1.4: Promoting the Installation of Tornado Safe Rooms in Homes and the Construction of Community Tornado Shelters	Safe Room	52
Goal 2: Reduce or Eliminate Damages or Risks to Property from Natural Hazard Events	*2.1:* Reducing Property Losses from Flooding	Acquisition	59
		Drainage/Elevation[43]	40
	2.6: Reducing the Vulnerability of Kentucky's Structures and Infrastructure to the Effects of Geologic Hazards…	Landslide Acquisitions/Soil Stabilization	7
Goal 3: Promote Sustainable Communities	*3.3:* Supporting the Efforts that Will Assist with the Continuity of Critical and Business Operations	Burial of Utility Lines	10
		Generator	128

REQUIREMENT
§201.4 (c) (3) (v):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

WITHIN TABLE; APPENDIX TO TABLE

E. Describing Specific Actions That Have Been Implemented to Mitigate Both Repetitive-Loss and Severe Repetitive-Loss Properties,

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[42] The numbers below represent the number of *projects* undertaken that concern the project type. They do not represent *how many* of each project type was incorporated within each *project*. For example, one of the two (2) Weather Radio *projects* resulted in disseminating approximately 6,500 weather radios.

[43] The "Drainage/Elevation" project type category can be a broad category, i.e., there are many ways to "elevate" a property.

The Assessment of 2010 Mitigation Goals and Objectives

Using the mitigation project successes (and future successes) in order to assess the goals that guided state-wide mitigation activity during the 2010 – 2013 planning cycle, a few trends are immediately noticeable:

One, in 2010, the Commonwealth of Kentucky cited 32 “Objectives” by which to meet six (6) “Goals.” Yet only five (5) of those 32 “Objectives” could be met and assessed with actual mitigation project outcome data. This is not to say that Kentucky did not satisfy or at least address the other 27 “Objectives” articulated in 2010. However, arguably, the primary purpose for mitigation planning – especially from the state level-of-analysis – is to guide the distribution of mitigation projects, in this case, throughout the Commonwealth of Kentucky: The FEMA and Kentucky Emergency Management (KYEM) goal of protecting individuals and the critical infrastructure that augments that ability from the devastating effects of oft-times sudden and many times seemingly mercurial natural hazards and from the currently unpredictable and aberrant human-made hazards primarily requires the construction of or improvement to new or existing infrastructure. In other words, protecting individuals from hazards primarily implies expensive/cost-prohibitive, generational capital projects. Planning at both the local and the state level acknowledges the public’s finite resources (i.e. a local, state, or federal government can only confiscate 100% of an individual or community’s money and property – there is a limit) that can be used toward a potentially asymptotically limitless amount of demand for capital projects that will protect individuals from hazards. Hazard mitigation planning is about capital projects primarily, and Kentucky possessed 32 “Objectives” of which only five (5) could be met using capital projects. It seems deficient of the Commonwealth to have the bulk of its “Objectives” lead to the bulk of its “Actions” being immeasurable.

Two, as of the publishing of this hazard mitigation plan and since the 2010 update of this plan, there are approximately 325 capital/mitigation projects in varying degrees of completion throughout Kentucky. Of these roughly 325 projects, nearly 40% of them involve solely the acquiring and installation of generators. When one includes safe room mitigation capital projects, this proportion surpasses 55%. This is not to deny the importance or cost effectiveness of generators or safe rooms: They are incredibly efficient methods to protect individuals from hazards. But, compared to other types of mitigation projects, these are simplistic; “quick fixes”; “Band-Aids,” perhaps.

Together, the above trends imply an inevitable deficiency to relying solely upon to what this plan has termed *deductive planning*. Both trends reflect a fallacy of top-down planning. Regarding the first trend, for 2010 there simply were too many “objectives” (and too many “actions.”) While based in considerable mitigation experience, the “objectives” could ever only be little more than a laundry list of ways by which a mitigation goal *might* or *could possibly* be achieved. Given that the objectives were articulated by a central planner, realistically there could be no consideration for whether or not those implementing the actions that met the objectives that were the vehicle for the mitigation goal actually had the capability or desire to do so. No one person or set of people or agency can know the will or, more aptly, the preferences of a collection of individuals. And in the case of mitigation planning, the preferences of individuals and their communities are extraordinarily relevant. This will be a point addressed again below; but, 2010's objectives and actions imply inconsideration that a state does not actually suffer the effects from hazards. Tornadoes, floods, earthquakes, bombings do not affect the Commonwealth of Kentucky per se. They affect the local jurisdictions and the individuals *within* Kentucky. Thus, if the goal of Kentucky and of FEMA truly is to protect individuals from hazards, the mitigation preferences and demands from individuals and from local jurisdictions within Kentucky must take precedence over what the state generally and what the Commonwealth of Kentucky specifically thinks or imagines or (worst) presumes its individuals and local jurisdictions demand in terms of hazard protection. A list of 32 "Objectives" of which five (5) can only be met with mitigation projects is, at worst, a baseless and arbitrary bit of presumption or, at best, simply an overexcited attempt to think of and plan for everything while discounting that all plans must be implemented.

Regarding the second trend and related to the previous discussion about the first, with over half of all FEMA-approved mitigation capital projects in Kentucky since 2010 devoted to either generators or safe rooms, once again it is evident that it was the demands of the Commonwealth of Kentucky (and perhaps of FEMA) that were promoted over the mitigation demands of the localities actually suffering from hazards. Again, it cannot be overlooked that from cost-benefit perspective, generators and safe rooms are extraordinarily effective and valuable mitigation projects. From a bureaucratic perspective, they are also relatively attractive: They are effective, cost-efficient projects that are not overly burdensome in terms of harmonizing with multiple and conflicting federal and state agencies' regulatory frameworks. But, while attractive from an administrative, regulatory, and cost-benefit perspective (thus making such projects attractive to federal and state agencies), it is doubtful that, even if the projects were by any and all criteria considered by every individual everywhere in every time the most perfect mitigation projects, demand for these Paragon Projects of Perfection would be so disproportionately realized without the soft nudging deriving and apparent from those centrally planning for and the agencies ultimately providing for the funding for them. To clarify, it is obvious that the Commonwealth of Kentucky (through its agent, Kentucky Emergency Management and through the Kentucky Hazard Mitigation Council) focused considerable energy to promoting or selling generator and safe room projects. This is by no means a negative statement. Rather, it only serves as impetus to reassess whether or not Kentucky Emergency Management wants to continue to devote *as much of* its energies to the promotion of generators and safe rooms.

Finally, evidenced in the 2010 goals, objectives, and actions is some confusion over the role of the Commonwealth of Kentucky in helping to mitigate the hazards that affect its localities. Again, the "Commonwealth of Kentucky" is an abstract; it is a concept. Any role in hazard mitigation for the "Commonwealth of Kentucky" really is a role for its agencies whose responsibilities toward hazard mitigation extend only so far as its legal status and organizational structure allow. For hazard mitigation, then, the "Commonwealth of Kentucky" is synonymous of "Kentucky Emergency Management (KYEM)" and its chosen partners. Goals, objectives, and actions that require KYEM to possess organizational function or power beyond what it is allowed (or beyond what power its status provides) are meaningless and futile. So, for example, the Commonwealth of Kentucky cannot "prevent or reduce damages to structures through elevation, acquisition/demolition, or other flood protection means…[Action 2.1.2].” KYEM will never have the power or the function to mandate communities to pursue elevation and/or acquisition projects. Nor will KYEM apply for such projects themselves to be constructed in a community of its choosing. Those are not KYEM’s functions and, thus, those are not the Commonwealth of Kentucky’s functions. It is this consideration that will guide what this plan will term “inductive planning mitigation actions”: Assigning mitigation actions that implicitly recognize the role of KYEM and, hence, the Commonwealth of Kentucky[44]. Following the discussion of the Commonwealth’s 2013 mitigation goals, this plan will dissect the 2010 plan’s mitigation *actions* and reform and meld them into a new set of actions that hopefully are clearer, less redundant, and more easily evaluated than those presented in the Commonwealth’s 2010 hazard mitigation plan. These will be termed “deductive planning mitigation actions.”

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[44] Inductive planning mitigation actions will also provide a list of actions that are technically feasible and measurable for Kentucky’s next planning cycle.

The Important Caveat to Assessment of the 2010 Mitigation Goal and Objectives That Leads into the Commonwealth of Kentucky's Mitigation Goal

All of the above is not to say that the Commonwealth of Kentucky and Kentucky Emergency Management (KYEM) et al. should deemphasize what this plan document has termed *deductive planning*. For example, from the above table summarizing those current mitigation projects that met 2010 objectives this plan pointed out the disproportionate number of generator and safe room projects. However, the 2010-2013 planning cycle also saw a significant proportion of acquisition projects as a way to meet the mitigation goals of the Commonwealth and its localities.

Acquisition projects can be complicated projects due, at the very least, to politics: Blunt in its name, these projects acquire *property*. Regardless of the fair terms and voluntary contractual basis of the property buy-outs involved in an acquisition project, when some entity – especially a government entity – seeks to take an individual's property, there is always a tightrope to walk. Further, acquisition projects are, by implication, difficult to implement for the individual seeking to have his or her property acquired. If an individual or family's property is repeatedly impacted by flooding with all of the prohibitive costs that such a situation involves (e.g., ever-increasing insurance rates, even under NFIP; constant damage-and-repair; et al.) to whom could that individual or family turn easily and without first garnering community-wide, union-like support before demanding to have his or her property acquired? And simply selling the property on the market is an exceedingly unattractive option due to the likely need for information asymmetry in order to sell and due to general market failure. Even likelier, the sale of the property is outright prohibited by statute or regulation.

The point is acquisition projects show a positive example of *deductive planning*: The Commonwealth of Kentucky needs to be able to direct, facilitate, and coordinate some of the mitigation needs and demands of its local jurisdictions. That acquisition project that the individual or family demanded likely could never have come to fruition if Kentucky Emergency Management (KYEM) and/or the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grant Program (UK-HMGP), the Kentucky Division of Water (KDOW), the Department of Local Governments (DLG), and/or KYEM's Intergovernmental Liaison had not centrally sought out areas and responded to demands of individuals where acquisition and demolition was an effective, efficient, and preferred option in mitigating hazards (floods).

B. *Assessing Previous Mitigation Goals (Continued)*

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A. *Describing the Mitigation Goals That Guide the Selection of Mitigation Activities*

The Mitigation Strategy

The Commonwealth of Kentucky, through its agent Kentucky Emergency Management (KYEM), operates with the following mitigation strategy as its focus:

- ***That the Commonwealth of Kentucky will direct, facilitate, and coordinate the planning and mitigation activities and projects of the localities it oversees.***

Resulting mitigation goals and actions will rely upon the conclusions regarding Kentucky's overall risk assessment detailed in the *Risk Assessment* portion of this 2013 update of Kentucky's hazard mitigation plan. The goals from the 2010 update of Kentucky's hazard mitigation plan will change thusly: Four goals (Goal #1, Goal #2, Goal #3, and Goal #4) will be deleted; additional goals will be added; the wording will be revised for existing goals. Such changes will not represent substantive deviation from Kentucky Emergency Management's (and thus the Commonwealth of Kentucky's) past intent to implement a mitigation strategy. Kentucky Emergency Management and the Commonwealth of Kentucky always have attempted to direct and coordinate the planning and mitigation activities/projects of the communities it oversees. This 2013 update simply will attempt more accurate articulation of that strategy through more precise goals that emphasize Kentucky Emergency Management's stated and everyday functions.

The Commonwealth of Kentucky and Kentucky Emergency Management's goals and actions are thematically linked. This will be rearticulated below when discussing the mitigation actions' contribution to the overall Kentucky mitigation strategy; but, the Commonwealth of Kentucky's goals and actions are thematically linked to its risk assessment and then grouped into sub-categories.

Addressing the latter, Kentucky's mitigation actions are grouped into the following sub-categories:

1) What this plan document refers to as "Deductive Action Categories," or actions derived from the state-/agency-level and administered downward to Kentucky's localities. These are further categorized accordingly:
    a. Actions that can be considered outreach and/or training (categorized as *Outreach*),
    b. Actions that increase the number and variety of mitigation options available to a community (categorized as *Option Diversification*), and
    c. Actions that provide a public good to the state, i.e. actions from which all of Kentucky's communities can benefit but which – due to their inclusiveness and the free-riding that they incentivize – are not usually undertaken by a single community (categorized as *Public Goods-Type*).
2) What this plan document refers to as "Inductive Action Categories," or actions resulting from local hazard mitigation plan review.

The above categories are very important to the link between mitigation action and the Commonwealth of Kentucky's mitigation strategy. Keep in mind that the categories are intended to link directly to the objectives deriving from each of the Commonwealth's goals articulated below.

Regarding the former (that Kentucky's goals and actions are thematically linked to its risk assessment), the risk assessment's purpose in a state plan is to provide background information via an overview of all of the hazard risks that could affect the state. In Kentucky's case, its risk assessment – through two separate models – was able to provide extent of vulnerability to hazards to a very precise one square-kilometer grid level and to a more user-friendly county level. Thus, it is understood that mitigation actions aimed toward Kentucky's (through KYEM's) role in directing and coordinating mitigation activity will refer to the vulnerability outcomes derived in its risk assessment. Mitigation actions that can be categorized as "outreach" or "training" (*Outreach*) will be informed from the Commonwealth's risk assessment. Mitigation actions that inform about or, essentially, sell a larger array or more varied array of mitigation action options (*Option Diversification*) to communities will, again, need background provided by the Commonwealth's risk assessment. Mitigation actions acting as statewide "public goods" (*Public Goods-Type*) will be linked to the Commonwealth's risk assessment in a feedback loop: The Commonwealth's analysis of where specific hazard vulnerabilities are will inform which public goods projects to pursue and when to pursue them, and those areas most in need of those public goods projects will feed back to the Commonwealth (via KYEM) further need for public goods projects.

Finally, the list of mitigation actions deriving from the local hazard mitigation plans indirectly link to the Commonwealth's risk assessment: The difference between a local hazard mitigation plan's risk assessment versus the Commonwealth's lies only in methodology and process. It is doubtful that outcomes will change: Whether scraping Roman numerals on stone tablets the number of tornadoes that have hit a community and dividing that by the span of years in which that number occurred or whether layer-mapping using powerful GIS programs and dividing data points algorithmically using the (Jencks) Natural Breaks Method, it is highly likely that both conclude that the community suffers considerable risk from tornadoes. Having a set of mitigation actions deriving from local plans only helps Kentucky Emergency Management (KYEM) and the Commonwealth of Kentucky better meet the mitigation demands of its communities and, thusly, more effectively use all available mitigation funding.

Again, the above case will be made more formally and elaborated upon more fully when describing how the Commonwealth of Kentucky's mitigation actions contribute to its strategy of directing and coordinating the mitigation activity of its localities/communities.

Tabulated below are, again, Kentucky's 2010 goals accompanied by what will happen to them for this 2013 update and how such changes are justified. Following, new goals will be articulated. After discussing 2013's renewed and new mitigation actions, the new goals will be linked with the mitigation action categories (that replace "objectives") briefly discussed above and discussed more fully below and, thus, linked with the Commonwealth of Kentucky's overall mitigation strategy.

Table 4-3: Kentucky's 2010 Mitigation Goals and the Changes to Occur for 2013

2010 Goal #	*2010 Goal Language*	*Change to Occur*	*Justification for Change*
Goal 1	Reduce or eliminate injuries or risks to people from natural hazard events.	This goal will be deleted.	This is more fundamental than a goal for Kentucky and its agent in hazard mitigation KYEM. This is part of KYEM's reason for existence.
Goal 2	Reduce or eliminate damages or risks to property from natural hazard events.	This goal will be deleted.	This is more fundamental than a goal for Kentucky and its agent in hazard mitigation KYEM. This is part of KYEM's reason for existence.
Goal 3	Promote sustainable communities.	The goal will be deleted.	The promotion of sustainability, while perhaps laudable, is only tangentially linked to activity whose primary purpose is to mitigate hazards. Such a goal is beyond the scope of KYEM's mission and mitigation strategy.
Goal 4	Enhance state capability to implement a statewide comprehensive hazard mitigation strategy.	The goal will be deleted.	The wording of this goal is meaningless and possibly confused about the role of KYEM in hazard mitigation.
Goal 5	Increase public and private sector awareness of and support for hazard mitigation education practices as a means of developing a culture of hazard mitigation in Kentucky	The goal's wording will be revised.	The wording will be revised to reflect Kentucky's and KYEM's mitigation actions directed toward training and outreach whose outcome is expected to develop "a culture of hazard mitigation in Kentucky."

2010 Goal #	*2010 Goal Language*	*Change to Occur*	*Justification for Change*
Goal 6	Conduct scientific research to promote hazard mitigation	The goal's wording will be revised.	Conducting scientific research is worthy goal to maintain. The wording will change to apply more broadly to "public goods" types of mitigation actions (*Public Goods-Type*) that include scientific research.

2013 Goals Guiding Mitigation Activity

Presented, then, are the Commonwealth of Kentucky's and Kentucky Emergency Management's (KYEM) updated 2013 goals that will help guide and direct its mission in hazard mitigation, implement its mitigation strategy, and guide the selection of mitigation activities:

- *GOAL I:* Increase awareness and support of, training toward and about, and education and proficiency in hazard mitigation (guided by the results of the Commonwealth's *Risk Assessment*).

- *GOAL II:* Maximize hazard mitigation activity throughout the Commonwealth of Kentucky (guided by the results of the Commonwealth's *Risk Assessment*).

- *GOAL III:* Provide to/develop for its local jurisdictions the tools and data-based research that will aid in facilitating, maximizing, and promoting hazard mitigation activity throughout the Commonwealth of Kentucky (guided by the results of the *Risk Assessment*).

- *GOAL IV:* Improve direction and coordination/prioritization of the mitigation activity undertaken by the Commonwealth of Kentucky's local jurisdictions.

2013 Objectives by Which to Meet 2013 Goals Guiding Mitigation Activity

The above goals are intended to be focused using the following “objectives”:

- *GOAL I:* Increase awareness and support of, training toward and about, and education and proficiency in hazard mitigation.
  - *Objective I.1*: Provide ample training opportunities, generally.
  - *Objective I.2*: Conduct constant outreach toward Kentucky’s local jurisdictions, generally.
  - *Objective I.3*: Focus outreach and training toward floodplain management, flood insurance/National Flood Insurance Program (NFIP), Repetitive-Loss and Severe Repetitive-Loss properties, etc.
  - *Objective I.4*: Focus outreach and training toward Kentucky’s susceptibility to geologic hazards.
  - *Objective I.5*: Continue focusing outreach toward safe rooms and warning systems.
  - *Objective I.6*: Focus training on human-made hazards.
  - *Objective I.7*: Continue increasing participation in hazard mitigation committees, commissions, etc.

- *GOAL II:* Maximize hazard mitigation activity throughout the Commonwealth of Kentucky.

  - *Objective II.1:* Increase the number and variety of mitigation options available to local jurisdictions, generally.

- *GOAL III:* Provide to/develop for its local jurisdictions the tools and scientific research that will aid in facilitating, maximizing, and promoting hazard mitigation activity throughout the Commonwealth of Kentucky.

  - *Objective III.1*: Focus research on critical facility identification.
  - *Objective III.2*: Focus research on collection of information regarding geologic hazards.
  - *Objective III.3*: Focus research on dam failure.
  - *Objective III.4*: Focus research on improving risk assessment methodologies, generally.
  - *Objective III.5*: Perform site visits toward ends of enhancing data collection.
  - *Objective III.6*: Focus research on human-made hazards.
  - *Objective III.7*: Implement loss avoidance studies.

- *GOAL IV:* Improve direction and coordination/prioritization of the mitigation activity undertaken by the Commonwealth of Kentucky’s local jurisdictions.

  - *Objective IV.1:* Identify demand for mitigation activity from local jurisdictions.

MITIGATION STRATEGY

PART IV: Mitigation Actions

D. *Explaining How Each Mitigation Activity Contributes to the Overall State Mitigation Strategy*

Explaining how each of the Commonwealth of Kentucky's 2013 mitigation actions is linked to its mitigation strategy will be discussed before listing 2013's mitigation actions. This format results from the relevance in this case of explaining the *process* of developing 2013's mitigation actions before listing the actions. It is through the *process* of mitigation action development that the Commonwealth of Kentucky's mitigation actions are linked with its strategy.

REQUIREMENT §201.4 (C) (3) (III):

The Commonwealth of Kentucky shall include an identification, evaluation, and prioritization of cost-effective, environmentally-sound, and technically feasible mitigation actions and activities that the Commonwealth is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.

Assessment of 2010 Mitigation Actions

The Kentucky Hazard Mitigation Council (KYMC) assessed its 2010 mitigation actions. As discussed above, one finding from the assessment involved the ability to evaluate: The Commonwealth of Kentucky listed 32 objectives intended to guide the Commonwealth toward meeting six (6) goals. However, of the 32 objectives, only five (5) could be evaluated quantitatively and using mitigation projects completed throughout the Commonwealth. In terms of mitigation actions intended to meet the 32 objectives that guided the six (6) goals, the Commonwealth of Kentucky had listed 73 actions. Only nine (9) of the 73 actions could be evaluated quantitatively using mitigation project attempts and success pursued by its localities and communities.

Again, as abovementioned, superficially this seems a disappointing assessment. However, the Commonwealth of Kentucky via Kentucky Emergency Management (KYEM) and the KYMC assert that 2010's goals-via-objectives were generally met.

The Nature of a State Hazard Mitigation Plan Vis-à-vis a Local Hazard Mitigation Plan

That only five (5) objectives of 32 and nine (9) actions of 73 can be evaluated through mitigation projects is a consequence of the difference between state and local hazard mitigation plans.

In terms of format for their respective mitigation strategies, a state and local hazard mitigation plan are displayed similarly: Goals are articulated; objectives are identified to focus the goals; actions are assigned to meet the objectives-cum-goals.

This is a superficial similarity, though. There is a fundamental difference between the *types* of mitigation actions that a state hazard mitigation plan will list vis-à-vis the *types* that a local plan can list: A state generally will not be applying to the Federal Emergency Management Agency (FEMA) (or toward other federal/state funding sources) for funds to construct mitigation projects, i.e. capital projects. Local jurisdictions will be the entities ultimately applying for federal funds to build capital mitigation projects.

This difference in mitigation action *type* is symptom of a state's characteristic and role in hazard mitigation in relation to a local jurisdiction's characteristic and role: A state will never suffer the malefic effects of a natural or human-made hazard. Or, rather, a state – which is an abstraction – will never suffer the ruinous effects of natural or human-made hazards so long as it has local jurisdictions. While counties and cities et al. similarly are abstractions (county borders can move or be recreated, for example), counties, cities, etc. are the abstractions that house the individuals who will be harmed by natural and human-made hazards. It is these local jurisdictions (on behalf of the individuals residing within them) that have been, are, and will be requesting funds to build the capital projects that will mitigate the effects from natural and human-made hazards. A state (the Commonwealth) will never ask for such funds for itself.

Consequently, a local hazard mitigation plan's mitigation actions primarily will consist of capital projects, e.g. elevations, safe rooms, culvert-expansions, acquisition/demolition of edifices, etc. In contrast, a state's hazard mitigation plan's mitigation actions will primarily consist of activities that indirectly affect the ability and propensity of local jurisdictions to construct mitigation projects that will mitigate the effects of hazards. In other words, a state (via its designated agency) primarily is limited to *promoting types of*, *outreach toward*, *education about*, *prioritizing*, *finding funding for*, *implementing programs aimed toward, etc.* the mitigation (capital) projects for which local jurisdictions actually will apply.

That a state's mitigation actions typically are of the type described above presents a dilemma unique for a state: Whereas there is a limit to the number of mitigation actions that can be listed in a local hazard mitigation plan (i.e. if mitigation actions primarily are projects, then there are a finite number of mitigation options available within a finite geographic space), there is no limit to the number and variety of mitigation actions toward which a state can direct its efforts. Until the actions of every individual can be perfectly controlled by a central power (which hopefully can never occur), there will never be enough promotion, outreach, education, funding, program-implementation, etc. that could take place.

So long as regulation requires an attempt at an exhaustive list of mitigation action, limits upon such actions must be self-imposed.

Self-imposition of limits typically occurs through two means: 1) A clearly-defined and limited role for the state and 2) evaluation.

The Commonwealth of Kentucky argues that it consistently has implemented its hazard mitigation activities around a clear and clearly delimited role: Hazard mitigation activity in Kentucky is managed through Kentucky Emergency Management (KYEM) and its partners; KYEM and its partners have very distinct and very concrete functions and parameters under which it operates. In other words, Kentucky through KYEM and its partners suffer very little from mission creep. Plans, training, programs, administration, and leadership of KYEM all have been implemented within clear boundaries and with clear and concrete goals. Bluntly, Kentucky (through KYEM et al.) rarely has tried to expand its scope or its mission beyond what it is capable. Kentucky's mission in hazard mitigation is clear and its administrative efforts and programs consistently have emphasized being most effective in this mission.

This 2013 hazard mitigation plan update exemplifies no difference in this trend in administration of Kentucky's hazard mitigation activity. The plan document itself is a work and an argument supported by the definition and subsequent assertion of Kentucky's clear role in hazard mitigation. However, it is in the assessment and update of its goals and mitigation actions that comprehending and articulating the functions, responsibilities, and capabilities of KYEM and its partners is of most significance. Thus, from 2010, where goals have been changed or deleted and how mitigation actions have been organized and changed, such change is motivated by the need to reflect accurately the role of the Commonwealth of Kentucky and the functions of KYEM and its partners so as to be able to limit that for which it is responsible. Knowing its parameters and limiting its mitigation activity to those parameters allows administration and funding to be focused on *effectiveness* of Kentucky's hazard mitigation program.

The above is one link between Kentucky's mitigation activity and its strategy: Actions are limited to those that help direct, facilitate, and coordinate the project-focused mitigation activity of Kentucky's local jurisdictions.

The second means of self-imposition of limits involves evaluation, or the ability to evaluate. A set of mitigation actions should be evaluable. It is ultimately argued above, however, that the fundamental difference of the *types* of mitigation actions that comprise a state's mitigation strategy vis-à-vis the capital project-oriented types comprising local mitigation strategies involves evaluation[45] (or the lack of ability to evaluate): The capital projects (e.g. acquisition/demolitions, elevations, etc.) populating local hazard mitigation plans will have countable outcomes. Projects eventually will be completed. If a county or a city wants to address its vulnerability to tornadoes by constructing a safe room, a safe room can be constructed; an outcome exists and is tangible. The completion and success of the project quantitatively can be evaluated. More relevantly, the county or the city naturally is limited to how many safe rooms it can construct. If in 2010's local

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[45] Evaluation is a theme that also underlies how Kentucky's 2013 mitigation actions will be placed temporally. This is discussed below.

hazard mitigation plan, five safe rooms in five locations are proposed as mitigation actions and if those five safe rooms are indeed funded and subsequently constructed in those five locations, then in 2015's local hazard mitigation plan, five more safe rooms in those exact five locations can no longer be included in the mitigation action list. There is a limit.

That a state's (that Kentucky's) mitigation action list will consist primarily of actions that are more intangible and temporally ever-existing in character presents a problem for limits to the possible listing of mitigation actions. For the most part, outcomes to state-level mitigation actions will not exist or will be exceedingly difficult to identify and quantify. Where a state does implement an evaluable action (e.g. Kentucky's CHAMPS system), there still is difficulty in determining when that action is "complete." Using Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) as the example, there will, of course, be evaluable outcomes; but, there also will be an ever-existing need to refine and update the system. Surely, it is not expected that CHAMPS will reach a final completion date whereby the technology sits and becomes outdated. Further, a state's mitigation actions are not limited by geographic space or time as a list populated primarily with capital projects would be.

In other words, when it comes to directing, facilitating, and coordinating the mitigation activities of its local jurisdictions, the state's work is never done.

Consequently, an exhaustive list of mitigation actions limited to the year in which the plan document is written cannot be conceived. But, a state (the Commonwealth) must have a method of limiting the endless possibilities of mitigation action that it could pursue. Further, it must have some way to evaluate what would be the limited set of actions.

The second link between the mitigation actions and the Commonwealth of Kentucky's mitigation strategy, then, is that the actions (separate from those derived from local plans) continued (but revised) from the 2010 plan and new actions devised by Kentucky Hazard Mitigation Council (KYMC) for this 2013 update will be categorized. The categories fall under "Deductive Planning Actions" and consist of the three categories listed above:

- ***Category 1: Outreach***
- ***Category 2: Option Diversification***
- ***Category 3: Public Goods-Type***

These categories will be described again below; but, Category 1 (*Outreach*) refers to those mitigation actions directed simply toward training and public relations/education.
Category 2 (*Option Diversification*) will refer to mitigation actions whose purpose is to provide local jurisdictions with an increased array of mitigation actions. While the Commonwealth's identification and categorization of local jurisdictions' mitigation actions reflects the Commonwealth's identification of the demand for mitigation activity by its local jurisdictions, the demand for mitigation projects can be influenced by offering/educating/informing/supplying mitigation activity/project options that may not have been considered in a local jurisdiction's demand calculus. Category 3 (*Public Goods-Type*) will refer to mitigation actions undertaken by the Commonwealth whose purpose is to develop or supply a mitigation-oriented product from which all local jurisdictions would benefit. These actions will be the closest thing to "mitigation project" that the Commonwealth of Kentucky can devise.

Categorizing the Commonwealth's devised mitigation actions in such a manner serves the mitigation strategy of the Commonwealth: It focuses the Commonwealth's mission and strategy of "directing, facilitating, and coordinating the mitigation activity of its localities" into concrete areas of specialization. The categories link with the objectives and with the Commonwealth's mitigation goals articulated above.

Further, the categories provide a means of evaluation: The mitigation actions themselves may not be evaluable, or may be exceedingly difficult to evaluate. But the category can be evaluated. There may be confusion here as to the difference between the categorization of the Commonwealth's devised (versus induced) mitigation actions and the objectives toward which the individual actions are intended to meet. The problem with "objectives" is that they must be met with individual mitigation actions. The idea behind categorizing mitigation actions and linking the categories to the objectives and goals is that with such a system success does not depend upon the individual actions themselves. Again, the Commonwealth of Kentucky, KYEM, and KYMC recognize mitigation actions derived from the state-level downward may not be individually evaluable and certainly do not represent an exhaustive list. But, the Commonwealth can focus its mitigation efforts toward three general categories of mitigation activity from which individual actions contribute. The hope is that in three (or five) years' time, the Commonwealth of Kentucky can argue that it met its three categories of mitigation activity and, thus, satisfied its objectives and proceeded toward its goals. That the Commonwealth of Kentucky had previously been attempting to evaluate individual actions devised from the top-down within a singular point in time and under the assumption of static demand for mitigation activity confused the larger argument that Kentucky had indeed and consistently has met its mission, strategy, goals, and objectives even if not by the particular means articulated by October 28, 2013.

Summary

To summarize, then, the link/contribution between Kentucky's mitigation actions and its overall mitigation strategy is as follows:

1) From the actions derived from the state-level downward and from those continued from the 2010 plan update, the intent was to choose those that would focus the Commonwealth's role and KYEM's (and its partners') functions toward directing, facilitating, and coordinating the mitigation activity of its local jurisdictions (who will be the entities actually applying for FEMA grants to construct mitigation capital projects).

2) The actions derived from the state-level downward were placed into three (3) categories. These categories represent the means by which the Commonwealth intends to meet its mission, strategy, objectives, and goals. The actions within each category simply represent an incomprehensive list of possibilities by which the Commonwealth can and, at this point in time, intends to meet its goals and objectives and, hence, its strategy.

3) Kentucky identified and categorized the mitigation actions of its local jurisdictions. This implies that each item under its "Inductive Planning Actions" list (described below) represents, literally, multiple individual mitigation actions from the local level. Rather than attempt to interpret demand for mitigation activity, Kentucky decided simply to identify demand. From this 2013 mitigation plan, Kentucky now knows generally from which areas certain types, or categories, of mitigation capital project are demanded. This identification of demand is a beneficial link and contribution to Kentucky's mitigation strategy: How better to direct, facilitate, and coordinate mitigation activity (and most effectively use available mitigation funds) than by focusing its efforts and time toward the articulated preferences and demands of its local jurisdictions?

A. *Identifying Cost-Effective, Environmentally-Sound, and Technically Feasible Mitigation Actions and Activities*

Below is the table of Kentucky's 2010 mitigation actions with a column added that describes which actions were removed, revised, and kept for this 2013 update of Kentucky's hazard mitigation plan and why each was removed, revised, and kept.

Table 4-4: 2010 Mitigation Actions and Their Place within the 2013 Update

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Use eligible funds from the HMGP and other sources to assist communities in the purchase and installation of indoor and outdoor warning systems, including, but not limited to, weather-alert radios, telephone "ring-down" systems and outdoor warning sirens.	1.1.1	Severe Storm, Dam Failure, Earthquake, Hail, Tornado	No revision; though has been met with mitigation projects prior to 2013 update.
Identify vulnerable populations through the risk assessment.	1.2.1	All Hazards	No revision
When funding permits target FEMA mitigation funds for projects that benefit vulnerable populations.	1.2.2	All Hazards	No revision
Assist where possible to include mitigation activity in emergency management training.	1.3.1	All Hazards	No revision
Provide information to the general public and the housing industry through publications and electronic resources about the value of residential and non-residential safe rooms, as well as guidelines and criteria for their construction.	1.4.1	Tornado, Severe Storm, Hail	Combined with 1.4.2; though has been met with mitigation projects prior to 2013 update
Where resources permit and eligibility criteria can be met, make FEMA mitigation funds and other funding sources available for grants to communities interested in construction of residential and non-residential safe rooms.	1.4.2	Tornado, Severe Storm, Hail	Combined with 1.4.1; though has been met with mitigation projects prior to 2013 update
Promote the purchase of flood insurance for structures vulnerable to flooding.	2.1.1	Flood, Dam Failure	No revision

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Where communities and citizens express a desire to participate, and as funding resources permit, prevent or reduce damages to structures through elevation, acquisition/demolition or other flood protection means, using available FEMA and other mitigation funds.	2.1.2	Flood	Revised: was over-specified; state cannot dictate demand. Rather, state only can promote. Still, has been met with mitigation projects prior to 2013 update
Where communities express a desire to participate and as funding resources permit, prevent or reduce flood prone property though the design and construction of minor engineered water management projects, using available FEMA and other mitigation funds.	2.1.3	Flood	Revised: was over-specified; state cannot dictate demand. Rather, state only can promote. Still, has been met with mitigation projects prior to 2013 update
Improve the information on the repetitive-loss list by visiting the sites of these properties to verify and correct the data on the list.	2.2.1	Flood	Combined with 2.2.3
Provide information through outreach to floodplain managers and local officials about the repetitive losses suffered at these locations.	2.2.2	Flood	Combined with 2.2.4, 2.3.1
Improve the information on the <u>severe</u> repetitive-loss list by visiting the sites of these properties to verify and correct the data on the list.	2.2.3	Flood	Combined with 2.2.1
Provide information through outreach to floodplain managers and local officials about the repetitive losses suffered at these locations.	2.2.4	Flood	Combined with 2.2.2, 2.3.1
Educate community leaders and floodplain managers about the program, its value to a community, and how to manage and enforce it.	2.3.1	Flood	Combined with 2.2.2, 2.2.4
Conduct community assessment visits and floodplain audits on a regular basis, including after major flooding events to promote the value of quality participation in the programs.	2.3.2	Flood	No revision

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Increase inter-agency communication to create better understanding among state and federal agencies about the impact of the NFIP and floodplain management and to tap the expert resources of other agencies for these efforts.	2.3.3	Flood	No revision
Prioritize communities with a greater flood hazard, more flood insurance policies and population growth, as well as enforcement and program management capabilities.	2.4.1	Flood	Removed: Conflicts with updated prioritization system
Continue a partnership with University of Louisville and the CHR to provide outreach, development of floodplain management publications, and promotional materials.	2.4.2	Flood	Revised: No need for specific mention of agencies
Increase inter-agency communication to create better understanding among state and federal agencies about the impact of the CRS and to tap the expert resources of other agencies for these efforts.	2.4.3	Flood	No revision
Establish hazard mitigation priorities for retrofitting of existing state critical facilities and infrastructure based upon risk and vulnerability assessment.	2.5.1	Earthquake, Flood, Hail, Karst/Sinkhole, Mine Subsidence, Landslide, Severe Storm, Severe Winter Storm, Tornados, Extreme Heat	No revision
Ensure that state facilities and infrastructure are located, designed and constructed to complement / support local priorities as defined in the Local Mitigation Strategies.	2.5.2	All Hazards	Removed: Conflicts with updated prioritization system; outside the strategy/scope of KYEM
Visit sites of interest, such as landslide location after heavy rains, when requested by individuals or agencies affected by geologic hazards in order to gather information on the hazard and disseminate it to other agencies with regulatory or programmatic interests in mitigating the effects of these hazards.	2.6.1	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	Combined with a new mitigation action

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Part I. - Use funds available through HMGP, the Pre-Disaster Mitigation Program and any other available funding source for the following types projects: The voluntary acquisition and demolition of geologically-threatened structures which meet the required benefit-cost analysis, and other requirements of the funding agency, and the restriction of future development on the land. Such projects permanently eliminate damages in the areas of the project.	2.6.2 PART I	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	Removed: That this action will be addressed is implicit in updated prioritization system. Had been met with mitigation projects prior to 2013 update
PART II. - The retrofitting of existing structures, which meet any required benefit / cost analysis and other requirements of the funding agency, against structural or non-structural damages from geologic hazards, particularly earthquakes.	2.6.2 PART II	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	Revised: Rid the presumption that KYEM will be applying for projects. Has been met with mitigation projects prior to 2013 update
Promote land use planning for geologically high risk areas.	2.6.3	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	No revision
Where funding permits, conduct outreach activities with local jurisdictions to provide technical assistance in the proper enforcement of building codes.	2.7.1	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	No revision
Where funding permits, conduct training seminars and workshops for local building enforcement officials.	2.7.2	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	No revision
Through outreach and education, encourage the creation of local building enforcement capabilities in communities that currently do not have them.	2.7.3	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	No revision
Explore the possibilities of a state-required builder-licensing program to include continuing education, insurance or builders and mediation of disputes over the quality of construction.	2.7.4	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	Removed: Outside the strategy/scope of KYEM
Explore possible opportunities for financial incentives for owners of manufactured housing to secure their homes to their sites.	2.8.1	Flood, Severe Storm, Severe Winter Storms, Tornado	No revision

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Examine and evaluate the need for emergency action plans, including impact area / inundation maps, for KY's high hazard dams.	2.9.1	Dam Failure, Flood	Combined with 2.9.2
Examine the issues related to how unregulated development below a dam can change its designation form low or moderate to high hazard, thus necessitating an improvement to the dam or its removal.	2.9.2	Dam Failure, Flood	Combined with 2.9.1
Investigate the use of tax incentives to promote smart development in hazard-prone locations.	3.1.1	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence, Wildfire	Removed: Outside the strategy/scope of KYEM
Provide FEMA mitigation grant opportunities for communities who develop, maintain, and update their hazard mitigation plans.	3.1.2	All Hazards	Removed: This is not an action. This is a reason for KYEM's existence.
Establish a working system in which local governments can work together to promote and encourage smart development.	3.2.1	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence, Wildfire	Removed: Outside the strategy/scope of KYEM. Smart development is not an explicit goal of KYEM.
As funding permits; provide grants to communities for utility protection measure projects including electrical, water, and sanitary sewer.	3.3.1	Dam Failure, Drought, Earthquake, Flood, Hail, Karst/Sinkhole, Land, Dam Failure, Drought, Earthquake, Flood, Hail, Karst/Sinkhole, Landslide, Mine Subsidence, Severe Storm, Severe Winter Storm, Tornado, Wildfire	Revised: Wording reflects deviance from the strategy/scope of KYEM. KYEM itself does not provide directly grants. Redact "provide" to say instead "promote." Has been met with mitigation projects prior to 2013 update

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
As funding permits, provide grants to communities for mitigation activities involving transportation systems.	3.3.2	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence	Revised: Wording reflects deviance from the strategy/scope of KYEM. KYEM does not provide directly grants. Redact “provide” to say instead “promote.”
As funding permits; provide grants to communities for the purchase of generators and generator hook ups for critical facilities.	3.3.3	Dam Failure, Earthquake, Flood, Hail, Severe Storm, Severe Winter Storm, Tornado	Revised: Wording reflects deviance from the strategy/scope of KYEM. KYEM does not provide directly grants. Redact “provide” to say instead “promote.” Has been met with mitigation projects prior to 2013 update
Review the existing state agency programs, plans and policies every three years.	4.1.1	All Hazards	No revision
Incorporate State policies into the State Hazard Mitigation Plan.	4.1.2	All Hazards	Removed: This is not an action. This is a component of the Commonwealth’s mitigation plan.
Invite interested or needed agencies to join the State Hazard Mitigation Team.	4.2.1	All Hazards	No revision
Hold bi annual meetings of the State Mitigation Team or in post disaster setting as necessary.	4.2.2	All Hazards	No revision
Promote the gathering and archiving of data by local governments on the types and amount of damages after a natural hazard event.	4.3.1	All Hazards	No revision

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Establish criteria for risk and vulnerability assessment of state-owned critical facilities and infrastructure.	4.5.1	All Hazards	Combined with 4.5.2, 4.5.3, 4.5.4
Update the inventory of state-owned facilities.	4.5.2	All Hazards	Combined with 4.5.1, 4.5.3, 4.5.4
Inventory critical facilities and infrastructure that are leased.	4.5.3	All Hazards	Combined with 4.5.1, 4.5.2, 4.5.4
Inventory identified vulnerable structures from the ADD's structure point data sets when complete.	4.5.4	All Hazards	Combined with 4.5.1, 4.5.2, 4.5.3
Continue the state's cost-share on the Hazard Mitigation Grant Program.	4.6.1	All Hazards	No revision
Develop guidelines for enhancing local community risk and vulnerability assessments.	4.8.1	All Hazards	Removed: Outside the strategy/scope of KYEM. FEMA develops guidelines. KYEM reviews guidelines.
Where resources permit, provide technical assistance to local governments in establishing, enhancing, standardizing, and implementing local mitigation strategies.	4.8.2	All Hazards	No revision
Identify effective local regulatory approaches to hazard mitigation.	4.8.3	All Hazards	No revision
Identify pre and post disaster mitigation related funding opportunities for local communities throughout the state.	4.8.4	All Hazards	No revision
Identify mitigation best practices for pre and post disaster hazards mitigation activities.	4.8.5	All Hazards	No revision

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Encourage the integration of applicable hazards mitigation objectives from the local mitigation strategies into local comprehensive plans.	4.8.6	All Hazards	No revision
Review and update local hazard mitigation plans at a minimum of every five (5) years.	4.8.7	All Hazards	No revision
Build a website for KYEM and local planners to use during plan updates that could be used for data transfer, public outreach, and project management.	5.1.1	All Hazards	Revised: The website is built; maintaining it, improving it is of relevance now.
Develop brochures defining hazards and mitigation funding opportunities.	5.2.1	All Hazards	No revision
As resources permit, develop a public awareness campaign on the benefits of pre- and post-disaster mitigation through the dissemination of mitigation success stories or best practices.	5.2.2	All Hazards	Removed: This is not an action. This is quotidian task for KYEM.
Develop a strategy for working with the print, electronic and broadcast media to disseminate mitigation education and outreach material.	5.2.3	All Hazards	Removed: This is not an action. This is quotidian task for KYEM.
As requested hazard mitigation staff will conduct workshops, training, and seminars on hazard mitigation techniques, grant program funding, planning, and benefit cost analysis.	5.2.4	All Hazards	Combined with 5.3.1, 5.3.2, 5.3.3
As resources allow, maintain an ongoing education and outreach effort to educate public and private schools about the importance of hazard mitigation.	5.3.1	All Hazards	Combined with 5.2.4, 5.3.2, 5.3.3
As resources allow, maintain an ongoing education and outreach effort to educate elected officials about the importance of hazard mitigation to include in an annual report to the legislature and other appropriate officials.	5.3.2	All Hazards	Combined with 5.2.4, 5.3.1, 5.3.3
As resources allow, maintain an ongoing education and outreach effort to educate the general public about the importance of hazard mitigation.	5.3.3	All Hazards	Combined with 5.2.4, 5.3.1, 5.3.2

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Promote the design of a functional statewide emergency responders communication system.	5.4.1	All Hazards	No revision
Promote NIMS compliancy so that local governments communicate more efficiently during large scale, multi-jurisdictional events.	5.4.2	All Hazards	No revision
Establish a catalog of KY's hazards and mitigation research studies.	6.1.1	All Hazards	No revision
Establish access and / or interchange privileges with pertinent resource centers throughout the country and internationally.	6.1.2	All Hazards	Removed: Outside the strategy/scope of KYEM; if accomplished, will be the result of opportunity.
Recommend the creation of a memorandum of collaboration with FEMA and Kentucky public and private universities for designing higher ed. Curriculum for EM professionals, including the hazard mitigation and related fields.	6.2.1	All Hazards	Removed: Outside the strategy/scope of KYEM as stated; can be combined with 6.2.2
Participate in education program course development.	6.2.2	All Hazards	No revision; combined with 6.2.1
Update and modernize KY's flood maps and flood insurance studies in order to improve the information on current maps and studies, and to provide mapping where there currently is none.	6.4.1	Dam Failure. Flood	No revision
Continue to work with FEMA to prioritize communities for new mapping based on population growth and number of flood insurance policies.	6.4.2	Dam Failure, Flood	No revision
Continuously update the database of information and knowledge of KY's geologic hazards through research work such as that done by KGS, the University of KY, Dept. of Geological Sciences and USGS.	6.4.3	Earthquake, Karst/Sinkhole, Landslide, Mine Subsidence	No revision

2010 Action	2010 Action Number	Hazard(s) Addressed	Revision to 2010 Action for 2013
Monitor, update, and maintain seismic activity using the KY Seismic and Strong Motion Network.	6.4.4	Earthquake	No revision

Actions Derived from the Commonwealth of Kentucky: Deductively Planning

To succeed at its motivating strategy to direct, facilitate, and coordinate the planning and mitigation activities and projects of the localities it oversees, the Commonwealth of Kentucky needs to articulate mitigation actions that will help to satisfy the strategy undergirding its goals and objectives. As mentioned above, there is a necessary and vital role for the Commonwealth of Kentucky to play in *aiding* (directing, facilitating, coordinating) local jurisdictions to mitigate hazards that affect them. What the Commonwealth of Kentucky cannot do well is be exhaustive in listing all that it could do to accomplish its strategy guided by direction, facilitation, and coordination.

Deductive planning, then, conceivably comes in two general (2) forms: outreach and public good provision. Mitigation actions addressing the former (outreach) will be divided into two subsets: “Outreach” and “Option Diversification.” Mitigation actions addressing public goods provision will be termed “Public Goods-Type” actions.

Outreach

Outreach mitigation actions are those actions that, generally, educate. There are two (2) ways to think of this outreach-cum-education: One is as literally as possible, i.e. via training. Continued and continual training of Kentucky’s local emergency managers, public officials and of interested citizens is certainly an action that facilitates and coordinates planning and mitigation activities and projects. This plan document refers to these types of actions as *Outreach*.

A second way to think about outreach-cum-education is to think of it economically, i.e. in economic terms: Local jurisdictions demand mitigation projects. In a sense, FEMA and Kentucky Emergency Management and its affiliated agencies are suppliers of those projects[46].

As the Commonwealth of Kentucky and the Federal Emergency Management Agency (FEMA) do not actually produce anything per se but still act in a way as a supplier of mitigation projects, there is the consideration that local jurisdiction demand for mitigation projects may be limited by the supply, or by what mitigation projects are known. This plan addressed earlier in its assessment of the 2010 update of Kentucky’s hazard mitigation plan: It may be the case that generator projects and safe room projects took up such a large proportion of Kentucky’s mitigation action outcomes because those projects were the projects “supplied” or “on the shelves” at Kentucky Emergency Management and FEMA. One can only demand what one knows is available.

An important role for outreach, then, and deductive planning, generally, is to be able to “supply” local jurisdictions with a wider array of mitigation options that they can then “demand.” This plan document refers to this as *Option Diversification*. Kentucky Emergency Management (KYEM) and its administrative affiliates can provide its Area

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[46] At first, it may seem that FEMA and the Commonwealth of Kentucky act more as “financiers” or “bankers” of mitigation projects than actual suppliers, as ultimately FEMA (and to a lesser extent the Commonwealth of Kentucky) offer ways (via grants mainly) to finance demanded mitigation projects. However, this plan assumes that the role of FEMA and the Commonwealth of Kentucky surpass the indirect supply role of “financier/banker.” While the product ultimately is a source of funds, as is implicit in the need for this hazard mitigation plan FEMA and the Commonwealth of Kentucky also direct its local jurisdictions toward the supply of mitigation projects for which they ought to be requesting financing options.

Development Districts and public officials at the local level with a broader assortment of mitigation options *and* a wider array of ways to finance those projects and options. Thus, demand for mitigation projects and options is increased by the increased ability to pay for those projects and options which results from knowing about (being supplied with) more project options and more ways to “increase income” by tapping into more varied funding sources.

Public Goods

The other form that deductive planning can take involves public good provision.

A (pure) public good, in theory, is a good (or service) that can be consumed by two or more parties simultaneously without the quantity of that good diminishing (non-rival) and whose benefits cannot be excluded from other parties (non-excludability) even if the other parties did not pay anything for the good (free-rider problem).

If a good or service is “non-rival” and “non-excludable,” then that begs the question: Who is willing to pay for the good or service? Essentially, if anybody or any party can benefit from something that one party purchased (and without the quantity of that something diminishing), then why should that party take on the burdensome task to purchase it?

Still, the good or service may be demanded.

And this creates a vital role for the Commonwealth of Kentucky in directing, facilitating, and coordinating the mitigation activities of its local jurisdictions: There are public good-type mitigation actions that benefit all of Kentucky. “Initiative projects” are an example of this mitigation action. Because such projects benefit all of Kentucky, there is little to no incentive for constantly resource-constrained local governments to pursue this type of mitigation action. Thus, to satisfy the objective of successfully and wisely deductively planning in order to meet the administrative/mitigation goal of facilitating the mitigation activity of its local jurisdictions, the Commonwealth of Kentucky can devote its mitigation efforts to the pursuance of *Public Good-Type mitigation actions.*

The Commonwealth of Kentucky’s “Deductive Planning” list of mitigation actions conveys some new *Public Goods-Type* actions that should be introduced:

Kentucky’s Department of Forestry (KDF) has submitted some preliminary work that is excerpted and appended to this *Mitigation Strategy* section: KDF consistently improves its wildfire hazard assessment contribution. This 2013 update of Kentucky’s hazard mitigation plan has referred to this document periodically throughout. It is presented in its entirety as ***Appendix 4-2***. But, the work of KDF prompts an action that further assesses Kentucky’s wildfire hazard events.

Kentucky’s Division of Water (KDOW) recently has submitted to FEMA and as a result of a grant from FEMA its methodologically intense contribution to increasing the accuracy and feasibility of dam failure hazard risk assessment. Its “Introduction,” “Executive Summary,” and “Methodology” sections are presented and excerpted here as ***Appendix 4-3***. Again, the work of KDOW prompts a mitigation action that seeks to allow continued improvement in such hazard assessment.

It should be reminded that Kentucky's derived list of mitigation actions (its "Deductive Planning List") cannot be exhaustive. This is addressed above. Rather, an important consideration to its overall mitigation strategy is that Kentucky via KYEM and its partners must be flexible and must realize that mitigation actions conceived at the time of this plan writing may not represent all that is adequate to achieve effective direction, facilitation, and coordination of local mitigation activity. Consequently, there may be other *Public Goods-Type* mitigation actions which could result from continual planning and local outreach.

Finally, an explicit connection should be made that, while below is mentioned some specific repetitive-loss-oriented mitigation actions resulting from local jurisdictions, the Commonwealth of Kentucky's distinction between deductive planning and responsive inductive planning implicitly supports the selection of mitigation activities for repetitive-loss properties: Kentucky's strategy for direction, facilitation, and coordination of mitigation activities to be achieved via deductive and inductive planning means that, regarding the former, Kentucky will identify for itself and for later distribution and via means of which only it can take advantage mitigation activities for repetitive-loss properties. Regarding the latter, and to be explained further below, prioritization of mitigation activity will explicitly and implicitly favor activities addressing repetitive losses.

REQUIREMENT
§201.4 (C) (3) (V):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

EXPLICITLY ADDRESSED ON PREVIOUS PAGE

A. Describing Mitigation Goals That Support the Selection of Mitigation Activities for Repetitive-Loss Properties

Above the following is discussed: what is to become of 2010’s mitigation actions (i.e. which are to be removed, revised, and continued); the logic behind placing the Commonwealth’s top-down, devised mitigation actions into categories; and how the categories serve as the contribution to the Commonwealth’s mitigation actions and its overall mitigation strategy. Below, then, is listed the Commonwealth of Kentucky’s devised mitigation actions for its 2013 update of its hazard mitigation plan accompanied by the hazards each action is supposed to address. Further, this table adds a column that reminds from where each action derives. This column will be deleted for the finalized table as it is superfluous, process-oriented information. The overall table describes what is termed here as the Commonwealth’s *Deductive Actions*.

Following this table will be a discussion of the portion of Kentucky’s mitigation actions that derive from its local plans. Listed, then, will be the corresponding mitigation actions termed here as *Inductive Actions*.

Finally, this below list of *Deductive Actions* and the following list of *Inductive Actions* is reprinted and finalized to include evaluation timeframes and terminology. Such finalization will, of course, follow a discussion of Kentucky’s new terminology for evaluation of the below mitigation actions.

Table 4-5: Compiled 2013 Mitigation Action List without Evaluation in Terms of Time

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Outreach: *Objectives I.1 – I.7*	Assist where possible to include mitigation activity in emergency management training	All Hazards	2010: • Action 1.3.1
Outreach: *Objectives I.1 – I.7*	*Regarding Residential and Non-Residential Safe Rooms:* Provide information to the general public and the housing industry about; find grants and other funding sources toward construction of	Tornadoes; Severe Storm; Hail Storms	2010: • Action 1.4.1 • Action 1.4.2
Outreach: *Objectives I.1 – I.7*	*Regarding Repetitive-Loss and Severe Repetitive-Loss Properties:* Provide/ improve information and conduct outreach about Repetitive-Loss and Severe Repetitive-Loss properties within local jurisdictions' areas; educate community leaders and floodplain managers about the Repetitive-Loss/Severe Repetitive-Loss program	Flooding	2010: • Action 2.2.2 • Action 2.2.4 • Action 2.3.1
Outreach: *Objectives I.1 – I.7*	Conduct community assessment visits and floodplain audits on a regular basis, including after major flooding events	Flooding	2010: • Action 2.3.2
Outreach: *Objectives I.1 – I.7*	Increase interagency communication (at both state and federal levels) regarding impact of the NFIP and floodplain management; use experts from other agencies to aid in these efforts	Flooding	2010: • Action 2.3.3
Outreach: *Objectives I.1 – I.7*	Continue agency partnerships to provide outreach, to develop floodplain management publications/promotional materials	Flooding	2010: • Action 2.4.2
Outreach: *Objectives I.1 – I.7*	Increase interagency communication regarding impact of the CRS; use experts from other agencies to aid in these efforts	Flooding	2010: • Action 2.4.3

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Outreach: *Objectives I.1 – I.7*	Promote land-use planning for geologically high-risk areas	Earthquakes; Karst/Sinkholes; Mine/Land Subsidence; Landslides	2010: • Action 2.6.3
Outreach: *Objectives I.1 – I.7*	Conduct outreach toward local jurisdictions to provide technical assistance regarding the proper enforcement of building codes	Earthquakes; Flooding; Severe Storms; Severe Winter Storms; Tornadoes; Forest Fires	2010: • Action 2.7.1
Outreach: *Objectives I.1 – I.7*	Conduct training seminars and workshops regarding for local building enforcement officials	Earthquakes; Flooding; Severe Storms; Severe Winter Storms; Tornadoes; Forest Fires	2010: • Action 2.7.2
Outreach: *Objectives I.1 – I.7*	Continually increase membership to the Kentucky Hazard Mitigation Council (KYMC)	All Hazards	2010: • Action 4.2.1
Outreach: *Objectives I.1 – I.7*	Hold regular meetings of the Kentucky Hazard Mitigation Council (KYMC)	All Hazards	2010: • Action 4.2.2
Outreach: *Objectives I.1 – I.7*	Promote the gathering and archiving of data by local jurisdictions regarding the types and extent of damages that occur after a hazard event	All Hazards	2010: • Action 4.3.1
Outreach: *Objectives I.1 – I.7*	Provide technical assistance to local jurisdictions regarding establishing, standardizing, and, ultimately, implementing local mitigation strategies	All Hazards	2010: • Action 4.8.2
Outreach: *Objectives I.1 – I.7*	Maintain an ongoing education and outreach effort aimed to educate public and private schools, elected officials, and the general public about the importance of hazard mitigation; conduct workshops, training, seminars, etc. regarding mitigation techniques, funding, planning, and benefit-cost analysis to aid in such efforts	All Hazards	2010: • Action 5.2.4 • Action 5.3.1 • Action 5.3.2 • Action 5.3.3

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Outreach: *Objectives I.1 – I.7*	Develop new training programs where applicable and when the need arises	All Hazards	New
Outreach: *Objectives I.1 – I.7*	Continue to develop and improve and to disseminate "Best Practices" in hazard mitigation	All Hazards	New
Outreach: *Objectives I.1 – I.7*	Train specifically for human-made hazards	Human-Made	New
Option Diversification: *Objective II.1*	Promote to/Assist local jurisdictions in the purchasing and installation of indoor and outdoor warning systems (e.g., telephone "ring-down" systems, weather-alert radios, and outdoor warning sirens)	Severe Storms; Dam Failure; Earthquakes; Hail Storms; Tornadoes	2010: • Action 1.1.1
Option Diversification: *Objective II.1*	Promote the purchasing of flood insurance; actively seek flood insurance participants	Flooding; Dam Failure	2010: • Action 2.1.1
Option Diversification: *Objective II.1*	Promote the use of mitigation projects aimed toward protection from flooding (e.g., elevations, acquisitions/demolitions)	Flooding	2010: • Action 2.1.2
Option Diversification: *Objective II.1*	Promote the design and construction of minor engineered water-management projects	Flooding	2010: • Action 2.1.3
Option Diversification: *Objective II.1*	Promote the retrofitting of existing structures	Earthquakes; Karst/Sinkholes; Mine/Land Subsidence; Landslides	2010: • Action 2.6.2
Option Diversification: *Objective II.1*	Encourage the creation of local building enforcement capabilities in communities that currently do not have such capabilities	Earthquakes; Flooding; Severe Storms; Severe Winter Storms; Tornadoes; Forest Fires	2010: • Action 2.7.3
Option Diversification: *Objective II.1*	Explore possible options to promote toward owners of manufacture homes regarding financial incentives to secure their homes to their sites	Flooding; Severe Storms; Severe Winter Storms; Tornadoes	2010: • Action 2.8.1

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Option Diversification: *Objective II.1*	Promote utility-protection projects (e.g., those projects protecting electrical and water supplies and involving sanitary sewers)	All Hazards	2010: • Action 3.3.1
Option Diversification: *Objective II.1*	Promote mitigation activities involving transportation systems	Dam Failure; Earthquakes; Flooding; Karst/Sinkholes; Landslides; Mine/Land Subsidence; Human-Made Hazards	2010: • Action 3.3.2
Option Diversification: *Objective II.1*	Promote the purchasing of generators and generator “hook-ups” for critical facilities	Dam Failure; Earthquakes; Flooding; Hail Storms; Severe Storms; Severe Winter Storms; Tornadoes; Human-Made Hazards	2010: • Action 3.3.3
Option Diversification: *Objective II.1*	Encourage the integration of applicable hazard mitigation objectives developed for local hazard mitigation plans into local-level comprehensive plans	All Hazards	2010: • Action 4.8.6
Option Diversification: *Objective II.1*	Promote NIMS compliancy (so that local governments can better and more efficiently communicate during large-scale, multi-jurisdictional hazard events	All Hazards	2010: • Action 5.4.2
Option Diversification: *Objective II.1*	Maintain a catalog of the hazards from which Kentucky suffers and mitigation research studies regarding said hazards	All Hazards	2010: • Action 6.1.1
Option Diversification: *Objective II.1*	Make regular visits to Area Development Districts (ADDs) to elicit feedback from local jurisdictions and present mitigation options/projects	All Hazards	New

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Option Diversification: *Objective II.1*	Continue identifying locations where acquisitions are a preferable and viable mitigation option	Flooding	New
Option Diversification: *Objective II.1*	Promote residential hazard preparedness	All Hazards	New
Option Diversification: *Objective II.1*	Conduct mitigation funding seminars	All Hazards	New
Option Diversification: *Objective II.1*	Promote increased participation (where participation is not limited to appointment) in one of Kentucky's many mitigation-oriented committees, commissions, etc.	All Hazards	New
Option Diversification: *Objective II.1*	Educate about evacuation routes and procedures	All Hazards	New
Public Goods-Type: *Objectives III.1 – III.7*	Identify vulnerable populations through the Commonwealth of Kentucky's risk assessment	All Hazards	2010: • Action 1.2.1
Public Goods-Type: *Objectives III.1 – III.7*	Target prioritization of mitigation activity toward projects that benefit vulnerable populations	All Hazards	2010: • Action 1.2.2
Public Goods-Type: *Objectives III.1 – III.7*	Visit sites listed on Kentucky's Repetitive-Loss and Severe Repetitive-Loss lists in order to verify the accuracy of the lists	Flooding	2010: • Action 2.2.1 • Action 2.2.3

Deductive Action Category	Action	Hazard(s) Addressed	From Where Action Derived
Public Goods-Type: *Objectives III.1 – III.7*	Establish hazard mitigation priorities for the retrofitting of existing state-level critical facilities and infrastructure (based upon the Commonwealth of Kentucky's risk and vulnerability assessment)	Earthquakes; Flooding; Hail Storms; Karst/Sinkholes; Mine/Land Subsidence; Landslides; Severe Storms; Severe Winter Storms; Tornadoes; Extreme Temperatures; Human-Made Hazards	2010: • Action 2.5.1
Public Goods-Type: *Objectives III.1 – III.7*	Collect data on and identify locations and effects of landslides in Kentucky, both current and historical; visit the sites of past landslides to collect the data	Earthquakes; Mine/Land Subsidence; Landslides	New 2010: • Action 2.6.1
Public Goods-Type: *Objectives III.1 – III.7*	Develop, improve hazard assessment methodology related to dam failure: Examine, evaluate need for emergency action plans; examine the issues related to the effects of unregulated development below dams	Dam Failure; Flooding	New 2010: • Action 2.9.1 • Action 2.9.2
Public Goods-Type: *Objectives III.1 – III.7*	Review existing state-level agency programs, plans, and policies at least every three (3) years	All Hazards	2010: • Action 4.1.1
Public Goods-Type: *Objectives III.1 – III.7*	Inventory critical facilities, leased infrastructure, identified vulnerable structures (from Area Development Districts' data); update inventory of state-owned facilities; continue improving risk and vulnerability criteria for all of the above	All Hazards	2010: • Action 4.5.1 • Action 4.5.2 • Action 4.5.3 • Action 4.5.4
Public Goods-Type: *Objectives III.1 – III.7*	Continue the Commonwealth of Kentucky's cost-share (12%) for FEMA Hazard Mitigation Grant Program (HMGP)-funded projects	All Hazards	2010: • Action 4.6.1

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Public Goods-Type: *Objectives III.1 – III.7*	Identify effective local regulatory approaches to hazard mitigation	All Hazards	2010: • Action 4.8.3
Public Goods-Type: *Objectives III.1 – III.7*	Identify pre- and post-disaster mitigation-related funding opportunities for local jurisdictions	All Hazards	2010: • Action 4.8.4
Public Goods-Type: *Objectives III.1 – III.7*	Identify further "Best Practices" that can later be the subject of future outreach	All Hazards	2010: • Action 4.8.5
Public Goods-Type: *Objectives III.1 – III.7*	Review and update local hazard mitigation plans at least every five (5) years	All Hazards	2010: • Action 4.8.7
Public Goods-Type: *Objectives III.1 – III.7*	Maintain, continue improving and updating the Kentucky Emergency Management (KYEM) website	All Hazards	2010: • Action 5.1.1
Public Goods-Type: *Objectives III.1 – III.7*	Develop brochures etc. defining hazards and mitigation funding opportunities	All Hazards	2010: • Action 5.2.1
Public Goods-Type: *Objectives III.1 – III.7*	Continue to promote the design, improvement of a functional statewide emergency responders communication system	All Hazards	2010: • Action 5.4.1
Public Goods-Type: *Objectives III.1 – III.7*	Participate in, provide support to education/higher education program/curricular development, especially toward coursework aimed at emergency management professional and that focus on hazard mitigation and related fields	All Hazards	2010: • Action 6.2.1 • Action 6.2.2
Public Goods-Type: *Objectives III.1 – III.7*	Continue to update and modernize Kentucky's flood maps and flood insurance studies; provide mapping where currently there is little or none	Dam Failure; Flooding	2010: • Action 6.4.1
Public Goods-Type: *Objectives III.1 – III.7*	Continue to work with FEMA to prioritize communities for new mapping based upon population growth and the number of flood insurance policies	Dam Failure; Flooding	2010: • Action 6.4.2

DEDUCTIVE ACTION CATEGORY	ACTION	HAZARD(S) ADDRESSED	FROM WHERE ACTION DERIVED
Public Goods-Type: *Objectives III.1 – III.7*	Collect data on and identify the effects from karst and sinkholes; continue to update databases regarding Kentucky's geologic hazards; work with Kentucky Geological Society (KGS), Department of Geological Sciences at the University of Kentucky, and USGS	Earthquakes; Karst/Sinkholes; Landslides; Mine/Land Subsidence	New 2010: - Action 6.4.3
Public Goods-Type: *Objectives III.1 – III.7*	Continue to monitor, update, and maintain information regarding seismic activity	Earthquakes	2010: - Action 6.4.4
Public Goods-Type: *Objectives III.1 – III.7*	Develop/Improve hazard assessment methodology related to forest fires	Forest Fires	New
Public Goods-Type: *Objectives III.1 – III.7*	Continue to improve the Commonwealth of Kentucky's hazard assessment methodology, generally	All Hazards	New
Public Goods-Type: *Objectives III.1 – III.7*	Continue updating/improving and implementing the Community Hazards Assessment and Mitigation Planning System (CHAMPS)	All Hazards	New
Public Goods-Type: *Objectives III.1 – III.7*	Develop/Improve hazard assessment methodology related to human-made hazards	Human-Made	New
Public Goods-Type: *Objectives III.1 – III.7*	Research how previously identified critical facilities are related to/networked with other facilities, i.e. "nested"	Human-Made	New
Public Goods-Type: *Objectives III.1 – III.7*	Identify vulnerabilities within and specific to individual critical facilities	Human-Made	New
Public Goods-Type: *Objectives III.1 – III.7*	Track progress of select mitigation projects after close-out in order to collect data to be used in loss avoidance studies	All Hazards	New

A. *Identifying Cost-Effective, Environmentally–Sound, and Technically Feasible Mitigation Actions and Activities (Continued)*

----------------------------AND---

E. *Actions and Projects Reflecting Those Identified in Local Plans*

Actions Resulting from Inductive Planning

The mitigation actions and activities that the Commonwealth will consider derive primarily from the mitigation actions and activities articulated by the localities comprising the Commonwealth. As aforementioned, the Commonwealth of Kentucky cannot receive the effects of hazards; there are no hazards that affect Kentucky (for which mitigation activities are necessary) that do not simultaneously affect one of Kentucky's localities. Thus, as previously stated, the Commonwealth's sole mitigation goal is an administrative one and is the justification for the existence of Kentucky Emergency Management and its accompanying university partners, the University of Louisville's Center for Hazards Research and Policy and the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grant Program Office: The Commonwealth of Kentucky is to serve a coordinating, facilitating, and prioritizing role (in other words, a management role) in addressing the needs of multiple localities that are vying for limited resources.

For the purposes of this 2013 hazard mitigation plan update, then, the Commonwealth has developed what will count for regulation as its non-administrative mitigation goals by synthesizing and identifying the categories of mitigation strategies devised by its localities in their multi-jurisdictional local hazard mitigation plans. By grouping Kentucky's localities' mitigation strategies into categories (and by acknowledging that the Commonwealth itself has no actual mitigation goals beyond the administrative), the Commonwealth can assume that such categories can be articulated as goals toward which the Commonwealth of Kentucky and its local entities have been and will continue to strive. *The Commonwealth of Kentucky's hazard mitigation goals are (and should be) the strategies of its localities.*

This is the Commonwealth of Kentucky and Kentucky Emergency Management (KYEM) *inductively planning*.

Provided in ***Appendices 4-4*** and ***4-5*** is the result of a thorough review of all of the Commonwealth of Kentucky's multi-jurisdictional local hazard mitigation plans. KYEM and UK-HMGP were able to group the local hazard mitigation plans' strategies for mitigation into categories. These categories will serve as the Commonwealth of Kentucky's mitigation actions. Again, these categories (Commonwealth actions) illuminate the goals toward which Kentucky should strive as they are the implicit goals toward which its localities are striving. As Kentucky's local hazard mitigation plans are generally multi-jurisdictional ones written and coordinated by its Area Development Districts (ADDs), ***Appendix 4-4*** shows the mitigation strategies identified according to each of Kentucky's ADDs. Accompanying ***Appendix 4-4***, ***Appendix 4-5*** lists all of the specific and most current mitigation strategies from each local hazard mitigation plan in the verbatim wording of each local plan. Therefore, the reviewer and the general audience can see from where the categorizations articulated in the table below and in ***Appendix 4-4*** derived.

From the thorough review of the Commonwealth's multi-jurisdictional local hazard mitigation plans, the following mitigation actions are articulated for the Commonwealth of Kentucky. The mitigation actions are grouped into six (6) categories[47]: (Actions related to) (1) Flooding, (2) Improved Information, (3) Physical Improvements, (4) Communications, (5) Planning, and (6) Enforcement. It is from these categories that the Commonwealth will derive its mitigation actions.

Table 4-6: "Inductive" Action Categories

INDUCTIVE ACTION CATEGORY	ACTION NUMBER	ACTION
Flooding (1)	Action 1.1	Remove Debris
	Action 1.2	Acquire Properties within Floodplains
	Action 1.3	Install, Repair, Address Culverts
	Action 1.4	Manage Vegetation, Wetlands
	Action 1.5	Address Storm Sewers
	Action 1.6	Address Flood Gauges
	Action 1.7	Elevate Structures
	Action 1.8	Provide Openings in Foundation Walls to Allow Flow of Water
	Action 1.9	Repair Road Slides/Breaks
	Action 1.10	Maintain Creek Banks
	Action 1.11	Monitor Erosion
	Action 1.12	Construct Levees/Flood Walls
	Action 1.13	Realign Streams
	Action 1.14	Eliminate Severe Repetitive Loss (SRL) Structures
	Action 1.15	Replace Inadequate Bridges
Improved Information (2)	Action 2.1	Construct, Improve GIS Databases of Critical Facilities
	Action 2.2	Update Flood Insurance Rate Maps (FIRMs)
	Action 2.3	Construct, Improve GIS Databases of Repetitive Loss (RL) Structures
	Action 2.4	Identify and Map At-Risk Bridges
	Action 2.5	Evaluate Recovery Shelters
	Action 2.6	Perform Earthquake Studies
	Action 2.7	Identify At-Risk Structure Identification
	Action 2.8	Identify County/Local Sources for Data
	Action 2.9	Create, Maintain List of Local Service Providers
	Action 2.10	Perform Housing Identification
	Action 2.11	Create, Provide Sinkhole Location Maps

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[47] As ***Appendix 4-4*** will show, there were actually seven (7) categories. The missing category concerns those actions related to "Education." These have been moved to the *deductive planning* portion of the Commonwealth of Kentucky's mitigation strategy.

INDUCTIVE ACTION CATEGORY	ACTION NUMBER	ACTION
Physical Improvements (3)	Action 3.1	Install Generators
	Action 3.2	Identify New Critical Facilities Outside of Hazard Areas
	Action 3.3	Construct Safe Rooms
	Action 3.4	Relocate Critical Facilities and Residential Structures
	Action 3.5	Bury Utilities
	Action 3.6	Acquire Emergency Equipment
	Action 3.7	Acquire Vehicles for Road Clearing
	Action 3.8	Remove, Regulate, Retrofit Buildings in Hazard-Prone Areas
	Action 3.9	Trim “Right-of-Ways”
	Action 3.10	Manage Hazard Areas
	Action 3.11	Improve Water Infrastructure
	Action 3.12	Construct Emergency Relief Warehouses
	Action 3.13	Install Drought-Proof Security Links
	Action 3.14	Maintain Lifeline Utilities
Communications (4)	Action 4.1	Install NOAA “All-Hazards” Radios
	Action 4.2	Generally Upgrade Communications Equipment
	Action 4.3	Install Other/Atypical Early Warning Systems
	Action 4.4	Install Warning Sirens
Planning (5)	Action 5.1	Recruit and Train Volunteers
	Action 5.2	Coordinate Debris Removal
	Action 5.3	Engage in Storm-water Management
	Action 5.4	Improve Interagency Communication
	Action 5.5	Protect Information Systems and Infrastructure
	Action 5.6	Identify “At-Risk” Critical Facilities
	Action 5.7	Formalize Hazard Mitigation Planning Committee
	Action 5.8	Develop, Improve Evacuation Plans, Policies, and Procedures
	Action 5.9	Better, More Explicitly Address Severe Repetitive Loss (SRL) Properties in Planning
	Action 5.10	Develop, Improve Floodplain Management Procedures
	Action 5.11	Plan to Maintain Water Supply
	Action 5.12	Better Staff Local Emergency Operations Centers (EOCs)
	Action 5.13	Improve Assistance to Special Needs Populations
	Action 5.14	Train, Equip, Maintain “Storm Spotters”
	Action 5.15	Monitor Repetitive Loss (RL) Properties
	Action 5.16	Develop Database of Recurring Flood Hazards
	Action 5.17	Develop, Continue Wellhead Protection Plans
	Action 5.18	Develop Supplements to Jurisdictions’ Emergency Operations Plans (EOPs)
	Action 5.19	Develop Regional Agreements that Allow the Use of Inventoried Equipment
	Action 5.20	Improve Planning that Assures Delivery of Emergency Services
	Action 5.21	Develop, Improve Land-Use Planning

INDUCTIVE ACTION CATEGORY	ACTION NUMBER	ACTION
Enforcement (6)	Action 6.1	Enforce National Flood Insurance Program (NFIP) Flood Ordinances
	Action 6.2	Pass and Enforce, Zoning and Land-Use Ordinances
	Action 6.3	Enforce Current Building Code Standards
	Action 6.4	Adopt Building Code Standards

B. *The Evaluation of Mitigation Actions and Activities*

Evaluation of the abovementioned mitigation actions involves two (2) variables:

Variable 1: "Near-Term" vs. "Enduring" vs. "Near-Term and Enduring"
The first variable considers dichotomously whether the action is a "near-term" mitigation action or whether it should be considered "enduring." The most obvious illustration distinguishing between these two evaluative categories can be exemplified comparing the actions categorized above as "Physical Improvements" versus many of those abovementioned actions categorized in the *deductive planning* portion of this mitigation strategy: The distinction lies in the ability to count. Those mitigation actions labeled "near-term" should produce countable results. At the end of the three-year state planning cycle, the Commonwealth of Kentucky should be able to count the absolute number of or the number of projects addressing actions such as installing generators, constructing safe rooms, or burying utility lines.

In contrast, evaluating whether or not jurisdictions became "more self-sufficient in preparing for hazards," or whether or not general education initiatives achieved their intentions is not countable. Alternatively, if they can be conceived as countable, it still may be unwise to attempt discrete evaluation or quantification when considering the goal of planning: Is the point to be able to count the number of general education initiatives undertaken during an arbitrary three-year cycle, or is the point that educating the public about hazard mitigation and all that is related is a constant, dynamic action that should never be achieved lest we admit perfection?

It should be clarified that this plan does purposefully use the adjective "near-term": While "near-term" mitigation actions can (or should be) quantified, they do not necessarily need to be quantified within the time limits arbitrarily placed upon updates to the Commonwealth's hazard mitigation plan.

Though this will be elaborated and focused upon when discussing prioritization, one of the consequences of Kentucky developing its goals and its actions from the mitigation strategies of its localities is to relinquish control over what types of mitigation actions are the foci of applications intended to (partially) fund mitigation actions between the years characterizing the planning cycle. While in its administrative role as a facilitator and coordinator, Kentucky Emergency Management and its supporting agencies can advertise or educate about different mitigation action types, the agencies (acting as proxies for the Commonwealth of Kentucky) cannot enforce or compel localities to heed their advice. As an unlikely yet illustrative example, KYEM can suggest that between 2013 and 2016, localities focus on mitigation actions that can be quantifiable like eliminating Severe Repetitive Loss (SRL) structures. However, if between 2013 and 2016 all 120 of Kentucky's counties submit only mitigation action applications for reimbursement towards generator-placement, ultimately KYEM and its agencies can do nothing about it. KYEM must evaluate (and prioritize) its mitigation actions based upon the pool of mitigation actions submitted to it by Kentucky's localities.

Thus, there are mitigation actions that will be evaluated as "near-term" in the sense that, at some point in the near future, Kentucky does expect to possess quantitative proof that such measures have been undertaken. (At some point some quantity of SRL structures will be eliminated.) However, there may be no quantifiable SRL elimination between the years of 2013 and 2016 when localities consider only the reimbursement for the purchasing of generators as best to mitigate their hazards.

The term "enduring" refers to those mitigation strategies that should never see results that are countable. As above illustrated, the Commonwealth should never be able to count the number of education initiatives it implemented. The Commonwealth can attempt to quantify or evaluate the results of a particular education initiative using some specified criteria and allowing for time; but, "evaluating" an education goal by counting how many education programs were implemented is not evaluation and is worse than meaningless. Education initiatives and the like are "enduring" mitigation strategies and actions. The Commonwealth hopes never to achieve "perfection" in or satiation for such acts.

The dichotomization between "near-term" and "enduring" does imply a third distinction to evaluation that this plan must consider: Those mitigation actions that ultimately are enduring but can provide some near-term countable results. The distinction relies upon location and time. Installing a siren cannot be considered "near-term" *and* "enduring." It is only "near-term": A project installs a warning siren at Location X; a new project will install a different siren at Location Y. Location X will not continuously need new sirens over time. The removal of debris, however, does allow for multiple "near-term" projects to be conducted in one location. Location A in Kentucky can have a debris removal project approved for reimbursement with FEMA funds. However, even with such a countable project completed, the nature of the hazard implies that the task of debris removal should never be wholly completed. Over time, there will be more debris requiring removal at Location A. Thus, while "near-term" projects can address debris removal at Location A at Time 0, another "near-term" project will have to address debris removal at Time 1. Debris removal is an "enduring" mitigation action that where countable "near-term" projects can address (over time).

Variable 2: Categorizing Mitigation

The second variable to evaluating the above mitigation actions involves isolating which actions mitigate which hazards if they are not intended to mitigate against all (or any) hazard. To aid in the evaluation of mitigation actions and activities by addressing specific hazards, the Commonwealth used a highly useful source written by FEMA's Region VIII (which oversees Colorado, Montana, North Dakota, South Dakota, and Utah):

The resource is entitled "Mitigation Ideas: Possible Mitigation Measures by Hazard Type." FEMA's Region VIII developed this document recognizing a need that planning involves both inductive and deductive reasoning. Most local, state, and federal planning for hazard mitigation is done inductively: Individuals within jurisdictions recognize specific needs for their jurisdictions and plan "upward" (or plan generally) to meet those specific needs. From the tables and appendices provided in and for this section, the audience will notice evidence of such induction: A local hazard mitigation plan will focus heavily on one or two hazard areas because specific events related to those hazard areas take prominence during the planning process. This inductive planning is laudable, of course. And arguably, the emphasis on planning should be inductive: Jurisdictions—however defined (local, state, federal)—deal with limited resources. There is a finite amount time and a finite amount of money that can be utilized for hazard mitigation projects (in this case) at any given point. Thus, it is indeed necessary to identify specific needs and plan "upward."

The danger of planning "upward" is myopia. Because a justified and righteous case can be made that limited resources should be targeted toward, say, projects associated with mitigating the effects of flooding because flooding happens most frequently and perhaps even most dramatically in an area does not or should not negate that this same area will feel (while perhaps less dramatic) effects from other types of hazards. There is a deductive logic that seems too often marginalized in the planning process where there is, thusly, a need to consider generally all types of hazards and plan "downward" toward specific solutions for such general considerations. This need for deductive planning is addressed by the creation of the FEMA Region VIII "Mitigation Ideas: Possible Mitigation Measures by Hazard Type[48]" report.

That FEMA Region VIII's "Mitigation Ideas: Possible Mitigation Measures by Hazard Type[49]" report is but an update of a preliminary attempt (in 2002 by FEMA Region V) at categorizing mitigation measures and providing an (incomprehensive) list of solutions for general hazard types is irrelevant for the purposes of the Commonwealth of Kentucky's hazard mitigation plan. If these ideas become more universal throughout all of FEMA, and/or if the mitigation measure categorizations become improved, streamlined, placed alternatively within different categories in future iterations of this document, then future updates to the Commonwealth of Kentucky's hazard mitigation plan's use of FEMA Region VIII's insights can easily accommodate such changes.

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[48] While this update of Kentucky's hazard mitigation plan used a draft copy of a FEMA Region VIII resource, please also see from FEMA Region V: Federal Emergency Management Agency (FEMA). [January 2013]. *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards.* It can be found here: fema_mitigation_ideas_final_01252013.pdf, or from FEMA's website.

[49] The full report is appended to this plan as ***Appendix 4-7***.

In ***Appendix 4-6***, the Commonwealth has re-categorized its above mitigation actions (i.e. the mitigation strategies of its localities) to “fit” into the mitigation strategy/action categories defined in the “Mitigation Ideas…” report. The results of that categorization inform the evaluation of the Commonwealth’s articulated mitigation actions by identifying those actions with specific hazard types. Necessarily, the reshuffling and forced fit of Kentucky’s localities’ mitigation strategies into FEMA (Region VIII)’s proposed mold also reshuffled which of Kentucky’s Area Development Districts (ADDs) account for which of FEMA’s mitigation strategy ideas.

REMEMBER:

Rather than assign the completion or address of mitigation actions a specific point or range in time, i.e. “short-term” vs. “long-term,” this plan seeks to be able to evaluate its actions in terms of both time and expected outcome. To assign merely a unidirectional “short-term” vs. “long-term” label is to assume that all actions have equal likelihood of producing a measurable or defined outcome. Kentucky makes no such presumptions here. Thus, evaluation of mitigation actions is conceptualized as follows:

Near-Term Actions: Implies that a “countable” or quantitative outcome can be expected from the action. Thus, it is expected that achieving this countable outcome occurs in a timely fashion.

Enduring Action: Implies that no “countable” outcome should be expected. Such actions should simply be or are expected to always be performed.

Near-Term & Enduring: Refers to those actions that do produce “countable” outcomes but that, essentially, require maintenance. Such actions have both “short-term” and “long-term” horizons. Debris removal is an adequate example: Debris can be removed, i.e. countable outcome. But, it is expected that future debris will need to be removed again. Thus it is a “long-term” concern also.

Table 4-7: 2013 Derived Mitigation Actions (Deductive Actions): Finalized

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Outreach: *Objectives I.1 – I.7*	Assist where possible to include mitigation activity in emergency management training	Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	*Regarding Residential and Non-Residential Safe Rooms:* Provide information to the general public and the housing industry about; find grants and other funding sources toward construction of	Enduring	Tornadoes; Severe Storm; Hail Storms
Outreach: *Objectives I.1 – I.7*	*Regarding Repetitive-Loss and Severe Repetitive-Loss Properties:* Provide/ improve information and conduct outreach about Repetitive-Loss and Severe Repetitive-Loss properties within local jurisdictions' areas; educate community leaders and floodplain managers about the Repetitive-Loss/Severe Repetitive-Loss program	Enduring	Flooding
Outreach: *Objectives I.1 – I.7*	Conduct community assessment visits and floodplain audits on a regular basis, including after major flooding events	Near-Term & Enduring	Flooding
Outreach: *Objectives I.1 – I.7*	Increase interagency communication (at both state and federal levels) regarding impact of the NFIP and floodplain management; use experts from other agencies to aid in these efforts	Enduring	Flooding
Outreach: *Objectives I.1 – I.7*	Continue agency partnerships to provide outreach, to develop floodplain management publications/promotional materials	Enduring	Flooding
Outreach: *Objectives I.1 – I.7*	Increase interagency communication regarding impact of the CRS; use experts from other agencies to aid in these efforts	Enduring	Flooding

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Outreach: *Objectives I.1 – I.7*	Promote land-use planning for geologically high-risk areas	Enduring	Earthquakes; Karst/Sinkholes; Mine/Land Subsidence; Landslides
Outreach: *Objectives I.1 – I.7*	Conduct outreach toward local jurisdictions to provide technical assistance regarding the proper enforcement of building codes	Enduring	Earthquakes; Flooding; Severe Storms; Severe Winter Storms; Tornadoes; Forest Fires
Outreach: *Objectives I.1 – I.7*	Conduct training seminars and workshops for local building enforcement officials	Near-Term & Enduring	Earthquakes; Flooding; Severe Storms; Severe Winter Storms; Tornadoes; Forest Fires
Outreach: *Objectives I.1 – I.7*	Continually increase membership to the Kentucky Hazard Mitigation Council (KYMC)	Near-Term & Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	Hold regular meetings of the Kentucky Hazard Mitigation Council (KYMC)	Near-Term & Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	Promote the gathering and archiving of data by local jurisdictions regarding the types and extent of damages that occur after a hazard event	Near-Term & Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	Provide technical assistance to local jurisdictions regarding establishing, standardizing, and, ultimately, implementing local mitigation strategies	Enduring	All Hazards

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Outreach: *Objectives I.1 – I.7*	Maintain an ongoing education and outreach effort aimed to educate public and private schools, elected officials, and the general public about the importance of hazard mitigation; conduct workshops, training, seminars, etc. regarding mitigation techniques, funding, planning, and benefit-cost analysis to aid in such efforts	Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	Develop new training programs where applicable and when the need arises	Near-Term & Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	Continue to develop and improve and to disseminate “Best Practices” in hazard mitigation	Near-Term & Enduring	All Hazards
Outreach: *Objectives I.1 – I.7*	Train specifically for human-made hazards	Enduring	Human-Made

Deductive Action Category	Action	Near-Term vs. Enduring	Hazard(s) Addressed
Option Diversification: *Objective II.1*	Promote to local jurisdictions the purchasing and installation of indoor and outdoor warning systems (e.g., telephone "ring-down" systems, weather-alert radios, and outdoor warning sirens)	Enduring	Severe Storms; Dam Failure; Earthquakes; Hail Storms; Tornadoes
Option Diversification: *Objective II.1*	Promote the purchasing of flood insurance; actively seek flood insurance participants	Near-Term & Enduring	Flooding; Dam Failure
Option Diversification: *Objective II.1*	Promote the use of mitigation projects aimed toward protection from flooding (e.g., elevations, acquisitions/demolitions)	Enduring	Flooding
Option Diversification: *Objective II.1*	Promote the design and construction of minor engineered water-management projects	Near-Term	Flooding
Option Diversification: *Objective II.1*	Promote the retrofitting of existing structures	Near-Term	Earthquakes; Karst/Sinkholes; Mine/Land Subsidence; Landslides
Option Diversification: *Objective II.1*	Encourage the creation of local building enforcement capabilities in communities that currently do not have such capabilities	Enduring	Earthquakes; Flooding; Severe Storms; Severe Winter Storms; Tornadoes; Forest Fires

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Option Diversification: *Objective II.1*	Explore possible options to promote toward owners of manufacture homes regarding financial incentives to secure their homes to their sites	Near-Term	Flooding; Severe Storms; Severe Winter Storms; Tornadoes
Option Diversification: *Objective II.1*	Promote utility-protection projects (e.g., those projects protecting electrical and water supplies and involving sanitary sewers)	Near-Term	All Hazards
Option Diversification: *Objective II.1*	Promote mitigation activities involving transportation systems	Enduring	Dam Failure; Earthquakes; Flooding; Karst/Sinkholes; Landslides; Mine/Land Subsidence; Human-Made Hazards
Option Diversification: *Objective II.1*	Promote the purchasing of generators and generator "hook-ups" for critical facilities	Near-Term	Dam Failure; Earthquakes; Flooding; Hail Storms; Severe Storms; Severe Winter Storms; Tornadoes; Human-Made Hazards
Option Diversification: *Objective II.1*	Encourage the integration of applicable hazard mitigation objectives developed for local hazard mitigation plans into local-level comprehensive plans	Near-Term	All Hazards
Option Diversification: *Objective II.1*	Promote NIMS compliancy (so that local governments can better and more efficiently communicate during large-scale, multi-jurisdictional hazard events	Near-Term & Enduring	All Hazards
Option Diversification: *Objective II.1*	Maintain a catalog of the hazards from which Kentucky suffers and mitigation research studies regarding said hazards	Near-Term	All Hazards

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Option Diversification: *Objective II.1*	Make regular visits to Area Development Districts (ADDs) to elicit feedback from local jurisdictions and present mitigation options/projects	Near-Term & Enduring	All Hazards
Option Diversification: *Objective II.1*	Continue identifying locations where acquisitions are a preferable and viable mitigation option	Near-Term	Flooding
Option Diversification: *Objective II.1*	Promote residential hazard preparedness	Enduring	All Hazards
Option Diversification: *Objective II.1*	Conduct mitigation funding seminars	Near-Term & Enduring	All Hazards
Option Diversification: *Objective II.1*	Promote increased participation (where participation is not limited to appointment) in one of Kentucky's many mitigation-oriented committees, commissions, etc.	Near-Term & Enduring	All Hazards
Option Diversification: *Objective II.1*	Educate about evacuation routes and procedures	Enduring	All Hazards

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Public Goods-Type: *Objectives III.1 – III.7*	Identify vulnerable populations through the Commonwealth of Kentucky's risk assessment	Near-Term	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Target prioritization of mitigation activity toward projects that benefit vulnerable populations	Near-Term	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Visit sites listed on Kentucky's Repetitive-Loss and Severe Repetitive-Loss lists in order to verify the accuracy of the lists	Near-Term	Flooding
Public Goods-Type: *Objectives III.1 – III.7*	Establish hazard mitigation priorities for the retrofitting of existing state-level critical facilities and infrastructure (based upon the Commonwealth of Kentucky's risk and vulnerability assessment)	Near-Term	Earthquakes; Flooding; Hail Storms; Karst/Sinkholes; Mine/Land Subsidence; Landslides; Severe Storms; Severe Winter Storms; Tornadoes; Extreme Temperatures; Human-Made Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Collect data on and identify locations and effects of landslides in Kentucky, both current and historical; visit the sites of past landslides to collect the data	Near-Term	Earthquakes; Mine/Land Subsidence; Landslides
Public Goods-Type: *Objectives III.1 – III.7*	Develop, improve hazard assessment methodology related to dam failure: Examine, evaluate need for emergency action plans; examine the issues related to the effects of unregulated development below dams	Near-Term & Enduring	Dam Failure; Flooding
Public Goods-Type: *Objectives III.1 – III.7*	Review existing state-level agency programs, plans, and policies at least every three (3) years	Near-Term	All Hazards

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Public Goods-Type: *Objectives III.1 – III.7*	Inventory critical facilities, leased infrastructure, identified vulnerable structures (from Area Development Districts' data); update inventory of state-owned facilities; continue improving risk and vulnerability criteria for all of the above	Near-Term	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Continue the Commonwealth of Kentucky's cost-share (12%) for FEMA Hazard Mitigation Grant Program (HMGP)-funded projects	Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Identify effective local regulatory approaches to hazard mitigation	Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Identify pre- and post-disaster mitigation-related funding opportunities for local jurisdictions	Near-Term & Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Identify further "Best Practices" that can later be the subject of future outreach	Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Review and update local hazard mitigation plans at least every five (5) years	Near-Term	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Maintain, continue improving and updating the Kentucky Emergency Management (KYEM) website	Near-Term & Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Develop brochures etc. defining hazards and mitigation funding opportunities	Near-Term	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Continue to promote the design, improvement of a functional statewide emergency responders communication system	Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Participate in, provide support to education/higher education program/curricular development, especially toward coursework aimed at emergency management professional and that focus on hazard mitigation and related fields	Enduring	All Hazards

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Public Goods-Type: *Objectives III.1 – III.7*	Continue to update and modernize Kentucky's flood maps and flood insurance studies; provide mapping where currently there is little or none	Near-Term & Enduring	Dam Failure; Flooding
Public Goods-Type: *Objectives III.1 – III.7*	Continue to work with FEMA to prioritize communities for new mapping based upon population growth and the number of flood insurance policies	Near-Term	Dam Failure; Flooding
Public Goods-Type: *Objectives III.1 – III.7*	Collect data on and identify the effects from karst and sinkholes; continue to update databases regarding Kentucky's geologic hazards; work with Kentucky Geological Society (KGS), Department of Geological Sciences at the University of Kentucky, and USGS	Near-Term	Earthquakes; Karst/Sinkholes; Landslides; Mine/Land Subsidence
Public Goods-Type: *Objectives III.1 – III.7*	Continue to monitor, update, and maintain information regarding seismic activity	Near-Term	Earthquakes
Public Goods-Type: *Objectives III.1 – III.7*	Develop/Improve hazard assessment methodology related to forest fires	Near-Term	Forest Fires
Public Goods-Type: *Objectives III.1 – III.7*	Continue to improve the Commonwealth of Kentucky's hazard assessment methodology, generally	Near-Term & Enduring	All Hazards
Public Goods-Type: *Objectives III.1 – III.7*	Continue updating/improving and implementing the Community Hazards Assessment and Mitigation Planning System (CHAMPS)	Near-Term & Enduring	All Hazards

DEDUCTIVE ACTION CATEGORY	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Public Goods-Type: *Objectives III.1 – III.7*	Develop/Improve hazard assessment methodology related to human-made hazards	Near-Term	Human-Made
Public Goods-Type: *Objectives III.1 – III.7*	Research how previously identified critical facilities are related to/networked with other facilities, i.e. "nested"	Near-Term	Human-Made
Public Goods-Type: *Objectives III.1 – III.7*	Identify vulnerabilities within and specific to individual critical facilities	Near-Term	Human-Made
Public Goods-Type: *Objectives III.1 – III.7*	Track progress of select mitigation projects after close-out in order to collect data to be used in loss avoidance studies	Near-Term	All Hazards

REQUIREMENT
§201.4 (C) (3) (V):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

WITHIN TABLES, ABOVE AND BELOW

D. Identifying, Evaluating, and Prioritizing Cost-Effective, Environmentally-Sound, and Technically Feasible Mitigation Actions for Repetitive-Loss Properties

Table 4-8: 2013 Inductive Mitigation Actions: Finalized

INDUCTIVE ACTION CATEGORY: *Objective IV.1*	ACTION NUMBER	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Flooding (1)	Action 1.1	Remove Debris	Near-Term & Enduring	Flooding, Landslide/Debris Flow, Tornadoes
	Action 1.2	Acquire Properties within Floodplains	Near-Term	Flooding
	Action 1.3	Install, Repair, Address Culverts	Near-Term	Flooding
	Action 1.4	Manage Vegetation, Wetlands	Enduring	Flooding
	Action 1.5	Address Storm Sewers	Near-Term	Flooding
	Action 1.6	Address Flood Gages	Near-Term	Flooding
	Action 1.7	Elevate Structures	Near-Term	Flooding
	Action 1.8	Provide Openings in Foundation Walls to Allow Flow of Water	Near-Term	Flooding
	Action 1.9	Repair Road Slides/Breaks	Near-Term	Flooding
	Action 1.10	Maintain Creek Banks	Near-Term & Enduring	Flooding
	Action 1.11	Monitor Erosion	Enduring	Flooding
	Action 1.12	Construct Levees/Flood Walls	Near-Term	Flooding
	Action 1.13	Realign Streams	Near-Term	Flooding
	Action 1.14	Eliminate Severe Repetitive Loss (SRL) Structures	Near-Term & Enduring	Flooding
	Action 1.15	Replace Inadequate Bridges	Near-Term	Flooding

INDUCTIVE ACTION CATEGORY: *Objective IV.1*	ACTION NUMBER	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Improved Information (2)	Action 2.1	Construct, Improve GIS Databases of Critical Facilities	Near-Term & Enduring	All Hazards, Human-Made
	Action 2.2	Update Flood Insurance Rate Maps (FIRMs)	Near-Term & Enduring	Flooding
	Action 2.3	Construct, Improve GIS Databases of Repetitive Loss (RL) Structures	Near-Term	Flooding
	Action 2.4	Identify and Map At-Risk Bridges	Near-Term & Enduring	Flooding, Snow Loads, Earthquakes
	Action 2.5	Evaluate Recovery Shelters	Enduring	Tornadoes, Winter Weather/Snowstorms, Radiological Emergencies
	Action 2.6	Perform Earthquake Studies	Near-Term & Enduring	Earthquakes
	Action 2.7	Identify At-Risk Structure Identification	Near-Term & Enduring	All Hazards, Human-Made
	Action 2.8	Identify County/Local Sources for Data	Near-Term & Enduring	All Hazards
	Action 2.9	Create, Maintain List of Local Service Providers	Near-Term & Enduring	All Hazards
	Action 2.10	Perform Housing Identification	Near-Term & Enduring	All Hazards
	Action 2.11	Create, Provide Sinkhole Location Maps	Near-Term	Landslide/Debris Flow, Earthquakes, Flooding[50]

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[50] Again, the "Hazards Addressed" use FEMA categories. Specific "Sinkhole" and "Karst" categories were not identified by the FEMA report that guided this evaluation.

INDUCTIVE ACTION CATEGORY: *Objective IV.1*	ACTION NUMBER	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Physical Improvements (3)	Action 3.1	Install Generators	Near-Term	Flooding, Severe Wind, Utility Failure
	Action 3.2	Identify New Critical Facilities Outside of Hazard Areas	Near-Term	All Hazards, Human-Made
	Action 3.3	Construct Safe Rooms	Near-Term	Tornadoes, Winter Weather/Snowstorms, Radiological Emergencies
	Action 3.4	Relocate Critical Facilities/Residential Structures	Near-Term	Flooding, Landslide/Debris Flow, Subsidence
	Action 3.5	Bury Utilities	Near-Term	Thunderstorms/Lightning, Severe Wind
	Action 3.6	Acquire Emergency Equipment	Near-Term & Enduring	All Hazards
	Action 3.7	Acquire Vehicles for Road Clearing	Near-Term & Enduring	Flooding, Winter Weather/Snowstorms, Wildfires
	Action 3.8	Remove, Regulate, Retrofit Buildings in Hazard-Prone Areas	Near-Term	Earthquakes, Flooding, Landslide/Debris Flow, Subsidence
	Action 3.9	Trim "Right-of-Ways"	Near-Term & Enduring	Severe Wind, Utility Failure
	Action 3.10	Manage Hazard Areas	Enduring	All Hazards
	Action 3.11	Improve Water Infrastructure	Near-Term & Enduring	Droughts, Flooding, Wildfires, Utility Failure, Public Health Emergencies
	Action 3.12	Construct Emergency Relief Warehouses	Near-Term	All Hazards
	Action 3.13	Install Drought-Proof Security Links	Near-Term	Droughts
	Action 3.14	Maintain Lifeline Utilities	Enduring	Utility Failure
Communications (4)	Action 4.1	Install NOAA "All-Hazards" Radios	Near-Term & Enduring	All Hazards
	Action 4.2	Generally Upgrade Communications Equipment	Enduring	All Hazards
	Action 4.3	Install Other/Atypical Early Warning Systems	Near-Term	Flooding, Thunderstorms/Lightning, Radiological Emergencies
	Action 4.4	Install Warning Sirens	Near-Term	Flooding, Tornadoes

INDUCTIVE ACTION CATEGORY: *Objective IV.1*	ACTION NUMBER	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
Planning (5)	Action 5.1	Recruit and Train Volunteers	Enduring	All Hazards
	Action 5.2	Coordinate Debris Removal	Near-Term & Enduring	Flooding, Landslide/Debris Flow, Tornadoes
	Action 5.3	Engage in Storm-water Management	Enduring	Flooding
	Action 5.4	Improve Interagency Communication	Enduring	All Hazards, Human-Made
	Action 5.5	Protect Information Systems and Infrastructure	Enduring	Human-Made
	Action 5.6	Identify "At-Risk" Critical Facilities	Near-Term	Human-Made
	Action 5.7	Formalize Hazard Mitigation Planning Committee	Near-Term & Enduring	All Hazards
	Action 5.8	Develop, Improve Evacuation Plans, Policies, and Procedures	Enduring	Hazardous Materials, Wildfires
	Action 5.9	Better, More Explicitly Address Severe Repetitive Loss (SRL) Properties in Planning	Enduring	Flooding
	Action 5.10	Develop, Improve Floodplain Management Procedures	Enduring	Flooding
	Action 5.11	Plan to Maintain Water Supply	Enduring	Droughts, Extreme Temperatures
	Action 5.12	Better Staff Local Emergency Operations Centers (EOCs)	Enduring	All Hazards, Human-Made
	Action 5.13	Improve Assistance to Special Needs Populations	Enduring	All Hazards
	Action 5.14	Train, Equip, Maintain "Storm Spotters"	Enduring	Severe Wind, Thunderstorms/Lightning, Tornadoes
	Action 5.15	Monitor Repetitive Loss (RL) Properties	Enduring	Flooding
	Action 5.16	Develop Database of Recurring Flood Hazards	Near-Term & Enduring	Flooding
	Action 5.17	Develop, Continue Wellhead Protection Plans	Enduring	Oil and Natural Gas

INDUCTIVE ACTION CATEGORY: *Objective IV.1*	ACTION NUMBER	ACTION	NEAR-TERM VS. ENDURING	HAZARD(S) ADDRESSED
	Action 5.18	Develop Supplements to Jurisdictions' Emergency Operations Plans (EOPs)	Enduring	All Hazards
	Action 5.19	Develop Regional Agreements that Allow the Use of Inventoried Equipment	Enduring	All Hazards
	Action 5.20	Improve Planning that Assures Delivery of Emergency Services	Enduring	All Hazards
	Action 5.21	Develop, Improve Land-Use Planning	Enduring	All Hazards
Enforcement (6)	Action 6.1	Enforce National Flood Insurance Program (NFIP) Flood Ordinances	Enduring	Flooding
	Action 6.2	Enforce, Pass Zoning and Land-Use Ordinances	Enduring	Flooding, Landslide/Debris Flow, Wildfires
	Action 6.3	Enforce Current Building Code Standards	Enduring	Flooding, Landslide/Debris Flow, Winter Weather/Snowstorms, Earthquakes, Wildfires, Structure Fires
	Action 6.4	Adopt Building Code Standards	Near-Term	Flooding, Landslide/Debris Flow, Winter Weather/Snowstorms, Earthquakes, Wildfires, Structure Fires

C. *Prioritizing Mitigation Actions and Activities*

Reasons for Revising Prioritization Strategy:

For the 2010 update of the Commonwealth's hazard mitigation plan, prioritization of mitigation actions was performed with a seemingly straightforward grading scale:

Priority	Description
A	Projects or activities which permanently eliminate damages or deaths and injuries across the State from any hazard.
B	Project or activities which reduce the probability of damages, deaths, and injuries across the State from any hazard.
C	Project or activities which educate the public on the subjects of hazard mitigation, hazard research, and disaster preparedness.
D	Project or activities which warn the public to the approach of a natural hazard threat across the State.

There are obvious flaws with the 2010 grading scale that necessitate changing it, however: The scale represents false gradation. Why are warning sirens ranked lower than education campaigns? Could not one argue the opposite? Alternatively, why are education campaigns and warning sirens perhaps not placed with similar priority? It is arguable that the criterion for "A" is superfluous: Only one type of project can "permanently eliminate damages or deaths and injuries": Acquisitions and demolitions. Why can the Commonwealth not simply assume that an acquisition or demolition mitigation action is in a category of its own? It is axiomatic that acquisition and demolition mitigation actions will take priority above any other type of mitigation action.

Using the 2013 mitigation actions, as is the 2010 prioritization scale cannot offer any substantive way to prioritize the actions: If garnering an A, C or D refers to specific projects (A = acquisition, C = education, D = warnings/sirens), then every other type of project category falls under "B." This creates a need for a "sub-prioritization." The varied projects comprising the "B" grade all still need to be prioritized. A safe room and a drainage project both would receive a "B" using the 2010 prioritization scale. Yet a safe room and a drainage action do not nor should not necessarily carry equal weight. They are not necessarily substitutable mitigation actions.

Prioritization of Mitigation Actions for 2013:

The 2013 update of the Commonwealth's hazard mitigation plan will attempt a more systematic prioritization system that uses the priorities of its localities as a basis for selection.

First, some assumptions in order to allow the model:

1) It is assumed that projects addressing acquisition and demolition as the underlying strategy exist in a separate category. This is due to the unique outcome resulting from such mitigation actions: Complete and permanent elimination of damages and/or deaths and injuries from any hazard. It is further assumed that given such a uniquely desired outcome, such mitigation actions take precedence (are prioritized) above any other.
2) It is assumed that education campaigns also exist as a separate category. Such campaigns are important and relevant mitigation actions, but oft-times accompany other mitigation actions and/or can be funded through other sources. Such actions are prioritized on an ad-hoc basis and, thusly, do not need inclusion into a systematized prioritization process.
3) It is assumed that a local jurisdiction's prioritization of its mitigation actions is jointly determined with a local jurisdiction's assessment and ranking of the hazards that affect it.
4) It is assumed the protection of critical facilities ranks more highly than any other consideration in mitigation action prioritization and subsequent selection.

Prioritization among mitigation actions that (a) do not permanently eliminate damages and/or deaths and injuries and that (b) are not education campaigns can occur acknowledging two (2) considerations:

1) What the mitigation action protects, and
2) How localities would prioritize their mitigation actions.

RE: What the Mitigation Action Protects

For any project application intended to mitigate hazards, two specific questions are asked:

1) Does the project intend to protect a critical facility?
2) What is the population the project is intended to protect?

Thus, the Commonwealth of Kentucky has implied that, generally, there are two (2) mitigation action/project classifications that take primary consideration when selecting projects: Those projects that protect critical facilities, and those projects that protect populations only[51].

This creates two categories: A-Projects and B-Projects.

- ***A-Projects*** are all projects that protect critical facilities.
- ***B-Projects*** are all projects that protect populations only.

RE: Locality Prioritization

After dividing mitigation actions into either A-Projects or B-Projects, there is further prioritization ranking that must occur. In other words, mitigation actions within the A-Projects category must be ranked and mitigation actions within the B-Projects category must be ranked.

In order to reflect locality prioritization, such intra-categorical ranking is linked with how the Area Development Districts (ADDs) identified and ranked which hazards affected them when updating their respective local hazard mitigation plans:

A mitigation action submitted by ADD X that addresses a hazard that it ranked as "high-risk" will be prioritized more highly than a mitigation action submitted by ADD Y that addresses a hazard that it ranked "low-risk."

The distinction amongst the ADDs' rankings of their identified hazards derives from a thorough local hazard mitigation plan review and synopsis conducted by UK-HMGP and originally intended to help guide stakeholder meetings that were an integral part of the Commonwealth of Kentucky's planning process. The results of this local hazard mitigation plan synopsis are provided in ***Appendix 4-8***[52]. It should also be noted that results provided in ***Appendix 4-8*** were confirmed through the stakeholder meetings described in the *Planning Process* section of this hazard mitigation plan.

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[51] It is assumed that there are no mitigation actions/projects that protect neither critical facilities nor populations. There would be no point to mitigating a hazard that affects no one.

[52] The local plan summaries appended to the *Planning Process* section of this 2013 update of Kentucky's hazard mitigation plan [***Appendix 2-5***] also shows to which hazards high-, medium/moderate-, and low-risk labels were assigned from which Area Development District.

Ranking is reverse numerical order: “High-Risk,” “Medium/Moderate-Risk and “Low-Risk” will be assigned the numbers “3,” “2,” and “1,” respectively.

So, amongst mitigation actions/projects that reduce the probability of damages and/or deaths and injuries resulting from a hazard, the following prioritization matrix results:

A-Projects: Mitigation Actions that Protect Critical Facilities	A3: Addresses ADDs’ “High-Risk”
	A2: Addresses ADDs’ “Medium/Moderate-Risk”
	A1: Addresses ADDs’ “Low-Risk”
B-Projects: Mitigation Actions that Protect Populations Only	B3: Addresses ADDs’ “High-Risk
	B2: Addresses ADDs’ “Medium/Moderate-Risk”
	B1: Addresses ADDs’ “Low-Risk”

<u>A Note on “High-Risk,” “Medium/Moderate-Risk,” and “Low-Risk” Rankings</u>

This 2013 update of the Commonwealth of Kentucky’s hazard mitigation plan recognizes that relying solely upon the interpretation from local mitigation plans of which hazards are “high-risk” versus “medium-/moderate-risk” versus “low-risk” is insufficiently strict a justification to systematically rank actions within the “A-Project” and “B-Project” framework. Appendix 4-8 provides evidence as to why it is insufficiently justified: Throughout the 2010-2013 state-level planning cycle, local hazard mitigation plans were being written under two different sets of guidelines. Some were able to be approved using what is now an outdated “Plan Review Tool” or “Crosswalk.” The “Plan Review Tool” or “Crosswalk” is the method developed and used by FEMA (and used by the Commonwealth of Kentucky) to review hazard mitigation plans directed toward FEMA funding. In 2012, FEMA introduced a revised “Crosswalk” that streamlined much of the local plan review and prompted a more open-ended analysis of local hazard mitigation plans. In Kentucky’s case and during its 2010-2013 planning cycle, only three (3) of its multi-jurisdictional hazard mitigation plans were reviewed using the revised FEMA “Crosswalk.”

Of particular relevance to this subsection of the Commonwealth of Kentucky’s 2013 mitigation plan update and its project prioritization methodology is that the revised FEMA “Crosswalk” requires that local hazard mitigation plans ordinally rank the hazards it assesses for the jurisdictions they cover. So, for example, the Cumberland Valley Area Development District (CVADD) multi-jurisdictional local hazard mitigation plan – reviewed using the revised “Crosswalk” – will demonstrate that vulnerability to, say, flooding is ranked either “high,” “medium,” or “low.” If one trusts the hazard vulnerability and assessment analysis, then one trusts the ordinal ranking of the local jurisdictions’ hazards and little needs to be questioned in prioritizing CVADD’s mitigation actions according to the “A-Project/B-Project, A3-A1 and B3-B1” framework.

However, this requirement of ordinal ranking of hazards deriving from the revised “Crosswalk” does not apply to FEMA’s outdated version. Hazard ranking is encouraged and was looked highly upon; but, local mitigation plans in Kentucky were approved without any demonstrated ordinal ranking of hazards under the outdated “Crosswalk.”

For this 2013 state-level mitigation plan update and the project prioritization methodology described above, the Commonwealth of Kentucky relied upon context and qualitative analysis to distinguish between “high-,” “medium-,” and “low-risk” hazard ranks for those local mitigation plans that did not explicitly rank their hazards. The results from the contextual/qualitative analyses were confirmed in the stakeholder meetings described in the *Planning Process* section of this plan update.

During the upcoming 2013 – 2016 state-level planning cycle, most of Kentucky’s multi-jurisdictional local hazard mitigation plans will need to be revised. Though FEMA’s revised “Plan Review Tool” (“Crosswalk”) will require a ranking of hazards for these local mitigation plan updates, it is the Commonwealth of Kentucky’s (and Kentucky Emergency Management’s) intent to enforce standardization of the local jurisdictions’ method of ranking their hazards to which they are vulnerable. This standardization will be enforced through outreach generally and through the local mitigation plan review process.

A standardized method for ranking hazards at the local level enhances the rigor of the prioritization system described above.

Using the Commonwealth of Kentucky’s Hazard Assessment for Prioritization

The Commonwealth of Kentucky does not itself “define” (or categorize) what constitutes a “high-risk” versus a “medium/moderate-risk” versus a “low-risk” hazard.

Rather, the Commonwealth provides for its hazard mitigation plan a far less arbitrary, more data-driven and, hence, more rigorous distinction between possible “ranks” of hazards. In this 2013 mitigation plan update, the Commonwealth uses a technique called the *(Jenks) Natural Breaks Classification Method* (developed by George Jenks late in the first half of the twentieth century) to distinguish between the Commonwealth’s “severe-risk,” “high-risk,” “moderate-risk,” and “low-risk” hazards.

The point of the *Natural Breaks Classification Method* is to use data (in this case the data used to assess vulnerability to hazards) to “find” classifications. For example, a typical classification scheme is to divide data into quartiles: Thus, 1-25 is the lowest quartile and 76-100 is the highest quartile. However, this classification is defined externally. It has a very tenuous connection to the data from which the quartiles are constructed. In other words, organizing data into quartiles is potentially (or likely) to be arbitrary. The *Natural Breaks Classification Method*, rather, looks at the data that is input and attempts to locate were the classifications (the “breaks”) “naturally” are occurring. It does this through an iterative process: Having predetermined that the Commonwealth wants four (4) classifications or groups (“severe-risk,” “high-risk,” “moderate-risk,” and “low-risk”), the *Natural Breaks Classification Method* (using a methodology relying upon differencing the sum of squared deviations between the predetermined classifications from the sum of squared deviations from the entire matrix’s mean) literally uses data points to recreate the classifications so that they no longer are arbitrarily defined and moves data points from one newly defined classification to another until deviations *within* the new classifications are minimized[53]. These, then, are "natural breaks" in the data. In the Commonwealth's case, "severe-risk," "high-risk," "moderate-risk," and "low-risk" are defined through this method.

That the Commonwealth of Kentucky has defined its "severe-," "high-," "moderate-," and "low-risk" hazards using data rather than arbitrary definitions provides an ideal justification tool for mitigation project prioritization system described above: The Commonwealth of Kentucky can rank its "A-Projects" as either A3, A2, or A1 (and "B-Projects" as either B3, B2, or B1) depending upon local hazard mitigation plan determinations of hazard risk. But, that A3, A2, or A1 (B3, B2, or B1) ranking will be checked against the Commonwealth's risk assessment outcomes presented within this plan update. In other words, rather than use a Commonwealth-derived "definition" of "high," "medium/moderate," or "low," the Commonwealth will use the risk assessment's results to justify prioritization. The Commonwealth knows that if a local jurisdiction's vulnerability to tornadoes is deemed "severe" according to this plan update's risk assessment, then that assessment is backed up by rigorous data analysis.

The Final Prioritization Tools: Benefit-Cost Analysis (BCA) and Developmental Pressure

After categorizing mitigation actions into either A-Projects or B-Projects, and after ranking within the categories, the final systemic prioritization tool will consist of Benefit-Cost Analysis (BCA). The BCA Ratio should aid in determining between, say an A1 versus a B3 project or amongst multiple A2 or B2 projects et al.

Finally, as the Kentucky Hazard Mitigation Council (KYMC) is responsible for prioritization of local jurisdictions' hazard mitigation projects, on a case-by-case basis it will consider developmental pressure and other qualitative, anomalous variables in its prioritization decisions. In other words, the KYMC possess and will use judgment and discretion (backed by as many variables as possible) in its prioritization decisions.

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[53] Specifically, the *Jenks-Optimized Natural Breaks Classification Method* provides classifications using the following methodology:

1) Order the data that needs to be classified.
2) Place the ordered data into classifications. These classifications can be arbitrary. In other words, predetermine how many classifications will be created. In Kentucky's case, four classifications were desired: "sever-risk," "high-risk," "moderate-risk," and "low-risk."
3) Calculate the sum of squared-deviations between the predetermined classifications. Remember that all data exist within a matrix. Individual data points are squared in order to get rid of any negative numbers. This step has each individual data point first being squared. If there are four (4) classifications, each of these squared data points is subtracted from its corresponding squared data point housed under a different classification. The individual differences between each data point from data points housed under different predetermined classifications are then summed together. We'll call this number SSDBC.
4) Calculate the sum of squared-deviations from the mean of the entire matrix. Again, all data exist within a matrix. Squaring each of the data points within the matrix, summing up all of those points, and dividing that number by the number of data points provides the mean (or average) of the matrix. So, during this step, each data point is squared and subtracted from this mean of the matrix. The individual differences between each data point and the mean of the matrix are then summed together. We'll call this number SSDMM.
5) Subtract SSDBC from SSDMM (i.e. SSDMM – SSDBC).
6) This difference allows a decision to be made to move a data point from within a classification with a comparatively high (sum of squared) deviation between the predetermined classifications to the classification with a comparatively low (sum of squared) deviation between the predetermined classes.
7) The movements in 6) determine the (new) four classifications. Now the Commonwealth's "severe-risk," "high-risk," "moderate-risk," and "low-risk" classifications no longer are arbitrarily defined.
8) Repeat 3) through 6) until the sum of squared-deviations *within* each of the new classifications is minimized.

MITIGATION STRATEGY

PART III:
Local Capability Assessment

REQUIREMENT
§201.4 (C) (3) (II)

Kentucky's mitigation strategy shall include a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.

Given the emphasis toward the Commonwealth of Kentucky's local jurisdictions (and *inductive planning*) and given that Kentucky's mitigation actions primarily derive from the mitigation actions articulated from its local jurisdictions, a discussion of the local capability to implement said actions is necessary here.

It assumed that "capability" overwhelmingly considers two (2) questions:

1) Are local jurisdictions able to fund the actions that will mitigate hazards?
2) What policies and agencies are available to a local jurisdiction that can administer the completion of actions that will mitigate hazards?

Consequently, this discussion will proceed as follows: First, a general discussion of public financing for local jurisdictions is necessary. Such a discussion is universal, i.e. most jurisdictions in any state will have access to the discussed financing capabilities. However, information relevant and specific to Kentucky only and related to the general public financing discussion will be included, of course. This will be followed by a discussion of which authorities, agencies, programs, plans, and resources are available to local jurisdictions. True to the locality-first emphasis of this hazard mitigation plan, all local authorities, policies, and programs have been catalogued and categorized from each county [54] in Kentucky through an analysis of each county's regional multi-jurisdictional hazard mitigation plan.

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[54] One regional exception applies here: The counties within the Cumberland Valley Area Development District (CVADD) did not specify which local agency et al. capabilities applied to each *county*. It is simply assumed that what applies regionally applies to each county for the purposes of this plan. City-level capabilities were articulated for the CVADD local hazard mitigation plan, however.

A. *Presenting a General Description of and*

B. *Providing a General Analysis of the Effectiveness of Local Mitigation Policies, Programs, and Capabilities*

Public Financing Capabilities of Local Jurisdictions

The United States Constitution and federalism do not guarantee the existence of local governments. A local government exists at the pleasure of the state only. The dominant rationale for the existence of local government centers on public service provision: "A government closest to the people" is a concept that has been fundamental to American identity since the invention of America from its Revolutionary War. In the latter half of the twentieth century, public finance theory finally formalized why this concept has been so enduring. Charles Tiebout in 1956[55] would give us the eponymous Tiebout Model, which we conceive more commonly as "vote-with-your-feet." Local governments exist to provide the public services we demand. We very much choose where to live based upon what a local government can offer and how that matches our individual preferences. In other words, Tiebout established that local governments can supply public goods and services efficiently and we know this because individuals "vote with their feet." Related to the assumption underlying Tiebout's work that individual preferences apply to public goods provision, Wallace Oates in 1972[56] would give us *fiscal federalism*, and show in theory how local governments are the most efficient at providing those public goods that most accurately correspond with our individual preferences. This theoretical insight has consistently been supported through other scholarly work[57]. "So long as there are variations in tastes and costs, there are clearly efficiency gains from carrying out public sector activities in as decentralized a fashion as possible [Bird 1993, p. 211[58]]."

Local governments, then, have been the jurisdictions most responsible for provision of the basic public services. These include elementary and secondary education, basic transportation infrastructure, and, most relevantly to this hazard mitigation plan, public health and safety services, which, of course, include emergency management services.

Generally, when it comes to assessing the capability of local jurisdictions and governments to finance hazard mitigation activities, there are three (3) factors to consider: 1. the ability to tax, 2. the ability to budget, and 3. the ability to spend and incur debt.

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[55] Tiebout, Charles M. [1956]. "A Pure Theory of Local Expenditures." *Journal of Political Economics* 64(5): 416-424.

[56] Oates, Wallace E. [1972]. *Fiscal Federalism*. New York City, NY: Harcourt, Brace, Jovanovich.

[57] See, for example: Gramlich, Edward M. [1993]. "A Policy-Maker's Guide to Fiscal Decentralization." *National Tax Journal* 46(2): 229-235.

[58] Bird, Richard M. [1993]. "Threading the Labyrinth: Some Issues in Fiscal Decentralization." *National Tax Journal* 46(2): 207-227.

I: The Ability to Tax

Local governments basically have three (3) categories of tax from which they can derive revenue. These are the property tax, the local-option sales tax and excise tax, and the local-option income and business tax.

The Property Tax

The property tax is the only tax that is collected from all 50 states and the District of Columbia (D.C.). It is and has been, by far, the most dominant source of "own-source"[59] revenue collected by a local government: As of 2005, 72% of all local governments' *own-source* revenue derived from property taxation [Brunori 2007[60]]. Alternatively stated, property taxes provided about 27% of the *general* revenue of local governments or provided almost 75% of *total local* government taxes in 2002 [Fisher 2007[61]]. Finally, 96.5% of all property tax revenue goes to local governments [Fisher 2007[62]].

Specifically for local governments, 49 states allow "municipalities" to collect property tax; 45 states allow "counties" to collect it; and 24 states allow "townships" to collect it. Further 42 states allow "school districts" to levy the tax, and 20 states allow its special districts the ability to tax property [Rafool 2002[63]].

Related to Kentucky, aside from independent school districts, generally small counties and cities (i.e. the types of local government that dominate Kentucky) rely the most heavily upon the property tax for its revenue.

The property tax is a unique tax in that the local government determines both the tax *base* and the tax *rate.* Essentially and typically, the local government decides upon how much revenue it needs, assesses the total value of all property within the taxing jurisdiction (through an agency or an assessor), and then sets a tax rate sufficient to generate the revenue desired [Fisher 2007[64]]. The local government is assumed to know how much money it needs before it adopts its budget. The local government sets its property tax rate accordingly. This implies much variability in tax *rates* between the local governments of Kentucky: The tax *base*, i.e. the total value of the property within a local jurisdiction, determines the tax *rate*. A county like Jefferson County with a lot of property that can be taxed and, subsequently, with a "broad" tax *base* will have lower rates than a county in Kentucky where the total value of property is much smaller but the needs for revenue are similar to Jefferson County's needs.

Current to 2007, real property tax values in Kentucky ranged from $1.26 to $4.37 per $1,000 of assessed property value in county-level local governments and ranged from $0.49 to $4.79 per $1,000 of assessed property value in city-level local governments. [Klutkowski and Pupke 2009[65]].

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[59] "Own-source" revenue is the amount of money received by a government from external sources other than the money raised through debt instruments, the liquidation of investments, and as agency/private trust transactions.

[60] Brunori, David. [2007]. *Local Tax Policy: A Federalist Perspective, 2nd Edition*. Washington, D.C.: Urban Institute Press.

[61] Fisher, Ronald C. [2007]. *State and Local Public Finance, 3rd Edition*. Mason, OH: Thomson Higher Education.

[62] *Ibid.*

[63] Rafool, Mandy. [2002]. *A Guide to Property Taxes: An Assessment*. Washington, D.C.: National Conference of State Legislatures.

[64] Fisher, Ronald C. [2007]. *State and Local Public Finance, 3rd Edition*. Mason, OH: Thomson Higher Education.

[65] Klutkowski, Andrew and Peter Pupke (eds). [2009]. *2009 All States Tax Handbook*. New York City, NY: Thomson Reuters.

Property is assessed for taxation in Kentucky on January 1st of each year. Assessment is at *fair cash value*[66] [Klutkowski and Pupke 2009[67]]. Kentucky taxes all *tangible property*[68] (exempting household goods), but exempts *intangible property*[69] [CCH Editorial Staff 2010[70]].

One final fact to consider when thinking about Kentucky's local governments' capabilities to finance hazard mitigation actions and projects: Property tax revenues for local governments *increase* IF the assessed value of property within the local government increases *without* the local government adjusting the property tax *rate*.

In an economy where property values decrease, the calculus changes considerably: Property tax rates will rise in order to meet the predetermined revenue needs of the local government. Such a calculus has spawned "truth-in-taxation" procedures where a local government is not allowed to raise the property tax rate above the rate that will generate the same amount of revenue for the next fiscal year as was raised during the previous year.

Finally, it is relevant to note that by Kentucky Revised Statute (KRS 147.110), property owned (e.g. property that it acquires for mitigation purposes) is exempt from taxation.

Local-Option Sales Tax

"After the property tax, local-option sales taxes are the most important source of tax revenue for local governments [Brunori 2007[71], p. 69]." Nationally, it is a widely-used tax: Of the 45 states that levy a state sales tax, 33 of them also are allowed to levy local-option ones. Further, of the 33, 23 states allow both county government *and* city government to levy local-option sales tax, and nine (9) of the 33 states allow their transit authorities or school districts to levy this type of tax [Brunori 2007[72]].

Generally, the local-option sales tax is popular because it promotes local autonomy (i.e. it is a direct source of revenue for local governments that allows them to maintain some autonomy over fiscal affairs) that is administratively efficient (i.e. does not cost a lot in terms of administration to implement) and provides stability and diversification to a local government's tax base (i.e. it is not so influenced to economic conditions as the income tax is and it provides an extra source of revenue that decreases dependence on the property tax).

Of course, generally, the local-option sales tax also can be controversial due to a shrinking tax base (i.e. Americans increasingly buy services instead of manufactured goods), inter-jurisdictional competition (i.e. it can be a highly inefficient tax if there is a

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[66] "Fair Cash Value" is the "fair" or "reasonable" cash price for which a property can be sold in the market. The term is synonymous with "Actual Cash Value," which is the price a property will bring in a "fair" market, i.e. fair attempt has been made to identify the purchaser who will pay the highest price for the property.

[67] Klutkowski, Andrew and Peter Pupke (eds). [2009]. *2009 All States Tax Handbook*. New York City, NY: Thomson Reuters.

[68] "Tangible Property" is includes both real property and personal property.

[69] "Intangible Property" refers to "property" that has no physical substance, e.g., patents, copyrights, intellectual property generally.

[70] Bjur, Timothy; Cathleen Calhoun; Rocky Mengle; Julie Minor; Brian Nudelman; Joe Rebman; Kathleen Thies (eds.) a.k.a. CCH Editorial Staff. [2010]. *2011 State Tax Handbook*. Chicago, IL: CCH a Wolters Kluwer Business.

[71] Brunori, David. [2007]. *Local Tax Policy: A Federalist Perspective, 2nd Edition*. Washington, D.C.: Urban Institute Press.

[72] *Ibid.*

lot of competition amongst local governments), and it many times being considered "regressive" (i.e. poorer local residents pay a larger percentage of their income in local-option sales taxes than do wealthier local residents).

Kentucky currently does not levy one of these taxes [Kentucky Department of Revenue 2013[73]]. Sales and Use taxation currently only is collected at the state-level.

Local-Option Income Tax

This is a rare taxing ability for local governments to possess. This is largely because of its uselessness in generating any significant revenue [Brunori 2007[74]]: The Tiebout Model (i.e. "vote-with-your-feet") described above ensures a local income tax's futility in raising revenue: While the Tiebout model is suspect in practice when it assumes perfect mobility for individuals between, say, Kentucky and Maine, or between Kentucky and Oregon (i.e. in practice individuals do not just up and leave Kentucky for Oregon because of Oregon's local government services), arguably, the assumption of perfect mobility is best exemplified between local governments. Moving from Jefferson County, Kentucky to neighboring Oldham County, Kentucky does not represent a particularly prohibitive or difficult move, especially given the similarities between costs-of-living. So if Jefferson County levies a separate personal income tax (which it does as described below) while Oldham County does not, one is more likely to see the "vote-with-your-feet" phenomenon in action. The same logic applies to the ability to levy local-option business income taxes, as well.

Local-option *personal* income taxes typically are levied in one of two forms, either as a wage tax or as a general income tax. The former is more commonly referred to as a *payroll tax*; the latter is more commonly referred to as a *piggyback tax* (i.e. an income tax that "piggy-backs" onto a state income tax).

The primary motive for levying a local-option income tax is "fairness": For one, they are highly visible taxes, i.e. taxpayers see very clearly and often (weekly and bi-weekly for wage-earners) how much tax is being paid to support local government activity. Secondly, it is fair in that only residents of a local government pay local-option income taxes in the case of the *piggyback* (general income) form of the local-option income tax. Further, this *piggyback tax* is considered administratively efficient in that it is not costly to administer the tax and the cost of compliance for taxpayers is low. Such is not the case for the *payroll* (wage) version of the local-option income tax. Wage taxes do not conform to state income tax laws. Thus, local governments must enforce, collect, and administer its own wage tax laws. This is expensive. To add further expense, the local government also becomes responsible to audit the wage tax, as well. The wage tax also is not considered very fair in terms of visibility: The local-option income tax may not be levied at a consistent rate across all local governments implementing them. This takes away the predictability and visibility of the tax for businesses paying its employees.

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[73] Kentucky Department of Revenue. [January 7, 2013]. "Individual Information: Overview." *Can be accessed:* http://revenue.ky.gov/individual/. [Last accessed: July 1, 2013].

[74] Brunori, David. [2007]. *Local Tax Policy: A Federalist Perspective, 2nd Edition*. Washington, D.C.: Urban Institute Press.

Even rarer is the ability for local governments to tax the income of its businesses. A local government given this ability will tax businesses in one of four manners: a local-option business income tax, a gross receipts/license tax, payroll taxes, or a business's personal property tax [Brunori 2007[75]]. Taxing a business at the local level is generally frowned upon due to its supposed adverse effects on economic development. However, a local business income tax can prove savvy politically: Rhetorically, a business income tax exports the burden of the tax to non-residents of the local government, i.e. this is how a business income tax is sold to the public. The residents of the local government end up viewing a business income tax as only harming outsiders and, thus, "victimless." In practice, however, the owners of local businesses, their employees, and their customers do end up bearing the burden of a local business income tax.

In light of and despite the aforementioned, Kentucky is one of the few states that allow local-option income taxation [Brunori 2007[76]]. Currently, eight (8) of Kentucky's local governments levy extra *personal*-income taxes on its residents and non-residents. These local governments are (with local income tax rate in parentheses):

- Bowling Green (1.85%)
- Covington (2.5%)
- Florence (2.0%)
- Lexington-Fayette Urban County Government (LFUCG) (2.25%)
- Louisville (2.2% for residents; 1.45% for non-residents)
- Owensboro (1.33%)
- Paducah (2.0%)
- Richmond (2.0%)

Further, Kentucky is one of only eight (8) states to authorize its local governments to levy *business* income taxes. Kentucky is not permitted, however, in levying business income taxes on gross receipts/licenses and on business's personal property [Brunori 2007[77]]. Currently, both Louisville-Metro (mainly Jefferson County) and the Lexington-Fayette Urban County Government (LFUCG) (i.e. two of Kentucky's major cities) levy local-option *corporate/business* income taxes [Moreno 2010[78]].

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[75] Brunori, David. [2007]. *Local Tax Policy: A Federalist Perspective, 2nd Edition*. Washington, D.C.: Urban Institute Press.

[76] *Ibid.*

[77] *Ibid.*

[78] Moreno, Tonya. [September 20, 2010]. "City Income Taxes: U.S. Cities That Levy Income Taxes." About.com: Money: Tax Planning: U.S. *Can be accessed*: http://taxes.about.com/od/statetaxes/a/City-Income-Taxes.htm. [Last accessed June 25, 2013].

II: The Ability to Budget

Of likely most relevance to a local government's capability to implement the mitigation actions and projects for which the Federal Emergency Management Agency (FEMA) will (partially) reimburse upon approval is the management of a local government's cash flow. A local government's revenue collection and its expenditures rarely coincide with each other during a fiscal year. Those responsible for a local government's fiscal resources must constantly operate a tightrope calculus: The local government must have enough cash available to pay its bills when the bills become due; but, the local government suffers if it has cash in excess of what it needs to meet said financial obligations (bills) as the local government is robbing itself of higher yields that could be accrued if the cash was converted into other less liquid investment instruments such as stocks and bonds. To ensure that cash (i.e. the local government's ability to pay) is managed well, taxes usually are collected speedily and expenditure flows typically are slowed as much as is feasible. Local governments must abide by state and local laws stipulating a maximum time period by which those paid using local government expenditures receive their money. Further, state-level statutes frequently specify payment dates for a local government's major assistance payments, e.g. transportation aid, school aid, and any revenue-sharing that occurs [Dresang and Gosling 2002,[79] p. 453].

Such underlies the importance of budgeting in a local government.

A local (and state) government generally and in Kentucky typically has two (2) forms of budget: an operating budget and a capital budget.

> "The operating budget deals with everyday types of activities. The capital budget deals with large expenditures for capital items. They differ in the nature of items purchased, methods of financing, and even the accompanying decision-making process. In most instances, operating expenses are depleted in a single year. Normally, capital items have long-range returns and useful life spans, are relatively expensive, and have physical presences, such as a building, road, water supply, or sewage system [Lynch 1990[80], p. 270]."

The purpose of a local or state government separating its operating from its capital budgets partially involves the abovementioned management of cash flow[81]: Even without requirement for a capital budget, it is useful for local governments to distinguish among the three (3) types of government investment, which are: 1) physical assets for its own use over many years into the future (e.g. office buildings, machinery); 2) physical assets and facilities that enhance private economic development (e.g. infrastructure); and 3) the intangibles (e.g. research, education, et al.). The capital budget and the subsequent budgeting process assists in deciding how much of each type of investment is necessary[82] [Lee, Jr.; Johnson; and Joyce 2004[83], p. 429].

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[79] Dresang, Dennis L. and James J. Gosling. [2002]. *Politics and Policy in American States and Communities*. 3rd Edition. New York City, NY: Pearson Education.

[80] Lynch, Thomas D. [1990]. *Public Budgeting in America.* 3rd Edition. Englewood Cliffs, NJ: Prentice Hall.

[81] The other part of the separation of budgets likely is a response to state-level balanced budget requirements, which are discussed in reference to state capability.

[82] Even if only physical facilities and assets formally are included in the capital budget.

[83] Lee, Jr., Robert D.; Ronald W. Johnson; Philip G. Joyce. [2004]. *Public Budgeting Systems*. 7th Edition. Sudbury, MA: Jones and Bartlett Publishers.

Local (and state) government budgets are not uniform [Mikesell 2010[84], pp. 152-153]: For one, state budgets may be annual or biennial budgets. The rarer biennial budget simply means that two years' worth of appropriations is made within one legislative session. As will be mentioned again below, Kentucky's state budget is one of these less-common[85] biennial budgets. Local government budgets, however, have no tradition with biennial budgets. This is because local governments typically meet and budget more than once a year. Forrester and Mullins [1992[86]] point out that in cities, adjusting approved appropriations and "re-budgeting" mid-year is very common. Further, at every meeting of some local governments' councils and boards of governors, tweaks and adjustments consistently are being made to a budget that had been approved at the start of the fiscal year.

Secondly, a local (or state) budget can result either as a single appropriation law covering all expenditures or as a series of multiple appropriations. Kentucky's *state* budget, at least, tends to be passed as a single appropriations bill (every two years). As an extreme example of the latter variety of budget, Arkansas passes its state budget via approximately 500 separate appropriations bills.

Thirdly, local (and state) governments pass what is called "firm" appropriations in their budgets. Essentially, this means that local (and state) government budgets will not include any "entitlement" spending, i.e. spending that, rather than being set each year, simply continues based solely upon the demand for the "entitlement" throughout the year.

Fourth, local (and state) government budgets typically are very detailed in what is to be expended. For example, Kentucky's current highway appropriations portion of its state budget lists exactly on what money is to be spent making this portion of the budget resemble a "laundry" or grocery list.

Fifth, local (and state) government budgets specifically designate revenue that comes from broad sources (i.e. the personal income and general sales taxes described above and that will be described in the state capabilities section of this hazard mitigation plan) to very narrow uses. The most common example that certainly applies to Kentucky is the use of such broad revenue sources narrowly and specifically toward primary and secondary education.

Sixth, theoretically, local government budgets especially best represent the will of the people in what it includes as expenditures. This has to do with the abovementioned *fiscal federalism*. Local governments are closest to "the people." Arguably, then, a local government budget will reflect more accurate "fiscal choice" than a federal or state budget.

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[84] Mikesell, John L. [2010]. *Fiscal Administration: Analysis and Applications for the Public Sector*. 8th Edition. Mason, OH: Cengage Learning.

[85] 21 states have biennial budgeting cycles.

[86] Forrester, John P. and Daniel R. Mullins. [1992]. "Rebudgeting: The Serial Nature of Budgeting Processes." *Public Administration Review* 52: 467-73.

Finally and related to the discussion below of the local government's capability to spend its revenue, local government budgets reflect the comparative difficulty (to the federal government) in securing access to debt instruments and to borrowing generally.

To end this subsection and related to local capability generally, one must be aware of the wide range of budgeting practices that exist among local governments, which can present some problems in financing: According to Mikesell [2010[87], p. 147[88]], many local governments practice "Christmas list budgeting." As its name implies, this describes department heads within local agencies and local governments preparing requests with little or without any executive guidance about budget conditions or targets. This usually results in a list of unrealistic requests (i.e. a Christmas list) that will then have to be cut in such a way that ignores overall budget priorities and the priorities of local agencies. In other words, local agencies and departments submit budget requests that may be at odds with the requests from other agencies and departments and also may have been made without any coordinating guidance. Secondly, and certainly applying to many of Kentucky's local governments, local operating agencies are headed by an elected official (e.g. a county sheriff). These elected officials may not feel particularly bound to constraints on their agencies' or departments' budget requests. Thirdly and also applying to many of Kentucky's local governments and related to the aforementioned, local agency or department budget proposals are infrequently overseen or checked by an executive of any sort. This largely results from resource constraints within the locality; there is few staff and few staff specially trained to properly audit a budget request from a local agency or department. Finally, if there is guidance in local agencies' and departments' budget requests, the guidance typically focuses on the items that government *purchases* rather than on what *services* the government does and/or should provide [Mikesell 2010[89]].

These practices of local government (partially an understandable consequence of resource constraints and a by-product of the efficiency that local governments can provide its residents) do affect local capability in its relationship with those bodies that approve a local government's budget. In Kentucky, local governments (counties and cities) must have their budgets reviewed and approved by the Kentucky Department for Local Governments (DLG). Additionally, all local governments must submit quarterly financial reports to DLG.and failure to adhere to approved budgets does have serious consequences. While DLG has a responsibility to ensure that budgets reflect sound accounting, DLG has no authority to insist that cities or counties use their funds for particular projects or services.

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[87] Mikesell, John L. [2010]. *Fiscal Administration: Analysis and Applications for the Public Sector*. 8th Edition. Mason, OH: Cengage Learning.

[88] This page number refers to a "custom edition" for Strayer University of the Mikesell [2010] *Fiscal Administration* book. The page number may not match the standard edition of *Fiscal Administration*.

[89] Mikesell, John L. [2010]. *Fiscal Administration: Analysis and Applications for the Public Sector*. 8th Edition. Mason, OH: Cengage Learning.

III. The Ability to Spend and Incur Debt

A local government's ability to spend obviously is an important local capability: How local governments pay for the mitigation actions for which the hazard mitigation plan is written and the project toward which FEMA will partially reimburse matters for the Commonwealth of Kentucky's overall mitigation goals and strategy.

Discussing the ability of a local government to spend is really a discussion of its ability to finance expenditure using debt instruments. This is the link between the abovementioned capability to budget: Local (and state) governments normally prepare separate operating and capital budgets so that they have the information necessary to borrow to finance capital projects (e.g. mitigation projects that, upon approval, will be reimbursed by FEMA). A local government's current revenues rarely can pay for costly capital projects, especially given that those costs are incurred upfront.

Capital projects (e.g. mitigation projects) and general long-term expenditures can be financed without debt, of course. Pay-as-you-go (Pay-Go) financing is common: As the name bluntly refers, the local government pays for an expenditure from its operating expense account "as it goes," or as the costs arrive. Alternatively, local governments also have the ability to accumulate funds over time, i.e. a savings plan. This is called a *sinking fund*. The funds within a sinking fund are invested until the point when the money is needed.

Still, it is toward those durable, typically capital projects that local governments engage in debt-financing. Such financing is pursued through long-term borrowing primarily using the debt instrument known as "bonds" which, usually, are repaid during the "useful life" of a capital project.

Bonds are "sold" by local (and state) governments. They are agreements or promises between a lender and a borrower in which the lender "purchases" the bond from the borrower now (thus providing the borrower with funds in the present) and to which the borrower promises the lender to pay a fixed amount of money (or interest rate) per year for a fixed period of time toward repayment of the full original amount that is collected at a specified future date [Fisher 2007[90]].

Long-term bonds traditionally come in two forms: General Obligation[91] Bonds (GO Bonds) and Revenue[92] Bonds. GO Bonds pledge the *full-faith and credit* of the local government issuing the bond as security. This means that in issuing GO Bonds, local governments *must use* any available source of revenue to pay the interest on and ultimately repay the principal of the bond to the lender. This implies a guarantee for the lender. The lender is guaranteed to be paid back the funds he or she lent to the local government even if all of the personal income and property of the residents of the local government must be confiscated in order for those funds to be repaid:

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[90] Fisher, Ronald C. [2007]. *State and Local Public Finance*. 3rd Edition. Mason, OH: Thomson Higher Education.

[91] General Obligation Bonds oftentimes are referred to as *full-faith and credit bonds*.

[92] Revenue Bonds oftentimes are referred to as *nonguaranteed bonds*.

> "The government may use revenue from any tax or charges to repay the debt, and if existing revenue sources are not sufficient for that purpose, then the government pledges to raise taxes or charges to generate the necessary funds. If, for some reason, a state or local government is unable or unwilling to generate sufficient funds to repay the bondholders, then the government is said to *default* on the bonds. In that case, the government is effectively in bankruptcy and the bondholders may go to court to seize the assets of the government or agency [Fisher 2007[93], p. 235]."

Such a severe guarantee ensures that the interest rates toward which the local government is paying are comparatively low. However, it also ensures that there can be strict statutory or constitutional limits on the amount of GO Bond-financing that can result from a local (or state) government.

Revenue Bonds, meanwhile, are *not guaranteed* by the local government paying the interest and ultimate repayment of the bond. Only the revenues from a particular source (i.e. the capital project that is being financed by the revenue bond) are pledged to pay the interest and repay the principal to the lenders. Conversely, if the revenues from the source toward which the bond was issued are insufficient to pay the interest or pay back the principal of the amount borrowed, it is the lenders who bear the loss. Consequently, the interest rates paid by the local government to the lenders of its funds are theoretically higher than those paid if it is able to issue General Obligation Bonds.

Beyond these two nearly-universally used long-term financing instruments, many cities and municipalities also use the Moral Obligation Bond. This is a rather creative form of bond-financing where a city/municipality declares its "moral obligation" to repay the funds borrowed from the lenders who purchased the Moral Obligation Bond. However, a "moral obligation" is abstract; there is nothing legally or statutorily guaranteed to the local government's lenders. Lenders are purchasing a local government's bonds based upon trust of the local government. They are attractive to the local government because they allow a form of *nonguaranteed* debt to be issued that isn't tied directly to a particular revenue source. In other words, capital projects that are not expected to provide any revenue (e.g. mitigation projects) still can be financed while avoiding the strict limitations on General Obligation Bond-financing [Ross and Levine 2006[94]].

Further related to potential mitigation project-financing capability, local governments have used *lease-back* or *lease-purchase agreements* to avoid the stringent and state-imposed borrowing restrictions under which many local governments operate. These agreements involve the private sector building a facility or general capital asset after which the local government agrees to a long-term "lease" of the facility or capital asset, thus slowly repaying the private entity that constructed the capital asset while technically avoiding "borrowing" per se [Ross and Levine 2006[95]].

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[93] Fisher, Ronald C. [2007]. *State and Local Public Finance*. 3rd Edition. Mason, OH: Thomson Higher Education.

[94] Ross, Bernard H. and Myron A. Levine. [2006]. *Urban Politics: Power in Metropolitan America*. Belmont, CA: Thomson Higher Education.

[95] Ross, Bernard H. and Myron A. Levine. [2006]. *Urban Politics: Power in Metropolitan America*. 7th Edition. Belmont, CA: Thomson Higher Education.

Also, an important consideration to local capability to finance future mitigation actions concerns short-term debt financing/borrowing. In this case, “debt is used to harmonize those divergent patterns of current expenditures and revenues… Sometimes a debt is incurred in order to refinance an existing debt [Lynch 1990[96], p. 248].”

According to Thomas D. Lynch, short-term borrowing normally occurs for the following reasons:

1) “The community is short of the necessary revenue to pay for services. For example, the city forecasted the revenue incorrectly and there is not enough money to pay for planned expenditures.
2) A brief loan is needed and will be paid back as soon as taxes are collected. The money owed to the city may have been collected, but obligations must be paid. A brief loan is needed to bridge this cash flow problem until the debts owed the city are paid.
3) The community has an emergency and necessary funds are not available.
4) The funds are needed to start a capital improvement project, but a long-term bond issue has not yet been approved [Lynch 1990[97], p. 250].”

Ross and Levine (2006[98]) elaborate: “Cities borrow money for short periods of time to smooth out irregularities in revenue and expenditure cycles. Cities need money to pay workers, contractors, and suppliers today, yet property taxes may not be due for another month or so. Hence, municipalities borrow against expected revenues [p. 488].”

There is an added reason that local governments might borrow in the short-term: A local government can borrow at a lower interest rate than it can earn in the financial securities markets. Internal Revenue Service (IRS) arbitrage regulations (under specific circumstances) allow local governments to invest the revenues received from short-term borrowing [Lynch 1990[99]]. So, the local government borrows funds in the short-term at a low interest rate and invests those funds in a securities market that can pay a higher interest rate than the rate at which the local government borrowed, allowing the local government to “profit” from the difference in interest rates.

Bonds can be a tool in the short-term context, as well. However, short-term debt-financing more often occurs using the following instruments [Lynch 1990[100]]:

- Tax Anticipation Notes (TANs)
- Revenue Anticipation Notes (RANs)
- Bond Anticipation Notes (BANs)
- Tax-and-Revenue Anticipation Notes (TRANs)
- Grant Anticipation Notes (GANs)

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[96] Lynch, Thomas D. [1990]. *Public Budgeting in America*. 3rd Edition. Englewood Cliffs, NJ: Prentice Hall.

[97] *Ibid.*

[98] Ross, Bernard H. and Myron A. Levine. [2006]. *Urban Politics: Power in Metropolitan America*. 7th Edition. Belmont, CA: Thomson Higher Education.

[99] Lynch, Thomas D. [1990]. *Public Budgeting in America*. 3rd Edition. Englewood Cliffs, NJ: Prentice Hall.

[100] *Ibid.*

As the names imply, borrowing occurs in “anticipation” of a local government’s taxes/revenues, bonds, and/or grants. Repayment usually occurs 30 days to 120 days after the source of revenue being anticipated actually arrives [Ross and Levine 2006[101]]. Finally, it should be noted that specific to Kentucky via Kentucky Revised Statute (KRS 147.110), any capital (e.g. mitigation project) pursued by one of Kentucky’s Area Development Districts (ADDs) is exempt from taxation.

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[101] Ross, Bernard H. and Myron A. Levine. [2006]. *Urban Politics: Power in Metropolitan America*. 7th Edition. Belmont, CA: Thomson Higher Education.

Programs, Plans, Resources, and Authorities of Local Jurisdictions (Policies)

Tabulated below is a summary of the existing authorities, programs/(policies) and plans, and resources that all of Kentucky's county-level local governments listed in their hazard mitigation plans as "capabilities." The counties listed have been organized according to the Area Development District (ADD) under which they are regionally arranged.

This implies two (2) "capabilities" not listed in the table: First, as a resource, every county in Kentucky has access to a "regional development agency." These "regional development agencies" are the Area Development Districts (ADDs) about which this hazard mitigation plan previously has discussed and around which much of the Kentucky's mitigation strategy is based. Secondly, the fact that every one of Kentucky's counties is a member of a "regional development agency" implies that every county-level local government is covered under a local hazard mitigation plan, which serves as a type of capability-cum-policy. With two notable exceptions[102], every county-level[103] local government/jurisdiction is covered under a local *multi-jurisdictional* hazard mitigation plan that would have been developed by the "regional development agency," i.e. Area Development District, under which the county is a member. Consequently, the oft-cited "regional development agency" and "local hazard mitigation plan" are not included as "capabilities" in the table below: There is no reason to distinguish between counties; all county-level local governments/jurisdictions possess these two capabilities.

Further, where counties have additional capabilities not shared by other Area Development Districts and counties, it has been noted in footnotes throughout.

Related, one common "capability" is excluded from the table: Building codes. Again, this is due to the ubiquity of the capability. Every one of Kentucky's multi-jurisdictional hazard mitigation plans lists "building codes" as a "capability."

Finally, this table does not distinguish between county-level local capabilities and city-level local capabilities. It is true that some capabilities excluded at the county-level have been enacted at the city or general sub-jurisdictional level. ***Appendix 4-9*** has recreated the local capabilities sections from each of Kentucky's local multi-jurisdictional hazard mitigation plans so as to be able to show city-level capabilities along with other nuances necessarily omitted from this summary table.

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[102] Jefferson County/Louisville and Lexington-Fayette Urban County Government (LFUCG), while members of Area Development Districts (KIPDA and Bluegrass, respectively) have submitted individual local hazard mitigation plans separate from their Area Development District ("regional development agency")-submitted plans.

[103] This fact does not apply to city-level local governments: Not every city within a county is covered within a local multi-jurisdictional hazard mitigation plan.

Table 4-9: ADD Authorities, Programs, Plans, and Resources by County

		AUTHORITIES					PROGRAMS/PLANS/RESOURCES						
Area Development District	County	Floodplain Management Ordinance	Community Rating System	Zoning Regulations	Subdivision Regulations	Fire Prevention Codes (State-Level)	Capital Improvement Plans	Land Development Plans	Storm Water Management Plans	NWS StormReady Program	Emergency Operations/ Comprehensive Plan	Community Emergency Response Team (CERT)	Local Economic Development Agency
BLUEGRASS[104]	Anderson	✓		✓	✓	✓	[105]	[106]		✓	✓	✓[107]	✓
	Bourbon	✓		✓	✓					✓	✓	✓	✓
	Boyle	✓		✓	✓						✓	✓	
	Clark	✓		✓	✓	✓			✓	✓	✓	✓	✓
	Estill	✓											
	Fayette	✓		✓						✓	✓	✓	
	Franklin	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
	Garrard	✓			✓	✓				✓	✓	✓	✓
	Harrison	✓		✓	✓						✓	✓	✓
	Jessamine	✓		✓	✓				✓		✓	✓	
	Lincoln	✓	✓	✓	✓						✓	✓	✓
	Madison	✓	✓	✓	✓	✓			✓		✓	✓	
	Mercer	✓		✓	✓							✓	
	Nicholas	✓			✓						✓		
	Powell												
	Scott	✓		✓	✓				✓	✓	✓	✓	✓
	Woodford	✓		✓	✓	✓			✓	✓		✓	✓
BARREN RIVER[108]	Allen	✓			✓	✓	[109]	✓[110]			✓	[111]	
	Barren	✓			✓	✓		✓			✓		
	Butler	✓									✓		
	Edmonson	✓			✓			✓			✓		
	Hart	✓			✓	✓		✓	✓		✓		
	Logan	✓			✓	✓		✓			✓		
	Metcalfe	✓				✓					✓		
	Monroe					✓					✓		
	Simpson	✓		✓	✓			✓			✓		
	Warren	✓	✓	✓	✓	✓		✓	✓		✓		
BIG SANDY	Floyd	✓	✓				✓	✓		✓	✓	✓	✓
	Johnson	✓	✓			✓				✓	✓	✓	
	Magoffin	✓	✓							✓	✓	✓	
	Martin	✓	✓			✓				✓	✓		✓
	Pike	✓	✓	✓			✓			✓	✓	✓	✓

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[104] Bluegrass Area Development District (BGADD) recorded an extra local capability: the local planning commission. Only Estill, Mercer, and Powell counties within BGADD were not members of such commissions.

[105] Bluegrass Area Development District (BGADD) did not record whether any of its local jurisdictions had capital improvement plans. These counties' exclusion here does not imply that such capital improvement plans do not exist.

[106] Bluegrass Area Development District did not record whether or not any of its local jurisdictions had land development plans. These counties' exclusion here does not imply that such land development plans do not exist.

[107] Bluegrass Area Development District jurisdictions did not record specifically whether they had implemented CERT programs. Rather, they recorded whether or not there existed "local emergency management." For the purposes of this table, it assumed that those counties with "local emergency management" possessed de facto CER Teams.

[108] Some counties of the Barren River Area Development District (BRADD) listed the following extra capabilities:
1) open space management plans, 2) natural resource protection plans, 3) flood response plans, 4) continuity-of-operations plans, 5) evacuation plans 6) disaster recovery plans, 7) economic development plans, and 8) historic preservation regulations.

[109] Barren River Area Development District did not record whether any of its local jurisdictions had capital improvement plans. These counties' exclusion here does not imply that such capital improvement plans do not exist.

[110] Barren River Area Development District labeled this a "Comprehensive Land-Use Plan."

[111] Barren River Area Development District did not record whether any of its local jurisdictions had CERT programs. These counties' exclusion here does not imply that a CER Team is not operating in some or all of these counties.

		AUTHORITIES					PROGRAMS/PLANS/RESOURCES						
Area Development District	County	Floodplain Management Ordinance	Community Rating System	Zoning Regulations	Subdivision Regulations	Fire Prevention Codes (State-Level)	Capital Improvement Plans	Land Development Plans	Storm Water Management Plans	NWS StormReady Program	Emergency Operations/ Comprehensive Plan	Community Emergency Response Team (CERT)	Local Economic Development Agency
BUFFALO TRACE	Bracken	✓									✓		
	Fleming	✓											
	Lewis	✓										✓	
	Mason	✓										✓	
	Robertson	✓											
CUMBERLAND VALLEY[112]	Bell										✓		
	Clay										✓		
	Harlan										✓		
	Jackson										✓		
	Knox										✓		
	Laurel										✓		
	Rockcastle										✓		
	Whitley										✓		
FIVCO	Boyd	✓				✓						✓	✓
	Carter	✓			✓	✓			✓			✓	✓
	Elliott					✓							✓
	Greenup	✓			✓	✓		✓	✓		✓		✓
	Lawrence	✓	✓	✓		✓							✓
GREEN RIVER[113]	Daviess	✓		✓								✓	✓
	Hancock			✓								✓	✓
	Henderson	✓		✓								✓	✓
	McLean	✓		✓									✓
	Ohio	✓										✓	✓
	Union	✓		✓									✓
	Webster											✓	✓
GATEWAY	Bath	✓			✓		[114]				[115]		✓
	Menifee												✓
	Montgomery				✓								✓
	Morgan												
	Rowan		✓										

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[112] The counties of the Cumberland Valley Area Development District (CVADD) are anomalous amongst Kentucky's counties in terms of local capability: There are no local capabilities articulated at the county level of local government. Rather, all local capability is recorded at the city level. That said, CVADD tabulates only three types of local capability: membership to a planning commission (8/17 cities), the use of zoning ordinances (8/17 cities), and the existence of a comprehensive plan (5/17 cities). Still, through narration, all local jurisdictions are assumed to possess the following three (3) "capabilities": 1) a comprehensive economic development strategy, 2) a water management plan, and 3) an emergency operations plan. See page 23 of the CVADD's 2012 update of its hazard mitigation plan.

[113] The Green River Area Development District (GRADD) only accounts for the following local capabilities that are listed in the summary chart above: Floodplain Management Ordinance, Zoning Regulations, having a CER Team, and having an Economic Development Department. Again, because GRADD did not record the possession of or participation in the other local capabilities tabulated above does not imply that the counties of GRADD do not possess or participate in them. Additionally, GRADD lists the *AmeriCorps Homeland Security* program as a local capability: Daviess, Hancock, Henderson, and Ohio counties participate in it.

[114] Gateway Area Development District (GWADD) does not record whether any of its local jurisdictions possess capital improvement plans. It cannot be assumed, however, that these jurisdictions do not possess such capabilities.

[115] Gateway Area Development District (GWADD) does not record whether any of its local jurisdictions possess either Emergency Operations plans or comprehensive plans. It cannot be assumed, however, that these jurisdictions do not possess such capabilities.

		AUTHORITIES					PROGRAMS/PLANS/RESOURCES						
Area Development District	County	Floodplain Management Ordinance	Community Rating System	Zoning Regulations	Subdivision Regulations	Fire Prevention Codes (State-Level)	Capital Improvement Plans	Land Development Plans	Storm Water Management Plans	NWS StormReady Program	Emergency Operations/ Comprehensive Plan	Community Emergency Response Team	Local Economic Development Agency
Kentuckiana Regional Planning and Development Agency (KIPDA)	Bullitt	✓		✓	✓	✓	[116]		✓		[117]		✓
	Henry	✓		✓	✓	✓		✓	✓	✓		✓	✓
	Jefferson[118]	✓		✓				✓			✓	✓	✓
	Oldham	✓		✓	✓	✓			✓				✓
	Shelby	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
	Spencer	✓		✓	✓	✓						✓	✓
	Trimble	✓				✓						✓	✓
KENTUCKY RIVER	Breathitt	✓									✓		✓
	Knott	✓									✓		✓
	Lee	✓									✓		✓
	Leslie	✓									✓		✓
	Letcher	✓									✓		✓
	Owsley	✓									✓		✓
	Perry										✓		✓
	Wolfe										✓		✓
LAKE CUMBERLAND	Adair				✓					✓		✓	✓
	Casey		✓			✓	✓		✓	✓	✓	✓	✓
	Clinton	✓											✓
	Cumberland	✓	✓	✓	✓		✓	✓					✓
	Green						✓		✓		✓		✓
	McCreary	✓	✓			✓			✓	✓	✓	✓	✓
	Pulaski	✓	✓								✓		✓
	Russell					✓				✓			✓
	Taylor	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
	Wayne	✓				✓					✓		✓
LINCOLN TRAIL	Breckinridge	✓	✓[119]			✓		[120]		✓[121]		✓	✓
	Grayson	✓	✓			✓				✓		✓	✓
	Hardin		✓	✓	✓	✓			✓	✓	✓	✓	✓
	Larue	✓	✓	✓	✓	✓					✓	✓	✓
	Marion	✓	✓			✓	✓			✓[122]		✓	✓
	Meade	✓	✓	✓	✓	✓				✓[123]	✓	✓	✓
	Nelson	✓	✓	✓	✓	✓					✓	✓	✓
	Washington		✓		✓	✓				✓	✓	✓	✓

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[116] KIPDA does not record whether any of its local jurisdictions possess capital improvement plans. It cannot be assumed, however, that these jurisdictions do not possess such capabilities.

[117] KIPDA does not record whether any of its local jurisdictions possess Emergency Operations or comprehensive plans. It cannot be assumed, however, that these jurisdictions do not possess such capabilities.

[118] Jefferson County is not covered under the KIPDA local multi-jurisdictional hazard mitigation plan. Jefferson County (and Louisville) developed its own hazard mitigation plan separate from the KIPDA one.

[119] Lincoln Trail Area Development District (LTADD) recorded having FMA plans.

[120] Lincoln Trail Area Development District (LTADD) does not record whether any of its local jurisdictions possess land development plans. It cannot be assumed, however, that these jurisdictions do not possess such capabilities.

[121] Breckinridge County is “in the process” of implementing an NWS StormReady program.

[122] Marion County is “in the process” of implementing an NWS StormReady program.

[123] Meade County is “in the process” of implementing an NWS StormReady program.

		AUTHORITIES					PROGRAMS/PLANS/RESOURCES						
Area Development District	County	Floodplain Management Ordinance	Community Rating System	Zoning Regulations	Subdivision Regulations	Fire Prevention Codes (State-Level)	Capital Improvement Plans	Land Development Plans	Storm Water Management Plans	NWS StormReady Program	Emergency Operations/ Comprehensive Plan	Community Emergency Response Team (CERT)	Local Economic Development Agency
NORTHERN KENTUCKY	Boone	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Campbell	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
	Carroll	✓				✓	✓					✓	✓
	Gallatin	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Grant			✓		✓	✓	✓			✓		✓
	Kenton	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Owen	✓				✓				✓			✓
	Pendleton	✓			✓	✓		✓			✓		✓
(JACKSON)[124] PURCHASE	Ballard	✓					✓					✓	✓
	Calloway	✓		✓	✓					✓		✓	✓
	Carlisle	✓								✓		✓	✓
	Fulton	✓										✓	✓
	Graves	✓										✓	✓
	Hickman											✓	✓
	Marshall	✓				✓		✓		✓		✓	✓
	McCracken	✓		✓	✓	✓		✓		✓	✓	✓	✓
PENNYRILE	Caldwell		✓			✓		✓	✓			✓	✓
	Christian	✓	✓			✓		✓		✓	✓	✓	✓
	Crittenden	✓	✓			✓						✓	
	Hopkins	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
	Livingston	✓	✓			✓		✓				✓	
	Lyon		✓		✓	✓		✓			✓	✓	
	Muhlenberg	✓	✓		✓	✓		✓			✓	✓	
	Todd	✓	✓			✓						✓	
	Trigg	✓	✓			✓						✓	✓

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[124] Many of the local capabilities were not recorded at the county level; they were recorded within individual cities.

Policies Toward the National Flood Insurance Program (NFIP) of Local Jurisdictions

The inclusion as members of the National Flood Insurance Program (NFIP) is a uniquely relevant policy that describes local jurisdictions' capabilities to effectively mitigate the hazards that affect them. It is so relevant and so important for capability due to the following reasons articulated by Kentucky Emergency Management (KYEM):

1. "No owner of a residence, business, or public building will be able to purchase a flood insurance policy at the government rate. Force-placed or non-NFIP insurance is more expensive.
2. "No Federal grants or loans will be given for buildings or projects within an identified flood hazard area, if flood insurance is a condition of the grant or loan.
3. "There are restrictions on conventional loans in the non-participating communities. Lenders must notify the buyer or lessee that property is in a flood-hazard area and that property is not eligible for disaster relief and will pay higher insurance rates based on loan conditions.
4. "No Federal disaster assistance may be provided in identified flood-hazard areas if flood insurance is a condition of the assistance (i.e., disaster recovery loans and grants).
5. "No Federal mortgage insurance may be provided in identified flood-hazard areas.
6. "Uninsured construction today may be prohibitively expensive to insure should the community re-enter the program later.
7. "A local government body may be held liable by not participating because their action:
   a. Denies the ability of its citizens to purchase flood insurance; and
   b. Does not take positive steps to reduce the risk of damage to life and property.
8. "Local governments will not be eligible for federal assistance for roads or infrastructure located within the flood zone [KYEM 2013[125]]."

In other words, NFIP policy participation is so uniquely relevant to local capability to mitigate its hazards because, quite consequentially, without this policy local governments/jurisdictions are ineligible for significant funding that would allow them to mitigate the hazards deriving from flooding.

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[125] Kentucky Emergency Management (KYEM). [2013]. "National Flood Insurance Program: Things to Know about the National Flood Insurance Program; Impacts of Non-Participation in the National Flood Insurance Program." *Can be accessed here*: http://kyem.ky.gov/teams/Documents/For%20Main%20KYEM%20Page/National%20Flood%20Insurance%20Program%20Facts.pdf . [Last Accessed: July 3, 2013].

As of publication of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan, the following five (5) counties (of 120 counties) in Kentucky (accompanied in brackets by the Area Development District – ADD – to which it is a member) do not participate in the NFIP:

1. Casey County [Lake Cumberland ADD]
2. Cumberland County [Lake Cumberland ADD]
3. Hickman County [(Jackson) Purchase ADD]
4. Lyon County [Pennyrile ADD]
5. Wolfe County [Kentucky River ADD]

Further, out of 419 “incorporated communities,” 47 do not participate in the NFIP. Accompanied by their counties and to which Area Development District the county is a member, these are:

Table 4-10: Incorporated Communities Not Participating in NFIP, 2013

Incorporated Community (City of)	County	Area Development District
Park City	Barren	Green River
Owingsville	Bath	Gateway
North Middletown	Bourbon	Bluegrass
Fox Chase	Bullitt	Kentuckiana Planning & Development Agency (KIPDA)
Hebron Estates	Bullitt	Kentuckiana Planning & Development Agency (KIPDA)
Mount Washington	Bullitt	Kentuckiana Planning & Development Agency (KIPDA)
Highland Heights	Campbell	Northern Kentucky
Woodlawn	Campbell	Northern Kentucky
Lafayette	Christian	Pennyrile
Pembroke	Christian	Pennyrile
Marion	Crittenden	Pennyrile
Sandy Hook	Elliott	Five Counties (FIVCO)
Corinth	Grant	Northern Kentucky
Crittenden	Grant	Northern Kentucky
Dry Ridge	Grant	Northern Kentucky
Williamstown	Grant	Northern Kentucky
Water Valley[126]	Graves	(Jackson) Purchase
Clarkson	Grayson	Lincoln Trail
Bellefonte	Greenup	Five Counties (FIVCO)
Horse Cave	Hart	Barren River
Robards	Henderson	Green River
Elsmere	Kenton	Northern Kentucky
Fairview	Kenton	Northern Kentucky
Fort Mitchell	Kenton	Northern Kentucky
Kenton Vale	Kenton	Northern Kentucky
Lakeside Park	Kenton	Northern Kentucky
Park Hills	Kenton	Northern Kentucky
Walton	Kenton	Northern Kentucky
Blaine	Lawrence	Five Counties (FIVCO)
Concord	Lewis	Buffalo Trace
Carrsville	Livingston	Pennyrile
Salem	Livingston	Pennyrile
Grand Rivers	Livingston	Pennyrile
Eddyville	Lyon	Pennyrile
Gilbertsville	Marshall	(Jackson) Purchase
Fountain Run	Monroe	Barren River
Gamaliel	Monroe	Barren River
Camargo	Montgomery	Gateway
South Carrollton	Muhlenberg	Pennyrile
Fordsville	Ohio	Green River

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[126] Using a demotic term, the City of Water Valley is an “on-again, off-again” city: It has in the past existed as a city. It currently is a city. But for the past 9 out of 11 years, there has been no city of Water Valley. Its boundaries still are a source of contention.

Kentucky Emergency Management (KYEM), through its Intergovernmental Liaison and accompanied by the Kentucky Department of Water (KDOW) is actively pursuing an increase in membership to the NFIP from this above list of non-participating counties and cities. The results current to the time this document was submitted to FEMA for review and approval are discussed in the *Planning Process* section of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan.

REQUIREMENT
§201.4 (C) (3) (V):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

COMPLETED HERE

B. Considering Repetitive-Loss Properties in Kentucky's General Description of the Local Mitigation Capabilities…

MITIGATION STRATEGY

PART II:
State Capability Assessment

REQUIREMENT §201.4 (C) (3) (II):

Kentucky's mitigation strategy shall include a discussion of Kentucky's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of Kentucky laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas and a discussion of Kentucky's funding capabilities for hazard mitigation projects.

A. *Including an Evaluation of Kentucky's Pre-Disaster Hazard Management Policies, Programs, and Capabilities,*

B. *Including an Evaluation of Kentucky's Post-Disaster Hazard Management Policies, Programs, and Capabilities,*

C. *Including an Evaluation of Kentucky's Policies Related to Development in Hazard-Prone Areas,*

D. *Including a Discussion of Kentucky's Funding Capabilities for Hazard Mitigation Projects, and*

E. *Addressing Any Hazard Management Capabilities of Kentucky That Have Changed Since Approval of the 2010 Update of the Commonwealth of Kentucky's Hazard Mitigation Plan*

To account for the state's capabilities to mitigate the hazards within its locus-of-control, the 2010 update of the Commonwealth of Kentucky's hazard mitigation plan created a matrix identifying the programs, plans, policies, regulations, sources of funding, and practices available to the Commonwealth of Kentucky for hazard mitigation purposes. Further, this matrix identified whether the program et al.: was relevant to pre-disaster and post-disaster hazard management, affected development in hazard-prone areas, had the capability to fund its role in hazard mitigation, and affected Repetitive-Loss Properties. The hazard mitigation-specific role that each program et al. possessed was elaborated upon within the matrix, as well.

This matrix has been updated for the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan.

An accompanying elaboration and update of Kentucky law (i.e. Kentucky Revised Statutes) related to pre- and post-disaster hazard management and mitigation is provided as an appendix to this section. See ***Appendix 4-10***.

Following the above-described matrix, elaboration on Kentucky executive agency-specific capability toward hazard management and mitigation is included.

Finally, for the sake of parallelism (with the elaboration of Kentucky's local jurisdictions' capabilities) and as a link to the final sub-section of the *Mitigation Strategy* (i.e. "Funding Sources"), Kentucky's public financing options are (very) briefly discussed.

REQUIREMENT
§201.4 (C) (3) (V):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

BEGINS HERE

B. Considering Repetitive-Loss Properties in Kentucky's Evaluation of Its Hazard Management Policies, Programs, and Capabilities…

Table 4-11: Commonwealth Capability Matrix

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
National Weather Service Warning Coordinator Meteorologist	X	X		All activities performed by the NWS are funded by NOAA	X	Educating the local population regarding storm safety, flood safety, and lightning safety. 'Turn Around - Don't Drown' is a national effort to help reduce drowning from flash floods. Partner with county and area Emergency Managers to ensure counties are prepared for severe weather events. The Storm Ready Program is a national program which certifies counties are ready to handle severe weather emergencies. Maintains and trains a cadre of weather spotters, to include ham radio operators, who call in a give damage reports and information which can help forecasters to issue better and more timely severe weather and flood warnings.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
The Kentucky Association of Counties (KACo) Leasing Trust Program (CoLT)	X			X	X	Formed in 1989, was designed to offer county governments and related political subdivisions an efficient method of financing for a wide variety of capital projects, including construction, renovation, equipment purchases or even grant anticipation. Since 1996, CoLT has offered general obligation leases for any governmental purpose. Leases can be made for any amount needed and for terms of 30 days up to 30 years
Kentucky Interchurch Disaster Recovery Program	X	X				Coordinate responses to disasters occurring in the Commonwealth of Kentucky through the Kentucky Interchurch Disaster Recovery Program.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Department for Facilities Management Division of Historic Properties (DHP)	X		X	X	X	All state-owned buildings of fifty years and older are documented in a database. The goal is to ultimately use this information to recommend needed appropriations for the preservation and conservation needs of the most historic structures. Currently, there are over 1,000 entries in the database. DHP is responsible to administer this database.
Department for Local Government (DLG) Renaissance Kentucky	X		X	X	X	Is an effort to unite communities and resources necessary to revitalize and restore the Commonwealth's downtown areas. The Kentucky Department for Local Governments, the new lead agency, partners with the Kentucky Heritage Council, the Kentucky League of Cities, and the Kentucky Housing Corporation and the Kentucky Transportation Cabinet to implement this program.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
DLG Federal Housing Subsidy Programs				X	X	HUD administers housing and community development programs statewide. Programs include single family, multifamily, public housing, Housing Choice Vouchers, homeless, etc.
						Assistance grants and Community Development Block Grant funds. It also administers and monitors Disaster Recovery Assistance grants.
Kentucky Department of Mines and Minerals Design Branch & Construction Branch	X		X	X		Oversees the day-to-day construction activity on all Abandoned Mine Lands (AML) reclamation projects in the state, provides engineering services and develops plans for reclamation projects, KRS 350 includes the statutes governing the environmental regulation of surface mining of coal and other minerals and the surface effects of underground mining.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Department of Mines and Minerals Kentucky Abandoned Mine Land Reclamation Program	X			X		Program is authorized pursuant to PL95-87 and KRS 350 to mitigate the hazards caused by abandoned coal mines. Division funds contracts for reclamation of on-ground mine hazards and executes Memoranda of Agreement with local entities to fund waterlines into areas where past mining has contaminated the groundwater. Projects focus on mitigating hazards to: 1) public health and safety and 2) the environment.
Kentucky Division of Water (KDOW) Floodplain Management	X	X	X		X	Based on KRS 151, KY Division of Water (KDOW) has been designated as the state coordinating agency for the National Flood Insurance Program (NFIP). As the coordinating agency, the KDOW assists local governments and state agencies in answering all questions concerning the program.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KDOW Floodplain Development Permit Program	X		X		X	This program has the primary responsibility for the approval or denial of proposed construction and other activities in the 100-year floodplain of all streams in the Commonwealth. Typical activities permitted are dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations or relocations, small impoundments, water, and wastewater treatment plants.
KDOW Dam Construction Permit Program	X		X		X	The Dam Safety and Floodplain Compliance Section shares responsibility with the Floodplain Management Section for the review and permitting of dams and hazardous impoundments as defined in KRS 151.100 and 401 KAR 4:030.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KDOW Dam Safety Program	X				X	Conducts safety inspections (approximately 300 annually) and initiates emergency action if a structure is in danger of failing, poses a threat to life or may cause serious property damage. KRS 151.297 empowers the Kentucky Energy and Environment Cabinet to take emergency action if an owner abandons a dam or refuses to take necessary action.
KDOW Kentucky Watershed Management Initiative Education	X		X		X	The watershed approach is a coordinating framework for environmental management that focuses public and private sector efforts on selected priority problems within hydrologically defined geographic areas, taking into consideration both ground and surface water flow.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Division of Forestry Fire Management Program	X					The Division of Forestry is responsible for fighting wild land fires on private lands. Since 1977, the Division of Forestry has averaged 2,031 fires that burned 81,025 acres annually. Almost 90 percent of these fires are caused by humans, with over 55 percent caused by arson. The damage to the Commonwealth's timber resources is valued at $85.58 per acre.
Kentucky Division of Forestry Kentucky FireWise Program	X			X		Grants may be awarded for projects to reduce the wildfire risk and hazard in Kentucky's wild land/urban interface communities. Grant priority will be given based on community-at-risk level, establishment of a local Firewise Council or Board, and type of project submitted.
Kentucky Division of Forestry Urban Forestry Program	X					This program promotes the proper management of the urban forest including citizen support and a properly trained work force.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Division of Forestry Forest Education Program	X			X		This program works to educate the citizens of the Commonwealth about the value of our forests by providing leadership, technical assistance and financial support.
Kentucky Division of Forestry Reforestation Program	X			X		There are more than a million acres of land in KY which could benefit from tree planting. This program grows and provides trees to certain companies and individuals.
Division of Conservation Equipment Loan Revolving Program	X	X		X		This program was established by the 1948 General Assembly to provide loans to Kentucky's conservation districts for heavy and specialized conservation equipment. Through loan/lease agreements with local contractors and farmers, the districts ensure that this equipment is available at the local level to perform conservation work.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Division of Conservation Kentucky Soil Erosion & Water Quality Cost Share Program	X			X		This program was established to assist landowners address existing soil erosion, water quality, and other environmental problems associated with farming or woodland operations.
KY Dpt. Of Housing, Buildings, and Construction KY Building Code KRS 198B.020.	X					The Kentucky Building Code became effective February 15, 1980, completing Phase I of a three-phase implementation plan. This plan was fully implemented on August 15, 1982. This code is updated annually.
KY Dpt. Of Housing, Buildings, and Construction Plan Review Division	X				X	Architectural plans are reviewed prior to construction to ensure compliance with the Kentucky Building Code. There is a plan review fee, which is based on total square footage.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KY Dpt. Of Housing, Buildings, and Construction Inspection Division	X					Inspections are made on approved constructions periodically to ensure construction is done according to approved plans. Any variations must be approved. Upon final inspection, an occupancy permit is issued and the case file is transferred to the General Inspection Section in the Division of Fire Prevention for future inspections. The plan review fee includes charges for inspections.
State Fire Marshal Fire Prevention	X					Enforces various codes to ensure that all public structures, facilities, and regulated vehicles are maintained in such a manner that all occupants and users of these facilities will be protected from fire, explosion, or other similar hazard.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Emergency Management (KYEM) Hazard Mitigation Grant Program		X	X	X	X	Following a Presidential disaster declaration, the Hazard Mitigation Grant Program (HMGP) provides funding to the State for projects to reduce damages, losses and suffering in future disasters. The intent of HMGP is to provide a federal, state and local partnership in developing and funding mitigation projects. Funding is available from the FEMA (up to 75% of the project) and State (up to 12% of the project).

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Emergency Management (KYEM) Public Assistance Program		X		X	X	The Public Assistance Program provides supplemental Federal disaster grant assistance for the repair, replacement, or restoration of disaster damaged, publicly-owned facilities and the facilities of certain private non-profit organizations. The Federal share of assistance is not less than 75% of the eligible cost for emergency measures and permanent restoration. The state determines how the non-federal share is split among the applicants. The program also allows for mitigation measures to be completed during the restoration phase so that future damages are reduced. The mitigation measure must be identified before repair begins and must be cost effective.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Emergency Management (KYEM) Kentucky Emergency Operations Plan	X	X				The KYEOP establishes policies and provisions for coordinating state and federal emergency response to natural, technological, or war related disasters and emergencies. The KyEOP also details preparedness actions to be taken by state and local governments prior to a disaster. This plan provides concepts and procedures, which are to be utilized by local government through local plans written in conjunction with the state plan.
KYEM Earthquake Preparedness Program	X		X			Provides coordination and oversight of seismic safety programs, supports public education and mitigation planning, and provides tools to support hazard reduction.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KYEM Flood Mitigation Assistance Grant Program	X		X	X	X	The Flood Mitigation Assistance (FMA) grant program provides funding to the Commonwealth for cost-effective measures which reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA program is funded on an annual cycle. Each year the state receives a target allocation of funding for which local communities can apply. The FMA program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KYEM Pre-Disaster Mitigation Grant Program	X		X	X	X	The Pre-Disaster Mitigation Program (PDM) provides funds to the State for pre-disaster mitigation planning and the implementation of cost-effective mitigation projects prior to a disaster event. The PDM program is a nationally competitive program. There is no state allocation and no national priority for projects. The PDM program is funded on an annual cycle. The PDM program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KYEM Severe Repetitive Loss Grant Program	X		X	X	X	The Severe Repetitive Loss (SRL) grant program provides funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the National Flood Insurance Program (NFIP). SRL Properties are residential properties that have at least four NFIP claim payments over $5,000 each. Further, at least two such claims have to occur within any ten-year period and the cumulative amount of claims payments must exceed $20,000. Alternatively, an SRL Property has at least two separate claims payments made where the building portion total of each claim exceeds the value of the property. At least two such claims have to occur within any ten-year period. The purpose of the program is to reduce or eliminate claims under the NFIP through project activities that will result in the greatest savings to the National Flood Insurance Fund (NFIF). Eligible flood mitigation project activities include: flood-proofing (historical properties only); relocation; elevation; acquisition; and minor physical localized flood control projects.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KYEM Repetitive Flood Claims Grant Program	X		X	X	X	The Repetitive Flood Claims (RFC) grant program provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) that have had one or more claim payment(s) for flood damages. RFC funds may only be used to mitigate structures which are located within a State or community that is participating in the NFIP that cannot meet the requirements of the Flood Mitigation Assistance (FMA) program because they cannot provide the non-Federal cost share or do not have the capacity to manage the activities. The long-term goal of the RFC grant program is to reduce or eliminate the number reoccurring flood insurance claims, through mitigation activities which are in the best interest of the National Flood Insurance Fund (NFIF). All RFC grants are eligible for up to 100 percent Federal cost assistance. RFC grants are awarded to Applicants on a nationwide basis without reference to State allocations, quotas, or other formula-based allocations.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
						RFC funds may only be used to mitigate structures which are located within a State or community that is participating in the NFIP that cannot meet the requirements of the Flood Mitigation Assistance (FMA) program because they cannot provide the non-Federal cost share or do not have the capacity to manage the activities. The long-term goal of the RFC grant program is to reduce or eliminate the number reoccurring flood insurance claims, through mitigation activities which are in the best interest of the National Flood Insurance Fund (NFIF). All RFC grants are eligible for up to 100 percent Federal cost assistance. RFC grants are awarded to Applicants on a nationwide basis without reference to State allocations, quotas, or other formula-based allocations.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KY Geological Survey at UK Advice on Landslide Susceptibility of Selected Regions in Kentucky	X					KGS geologists have sponsored workshops for local officials in northern Kentucky on the susceptibility of the region to landslides and provided expertise on recognizing landslide features, mitigating the effects of landslides and responding in the event of a landslide.
KY Geological Survey at UK Mapping	X					Several current and planned mapping programs at KGS can provide information for careful development. These include sinkhole maps and databases, land-use planning maps, and landslide susceptibility maps.
KY Geological Survey at UK Earthquake Monitoring	X					The Kentucky Seismic and Strong-Motion Network is a series of earthquake-monitoring devices which, over time, are gathering detailed information about earthquake motions in Kentucky. This helps to determine the actual earthquake risk and assists in enacting appropriate building codes.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Professional Consultations and Evaluations of Landslide-Damaged Homes	X					Geologists from KGS have the capability of assessing the damages to homes threatened or damaged by landslides and providing professional assessments to help qualify some homes for buyout under FEMA mitigation programs.
Division of State Risk, RISK System	X	X			X	RISK system is a database that identifies the construction, value, and risk exposures (Flood plain denotation, fire prevention, etc) for all owned properties, both personal and real properties, of the Commonwealth. With this information, insurance is procured on all subject properties to minimize financial loss to the Commonwealth in the event of a catastrophe.
The State Fire and Tornado Insurance Fund	X	X		X		Provides insurance for real property, office contents, computers, telephones, etc. It is a self-insurance program that provides all risk form coverage on an actual cash basis (ACV) or replacement cost basis (RCV) for state buildings and contents.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
KY Dept. of Mines and Minerals Mine Subsidence Program		X	X	X		Provides assistance to property owners in 34 qualified counties which have experienced property damage resulting from collapsed underground coalmines.
Kentucky Transportation Cabinet - Rural and Municipal Aid Program		X		X		Under Emergency and Emergent Provisions, the program provides funding for temporary or permanent restoration work on rural roads.
Kentucky Transportation Cabinet County Bridge Replacement Program	X			X		Two phase program. First phase, between 1989-1994 all county bridges on school bus routes identified by a county judge were replaced. The second phase works with remaining state bridges on a case-by-case basis.

Programs, Plans, Policies, Regulations, Funding or Practices	*Pre-Disaster*	*Post-Disaster*	*Affects Development in Hazard-Prone Areas*	*Capable of Funding Mitigation Initiatives*	*Affects Repetitive Loss Properties and Mitigation Activities*	*Hazard Mitigation Application*
Kentucky Transportation Cabinet SAFE Patrol Program		X				SAFE Patrol operators are available through the Transportation Operations Center to assist local, state, and federal authorities in establishing and controlling routes of ingress and egress via the limited-access highway system to affected areas. Possibility exists to bring Roadway Security Branch assets from other geographic regions of the Commonwealth to assist.
Western Kentucky University The Center for Cave and Karst Studies	X		X			The Center for Cave and Karst Studies, established in 1978 at Western Kentucky University (WKU), was the first center established primarily to deal with karst problems in the United States. The Center's offices and laboratories are located within the Department of Geography and Geology in the Environmental Science and Technology building at WKU.
Western Kentucky University The Kentucky Climate Center	X					Historical record of climatic events in Kentucky

Executive Agency Contribution to State Capability to Manage and Mitigate Hazards

Though most of Kentucky's executive agencies (the bureaucracy) play some role in the management of and mitigation of hazards that affect Kentucky, there are those that either are tasked primarily with hazard management and mitigation activities or provide some specific form of hazard management. Some of these agencies house and/or promote many of the programs, plans, policies, regulations, funding and practices elucidated in the above matrix of state capabilities. The agencies spotlighted in this subsection are as follows:

I. **Energy and Environment Cabinet**, under which the
    a. *Department for Energy Development and Independence (DEDI)*,
    b. *Department for Natural Resources (DNR)*, and
    c. *Department for Environmental Protection (DEP)* are housed.

II. **Kentucky Transportation Cabinet (KYTC)**

III. **The Cabinet for Health and Family Services (CHSF)**

IV. **Kentucky Department of Agriculture**

Energy and Environment Cabinet

The Kentucky Energy and Environment Cabinet is responsible for ensuring that the quality of natural resources are properly preserved and protected, that Kentucky's environment is protected and enhanced, and that the quality and security of life in Kentucky is improved through access to efficient and sustainable energy.

To accomplish these missions, the Energy and Environment Cabinet is comprised of the following three (3) departments:

1. Department for Energy Development and Independence (DEDI)
2. Department for Natural Resources (DNR)
3. Department for Environmental Protection (DEP)

The Department for Energy Development and Independence (DEDI)

The Department for Energy Development and Independence (DEDI) defines its mission as being responsible to improve the quality and security of life for all Kentuckians by creating efficient, sustainable energy solutions and strategies; to protect the environment; and to create a base for strong economic growth. DEDI's plan for achieving this mission focuses on the use of renewable energy sources, improving energy efficiency, developing clearer methods of fossil energy resources, diversifying electricity and transportation energy portfolios, and fully integrating agriculture and energy economies.

DEDI's work toward its mission is accomplished through the following six (6) divisions:

1. Division of Biofuels (DOB)
2. Division of Carbon Management (DCM)
3. Division of Efficiency and Conservation (DEC)
4. Division of Energy Generation Transmission and Distribution (DEGTD)
5. Division of Fossil Energy Development (DFED)
6. Division of Renewable Energy (DRE)

The Department for Natural Resources (DNR)

The Department for Natural Resources (DNR) provides technical assistance, education, and funding to help landowners, institutions, industries, and communities to conserve and sustain Kentucky's natural resources. Within DNR are the following seven (7) divisions:

1. Division of Abandoned Mines (DAM)
2. Division of Conservation (DOC)
3. Division of Forestry (KDF)
4. Division of Mine Permits (DMP)
5. Division of Mine Reclamation (DMR)
6. Division of Mine Safety (DMS)
7. Division of Oil and Gas (DOOG)

Of particular note, DNR's Division of Forestry (KDF) conducts an aggressive program to mitigate wildfires in the Commonwealth of Kentucky. The Division of Forestry awards landowners with mitigation grants which are used to clear combustible materials away from homes and other structures. In addition to these mitigation grants, the KDF provides extensive training on sustaining forest resources and wild-land fire management.

The Divisions tasked with oversight of mining matters (DAM, DMP, DMR, DMS) also provide technical assistance and training to mine operators. Proper mining and reclamation techniques will lessen the probability of future mine-related landslides, subsidence, and karst failures.

The Department for Environmental Protection (DEP)

The Department for Environmental Protection (DEP) is responsible for the protection and enhancement of Kentucky's environment. The work of DEP is accomplished by the following six (6) divisions:

1. Division of Air Quality (DAQ)
2. Division of Compliance Assistance (DCA)
3. Division of Enforcement (D-ENFORCE)
4. Division for Environment Program Support (DEPS)
5. Division of Waste Management (DWM)
6. Division of Water (KDOW)

The Division of Air Quality (DAQ) provides technical assistance toward mitigating future air pollution to local governments, nonprofits, and citizens of the Commonwealth of Kentucky. DAQ is of particular interest to Kentucky Emergency Management (KYEM) and its applicants as they strive to reduce the impact of future disaster events which will involve the disposal of debris.

The Division of Compliance Assistance (DCA) provides technical assistance and training to ensure compliance with air, water, and waste regulations to Kentucky's communities.

The Division of Enforcement (D-ENFORCE) is responsible for gaining environmental compliance through the resolution of enforcement cases.

The Division of Environment Program Support (DEPS) is responsible for providing laboratory testing of samples related to Department of Environmental Protection (DEP) compliance cases.

The Division of Waste Management (DWM) develops and administers waste management programs across the Commonwealth of Kentucky and provides technical assistance regarding the reduction of waste generation and the maximization of recycling efforts to Kentucky's communities and citizens.

The Division of Water (KDOW) ultimately is responsible for managing, protecting, and enhancing the water resources of the Commonwealth of Kentucky. Most relevantly for hazard mitigation, KDOW administers the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) throughout the Commonwealth. In overseeing NFIP, KDOW provides technical assistance regarding how to identify flood-prone areas and protect against the effects of flood events to Kentucky's citizens and community officials.

Kentucky Transportation Cabinet (KYTC)

The Kentucky Transportation Cabinet (KYTC) is responsible for all state and federal road systems within the Commonwealth of Kentucky. It also oversees many forms of transportation such as air, freight, railroads, bike routes, ferries, and river-ports. While KYTC is not responsible for the maintenance or oversight of city- and county-owned roads and bridges, KYTC does play a vital role in the viability of those systems. KYTC provides funding to local governments for the maintenance and development of rural and secondary road systems. Additionally, KYTC provides technical advice and training to local road foremen and maintenance crews.

KYTC partners with the University of Kentucky (UK) through the Kentucky Transportation Center (KTC). KTC provides technical assistance in the form of topic workshops and training courses for in-service transportation professionals in consulting firms and state-level transportation entities. The purpose of KTC is to provide advanced transportation courses which guide transportation professionals in the design, construction, and maintenance of safe and sustainable road systems that are to be developed using methods which will mitigate the effects of hazards associated with future natural and human-made events.

The Cabinet for Health and Family Services (CHFS)

The Cabinet for Health and Family Services (CHFS) provides oversight for the Commonwealth of Kentucky's programs that administer human services, such as those concerning physical and mental health and concerning the protection of and assistance to seniors, adults, children, and families.

During emergency activations associated with disaster events, CHFS participates in the operation of the Commonwealth Emergency Operations Center (EOC). The main focus of the CHSF during disaster events is to ensure that proper measures are taken to protect the health and safety of impacted citizens and to emphasize particularly the prevention of disease.

Through its oversight of local Health Departments, CHSF is able to provide technical assistance to state and local officials regarding activities which can be implemented to lessen or to mitigate the effects of natural and human-made incidents. In some instances, CHSF takes the lead in disaster-related initiatives which would mitigate the effects of the disaster on citizens. For example, during the 2010 flooding that severely impacted the western portion of Kentucky, CHSF spearheaded a massive effort to conduct vector control of mosquitos that had the potential to infect citizens with the West Nile Virus.

CHSF is also a statutorily-defined member of the Commonwealth Emergency Response Commission (CERC). The CERC – established through the set of Kentucky Revised Statutes (KRS) under Chapter 39E.000—was established to implement federal regulations related to hazard substances. The role of CERC is now comprehensive and it serves as an advisory group to Kentucky Emergency Management (KYEM) regarding all hazard types.

Kentucky Department of Agriculture (KDA)

The Kentucky Department of Agriculture (KDA) is a constitutionally-established department that is headed by a commissioner who is elected via popular vote. While the primary focus of KDA is to protect and promote the agricultural resources of the Commonwealth of Kentucky, KDA also is an active participant in emergency and disaster responses and planning efforts. Kentucky's Department of Agriculture maintains an ongoing mitigation effort to control the mosquito population across the Commonwealth in order to prevent and control the spread of the myriad diseases associated with this insect.

Kentucky's Department of Agriculture also provides technical advice to the agriculture community regarding efforts and practices which can be implemented to mitigate the effects of drought and other natural events which can have a negative impact on farming efforts.

A Brief Note about Legislation Related to Hazard Mitigation

Appended to this *Mitigation Strategy* section (***Appendix 4-10***) is a list of Kentucky legislation related at least tangentially to hazard mitigation. Kentucky legislation is codified via Kentucky Revised Statutes (KRS).

What should be noticed in relation to state capability to fund and administer mitigation programs across the Commonwealth of Kentucky is how significant a proportion of Kentucky's mitigation practices actually are codified into law. The formation of many of Kentucky's agencies and the interrelation between them is law. The formation of important hazard mitigation committees and commissions that incorporate a wide array of stakeholders is law. The Area Development Districts around which so much of Kentucky's mitigation practices revolve are all law. The financing of mitigation-oriented capital projects is aided by law. Kentucky very much legislates its mitigation practices.

So, while this 2013 update of Kentucky's hazard mitigation plan implicitly argues that it is only articulating what Kentucky does on a quotidian basis and is only articulating Kentucky's mitigation practices, it is relevant to consider just how great a proportion of these day-to-day mitigation activities and behaviors are, in fact, codified into law and, hence, far more binding than informal agency activities and statewide norms, as inspired as they might be. It certainly augments Kentucky's state capability to ensure its residents are protected from the destructive hazard events.

Commonwealth of Kentucky Public Financing

As a parallel to the earlier discussion of local jurisdictions' public financing options, it is relevant to briefly discuss the Commonwealth of Kentucky's public financing and capital project implementing capability.

Generally (and a bit uniquely[127]), the Commonwealth of Kentucky possesses all of the same public financing options as its local jurisdictions.

The differences between local jurisdictions' public financing options and the Commonwealth's capabilities to finance reside in which financing mechanisms are most emphasized. This applies overwhelmingly to taxation. The discussion of the concerns, strategies, etc. of the other public financing options discussed in relation to local jurisdictions (budgeting and the ability to incur debt) applies at the state level, as well. It will not be discussed further here.

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[127] As mentioned earlier, it is rare for local governments to have taxing options like personal and corporate income taxation that states possess.

The Commonwealth's Ability to Tax

Property Tax

The Commonwealth of Kentucky does not rely on the collection of property taxation for its revenue. Property tax revenue is local government revenue. Rather, the Commonwealth of Kentucky will set the rules regarding how local governments collect property taxes. When local governments have to consider exemptions, rates, and tax-and-expenditure limits (TELs) in property taxation, it is the consequence of the role of the state.

As far as property tax rules and levies are concerned for the Commonwealth of Kentucky, the following is relevant to generalize about state capability[128]:

- Property is assessed for taxation in Kentucky on January 1st of each year.
- Property is assessed at "fair cash value." "Fair cash value" refers to the fair or reasonable cash price that a property can be sold on the market.
- There are no specific statutory provisions for property taxation on construction works-in-progress.
- Property owned and acquired by Kentucky's Area Development Districts (ADDs) are exempt from property taxation.
- Current to 2007 at least, Kentucky real property tax values ranged from $1.26 to $4.37 per $1,000 of assessed values within Kentucky's counties. Amongst its cities, property tax values ranged from $0.49 to $4.79 per $1,000 of assessed values. These ranges may have or are likely to have changed since the advent of this current recession that started with plummeting housing values. The important point to note is how variable Kentucky's property tax rates are. Further, there are special rates that apply to many types of property.

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[128] From Klutkowski, Andrew and Peter Pupke (eds). [2009]. *2009 All States Tax Handbook*. New York City, NY: Thomson Reuters.

Sales Tax

Kentucky's sales tax is considered a "seller's" tax, which means that the tax liability falls on the seller rather than on the consumer. In other words, the seller is responsible to the government to pay the tax; the consumer is not.

Kentucky charges 6% on gross receipts for the "sale" (instead of the "purchase") price of tangible goods. This means that Kentucky taxes:

- Conditional and credit sales;
- Barter exchanges;
- Leases and rentals;
- Trade-ins or used property;
- Repossessed property;
- Sale of materials to repairers;
- Sale of materials to contractors;
- Sale of machinery to contractors, manufacturers, and producers;
- Withdrawal from one's own stock;
- Retail sales; and
- Special orders.

Kentucky exempts the following from its sales tax:

- Casual or isolated sales
- Repair charges
- Installation services
- Selling materials to manufacturers, producers, and processors
- Sales to nonprofits
- Sales to the federal government (and its agencies)
- Sales to the Commonwealth itself (and its divisions and agencies)
- Sales of wrappers and containers
- Alterations (to clothing)

Income Tax

The personal income tax rates in Kentucky are as follows:

First (1st) $3,000	***2%***
Next $1,000	***3%***
Next $1,000	***4%***
Next $3,000	***5%***
Next $67,000	***5.8%***
Over $75,000	***6%***[129]

The corporate income tax rates in Kentucky are as follows:

First (1st) $50,000	***4%***
Next $50,000	***5%***
Over $100,000	***6%***

Further, Kentucky levies the LLE (Limited Liability Entity) Tax on some corporations. The LLE Tax works similarly to the Corporate Income Alternative Minimum Tax (AMT): An LLE Tax is imposed on corporations in addition to its income tax. It replaces the AMT and incorporates Kentucky's $175 minimum tax levy.

Kentucky does exempt taxation on S Corporations, though they still are subject to the LLE Tax.

Generally, there are five (5) broad mechanisms that states can use to derive corporate income from other states:

The first mechanism is referred to as the *Double-Barreled Tax*. "States imposing both a privilege tax (to reach all income of qualified domestic and foreign corporations) and a direct income tax (specifically designed to reach the in-state income of interstate corporations) include California, Idaho, Montana, Oregon, Pennsylvania, Utah, and Wisconsin…[Klutkowski and Pupke 2009[130], p. 51]."

The second mechanism is referred to as *Income from Property In-State*. Statutes that claim income from property with an in-state situs (legal location) are usually effective even if it applies to companies not active in ordinary business operations in the state. For example, income from patents, copyrights, licenses-to-use, or other such royalties would be taxed under this mechanism, even if the corporate owner had no other contact with the state.

The third mechanism is termed the *Income from In-State Business*. It is a broad mechanism: While it is true that by interpretation, a tax limited to "business" could be less far-reaching than statutes that are not so restricted by diction. However, in practice,

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[129] At this level of personal income, Kentucky has the ability to use an optional tax table.

[130] Klutkowski, Andrew and Peter Pupke (eds). [2009]. *2009 All States Tax Handbook*. New York City, NY: Thomson Reuters.

state courts ultimately decide how broad the ability to tax corporate income under this mechanism.

Related is the fourth mechanism for deriving inter-state revenue: *Income from Sources In-State*. This is, by far, the broadest mechanism by which to collect inter-state revenue. "Theoretically, *any* type of income derived from within the borders of a particular state could be gathered in under this type of clause…[Klutkowski and Pupke 2009[131], p. 51]."

Finally, there is the *Doing Business* mechanism for inter-state tax collection. Of the five inter-state tax collecting mechanisms, it has the narrowest interpretation: It can only be imposed on state net income by corporations "doing business" within the state. In other words, this mechanism restricts the reach of the tax only to those corporations solidly grounded within the state's borders, i.e. solidly emplaced commercial activities.

Thus, of the five mechanisms for collecting inter-state corporate income tax revenue, Kentucky uses *Income from In-State Property*, *Income from In-State Business*, and *Income from In-State Sources*. In other words, Kentucky taxes corporations broadly.

Other Taxes

Kentucky also administers these other sources of revenue:

Inheritance, Estate, and Gift Taxes

Regarding an inheritance tax, there are three "classes" of possible beneficiaries of inheritance that receive a different range of rates of taxation.

"Class A" refers to a surviving spouse, parent, child, grandchild, brother, sister, half-brother, and/or half-sister. The tax rate for this "class" of inheritance recipients ranges from 2% on the first (1st) $20,000 of inheritance to 10% for inheritance values over $500,000. There are exemptions to this range of rates, however, that apply if the "Class A" recipient of an inheritance is an infant child.

"Class B" refers to a niece, nephew, half-niece, half-nephew, daughter-in-law, son-in-law, aunt, uncle, and/or great-grandchild. Tax rates for this "class" of inheritance beneficiaries ranges from 4% on the first (1st) $10,000 of inheritance to 16% on inheritances valuing over $200,000.

"Class C" refers to, of course, all those inheritance beneficiaries that are not either "Class A" or "Class B." Inheritance tax rates for this "class" ranges from 6% on first (1st) $10,000 to 16% for inheritances worth over $60,000.

Regarding estate taxes, the estate tax is not imposed on decedents dying on or after January 1, 2005.

Further, there is no "generation-skipping transfer tax" imposed.

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[131] *Ibid.*

Finally, Kentucky does not impose a “gift tax.”

Beer Excise Tax

The Beer Excise Tax is $0.08 per gallon of beer in addition to Kentucky’s sales tax. There is an 11% wholesale tax.

Distilled Spirits Excise Tax

The Distilled Spirits Excise Tax is $1.92 per gallon of spirits in addition to Kentucky’s sales tax. However, this rate varies depending upon the alcohol content of the distilled spirits: If under 6% alcohol by volume, then the tax is reduced dramatically to $0.25 per gallon. There is an 11% wholesale tax.

Wine Excise Tax

The Wine Excise Tax is $0.50 per gallon of wine in addition to Kentucky’s sales tax. There is an 11% wholesale tax.

Gasoline Tax

Kentucky does collect a “gasoline tax.” Current to 2009, it was 21.1¢ per gallon.

Cigarette Tax

On a twenty-pack carton of cigarettes, Kentucky charges $0.30 per carton and adds an extra $0.01 as an enforcement and administration fee for the collection of the tax.

Comity

Finally, Kentucky is one of 44 states that allow its courts to be used to collect the unpaid taxes of other states. This practice is called the “collection of other states’ taxes through comity.”

MITIGATION STRATEGY

PART V:
Funding Sources

REQUIREMENT
§201.4 (C) (3) (IV):

The Commonwealth of Kentucky's mitigation strategy shall include an identification of current and potential sources of federal, state, local, or private funding to implement mitigation activities

A. *Identifying Current Sources of Federal, State, Local, or Private Funding to Implement Mitigation Activities,*

B. *Identifying Potential Sources of Federal, State, Local, or Private Funding to Implement Mitigation Activities, and*

C. *Identifying the Sources of Funding Used to Implement Activities in the Mitigation Strategy Since Approval of the 2010 Update of the Commonwealth of Kentucky's Hazard Mitigation Plan*

Funding for mitigation activities currently, potentially, and historically has derived from five (5) major federal sources:

1. Hazard Mitigation Grant Program (HMGP)
2. Flood Mitigation Assistance (FMA)
3. Pre-Disaster Mitigation (PDM)
4. Repetitive Flood Claims (RFC)
5. Severe Repetitive-Loss (SRL)

These are all grant programs deriving from the Federal Emergency Management Agency (FEMA). The Hazard Mitigation Grant Program is unique among the five federal sources: It is a grant made available after a Presidential disaster declaration. The other four grant programs are competitive and, traditionally, have been offered yearly.

Most of the above grants reimburse 75% of the cost of an approved mitigation project or plan. The community implementing the mitigation action is responsible for the other 25%. Kentucky is unique in that it takes on some of the burden of the local responsibility for the remaining 25%. The Commonwealth of Kentucky will further reimburse an approved mitigation action up to 12%. This means that, ultimately, the local jurisdiction implementing the mitigation action only is responsible for 13% of the funding of that action.

Each of the above grants has a different Congressional authorization and, thus, slightly different rules. These are summarized in the following table:

Table 4-12: FEMA Grant Programs and for What They Are Eligible

Types of Projects Eligible for Funding	*HMGP*	*FMA*	*PDM*	*RFC*	*SRL*
Acquisition of an Entire Property by a Government Agency	✓	✓	✓	✓	✓
Relocation of a Building to a Flood-Free Site	✓	✓	✓	✓	✓
Demolition of a Structure	✓	✓	✓	✓	✓
Elevation of a Structure Above Flood Levels	✓	✓	✓		✓
Replacement an Old Building with a New Elevated Building	✓				✓
Local Drainage and Small Flood-Control Projects	✓				✓
Dry Flood-Proofing (to Non-Residential Buildings Only)		✓	✓		✓
Dry Flood-Proofing (to Historic Residential Structures)	✓	✓	✓	✓	✓
Minor Localized Flood-Reduction Projects	✓	✓	✓	✓	✓
Structural Retrofitting of Existing Buildings	✓		✓		
Non-Structural Retrofitting of Existing Buildings and Facilities	✓		✓		
Safe Room Construction	✓		✓		
Infrastructure Retrofit	✓		✓		
Soil Stabilization	✓		✓		
Wildfire Mitigation	✓		✓		
Post-Disaster Code Enforcement	✓				
5% Initiative Projects	✓				
Mitigation Planning	✓	✓	✓		

Regarding relevant information specific to each grant:

Hazard Mitigation Grant Program (HMGP)

Following a Presidential disaster declaration, the FEMA Hazard Mitigation Grant Program (HMGP) provides the affected state with funding for projects to reduce damages, losses, and suffering in future disasters. The intent of HMGP is to create a federal, state, and local partnership to develop and fund mitigation projects. Funding associated with a specific disaster requires Kentucky Emergency Management (KYEM) to provide FEMA with an Administrative Plan which details how the funds will be managed and protected from fraud.

Eligible applicants for the Hazard Mitigation Grant Program include local governments, state agencies, and certain nonprofit organizations.

HMGP may fund up to 75% of the mitigation expenditures for projects such as:

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

As aforementioned, the remaining 25% of funds must come from non-federal sources. In Kentucky, the state provides up to 12% of the project costs and the applicant must provide the remaining 13%.

The local cost share may be cash or provided through in-kind donations of labor, services, or materials related to the project. The applicant’s community may also apply to other agencies for funds which can be used as "local match." These funds, in some cases, may also be money originating from the federal government but which lose its federal identity at the state level.

Eligible projects must meet a FEMA-approved benefit-cost analysis, in which the applicant must demonstrate for every dollar spent on a project at least a dollar’s worth of future damage protection will be realized.

Projects must also meet other criteria. The Kentucky State Clearinghouse, comprised of a group of state regulatory agencies, must review projects to identify any adverse impact on environmental, archeological, and historic resources. These agencies may provide guidance on permits which must be obtained before the project may proceed or actions the applicant’s community must take to reduce the effects on such resources.

Up to ten percent (10%) of the HMGP funds allocated to the state after a disaster declaration may be spent on projects in which a benefit-cost analysis is difficult or impossible to perform. Applications for this subset of the HMGP often involve initiatives such as:

- Outdoor or indoor warning systems,
- Hazard mitigation education programs,
- NOAA weather radios, and
- Generators

Up to seven percent (7%) of the HMGP funds allocated to the state after a declared disaster may be used for local or state mitigation planning activities. Mitigation planning is mandated by the Disaster Mitigation Act of 2000 as a condition for receiving mitigation grants. A community receiving an HMGP grant for any project assumes responsibility to maintain, at its own expense, any equipment or property acquired with the grant.

Flood Mitigation Assistance Program (FMA)

The Flood Mitigation Assistance (FMA) grant program provides funding to the Commonwealth of Kentucky for cost-effective measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.

The FMA program is funded on an annual cycle. Each year the state gets a target allocation of funding for which local communities can apply. The FEMA program is split with up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

The Commonwealth of Kentucky's priority for this fund is to reduce the number of properties located on the National Flood Insurance Program's Repetitive Loss List. Other eligible projects include:

- Voluntary acquisition of insured real property to conversion to open space in perpetuity,
- Elevation of insured public or private structures to avoid flooding,
- Dry flood-proofing of insured non-residential structures, and/or
- Structural retrofitting and non-structural retrofitting of existing public or private structures to meet or exceed applicable building codes relative to floodplain management

Eligible applicants must have an approved FEMA FMA plan or a dual-approved standard mitigation plan. If a FEMA-approved FMA plan is not in place, a community may apply for FEMA funding during any grant cycle, to underwrite the cost of compiling a plan.

Pre-Disaster Mitigation Grant Program (PDM)

The Pre-Disaster Mitigation Program (PDM) provides funds to the State for pre-disaster mitigation planning and the implementation of cost-effective mitigation projects prior to a disaster event.

The PDM program is a nationally competitive program. There has been a $500,000 state allocation and no national priority for projects. The PDM program traditionally has been funded on an annual cycle.

The PDM program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

Eligible applicants include local governments, state agencies and public universities. Types of eligible projects include:

- Voluntary acquisitions and demolition or elevations of flood-prone structures to conversion to open space in perpetuity;
- Structural retrofitting and non-structural retrofitting of existing public or private structures to meet or exceed applicable building codes;
- Construction of tornado safe rooms and community shelters;
- Protective measures for utilities, water, and sanitary sewer systems and/or infrastructure;
- Storm-water management projects to reduce or eliminate long-term risk from flood hazards;
- Localized flood control projects, such as certain ring levees, bank stabilization, and floodwall systems which are designed specifically to protect critical facilities; and/or
- Planning

If a community is identified as located in a Special Flood Hazard Area, it must be a participant in good standing in the National Flood Insurance Program (NFIP). Also, the applicant must have a FEMA-approved local hazard mitigation plan.

Eligible projects must achieve a FEMA benefit-cost analysis which demonstrates for every dollar spent on a project; at least a dollar's worth of future damage protection will be realized.

Repetitive Flood Claims Program (RFC)

The Repetitive Flood Claims (RFC) grant program provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) which have had one or more claim payment(s) for flood damages. RFC funds may only be used to mitigate structures located within a state or community which is participating in the NFIP and can prove its inability to meet Flood Mitigation Assistance (FMA) program requirements because it cannot provide the non-Federal cost share or does not have the capacity to manage the program activities.

The long-term goal of the RFC grant program is to reduce or eliminate the number reoccurring flood insurance claims through mitigation activities which are in the best interest of the National Flood Insurance Fund (NFIF).

All RFC grants are eligible for up to 100% federal cost assistance. The RFC grants are awarded to applicants on a nationwide basis without reference to state allocations, quotas, or other formula-based allocations.

The priority is to fund the acquisition of severe repetitive-loss (SRL) properties, as well as non-residential properties which meet the same claims thresholds as severe repetitive-loss properties. As determined by the Flood Insurance Reform Act of 2004, to meet a small repetitive-loss designation, a property must be insured under the NFIP and have incurred flood losses that resulted in either:

- Four (4) or more flood insurance claims payments which each exceeded $5,000, with at least two (2) of those payments occurring in a 10-year period, and with the total claims paid exceeding $20,000; or
- Two (2) or more flood insurance claims payments which together exceeded the value of the property.

Acquisitions include the demolition or relocation of flood-prone structures and deed restricting the vacant land for open space uses in perpetuity.

Severe Repetitive-Loss Program (SRL)

The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the National Flood Insurance Program (NFIP).

SRL properties are residential properties which have at least four (4) NFIP claim payments over $5,000 each, when at least two (2) such claims have occurred within any ten-year period, and the cumulative amount of such claims payments exceeds $20,000; or for which at least two (2) separate claims payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two (2) such claims have occurred within any ten-year period.

The purpose of the program is to reduce or eliminate claims under the NFIP through project activities which will result in the greatest savings to the National Flood Insurance Fund (NFIF). Eligible flood mitigation project activities include:

- Flood-proofing (for historical properties only)
- Relocation
- Elevation
- Acquisition
- Mitigation reconstruction (demolition/rebuild)
- Minor physical localized flood control projects.

Communities with FEMA-approved standard or enhanced mitigation plans may receive up to 90% in Federal cost-share funding for projects.

The program was approved to begin funding at the start of the Fiscal Year 2008 grant cycle. For each of the above flood-related grant programs (FMA, RFC, and SRL) a riverine-limited data module can be used to assist with the needed Benefit-Cost Analysis.

A Note on Current and Potential Sources of Funding

For much of 2012 and through the middle of 2013, the future of the FEMA Pre-Disaster Mitigation Program (PDM) was not certain. The PDM program had ceased to be funded for more than a year and no indication that it would return would be confirmed. The PDM program has returned, however (and seemingly). It returned around the middle of July. The PDM program represents an important source of funding for the mitigation program because the money distributed through the program primarily was directed to planning. Its recent return (at the time of this plan-writing) was welcome. Funding levels for this year's reintroduction of the program were comparatively small compared with years past; but, planning is a necessary function of mitigation activity and is necessary in order to qualify for federal assistance in hazard mitigation.

Further, there had been discussion that Repetitive Flood Claims (RFC) and Severe Repetitive-Loss (SRL) grants would be collapsed into the Flood Mitigation Assistance (FMA) program. Under this circumstance, FMA would add a planning (for flood-related mitigation activity only) allowance to the competitive grant program. Currently, FMA funding – rather than contribute to individual FMA (floodplain management) plans – contributes instead to the funding of development of flood mitigation activity to be included in local hazard mitigation hazard plans.

Further Funding Sources for Repetitive-Loss Properties

In addition to the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) program, and especially the Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive-Loss (SRL) program grants, there are a couple of other funding sources to consider that can specifically target repetitive-loss properties:

The Increased Cost of Compliance (ICC) is an extra flood insurance claim payment that can be provided if an insured building was flooded and afterward declared “substantially damaged” by the local permit office.

ICC payments can be used to pay 100% of the following mitigation project types:

- Relocation of a building to a flood-free site,
- Demolition of a structure,
- Elevation of a structure above flood levels,
- Replacement of an old building with a new elevated building, and/or
- The dry flood-proofing (of nonresidential buildings).

The federal Small Business Administration (SBA) also provides low-interest loans that can be used to fund repairs and mitigation projects after a Presidential disaster declaration.

A Note on Current Funding Levels

Current FEMA Hazard Mitigation Grant Program (HMGP) funding levels for the Commonwealth of Kentucky's 2010-2013 planning cycle derive from funding resulting from five (5) presidentially-declared disasters:

1) DR-1912 (Declared May 11, 2010)
2) DR-1925 (Declared July 23, 2010)
3) DR-1976 (Declared May 4, 2011)
4) DR-4008 (Declared July 25, 2011)
5) DR-4057 (Declared March 6, 2012)

Below is tabulated the total amounts Kentucky has submitted under each of the five disasters. This information is accompanied by that disaster's "lock-in" amount. The "lock-in" amount is the maximum amount of money that FEMA is able to distribute toward hazard mitigation activities that take place under the HMG Program that opens after each presidentially-declared disaster.

Table 4-13: FEMA "Lock-In" Amounts and Commonwealth Submission Amounts

Presidential Disaster #	# of Projects Submitted	Total Levels of Funding Submitted (Approved and Pending Approval)	"Lock-In" Amount
DR-1912	35 Projects	$11,112,666.00	$9,884,338.00
DR-1925	21 Projects	$4,927,600.00	$4,118,251.00
DR-1976	21 Projects	$10,522,102.00	$8,319,661.00
DR-4008	9 Projects	$1,821,624.00	$1,492,346.00
DR-4057	14 Projects	$4,560,072.00	$5,363,974.00

As noted above, the Pre-Disaster Mitigation program recently has been reintroduced into Kentucky. Current levels of funding within this competitive program allow $250,000.00 in federal share. With this allotted money, Kentucky – at the time of this writing – is submitting for five planning projects.

Further, the Flood Mitigation Assistance (FMA) competitive program allows for further funding of local hazard mitigation plans under new rules that would have FMA planning incorporated with "all-hazards" planning (i.e., local hazard mitigation planning). Consequently, currently (and at the time of this writing), Kentucky also is submitting for an additional $125,000.00 in federal to be used to enhance the flood hazard assessment and mitigation strategies of upcoming local hazard mitigation plan updates.

Past Funding Sources and Levels of Funding

Tabulated below is a summary of the funding sources that Kentucky has utilized in the recent past and the number of mitigation projects submitted under the funding sources. Details about the individual projects can be found in ***Appendix 4-11***, which is subdivided into seven (7) different appendices (***4-11-1*** through ***4-11-7***).

Table 4-14: Funding Sources Used by Commonwealth for Mitigation Projects, 2010-2012

Funding Source	# of Mitigation Projects Funded Through the Listed Funding Source, 2010-2012
FEMA: Hazard Mitigation Grants Program (HMGP)	325 Projects
FEMA: Flood Mitigation Assistance (FMA) Competitive Program	5 Projects
FEMA: Pre-Disaster Mitigation (PDM) Competitive Program	23 Projects
FEMA: Severe Repetitive-Loss (SRL) Program	5 Projects
FEMA/Congress: Legislative Pre-Disaster Mitigation Program/Congressional Provision	7 Projects
FEMA: “406” Mitigation Projects	283 Projects
Kentucky Office of Homeland Security (KOHS)	9 Projects
Kentucky Department for Local Government (DLG)	52 Projects
Kentucky Division of Forestry (KDF)	27 Projects
Louisville Metropolitan Sewer District (Louisville MSD)	6 Projects
Lexington-Fayetted Urban County Government (LFUCG)	25 Projects

Though this will be elaborated more upon in the Enhanced portion of this 2013 update of Kentucky’s hazard mitigation plan, the non-FEMA funding sources used by the Commonwealth of Kentucky in its recent mitigation past total to $36,777,241.68. The breakdown is as follows:

- Kentucky Office of Homeland Security (2010-2012): ***$680,750.00***
- Kentucky Department for Local Government (2010-2012): ***$15,729,155.00***
- Kentucky Division of Forestry (2010 – 2012): ***$417,822.00***
- Louisville Metropolitan Sewer District (2010 – 2012): ***$13,517,405.00***
- Lexington-Fayette Urban County Government (2010 – 2012): ***$6,432,109.68***

Finally, FEMA’s mitigation projects approved in Kentucky under its Section 406 amounted to $4,724,596.00 from 2010 – 2012.

REQUIREMENT
§201.4 (C) (3) (V):

The Commonwealth of Kentucky may request the reduced cost share authorized under 79.4 (c) (2) of this chapter for the FMA and SRL programs. If it has an approved Mitigation Plan…that also identifies specific actions the Commonwealth of Kentucky has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the Commonwealth of Kentucky intends to reduce the number of such repetitive loss properties.

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F. Identifying Current and Potential Sources of Federal, State, Local, or Private Funding to Implement Mitigation Activities for Repetitive-Loss Properties

COORDINATION OF LOCAL MITIGATION PLANNING

PART I:
Local Funding and Technical Assistance

REQUIREMENT §201.4(C)(4)(I):

The Commonwealth of Kentucky must include a description of the State process to support, through funding and technical assistance, the development of local mitigation plans.

A. Describing Generally the Commonwealth Process to Support, Through Funding and Technical Assistance, the Development of Local Mitigation Plans

The Commonwealth, through Kentucky Emergency Management (KYEM), provides funding and technical support for the development of local hazard mitigation plans.

Generally the Commonwealth provides ample and easily accessible technical and funding assistance through one (1) or all of the following three (3) agencies:

1) Kentucky Emergency Management and its specialized planning staff (KYEM)
2) University of Kentucky Martin School of Public Policy and Administration Hazard Mitigation Grant Program (UK-HMGP)
3) University of Louisville Center for Hazards Research and Policy Development (CHR)

The process by which these agencies, on behalf of the Commonwealth, provide technical and funding assistance is detailed in the section below which specifies how the Commonwealth provided such assistance for local plan development during its 2010 to 2013 plan cycle. The methods and mechanisms that will describe the process were implemented and quotidian throughout the three-year cycle since the publication of the Commonwealth of Kentucky's previous state hazard mitigation plan update in 2010.

As the methods and mechanisms to be described have provided for an efficient, thorough, and multi-faceted experience in garnering funding and technical assistance (and thus, have been a success), it is expected that these same methods and mechanisms will continue and will animate the state-to-local mitigation planning relationship. Emphasis here needs to be placed on the accessibility of technical and funding assistance available to localities throughout the Commonwealth. KYEM, UK-HMGP, and CHR are unique for bureaucratic elements in that the agencies do not exist solely to perform the work of processing federal government initiatives and providing local governance and continuity.

Regarding general technical assistance for local plan development, a major function of KYEM, UK-HMGP, and CHR is providing customer service. With some rare and idiosyncratic exceptions, a locality is easily able to contact any of these agencies at will and receive technical or funding assistance. The agencies are highly interrelated and are in constant communication with each other. There is little segmentation of institutional knowledge, yet there is efficient specialization of task. Inter-organizationally, UK-HMGP is very much a direct appendage to KYEM; and CHR, while necessarily more autonomous, derives its raison d'être primarily from KYEM. For example, a request for assistance from a locality to UK-HMGP can, if necessary, simultaneously include customer service from CHR and KYEM. The same relationship results no matter the primary agency of contact. A specialist from one of these three (3) agencies is going to be able to provide technical and funding assistance for local plan development to any representative of a Kentucky locality at any given time.

Of particular importance, Kentucky provides significant technical assistance related to National Flood Insurance Program (NFIP) participation. Most evidently, Kentucky's Division of Water (KDOW) – an executive-branch agency that serves prominently on the Kentucky Mitigation Council and is a significant partner in Kentucky's hazard mitigation program –is primarily responsible for providing technical and funding assistance targeted to participation in the NFIP. KDOW largely meets this NFIP-related technical assistance through the Community Assistance Program State Support Services Element (CAP-SSSE). Through CAP-SSSE, KDOW provides local jurisdictions with training and education on the regulatory and administrative requirements for NFIP participation.

For those localities already participating in the NFIP, KDOW (through CAP-SSSE) provides guidance regarding alternative non-structural flood hazard management and provides information on flood-loss reduction techniques and strategies. Further and related to the technical assistance that Kentucky Emergency Management (KYEM) generally provides, KDOW offers said NFIP-related technical assistance primarily through outreach: The CAP-SSSE grant allots KDOW the resources to stay in contact with NFIP non-participants in order to gradually sell participation; to make visits to localities and communities; to train and to education regarding NFIP participation; to aid in strategic planning and plan-writing; and simply to be available in a customer service sense for general technical assistance. KYEM recently has been augmenting KDOW's considerable outreach activities that communicate the importance of NFIP participation by accompanying with and directing the KDOW to the political and community leader contacts nurtured through its Intergovernmental Liaison position.

Finally, regarding the newly prominent role that NFIP-participation and repetitive-loss properties play in the Federal Emergency Management's (FEMA) updated version of its Local Plan Review Tool (a.k.a. "New Crosswalk"), KDOW has been, and will continue to be, instrumental in gathering and distributing data related to the NFIP-insured structures that have suffered repetitive losses. Again, this specific data is a new consideration to be included in the development of local hazard mitigation plans and it is data that the KDOW has been especially diligent in collecting and disseminating upon request.

Generally, it is the intention of the Commonwealth to provide mitigation funding assistance primarily through its efficient distribution of FEMA, state, and other federal funding sources. The FEMA Hazard Mitigation Program funding for both projects and planning during the 2010-2013 planning cycle for the Commonwealth was available through the following types of Grants (which currently have been changed and are subject to change anew in the future):

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Severe Repetitive Loss (SRL)
- Repetitive Flood Claims (RFC)

KYEM, along with the University of Kentucky Martin School of Public Policy and Administration’s Hazard Mitigation Grants Program office (UK-HMGP) and with the University of Louisville’s Center for Hazards Research and Policy Development (CHR), have devoted, and will continue to devote, full-time staff that specialize in FEMA’s funding sources. It is of particular relevance that since the 2010 state-level mitigation plan update, KYEM, UK-HMGP, and CHR have hired additional staff so as to allow project managers to specialize, not only regarding the individual FEMA funding sources (which any individual project and planning manager should possess), but also regarding particular geographic areas of Kentucky, as well.

There are fifteen Area Development Districts (ADDs) established within the Commonwealth which create a collaborative means by which local governments may access technical and professional expertise. Member governments and citizens work with their respective ADD to develop a regional Hazard Mitigation Plan which ultimately are adopted and enacted by local governments within the ADD. Prior to 2010, state-level project managers were assigned mitigation project applicants[132] in a random manner. This approach meant that project applicants, applying for and working with multiple mitigation projects, could be working with multiple state-level staff. This further implied that state-level staff struggled to gain expertise with hazard nuances across the Commonwealth of Kentucky, which affected its ability to provide the best technical and funding assistance. In 2011, with the aforementioned newly-augmented staff, KYEM assigned mitigation project applicants to KYEM (and UK-HMGP) project managers according to ADD boundaries.

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[132] Please note that the use of the word “applicant” here and throughout the succeeding paragraphs does not refer to the use of “applicant” that is defined specifically for use within the mitigation community, i.e. FEMA, KYEM, etc.: Within the mitigation community of Kentucky, “applicant” usually refers to the Commonwealth’s role in project management. This is because, legally, it is always the Commonwealth of Kentucky applying to FEMA for funds used to reimburse those mitigation projects demanded by local governments. The local government doing the actual applying for a grant money is considered the “sub-applicant.” However, contextually, this discussion has little to do with the relationship between FEMA and the Commonwealth. “Applicant” is used generally here, i.e., as the party responsible for applying for mitigation project reimbursement funding.

Now mitigation project applicants have the consistency of dealing only with a single state-level project manager, regardless of which disaster or type of FEMA mitigation funding is applicable to their projects. Additionally, the relationship between an individual project manager and the locality is not one-sided, i.e. the project manager awaiting requests for assistance from localities: As in the past, project managers will continue to proactively inform project applicants within their assigned geographic regions about the FEMA funding opportunities available for mitigation projects and for planning, as funding becomes available. Related to technical assistance, these same project managers are helping local governments within their assigned ADD regions to prepare applications prior to funding cycles or disaster funding so as to streamline the application process once competitive or disaster funding does become available.

Kentucky is somewhat unique in that it provides funding assistance by contributing a portion of the percentage of a FEMA-funded mitigation project which must be matched with nonfederal funds, which is the applicant’s responsibility. If FEMA funds 75% of the cost of a mitigation project, this, of course, requires the applicant to match 25% of the project’s cost. Kentucky assists applicants by providing 12% of the 25% match requirement for HMGP projects, thus offsetting fiscal constraints that can often times prevent effective hazard mitigation. Related, Kentucky houses a Department for Local Government (DLG), which generally provides funding and technical assistance by helping cities and counties to identify other “match” funding streams that could offset all or a portion of the remaining match required for hazard mitigation projects.

Specifically related to plan development, funding assistance derives from federal disaster funding (via HMGP) and from the federal and competitive Pre-Disaster Mitigation (PDM) funding. Regarding the former, 7% of federal Hazard Mitigation Grant Program funds distributed to the Commonwealth following a Presidentially-declared disaster is set aside specifically for local plan development assistance. Primarily, of course, funds for planning assistance derive from the federal distribution of money to the Commonwealth under its PDM program. Generally, looking to the future, the funding mechanisms by which local plan development in the Commonwealth will be assisted are likely to change. Funding for the PDM program at the time of this writing has been discontinued. Meanwhile, the aforementioned Severe Repetitive Loss (SRL) and Repetitive Flood Claims (RFC) competitive programs may be collapsed into the Flood Mitigation Assistance (FMA) competitive program with an adjustment that a (yet to be defined) proportion of the competitive, cyclical funds will be designated for planning related specifically to flooding.

Tying in general funding assistance for both mitigation projects and planning with, specifically, local plan development, the Commonwealth’s 12% contribution to mitigation project funding, coupled with the targeted assistance provided towards individual regions of Kentucky by KYEM project managers yields more efficient, more effective, and more responsible distribution of highly-specified and limited funding assistance aimed solely toward plan development. Or otherwise stated, the Commonwealth could not provide the best possible funding assistance related specifically to plan development if it was not offering the best possible funding assistance related to regional mitigation projects and the planning process that underlies local project identification and justification and the Commonwealth's project selection and justification process.

B. *Providing Funding and Technical Assistance to Assist Local Jurisdictions in Completing Approvable Mitigation Plans During the Past Three (3) Years*

Funding Assistance

This subsection serves as a summary of the above information related to general funding assistance provided by the Commonwealth to aid localities in plan development: There has been no systematic deviation during the past three (3) years from the general methods of providing funding assistance for local plan development described above.

During the 2010-2013 planning cycle the Commonwealth provided funding assistance through the following sources:

- Pre-Disaster Mitigation (PDM) program assistance
- The 7% of Hazard Mitigation Grant Program (HMGP) assistance legally allotted for plan development

During the 2010-2013 planning cycle, no further means for federal funding assistance was sought. The effort to do so would have been an inefficient use of time and resources for two (2) reasons:

1) Administratively, the Commonwealth is highly efficient in local plan development. Rather than directly oversee (and directly financially assist) 120 counties, the Commonwealth devolved power to the 15 regional ADDs. The ADDs, with a couple of notable exceptions, are organized according to geographic similarity, i.e., they are "regional" as typically conceived.

   By grouping Kentucky's multitudinous counties into 15 "super-counties" of sorts, each administered by an ADD that is staffed by professional administrators, grant-writers, planners, et al. and (via their semi-private nature) whose services can be partially paid for by the local government members, the Commonwealth only has to provide funding assistance to 15 areas and does not have to inefficiently micromanage the entire Commonwealth.

2) Throughout multiple state planning cycles, Kentucky experienced frequent and severe disasters warranting presidential major disaster declarations. The 7% limit reserved for plan development within the HMG Program used federally to support "presidential disaster declarations" provided sufficient funding for plan development within an unfortunately larger distribution of money provided to Kentucky by FEMA.

Technical Assistance

For much of the past three (3) years, technical assistance related to local jurisdiction planning and completion of approvable mitigation plans has derived primarily from the KYEM-sponsored[133] University of Kentucky Martin School of Public Policy and Administration, Hazard Mitigation Grants Program Office (UK-HMGP). Since 2009, UK-HMGP has continuously employed a full-time hazard mitigation plan specialist devoted solely to assisting Kentucky's local jurisdictions in completing approvable mitigation plans and planning applications. The technical assistance provided to local jurisdictions from UK-HMGP has included and continues to include:

- Assisting with the interpretation of FEMA regulations which must be met in the local jurisdictional plans;
- Collecting of data when local plan-writers have had difficulty in retrieving or locating desired data;
- Interpreting of data;
- Facilitating communication between state agencies and those responsible for writing local jurisdiction plans;
- Editing and formatting of drafts of local jurisdictional plans;
- Identifying sources and plans by which, and to which, local hazard mitigation plans can be coordinated;
- Identifying cited sources for any other necessary information;
- Serving as a liaison with FEMA Region IV Mitigation Plan specialists
- Developing and editing of planning project applications;
- Tracking and updating of local jurisdiction plan application deadlines; and
- Managing local hazard mitigation plan creation and update projects.

Generally, then, UK-HMGP has traditionally provided customer service to the writers of local and multi-jurisdictional hazard mitigation plans. The writer of a local plan is able to contact UK-HMGP directly at any point during the planning process to receive technical assistance and to receive contact information and coordination for further technical assistance.

More recently, within the past three (3) years, KYEM has expanded its staff with the addition of two (2) full-time employees whose time is solely devoted to state and multi-jurisdictional planning activities. However, the responsibilities for KYEM's new planning staff are more varied and broad than those of the UK-HMGP planning specialist. Responsibilities include coordinating and integrating the KYEM State Hazard Mitigation Plan with all other relevant state plans and processes; ensuring planning process continuity; designing, refining, and revising the state's planning procedures; directly and preemptively finding and updating data; and coordinating the KYEM State Hazard Mitigation Plan with the goals of the Community Hazard Assessment and Mitigation Planning System (CHAMPS) initiative. Given the state-specific expertise of the KYEM planning staff, it also has been able, and will continue, to provide technical assistance to

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[133] "KYEM-sponsored" is to refer to the fact that UK-HMGP (despite its technical affiliation with the University of Kentucky) exists through contracts (and thus is funded) through KYEM. While FEMA is looking for the Commonwealth to provide local jurisdictions with funding and technical assistance related to completion of approvable local mitigation plans, UK-HMGP operates on behalf of the State-cum-KYEM, and, thus, is the Commonwealth providing such funding and technical assistance.

local jurisdictions of similar utility as that provided by UK-HMGP. This especially applies to application development and the advertisement of deadlines.

Of particular importance for local planners and plan-writers, KYEM primarily has been, and continues to be, responsible for facilitating the planning process. For the past three (3) years, KYEM has regularly held and sponsored training on planning and application development. KYEM regularly hosts application and planning workshops and seminars for KYEM, UK-HMGP, and CHR staff; for local planners and plan-writers; and for interested stakeholders. To do so, the Commonwealth has developed a pioneering weeklong Applicant Agent Certification Course which is delivered quarterly. One day of this course is devoted to training regarding mitigation planning, project development, and program requirements. The Applicant Agent Certification Course is discussed more thoroughly within the *Mitigation Strategy* section of this hazard mitigation plan, as it is a significant “state capability.”

Further, KYEM also has coordinated meetings with the ADDs and individual jurisdictions; notifying elected officials of planning meetings, sending out its staff (sometimes accompanied by UK-HMGP staff) to facilitate stakeholder meetings, eliciting feedback and opinions regarding hazard risks and mitigation strategies, and describing effective plan-writing for local jurisdictions. This is discussed more systematically in the *Planning Process* section of this hazard mitigation plan.

During the past three (3) years, the University of Louisville’s Center for Hazards Research and Policy Development (CHR) has provided, and continues to provide, technical assistance to local planners and plan-writers in completing approved hazard mitigation plans, as well. The assistance provided by CHR tends to be more focused and specific. CHR primarily provides technical assistance regarding risk assessments, risk vulnerabilities, hazard analyses, and various assessment studies pertaining to local jurisdictions. Whereas KYEM technical assistance for local plan development during the past three (3) years can be characterized as “administrative” and UK-HMGP’s technical assistance can best be characterized as “customer service,” CHR has and can continue to be characterized as the more “technical” in the delivery of technical assistance.

Via its unique status, CHR has also served (and continues to serve) as a subcontractor of some local entities with the responsibility of coordinating and writing a jurisdictional (or, in Kentucky's most-oft case, multi-jurisdictional) local hazard mitigation plan. These entities have been (and continue to be) able to hire CHR to manage and facilitate the planning process, collect data, conduct risk analyses, and complete a final (multi-) jurisdictional local hazard mitigation plan for review and subsequent approval by FEMA.

Finally, KYEM and UK-HMGP operate as facilitators between local planners and state bureaucracy. KYEM and UK-HMGP has facilitated, and will continue to facilitate, contact with, collect data from, and direct assistance with the appropriate and applicable state agencies from which the best technical assistance and information can be obtained.

COORDINATION OF LOCAL MITIGATION PLANNING

PART II:
Local Plan Integration

REQUIREMENT §201.4(C)(4)(II):

The Commonwealth of Kentucky must include a description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.

A. *Commonwealth (State)-Established Process and Timeframe for Reviewing Local Mitigation Plans*

As previously mentioned, during the planning process KYEM, UK-HMGP, and/or CHR provide technical and financial support and assistance.

However, once a local hazard mitigation plan has been completed, KYEM has established the following process and timeframe for the review of the completed local hazard mitigation plan.

The completed draft of a local jurisdiction’s hazard mitigation plan is sent either to the KYEM or UK-HMGP planning specialist responsible for management of the planning grant awarded to develop or update the hazard mitigation plan. Traditionally, this role for managing the project under which a local hazard mitigation plan is funded and for subsequent reviewing of the completed draft of a local hazard mitigation plan has belonged to UK-HMGP due to UK-HMGP’s niche and need as being a KYEM designee that can be most directly responsible and, hence, most directly accessible to local jurisdictions’ planners and plan-writers.

Upon receipt of a completed draft of a local hazard mitigation plan, the KYEM or UK-HMGP reviewer reads through the local hazard mitigation plan in its entirety, making notes and checking that each of FEMA’s requirements for plan approval is met before the draft is sent as an “original submittal” to FEMA for review. The process by which a KYEM or UK-HMGP reviewer confirms that FEMA requirements have been met is accomplished by using FEMA’s updated Local Plan Review Tool, which is colloquially referred to as FEMA’s “New Crosswalk.”

PLANNING TERMINOLOGY

Original Submittal: the 1st plan submitted for FEMA review

Revised Submittal: a plan submittal with revisions required per FEMA’s Original Submittal review

Approval Pending Adoption (APA): a plan which will be deemed as FEMA-approved after adoption by the applicable jurisdictions(s)

FEMA's "New Crosswalk" divides the review of a local or multi-jurisdictional hazard mitigation plan into four[134] (4) "Elements":

I. **"Element A"** refers to the "Planning Process" portion of a local multi-jurisdictional hazard mitigation plan. For a local hazard mitigation plan to be approved by FEMA, the following considerations must be present in the local hazard mitigation plan:

1. Documentation of the planning process, including how it was prepared and who was involved in the process
2. Documentation that neighboring communities (and local and regional agencies that would have any involvement in hazard mitigation activities) have the authority to regulate development and other relevant interests and were involved in the planning process
3. Documentation that the public was involved during and throughout the planning process, specifically during the drafting stage and prior to plan approval
4. A description that the local hazard mitigation plan reviewed and incorporated existing plans, studies, reports, and technical information
5. A discussion of the method by which the community or multi-jurisdictions will continue public participation during the plan maintenance process
6. A description of the method and schedule for keeping the local hazard mitigation plan current, i.e., monitoring, evaluating, and updating the local hazard mitigation plan within a five-year cycle

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[134] There are technically five (5) parts: "Element E" refers to the need for local jurisdictions covered under a (multi-jurisdictional) hazard mitigation plan to adopt a completed plan. The review of adoptions of a local hazard mitigation plan will *not* be a part of the initial review process of a local hazard mitigation plan. A local hazard mitigation plan can be reviewed and approved by FEMA without any adoptions. The plan is not implemented and hazard mitigation projects cannot be proposed or approved for a jurisdiction until it adopts the plan. In the case of a multi-jurisdictional local hazard mitigation plan, the plan will be implemented when only *one* local jurisdiction adopts the FEMA-approved local hazard mitigation plan.

II. “Element B” refers to the “Hazard Identification and Risk Assessment” portion of a local or multi-jurisdictional hazard mitigation plan. For a local hazard mitigation plan to be approved by FEMA, the following considerations must be present:

1. Descriptions of the type, location, and extent of all natural hazards that can affect each jurisdiction[135]
2. Information on previous occurrences of hazard events and the probability of future hazard events for each jurisdiction
3. Description of each identified hazard’s impact on the community accompanied by an overall summary of the community’s vulnerability to each identified hazard for each jurisdiction covered in the local hazard mitigation plan
4. Explicit language addressing of NFIP[136]-insured structures (within each jurisdiction covered under the local hazard mitigation plan) that have been repetitively damaged by floods

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[135] ***Note*:** This requirement by FEMA involves identifying the individual natural hazards that most affect the area for which you are planning. This implies a ranking and a justification for the ranking: For the jurisdiction or multiple jurisdictions for which the local hazard mitigation plan is being written, which natural hazards do you worry about most, the “second-most,” the least? Why? Once identification is done, this requirement by FEMA involves identifying where each of the identified relevant natural hazards typically occur and locations where relevant natural hazards are most susceptible. Finally, this requirement by FEMA asks how bad, how serious an identified natural hazard can become. This implies relating the past events that would have informed the identification and ranking of your hazards to some standard, e.g., the worst event of a particular natural hazard to have occurred within or surrounding the area about which the local hazard mitigation plan is written.

[136] NFIP refers to “National Flood Insurance Program.”

III. “Element C” refers to the “Mitigation Strategy” portion of a local or multi-jurisdictional hazard mitigation plan. For a local hazard mitigation plan to be approved by FEMA, the following considerations must be present in the local hazard mitigation plan:

1. Documentation of the existing authorities, policies, programs, and resources of each jurisdiction (covered under a local hazard mitigation plan) coupled with documentation of the jurisdiction’s ability to expand on and improve these existing policies and programs
2. Explicit language addressing of each jurisdiction’s participation in the NFIP and each jurisdiction’s continued compliance with the NFIP, if relevant and applicable
3. Inclusion of goals to reduce or avoid long-term vulnerabilities to the hazards identified in the local hazard mitigation plan
4. Identification and analysis of a comprehensive range of specific mitigation actions and projects that are being considered to reduce the effects of hazards - This range applies to each jurisdiction covered under a local hazard mitigation plan, i.e. each jurisdiction must consider and include its own “comprehensive range” of mitigation actions and projects that address each of the hazards identified for the area covered under the local hazard mitigation plan as a whole. The range of mitigation actions must demonstrate an emphasis mitigating hazards which may affect new and existing buildings and structures.
5. Description of how the previously-identified mitigation actions will be prioritized, implemented, and administered by each jurisdiction - as part of the prioritization of mitigation actions, cost-benefit analysis must be explicitly considered as a means of prioritization.
6. Description of the process by which local governments will integrate the requirements of the local hazard mitigation plan into other planning mechanisms such as capital improvement plans and comprehensive plans

IV. “Element D” refers to review criteria relevant for local hazard mitigation plan *updates only*. For a local hazard mitigation plan *update* to be approved by FEMA, the following considerations must be present within the local hazard mitigation plan. The update must demonstrate that the local hazard mitigation plan was revised to reflect:

1. Changes in development, i.e., changes in the physical, structural, and economic development of the jurisdictions covered under the plan;
2. Progressive local mitigation efforts; i.e., it must be obvious and explicit that the mitigation actions identified and prioritized during the local hazard mitigation plan update represent an updated list from the one presented in the previous iteration of the local hazard mitigation plan; and
3. Changes in the priorities of the jurisdictions covered under a local hazard mitigation plan.

The State, through KYEM and UK-HMGP will comment specifically upon the local hazard mitigation plan’s inclusion of the aforementioned “Elements” and the sub-elements that comprise them.

The State will complete its review within two (2) weeks upon receipt of the local hazard mitigation plan.

Upon completion of its review, the State will communicate directly with the point-of-contact (usually the planner) responsible for submitting the local hazard mitigation plan for review. In its correspondence with the point-of-contact, the State will detail any deficiencies related to the aforementioned “Elements” of review which must be addressed, corrected, improved, and included. This must be accomplished before sending the local hazard mitigation plan to FEMA for review as an “original submittal.”

Before the “original submittal” of the local hazard mitigation plan is made to FEMA for initial review, the local hazard mitigation planner must address all deficiencies identified during the State’s review.

Finally, upon receipt of the original submittal of the local hazard mitigation plan, FEMA will review the plan and will either: send the local hazard mitigation plan back for correction of deficiencies FEMA identified, or it will approve the local hazard mitigation plan “pending adoption[137].” If the former occurs, as with the State’s process, the local hazard mitigation planner must address the deficiencies detailed by FEMA. Upon addressing the deficiencies, the local hazard mitigation plan will be sent back to the State. The State will review the revisions and, barring any further deficiencies, the State will send the revised local hazard mitigation plan to FEMA as a “revised submittal” for review and eventual approval “pending adoption.” The State’s review of the revisions requested by FEMA will require approximately one (1) week.

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[137] “pending adoption”: Despite a local hazard mitigation plan being approved by FEMA, the plan cannot be implemented until the local jurisdiction covered under the plan formally adopts the plan. This a jurisdiction does through an “adoption resolution.” In the case of a multi-jurisdictional local hazard mitigation plan, the plan can be implemented with only one adoption resolution. However, the plan can only be implemented *for those jurisdictions* that have adopted and to no others. Finally, a local hazard mitigation plan must be updated every five (5) years. The five-year expiration date depends upon when the first jurisdiction adopts the plan.

B. *Commonwealth (State)-Established Process and Timeframe to Coordinate and Link Local Mitigation Plans*

Coordination

It is obvious the State's role in the *review* of local hazard mitigation plans – through KYEM, UK-HMGP, and CHR – is to ensure quality plans which comply with FEMA standards and requirements. This is a justifiable post hoc role. Localities are asking the federal government (and, thus, taxpayers) for funding. Further, they are requesting a commitment of funds before producing a product. Even though the federal money will be distributed as a reimbursement for expenses paid by the localities, the request for funds is made before a project that is supposed to achieve the expressed shared goals of the locality and of FEMA (i.e., to protect populations against hazards) has begun. Localities are not requesting a loan or issuing debt by which either the lender or the bond-issuer will receive payment for the risk taken in the form of interest regardless of whether or not the project succeeds in achieving the goal(s) that justified it.

Consequently FEMA, in its responsibility to protect taxpayer resources, must have mechanisms to determine which projects, in which cases, best deserve the limited resources within FEMA's discretion. Further, these decision-making mechanisms must be standardized. Providing a plan by which a locality presents that it has a grand strategy accompanied by multiple implementation strategies to achieve the shared goals of FEMA serves as an effective mechanism by which FEMA can determine the distribution of the requested funding. To evaluate hazard mitigation plans written uniquely by heterogeneous localities, FEMA must maintain standardized criteria for comparison of dissimilar local hazard mitigation plans. So, it is obvious the utility and necessity of the State (in the abstract) and the Commonwealth (specifically) to review the mitigation plans of its localities to ensure FEMA's standards are met, so that FEMA can best make decisions as to where to distribute its money, and so that localities can best present the case that their requests take equal or relative priority over other requests.

However, it is less clear the Commonwealth's role and that role's justification in many of the "pre-planning" activities of local hazard mitigation plans. The Commonwealth attempts to its utmost to coordinate a locality's goals of hazard mitigation with the projects and actions for which it will request reimbursement from FEMA.

In its hazard mitigation plan, a locality is expected to articulate the hazards likely to affect it; to prioritize which hazards the population should mitigate according to a logical and clearly-defined method; to conceive of general strategies by which to address the most important and most prioritized hazards; and to identify general actions or specific projects that would best mitigate against those hazards that are of most consequence to the locality. Having such a plan communicates to FEMA that such a locality is a safe place towards which to distribute money to achieve the goal of mitigation against hazards.

This connection between hazard identification, prioritization, and project reimbursement is not always so easily made. Certainly, other factors impede the continual link between hazard prioritization and mitigation projects. Politics, for example and of course, can break this link. However, most likely and most ambivalently, simply the perceptions of different stakeholders of how best to mitigate which hazards impedes or complicates what should be the direct connection between a hazard and the projects meant to mitigate it.

Thus, during a locality's planning process the Commonwealth advises, trains toward, and edits local hazard mitigation plans to ensure coordination between the identified and prioritized hazards and the projects meant to mitigate such hazards. Much of this planning process work has been described above in elaborating how the Commonwealth (KYEM, UK-HMGP, and CHR) provides technical assistance for local plan development by[138]:

- Specializing in different aspects of the planning process (KYEM, UK-HMGP, and CHR);
- Aiding localities with hazard identification and assessment (CHR);
- Providing customer service and editing services both proactively and upon request (UK-HMGP);
- Coordinating and facilitating stakeholder and planning meetings with individual ADDs where coordination serves a disproportionate focus (KYEM, UK-HMGP); as well as
- Serving as a hub from which individual assistance in coordination needs can be requested (KYEM)

Further, KYEM, UK-HMGP, and CHR provide coordination in the following two (2) ways:

1) *With project funding and funding assistance:* A locality must submit to KYEM (through UK-HMGP, or CHR, or directly[139]) Mitigation Action Forms (MAFs)[140] for review by KYEM before being allowed formally to apply for FEMA funding for mitigation projects and actions. The MAFs are used primarily by KYEM for coordination purposes. The locality's proposed mitigation action is compared with its hazard mitigation plan and assigned priority for funding, with the prioritization decision being significantly based upon how the action aligns with the mitigation goals and strategies articulated in the locality's hazard mitigation plan. If the locality expresses interest in a mitigation project or action to UK-HMGP or to CHR, those agencies will also help in coordinating the action with the strategies and goals of the locality before KYEM sees the MAF and makes funding prioritization decisions.

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[138] Accompanied by which of the Commonwealth's hazard mitigation-specific agencies are most responsible for said technical assistance in brackets.

[139] Mitigation Action Forms (MAFsare entered into Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) for reviewed by Kentucky Emergency Management.

[140] With the increasing use and reliance upon Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS), the term for LOI has been changed since the 2010-2013 planning cycle. "Letters of Intent" are now "Mitigation Action Forms (MAFs)."

2) *Through the plan amendment process:* KYEM, UK-HMGP, and CHR, in their customer service roles, are coordinating mitigation actions with mitigation goals, objectives, and strategies throughout the planning cycles of localities and the Commonwealth. Any of the above agencies will stress and aid in developing (with the Area Development Districts) amendments to local hazard mitigation plans upon notice that certain mitigation projects or actions should be receiving high funding priority for applicants whose local mitigation plan goals and strategies are not coordinating smoothly.

Linking I: Generally

The Commonwealth of Kentucky's hazard mitigation plan is to incorporate resources provided by its local hazard mitigation plans and is to be used by and useful for local hazard mitigation plans. This establishes the mutually beneficial link between the Commonwealth's hazard mitigation plan and its local hazard mitigation plans. Alternatively stated, local hazard mitigation plans are linked quite directly to the Commonwealth of Kentucky's hazard mitigation plan: It is the local hazard mitigation plans that, ultimately, provide the majority of the Commonwealth's mitigation measures. As stated previously, save for definitional "public goods" considerations that help the Commonwealth coordinate and facilitate the mitigation activities of its localities, the Commonwealth should not have mitigation goals separate from the goals and subsequent actions of the localities that actually suffer the effects from hazards.

A further link between the Commonwealth's plan and the plans of its localities is provided through the mechanism that the Commonwealth uses for evaluating and prioritizing mitigation measures deriving from its localities: Localities' hazard mitigation plans provide (sometimes through implication) the ranking and prioritization of types of hazards that help dictate how their mitigation measures submitted to the Commonwealth for approval should be prioritized.

As more fully described in the *Mitigation Strategy* section of this plan, the prioritization of mitigation actions by the Commonwealth involves two (2) factors: 1.Whether or not the project protects critical facilities (determining whether the project is an "A-Project" vs. a "B-Project") and 2. from what priority of hazard *within a locality* the action protects (i.e. whether the locality deems the hazard "high-," "medium/moderate-," or "low-risk").

This accompanying element to the prioritization of mitigation measures using local plans' determination of risk from types of hazards serves as a direct link between the Commonwealth's hazard mitigation plan and the plans of its localities.

Linking II: Local Hazard Mitigation Plans Using the Commonwealth Mitigation Plan:

The Commonwealth of Kentucky's hazard mitigation plan has been and continues to be useful for its local hazard mitigation plans as:

- **It establishes constant structures and streams of communication and interaction between the various levels of government.** The content and goals of local hazard mitigation plans cannot deviate liberally from the content and goals of the Commonwealth's hazard mitigation plan. Thus, in planning and writing, a locality must constantly communicate with the Commonwealth and the Commonwealth must constantly communicate with the locality.

- **It serves as a template for local plan development.** Local hazard mitigation plans have and can take their narrative, formatting, and plan organizational cues from the Commonwealth's mitigation plan. Confusion or difficulty in addressing all of FEMA's concerns has been, and can be, partially alleviated by looking to the Commonwealth's hazard mitigation plan and how it has addressed FEMA's planning requirements.

- **It serves as a source for data and methodology.** Especially related to the work of CHR with past plans and with this current Commonwealth hazard mitigation plan, local plans have incorporated and will continue to incorporate the methodology for hazard identification and vulnerability assessment used in the Commonwealth plan. The data sources used in the Commonwealth's hazard mitigation plan have frequently guided local mitigation planners.

- **It serves as an information verifier.** A local hazard mitigation plan uses its own data and insights to identify hazards, assess vulnerability, and consider strategies for addressing said hazards. As alluded above, many times these sources are inspired by the sources used in the Commonwealth's plan. However, more often, the sources for both the Commonwealth's and for localities' plans simply derive from the same public data sources. Thus, the locality's use of the public data source (e.g. for identifying critical facilities) can be checked and verified with the Commonwealth's use of those same public sources.

- **It serves as context.** The Commonwealth hazard mitigation plan has provided, and will continue to provide, fundamental information about the process of hazard mitigation. It provides context for the localities by identifying and assessing Kentucky's hazards and vulnerabilities.

Linking III: Commonwealth Hazard Mitigation Plans Using Local Mitigation Plans

Local hazard mitigation plans have been, and continue to be, useful and necessary for the development of the Commonwealth's hazard mitigation plan as:

- **Local hazard mitigation plans provide and incentivize necessary aspects to the planning process.** The Commonwealth hazard mitigation plan cannot be written in a vacuum. In every step of the planning process, local jurisdictions and, subsequently, their mitigation plans, guide the Commonwealth planning process. Local plans provide insight into the hazard assessment and vulnerability process. Most importantly, local mitigation plans guide the selection of the Commonwealth's hazard mitigation strategy and its subsequent mitigation actions.

- **Local hazard mitigation plans serve as a source and guide for data.** The collection and use of data is not unidirectional. Local plans guide which data to collect and include in the Commonwealth hazard mitigation plan. For the future, the Commonwealth intends to influence the data relationship to be disproportionately skewed toward its local jurisdictions. Ideally, the Commonwealth's hazard mitigation plan should primarily rely on data collected by jurisdictions to substitute for and enhance public data typically used by both localities and the Commonwealth. With such an ideal, the Commonwealth's plan would rely far more on the local jurisdictions' mitigation plans.

- **Local hazard mitigation plans serve as context.** A considerable portion of the background context provided in the Commonwealth hazard mitigation plan derives, and is contributed, from local hazard mitigation plans. The State certainly does not guide the context that animates the Commonwealth hazard mitigation plans and the plans of its localities. The Commonwealth mitigation plan serves more as an aggregator of local insight and context. The local hazard mitigation plans serve a crucial role in animating the Commonwealth mitigation plan with its context.

- **Local hazard mitigation plans make hazard mitigation relevant for local government officials.** It is not the Commonwealth's hazard mitigation plan itself that spurs interest in mitigation planning at the local level. Rather, it is the local planning and local plan incorporation and relevance to the Commonwealth's plan that legitimizes hazard mitigation planning efforts of the Commonwealth.

COORDINATION OF LOCAL MITIGATION PLANNING

PART III: Prioritizing Local Assistance

A. Providing Criteria for Prioritizing Communities and Local Jurisdictions That Would Receive Planning and Project Grants Under Available Mitigation Funding Programs

REQUIREMENT §201.4 (C) (4) (III):

The Commonwealth of Kentucky must include criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive-loss properties, and most intense development pressures.

Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost-benefit review of proposed projects and their associated costs.

The prioritization process for planning and project grants under available mitigation funding programs is fully described in the *Mitigation Strategy* portion of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan.

It is implicit from the Commonwealth of Kentucky's prioritization approach how communities and local jurisdictions receive prioritization. The implicitness derives from the communities and local jurisdictions (through their hazard mitigation plans) very much driving and determining the prioritization process.

A summary, then, of the mitigation action prioritization process found in the *Mitigation Strategy* section of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan, discretely linking the *mitigation action* prioritization with the prioritization of *local jurisdictions and communities*:

First, there are, essentially three (3) separate categories of mitigation action:

1. Acquisition and Demolitions
2. Education Campaigns et al.
3. All Other Types of Mitigation Action

Regarding (1.), acquisitions and demolition projects are the *only* hazard mitigation projects that completely and fully and for all calculable time mitigate hazards. This is, of course, because once property has been acquired and demolished, no property and no one ever is in danger again from a hazard hitting that area. Nothing exists and no one lives, or works, on that property: Perfect mitigation. Acquisition and demolition projects, due to the abovementioned unique nature, are considered and prioritized separately from most other types of hazard mitigation action/project. Further, even amongst and across all project types, due to the "perfect mitigation" result from such projects, they likely are prioritized above any other project type.

Regarding (2.), educational campaigns et al. also are considered a separate project type category. This, like acquisition and demolition projects, results from their unique status as a mitigation project. The uniqueness, though, is of a far different nature than the uniqueness surrounding acquisition and demolition actions: They are "enduring[141]" projects. While important, they are of tertiary concern if proposed as a stand-alone project. This is due largely to the inability physically to count the results of such campaigns toward meeting goals of mitigation. Consequently, educational campaigns et al. are usually or can be supplements to other mitigation projects. Most generally and using cliché, including educational campaigns et al. in a comprehensive list of all types of mitigation actions would require comparing apples to oranges. An educational campaign simply cannot be compared to a drainage project using similar criteria.

Acquisition and demolition mitigation actions (1.) and educational campaigns et al. (2.), again due to their unique natures, can be prioritized solely relying upon Cost-Benefit Analysis. (This is described below.)

Regarding (3.), any other mitigation action that is NOT an acquisition and demolition or an educational campaign et al. is sub-categorized into one of two (2) project categories: *A-Projects* or *B-Projects*.

> *A-Projects* are all those relevant mitigation actions that protect critical facilities.
>
> *B-Projects* are those relevant mitigation actions that protect only populations.

It is assumed, of course, that all mitigation actions and projects protect populations. So, the prioritization difference reflects that those projects that also protect critical facilities receive de juris (not necessarily de facto) higher ranking than those that do not.

Within *A-Project* and *B-Project* categories, mitigation actions are further prioritized into ascending numerical categories:

> A1 refers to *A-Projects* that mitigate "low-risk" hazards;
> A2 refers to *A-Projects* that mitigate "medium/moderate-risk" hazards;
> A3 refers to *A-Projects* that mitigate "high-risk" hazards.

The same prioritization symbolism applies to *B-Projects*, i.e. B1, B2, B3.

It is this above sub-ranking criteria that provides for the prioritization of communities and local jurisdictions in receiving planning and project grants: Whether an *A-Project* or *B-Project* is ranked within each category as 1 (Low), 2 (Medium/Moderate), or 3 (High) is entirely dependent upon *how the local jurisdictions prioritized their susceptibility to hazard types* (through their local, multi-jurisdictional hazard mitigation plans). The Commonwealth of Kentucky (through Kentucky Emergency Management) is not deciding for its localities which hazard types affect them most prominently.

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[141] "Enduring" is a specifically-defined term here: They are projects with uncountable results, i.e., they should never be completed. See this plan's *Mitigation Strategy* section.

To illustrate that prioritizing planning and project grants according to how communities and local jurisdictions prioritize their vulnerability to hazard types is de facto prioritizing communities and local jurisdictions themselves, consider the following example:

Hickman County applies for mitigation grant funding for a project that would fortify a hospital in the county against earthquakes. Metcalfe County also applies for mitigation grant funding to build a tornado safe room to protect a population using a public park in the event of a tornado. Kenton County similarly applies for mitigation grant funding to build a tornado safe room to protect a population in similar circumstances to that described in Metcalfe County.

Now, Hickman County resides within the jurisdiction of the (Jackson) Purchase Area Development District (PADD) multi-jurisdictional hazard mitigation plan. According to this local plan and the subsequent stakeholders involved in Purchase Area planning, earthquakes are a (very) high-risk hazard for not only Hickman County but for all of the Jackson Purchase area. (After all, Hickman County is located within the New Madrid Seismic Zone). Further, the fictitious fortification project proposed by Hickman County above protects a hospital, which is fairly universally considered a “critical facility.”

Metcalfe County resides within the jurisdiction of the Barren River Area Development District (BRADD) multi-jurisdictional hazard mitigation plan. According to this local plan and the subsequent stakeholders involved in “Barren River Area” planning, tornadoes similarly rank “high” as a hazard risk.

Kenton County resides within the jurisdiction of the Northern Kentucky Area Development District (NKADD) multi-jurisdictional hazard mitigation plan. According to this local plan and the subsequent stakeholders involved in “Northern Kentucky Area” planning, tornadoes are ranked below flooding and the effects from winter storms.

According, then, to Kentucky Emergency Management (KYEM) (and, by proxy, the Commonwealth of Kentucky), these project submissions would be ranked accordingly:

- The fortification-against-earthquake mitigation project in Hickman County would be considered A3.
- The tornado safe room mitigation project in Metcalfe County would be considered B3.
- The tornado safe room mitigation project in Kenton County would be considered B2.

Therefore:

- Hickman County is considered A3.
- Metcalfe County is considered B3.
- Kenton County is considered B2.

The prioritization of planning and project grants using the prioritization of hazard-type vulnerability determined by local jurisdictions results in a prioritization of local jurisdictions themselves. Quod erat demonstrandum (QED).

B. ***Including (for Non-Planning Grants) the Consideration of Benefit Maximization According to Benefit-Cost Analysis Methodology***

Prioritizing local assistance using the mechanism described above and in the *Mitigation Strategy* section of this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan is thoroughly linked with the extent to which benefits are maximized according to a "cost-benefit" review of proposed projects (and their associated costs), i.e. Benefit-Cost Analysis (BCA).

BCA is directly responsible for the prioritization of those proposed projects labeled "acquisition and demolition" and "educational campaign et al." As aforementioned, these projects provide unique mitigation results that disallow their inclusion into a more systematic method of prioritization that occurs with all other mitigation project types. Thus, within a set of "acquisition and demolition" projects and within a set of "educational campaign et al." projects, BCA takes on heightened and more direct importance in prioritization. The extent of the benefits exceeding the costs of the project, on a project-by-project basis and regardless of location, has been determined the primary and fairest method of project prioritization of these two project types.

Amongst all other projects, the relevance of BCA (and the subsequent consideration of it) is more implicit (yet no less important): If projects are being categorized and prioritized by their ability to protect critical facilities and then further by whether they protect against what a locality has deemed its "high-" versus "medium/moderate-" versus "low-risk" hazards, then, in practice, they are also being categorized and prioritized by the extent to which the benefits of a project exceed its cost, i.e. the Benefit-Cost Ratio (BCR). Using the symbols described above and within the *Mitigation Strategy* section of this plan, an A3 project (protection of critical facilities and from a locality's highest risk hazard-type) will very likely correlate with a comparatively high BCR vis-à-vis a B1 project (no protection of critical facilities and protection from a locality's lowest-rank hazard-type).

However, there will likely be instances where prioritization is less obvious: Should an A1 project (protection of critical facility but from a locality's lowest-ranking hazard) be prioritized over a B3 project (no focus on critical facilities, but protection from a locality's highest-ranking hazard)? In such situations, an ex post facto BCA and subsequent comparison of the A1 project's BCR vis-à-vis the B3 project's BCR is obviously relevant. And in these instances, BCA (and the subsequent BCR) provide a more direct role in prioritization of projects similar to its role in the prioritization of "acquisition and demolition" and "educational campaign et al." projects.

C. *Including Considerations for Communities with the Highest Risk*

That the 2013 Update of the Commonwealth of Kentucky's hazard mitigation plan includes considerations for communities with the highest risk is implicit in its planning and project grant selection criteria and in the role of the Benefit-Cost Analysis (BCA):

If project grant prioritization is a function of whether or not grant funding intends to protect critical facilities within a jurisdiction and by what degree of hazard-type affects the local jurisdiction according to the local jurisdiction itself, then (partially at least) a de facto "highest-risk" consideration is a part of the prioritization calculus. Those project grants that protect the critical facilities of communities from what said communities feel are one of its highest-risk hazard types are project grants that simultaneously address the highest-risk communities.

The further reliance of Benefit-Cost Analysis acts as a check that "high-risk" communities consistently are being considered: The highest risk communities likely will provide benefits that exceed the costs of planning or of a project that addresses the hazard mitigation needs of those communities. This is especially so if benefits address difficult-to-quantify benefits such as "social vulnerability."

Further consideration for the highest-risk communities naturally result from the Commonwealth of Kentucky's role and ultimate mitigation goal of facilitating and coordinating the mitigation needs of its communities: Previously discussed was the role of *deductive planning*. Simplifying, *deductive planning* refers to the ability of Kentucky Emergency Management (KYEM) et al. to enhance the planning and project grant application capabilities of local jurisdictions by presenting them a wider array of mitigation options to consider in future planning and project considerations. This *deductive planning* implies a consideration for Kentucky's highest-risk communities as such communities would naturally be the focus of such administrative efforts. This is especially so if there are high-risk communities that do not have a very deep history in pursuing hazard mitigation activities.

D. ***Considering Repetitive-Loss Properties***

The same logic that implies consideration for Kentucky’s highest-risk communities largely applies to Kentucky’s consideration of those areas with repetitive-loss properties.

Benefit-Cost Analysis should aid considerably in consideration of areas with repetitive-loss properties: By definition, a property (or set of properties) that experiences losses repeatedly through a given span of time will provide benefits that considerably exceed the cost of mitigating these repeated losses.

Again, as in the case with Kentucky’s highest-risk communities, the *deductive planning* efforts of Kentucky Emergency Management (KYEM), the University of Kentucky Martin School of Public Policy and Administration’s Hazard Mitigation Grants Program (UK-HMGP), and the University of Louisville’s Center for Hazards Research and Policy Development (CHR) naturally will focus on those communities that have properties that suffer from repetitive losses.

The difference between Kentucky’s considerations of its highest-risk communities and its consideration of communities’ repetitive-loss properties lies in the practice of prioritization of project grants that would inevitably occur: Repetitive-loss properties are most commonly addressed through acquisition and demolition project grants. As previously discussed earlier in this section and in the *Mitigation Strategy* section of this plan, acquisition and demolition projects are not prioritized in the same way and with other types of mitigation projects due to the unique nature of acquisition and demolition projects. Consequently, the system that would apply to most other mitigation activity-types (i.e. the prioritization of project grants into *A-Projects* and *B-Projects* with sub-prioritization by degree of vulnerability from hazard types per definition of individual jurisdictions) does not apply to acquisition and demolition projects.

Acquisition and demolition project grants are considered separately and are prioritized on a case-by-case basis relying heavily on Benefit-Cost Analysis. That said, in practice prioritization naturally will favor project grants that address repetitive-loss properties due to the likelihood of benefits considerably exceeding the costs of acquiring/demolishing the properties, due to the self-selection that occurs whereby most acquisition/demolition project grant applications will consist of repetitive-loss properties, and due to common sense.

E. *Considering Communities with the Most Intense Development Pressures*

Regarding the consideration of communities applying for grant funding for mitigation activities and projects that have intense development pressures, a heavy reliance upon Kentucky Emergency Management (KYEM) and its university affiliates' role in *deductive planning* will be necessary.

In terms of the ability to apply for grant funding to pursue necessary mitigation activity in Kentucky jurisdictions that experience intense development pressures, the difficulty mainly concerns that grant funding is distributed through reimbursement rather than upfront. Communities with intense development pressures will have difficulty contributing the upfront capital necessary to pursue mitigation activity that would later be (partially) reimbursed.

Generally, technical assistance regarding the financial pressures that communities with intense development pressures face in having to pay for a mitigation project upfront that will later be reimbursed derives mainly from the individual project management relationship that KYEM and the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) administration promotes.

While individual communities themselves apply for mitigation project grant funding, once a mitigation project has been selected it is assigned a project manager from either KYEM or UK-HMGP. This means that any mitigation project is administered by at least two (2) individuals: The community's project manager (who becomes the "sub-applicant") and KYEM/UK-HMGP's project grant manager (who becomes the "applicant').

A primary function of the "applicant" (i.e. the KYEM/UK-HMGP project grant manager) is to educate and assist the "sub-applicant" in timely reimbursement of the funds the "sub-applicant" has provided upfront in pursuing a mitigation project. Such assistance includes: educating constantly about and providing the necessary internal documentation that a "sub-applicant" would use in order to request reimbursement for a project, ensuring that all documentation necessary to justify reimbursement is collected, organizing and enhancing requests for reimbursement, setting up accounts into which reimbursed funds will be placed, and ensuring that all accounting is correct and that the "sub-applicant" receives the proper amount of reimbursement. A related and arguably more important function for the KYEM/UK-HMGP "applicant" regarding communities with intense development pressures is the identification of "cost-matches" or "cost-shares" within communities. The "cost-match"/"cost-share" not only generally identifies assets necessary for the pursuance of a mitigation project, but also provides a means by which a community experiencing intense development pressure can place upfront valuable assets that act as capital toward which reimbursement can be justified. Kentucky's Department of Local Government (DLG) also plays an important role in the identification of these "cost-match"/"cost-shares."

Beyond the abovementioned general customer service provided by KYEM and UK-HMGP – which generally aids communities experiencing the most intense development pressures, there are three practices that specifically consider these communities:

The first was mentioned above when discussing the Commonwealth's prioritization system: Beyond classifying mitigation projects into whether or not they address critical facilities followed by sub-categorizing potential projects by which hazards from which the project is intended to protect, the Commonwealth also relies upon Benefit-Cost Analysis (BCA) and the qualitative judgment of the Kentucky Hazard Mitigation Council (KYMC). The KYMC will take into consideration the whether or not a community applying for mitigation projects suffers from intense development pressure.

The second practice involves KYEM and UK-HMGP's outreach to local community banks. KYEM and UK-HMGP have been successful in many instances in securing lines of credit from local banks so that communities with intense development pressures can implement much-needed mitigation projects with upfront capital.

The final practice results from the Commonwealth's (and KYEM's) system for reimbursing the cost of mitigation projects. Earlier, this section acknowledged that the difficulty for Kentucky communities experiencing intense development pressures mainly revolves around the need for capital upfront in order to pay for mitigation projects that will later be (partially) reimbursed by FEMA (through the Commonwealth) and (partially) by the Commonwealth itself. FEMA partially reimburses 75% of the cost of an approved mitigation project. Kentucky contributes a further 12% toward the reimbursement of that approved project. A community, thusly, will receive 87% of its costs reimbursed for an approved mitigation project. (The community contributes 13% to the costs of an approved mitigation project.)

The system of reimbursement implemented by the Commonwealth and KYEM, however, can be used to address the needs of communities in need of upfront capital (due to intense development pressures): The Commonwealth of Kentucky and KYEM simply reimburse 87% of any approved invoice. This straightforward, proportional reimbursement system allows communities with intense development pressures to invoice for their 13% contribution to an approved project upfront. This is especially helpful if a significant portion of a community's 13% contribution to the costs of a project derives from "in-kind" payment or from "local matches[142]." Essentially, using a proportional reimbursement system allows a community with intense development pressure invoice for the identified "in-kind"/"local match" upfront and receives 87% of that invoice reimbursed. This acts as capital upfront that can be used to begin work on a mitigation project. So, for example, say that City Z uses city labor to implement a project. That labor is "in-kind" contribution: The city already is paying its labor out of (likely) operating budgets. The labor counts as the 13% required that the city pays for its approved mitigation project. Thus, City Z can invoice for the budgeted (in the project application) labor upfront and receive 87% of that invoice reimbursed. This 87% is capital to be used to purchase the materials, equipment, etc. necessary to implement a mitigation project.

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[142] Again, remember that KYEM, UK-HMGP, DLG, etc. aid communities in identifying "local matches" and "in-kind" contributions that can be used toward the communities' 13% contribution to an approved mitigation project.

PLAN MAINTENANCE

PART I:
Monitoring, Evaluating, and Updating the Plan

REQUIREMENT §201.4(C) (5) (I):

Commonwealth of Kentucky must include an established method and schedule for monitoring, evaluating, and updating the plan.

A. *Describing the Method and Schedule for Monitoring the Commonwealth of Kentucky's Hazard Mitigation Plan*

In its administrative role as facilitator and coordinator, it will be the primary responsibility of Kentucky Emergency Management (KYEM) and its agents, the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) and the University of Louisville's Center for Hazards Research and Policy Development (CHR), to monitor the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan.

Within KYEM, its staff and administrators and the Kentucky Mitigation Council (KYMC) (whose membership overlaps with the staff and administration of KYEM) will drive the monitoring process for the 2013 update of the Commonwealth's hazard mitigation plan. The monitoring process will incorporate three (3) methods:

1) Frequent reporting requirements
2) Local outreach
3) Community Hazard Assessment Mitigation Planning System (CHAMPS)

Frequent Reporting Requirements

KYEM is responsible for the implementation of FEMA's quarterly reporting requirement. This effective mitigation project monitoring tool gives KYEM legitimacy and authority in mandating that localities and local project managers (sub-applications) formally report on the status of their mitigation projects four (4) times a year. While KYEM cannot force reporting from local jurisdiction, as it has not express authority to do so: Federalism prevents formal authority; KYEM, however as an agency of the Commonwealth of Kentucky and the grantee of the federal funding, is responsible for the monitoring of subgrantee activities to ensure program compliance.

Kentucky law disallowing access to FEMA's funds without bilateral contracting also invokes informal authority as the contract language requires that subgrantees comply with the federal code (44 CFR) which defines mitigation program requirements – including quarterly reporting. KYEM does withhold funds from localities whose local project managers do not submit regular quarterly reports. While it is not KYEM's money to withhold, it is KYEM's responsibility to only distribute funds when program compliance is apparent. The contacting process maintains the status of the money as being FEMA's money (rather than KYEM's money) that is accessible for disbursement by KYEM.

Federalism technically prevents FEMA from explicitly mandating reporting and monitoring requirements; it lacks that formal authority. However, FEMA does provide compelling informal authority in that it is money that is funding the projects and applications that require monitoring-via-reporting. Thus, KYEM and its staff, administrators, and the KYMC monitor the status of the Commonwealth of Kentucky's hazard mitigation plan via the Commonwealth's projects and applications intended to mitigation hazards by using federal regulations as a means to compel quarterly reporting from Kentucky's localities and local project managers.

KYEM does, however, have legitimacy and authority over its staff. This authority is both formal and informal: An administrative hierarchy within the agency established formal authority; paychecks, promotions, and various other sticks and carrots establish informal authority. It is KYEM staff (in KYEM's role as facilitator and coordinator) that manages the project files and oversees the individual projects applied for and implemented by localities and local project managers. KYEM and the agencies comprising the non-overlapping parts of the KYMC can compel its staff to frequently report on the status of the projects it oversees. This includes mandating reporting from UK-HMGP and CHR, who also oversee projects (UK-HMGP) or directly provide technical assistance to individual hazards mitigation projects (CHR). Such monitoring occurs at the request of KYEM and the KYMC, and is recorded in various formats.

One oft-used format for monitoring is the KYEM "Project Tracker," which is an interactive spreadsheet into which the staff of KYEM, of UK-HMGP, and of CHR (where relevant) must keep current the status of all open mitigation projects and applications. Screenshots from the "Project Tracker" is provided in ***Appendix 6-1***. It is updated regularly, i.e. according to an as-needed schedule. Such documentation of mitigation measures is described below.

Related solely to planning, frequent reporting compelled from within KYEM (and UK-HMGP) also includes the "Statewide Time-Resource" form (***Appendix 6-2***) and "Trip Report" form (***Appendix 6-3***).

Both forms are related to local outreach (described below): They both compel documentation of local outreach. Further, both forms are related to each other so as to act as a system redundancy. The former ("Statewide Time-Resource") documents the *otherwise unaccounted for*[143] time spent on mitigation activities of those involved in mitigation besides KYEM (and UK-HMGP and CHR) staff and administration. The latter ("Trip Reports") document the time spent on local outreach for mitigation activity *by* KYEM (and UK-HMGP and CHR) staff and administration.

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[143] Those participating in mitigation activity besides KYEM et al. staff (e.g. Sub-Applicants, locality representatives attending training, etc.) do regularly document time spent on said mitigation activity. When such documentation is not required or has been neglected, the "Statewide Time-Resource" form accounts (or can account) for *otherwise unaccounted for* time spent by mitigation activity participants on mitigation.

Local Outreach

De facto monitoring of the plan and of the projects and actions and applications that are integral to implementing the Commonwealth's plan occurs with KYEM, UK-HMGP, and CHR's outreach to localities, which beyond quotidian outreach includes: Deductive Planning and Geographic Specialization.

Deductive Planning

The stakeholder meetings described in the Planning Process section of this 2013 update of the Commonwealth's hazard mitigation plan are designed to be implemented regularly throughout the planning process. The continued scheduling and implementation of the stakeholder meetings will be the primary systematized vehicle for *deductive planning*. As addressed in the Mitigation Strategy section, even though KYEM's main administrative theme consists of the "bottom-up" (*inductive planning*) coordinating of localities' needs, there still is a need for KYEM and its coordinating agencies (UK-HMGP and CHR) to provide guidance that facilitates better planning and eventual mitigation action management from "the top down," so to speak. In practice, this means that while KYEM ultimately will be directing its administration toward the mitigation concerns of its localities, KYEM *can offer* the localities an increased array of mitigation options and considerations that localities could then use in their mitigation planning calculus. Presenting this "increased array of mitigation options and considerations," or, in other words, adding mitigation options and considerations to those conceived by the localities ensures that statewide mitigation administration goals are addressed and that the terms of the Commonwealth's plan are monitored.

Local outreach and deductive planning, of course, also considers outreach to the Commonwealth's executive agencies. Better ensuring that KYEM meets its overarching administrative goal of facilitation and coordination of mitigation actions implies working in partnership with other Kentucky agencies that have a stake in mitigation planning.

REMEMBER:

DEDUCTIVE PLANNING:

Like "deductive reasoning": Devising the general plan first and using the general plan to implement its components downward toward those for whom the plan was devised; the "centrally-administered" interpretation of planning.

INDUCTIVE PLANNING:

Like "inductive reasoning": The general plan forms from the aggregation of the planning resulting from whom the general plan is devised; the "ideal" interpretation of planning.

Such local outreach and de facto plan monitoring would most concretely occur through the *Public Good-Type project*. If the theme of a Commonwealth-wide mitigation plan is administration, then seeking and applying for resources to conduct studies and general research, develop more accurate and more efficient methodology, and collect better natural hazard data does also simultaneously involve monitoring the Commonwealth's hazard mitigation plan. Such initiatives would be implemented through Kentucky's agencies that have a stake in mitigation planning. Examples of such initiatives have been provided in discussing the Commonwealth's administrative hazard mitigation goals. Kentucky's Department of Water (KDOW) and Division of Forestry (KDF) have provided appendices (***Appendices 4-3*** and ***4-2***), respectively to this 2013 update of the Commonwealth hazard mitigation plan that convey success with past initiatives and thus provide evidence and guidance toward effective plan monitoring through local outreach.

The link, then, between outreach to Kentucky's state governmental agencies and outreach to localities involves this concept of *deductive planning*. If KYEM et al. can offer its localities a wider and more varied array of mitigation options, some of those options will derive from the work (via Public Good-Type project, for example) of Kentucky's agencies who have a stake in mitigation.

REMEMBER:

PUBLIC GOODS-TYPE PROJECT:

A mitigation action or objective devised by an administrative body. Its importance here is to differentiate between "mitigation" actions, objectives, and initiatives.

These are actions taken by an administrative body for the sake of better facilitating and coordinating the actions of the entities over which the administrative body is responsible. Such initiatives are animated by a "public good" motivation: These are actions or objectives that would benefit all and subsequently are not expected to be pursued by any one entity.

Finally, deductive planning not only involves KYEM et al. offering localities a larger, more varied array of mitigation options and not only partners with other Kentucky agencies to produce some of those options to be provided. Deductive planning and local outreach can also be directed specifically toward localities' individual (multi-jurisdictional) hazard mitigation plans.

All mitigation plans, whether local plans or statewide, share the needs of monitoring, evaluating, and updating. Thus far, KYEM and FEMA have been presented with a wide variety of mechanisms to monitor and evaluate plans that have been developed by, in Kentucky's case, the Area Development Districts (ADDs) responsible for planning for multiple jurisdictions within their respective regions. However, such monitoring and evaluating mechanisms are typically region-specific: For example, committee structures responsible for monitoring and evaluating their local multi-jurisdictional mitigation plans vary considerably in terms of how they are organized, how often they meet, how much power they possess, etc. Region specificity (i.e. lack of generalizability) also results because many monitoring and evaluating mechanisms, while systemized, are informal.

For a statewide hazard mitigation plan with an emphasis is on its localities, monitoring the Commonwealth's plan would involve helping the localities monitor their multi-jurisdictional plans. If "deductive planning" means offering a larger, more varied array of mitigation options from which localities could consider, then one of those "options" includes offering localities mechanisms toward monitoring and evaluating their local mitigation plans. Such provision would also accomplish the abovementioned "frequent reporting" element that is involved in successful monitoring and evaluation of the Commonwealth's hazard mitigation plan.

In fact, the Commonwealth has already implemented some systematizing of local plan monitoring and evaluation through the contracts that the University of Louisville's Center for Hazards Research and Policy Development (CHR) make with local jurisdictions to administer their local plan processes. Granted, as of the writing and submittal of this 2013 update of the Commonwealth hazard mitigation plan, CHR has not developed specific *multi-jurisdictional* plan monitoring and evaluating mechanisms, it has provided some initial insight regarding what monitoring and evaluating options KYEM and UK-HMGP can offer to the Commonwealth of Kentucky's localities that would aid in KYEM's goal of facilitation and coordination of mitigation planning.

KYEM has included in this 2013 update of the Commonwealth's hazard mitigation plan a sample *local* plan monitoring tool (***Appendix 6-4***) that will be refined to be provided to the Commonwealth's localities through outreach and that might, at the very least, universalize a plan monitoring and evaluating process for the localities. Such documentation allows localities to keep track of existing and new projects and provides a formal outlet for proposing plan amendments to both this statewide hazard mitigation plan and to local plans. Again, better and more efficient local plan monitoring and evaluating implies monitoring and evaluating the Commonwealth's hazard mitigation plan, as well.

Geographic Specialization

The Commonwealth of Kentucky's hazard mitigation plan will also be monitored through the KYEM and UK-HMGP organization of its staff toward geographic specialization. Such specialization is more relevant for monitoring the progress of mitigation activities (discussed below); but, in a system where local and regional needs direct the administration of KYEM and thusly underlie the Commonwealth's hazard mitigation plan, effective mitigation *activity* monitoring implies effective mitigation *plan* monitoring. Briefly, the point is individual KYEM and UK-HMGP staff members are responsible for and specialize in specific regions of Kentucky.

The regions of Kentucky (as specified previously and throughout) are organized via Area Development Districts (ADDs). Thus, individual KYEM and UK-HMGP staff specialize in the mitigation activity that derives from their assigned ADDs. This implies the monitoring efficiency that results from "unity in the executive": If the facilitation and coordination goals of KYEM (and the Commonwealth) is lacking within an area of Kentucky, one individual is responsible and accountable to that area. Conversely, specialists for assigned regions are better able to collect, address, and articulate the mitigation needs of their regions. Such a feedback loop assures that the goal of the Commonwealth of Kentucky’s mitigation plan is monitored and that the progress of mitigation activities is monitored.

Community Hazard Assessment Mitigation Planning System (CHAMPS)

Monitoring of the 2013 update of the Commonwealth of Kentucky’s hazard mitigation plan occurs through its ever-evolving Community Hazard Assessment Mitigation Planning System (CHAMPS). The CHAMP System was the primary mechanism for plan and project monitoring and evaluation described in the 2010 update of the Commonwealth’s hazard mitigation plan. Thus, the CHAMP System’s current role will be discussed more fully when discussing updates from 2010 to 2013.

However, the point to be made here is that KYEM’s CHAMP System is functional, has already aided in plan monitoring (via project monitoring), and is currently able (and thus being implemented at the time of this writing) to monitor and evaluate the Commonwealth hazard mitigation plan in similar fashion to the mechanisms aforementioned.

Specifically, the CHAMP System contains a “Planning Module,” which uses the FEMA Mitigation Plan Review Tool (formerly “the Crosswalk”) as the programming basis by which to present to localities the ability to build local and regional hazard mitigation plans. The “Planning Module” guides planners and plan-writers through the hazard mitigation planning process. Once entered into the CHAMP System, CHAMPS provides a tool for Kentucky’s review of any local hazard mitigation plan before it is sent to FEMA for its review. The “Planning Module” is functional currently and does at the time of this writing contain the outlines of the15 Kentucky Area Development District (ADD) multi-jurisdictional hazard mitigation plans. Thus, as it becomes increasingly functional, allows statewide, systematized, and constant monitoring of local hazard mitigation plans which, in turn, implies systematized and constant monitoring of the Commonwealth of Kentucky’s hazard mitigation plan.

Beyond the “Planning Module” and in its most current implementable form and related solely to planning, CHAMPS allows the:

- Reporting of damage amounts, the identification and number of affected communities, and hazard types for specific incidents and disasters
- Reporting of threshold information for counties during and after a disaster;
- Standardization of guidance to assist in the development and maintenance of hazard mitigation plans

Finally, CHAMPS’ primary efficiency enhancement and applicability involves its use as a statewide monitor of mitigation action and project activity. The purpose for a “Planning Module” within CHAMPS is necessary, but secondary to the goal of CHAMPS: Locality hazard mitigation plans serve as the foundation for mitigation actions for which CHAMPS primary utility is designed. At the time of this writing, CHAMPS houses more than 600 such mitigation actions, all ultimately deriving from localities’ most current hazard mitigation plans. Thus, locality plan monitoring is performed on behalf of individual mitigation action monitoring which results in the monitoring the Commonwealth of Kentucky's hazard mitigation plan.

B. *Describing the Method and Schedule for Evaluating the Commonwealth of Kentucky's Hazard Mitigation Plan*

The mechanisms for evaluation of the 2013 update of the Commonwealth of Kentucky's hazard mitigation plan mirror the mechanisms for monitoring. The concepts, of course, are linked: Effective monitoring should yield effective evaluation.

KYEM (and the KYMC within), UK-HMGP, and CHR all will be primarily responsible for evaluating the Commonwealth's hazard mitigation plan. Evaluation will involve the same mechanisms as described above: Frequent reporting (to be further elaborated upon in the Enhanced Section of this plan), local outreach, and the CHAMP System. Beyond those necessary administrative reporting requirements (i.e. quarterly reports) and the quarterly KYMC meetings, there is no set schedule for the decentralized evaluation implied through such mechanisms. The schedule would be described vaguely as "regularly." The intent is that KYEM and its coordinating agencies are flexible and responsive to local needs. Localities suffer the effects of hazards, not KYEM or the Commonwealth of Kentucky as an abstract entity. KYEM's dynamism in locality and agency outreach and its implementation of a system (CHAMPS) that will compile the segmented mitigation strategies, actions, and needs deriving from each locality heretofore mutually exclusively implies a constant monitoring and evaluation of KYEM's and the Commonwealth of Kentucky's mitigation goals.

The grand idea is that, per the theme of this mitigation plan update, by localities maintaining their own mitigation plans (through their own mechanisms and through CHAMPS), by relevant Kentucky agencies continuing to improve mitigation activity either individually or through initiatives partnered with KYEM and FEMA, and by KYEM and its coordinating arms (UK-HMGP and CHR) taking full advantage of those limited areas where they have a locus of control (i.e. requiring reporting from its staff and in reaching out to localities to present them with fuller mitigation options and tools), the Commonwealth of Kentucky will be effectively monitoring its mitigation plan with effective and efficient facilitation of the needs of the localities comprising the Commonwealth. The constant feedback that such a system produces and documents provides evaluation of the Commonwealth's mitigation plan, which is, in function, an administrative plan. Alternatively stated, the Commonwealth of Kentucky's hazard mitigation plan is, in essence, little more than an administrative plan directed to aid the localities that suffer from the natural hazards produced within the state. Evaluation, then, is conducted through the localities successfully implementing their mitigation strategies and being provided access to the fullest set of mitigation options and tools for future strategizing against the harmful effects of hazards.

C. *Describing the Method and Schedule for Updating the Commonwealth of Kentucky's Hazard Mitigation Plan*

Despite the decentralized nature necessary of the monitoring and evaluation process, the updating process that comprises the interval of time between this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan and its next iteration is concrete and centralized.

Kentucky Emergency Management (KYEM) will be responsible for any updates to this statewide hazard mitigation plan.

The need for updates (namely amendments) partially will be derived from the usage of the Commonwealth Hazard Assessment and Mitigation Planning System (CHAMPS) as it will facilitate constant monitoring and evaluating of localities' mitigation activities. Through the use of CHMAPS, plans become living documents rather than static thoughts.

However, KYEM also houses the Kentucky Mitigation Council (KYMC), which meets quarterly and after every disaster declaration. The KYMC Council is comprised of KYEM, UK-HMGP, and CHR administration and staff and representatives from many Kentucky state agencies, e.g. the Department of Local Governments (DLG), the Department of Water (KDOW), and the Department of Health. The quarterly meetings of this Council explicitly will address and approve proposed updates and amendments to the Commonwealth of Kentucky's hazard mitigation plan that occur in between the approval of this 2013 update of Kentucky's hazard mitigation plan and the approval of the Kentucky's next iteration.

Addressing what would be either the 2016 or 2018 update to the Commonwealth of Kentucky's hazard mitigation plan. Again, the primary responsibility belongs to KYEM. Related to the abovementioned discussions of local outreach and "deductive planning," KYEM (with its partnering agencies UK-HMGP and CHR) will continue to conduct and document "stakeholder meetings" and trainings that all comprise the overall planning process that would be documented in the 2016 or 2018 iteration of Kentucky's hazard mitigation plan.

Depending upon whether or not the future update of the Commonwealth of Kentucky's hazard mitigation plan (HMP) will be required in 2016 or 2018, the following very general timeline/schedule is presented:

If Commonwealth Hazard Mitigation Plan is Due October 2016:	
KYMC Quarterly Overview/Assessment	Each quarterly meeting in 2014
Task:	Beginning:
KYMC Detailed Section Reviews	2015
Planning Process and Coordination of Local Plans	January 2015
Mitigation Strategy and Severe Repetitive Loss Strategy	April 2015
Risk Assessment	July 2015
Introduction and Plan Maintenance	October 2015
Stakeholder Meetings	October 2015
Development	October 2015
Drafting new plan	March 2016
Editing drafted plan	July 2016
Submission of the updated plan	October 2016

If Commonwealth Hazard Mitigation Plan is Due October 2019:	
KYMC Quarterly Overview/Assessment	Each quarterly meeting in 2017
Task:	Beginning:
KYMC Detailed Section Reviews	2018
Planning Process and Coordination of Local Plans	January 2018
Mitigation Strategy and Severe Repetitive Loss Strategy	April 2018
Risk Assessment	July 2018
Introduction and Plan Maintenance	October 2018
Stakeholder Meetings	October 2018
Development	October 2018
Drafting new plan	March 2019
Editing drafted plan	July 2019
Submission of the updated plan	October 2019

D. *Including an Analysis of Whether the Previously Approved Plan's Method and Schedule Worked, and Describing Which Elements or Processes Were Changed, If Applicable*

The Commonwealth of Kentucky's previous hazard mitigation plan update (2010[144]) (henceforth referred to as "2010 Update") focused almost exclusively upon the Community Hazards Assessment and Mitigation Planning System (CHAMPS) role in monitoring, evaluating, and updating that iteration of Kentucky's hazard mitigation plan. The format of the "Plan Maintenance" section in the 2010 Update traced the proposed monitoring, evaluating, and updating activities of CHAMPS across all areas of the planning process. For example, CHAMPS would monitor and evaluate coordination of local mitigation planning by providing "locals with the opportunity to search data, apply for grants, and to update their plans. The CHAMPS database structure was developed to create a synergized flow between local mitigation plans and state mitigation plans [2010, p. 263]."

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[144] Kentucky Emergency Management (KYEM). [2010]. *Kentucky State Hazard Mitigation Plan: 2010 Edition*. Louisville and Frankfort, KY: Kentucky Emergency Management.

The following table summarizes the Plan Maintenance strategy of the 2010 Update that used CHAMPS as the fulcrum upon which all of plan maintenance turned:

Section to Be Monitored	*Primacy of CHAMPS in 2010*
Planning Process	• CHAMPS would record individual hazard mitigation plans. • CHAMPS would record ("capture") and track the individuals responsible for monitoring their pre-assigned portions of the Commonwealth of Kentucky's hazard mitigation plan. • CHAMPS would keep a database where coordination between agencies and individuals was similarly tracked and, thusly, kept current. • CHAMPS would link stakeholders et al. to the most current hazard mitigation planning programs and products. • Users of CHAMPS could update their plans in real-time as process changes and updates occurred.
Risk Assessment	• CHAMPS would capture real-time hazard occurrence and loss data. • CHAMPS would capture the data needed to produce more inclusive Benefit-Cost Analyses (BCAs). • CHAMPS would capture exposure data that would improve hazard vulnerability assessments and loss estimations. • Implicit in the capture of much-improved data is better, more efficient monitoring and evaluation.
Mitigation Strategy	• CHAMPS would house multiple database tables that planning stakeholders et al. would be able to populate with updated mitigation strategies, objectives, and actions in real time. If local-level planners are constantly updating their mitigation strategies, then the Commonwealth of Kentucky can constantly review and integrate localities' strategies into its own, thus monitoring state strategies. • CHAMPS would introduce the Mitigation Action Form (MAF), which is essentially the form by which those applying for mitigation action and projects formally request review by KYEM before being submitted to FEMA for approval. MAFs imply a constant source of mitigation action that helps the Commonwealth of Kentucky monitor its mitigation actions. • CHAMPS would keep a database of state capabilities that, again, would and could be updated in real time. • CHAMPS could track avoided losses.
Coordination of Local Mitigation Planning	• The primary advantage of and motive for CHAMPS: With all of the abovementioned real-time data collection and database management, local jurisdictions would have more input into state planning activities and more ability to dynamically plan for themselves.
Plan Maintenance	• CHAMPS would offer a comprehensive planning system.

(For reference and further elaboration, the full Plan Maintenance portion of the 2010 Update has been provided as an appendix to this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan. It is ***Appendix 6-5***.)

While during the writing of the 2010 Update, CHAMPS was relatively new in terms of implementation (thus the reliance upon the future tense for verbiage in the 2010 Update in describing CHAMPS' intended role), by the time of this writing, much of CHAMPS has become fully implementable and focus regarding the system has evolved toward improving functionality and implementation and expanding the system's scope. Such improvement and expansion is identified through "versions" of the CHAMP System. Training throughout Kentucky in CHAMPS has been concluded successfully for Version 1.0, and training generally has been implemented across Kentucky regarding CHAMPS Version 2.0. ***Appendix 6-6*** provides a full report on CHAMPS' Version 1 training.

The point is that much of the proposed use of CHAMPS in terms of monitoring, evaluating, and updating Kentucky's hazard mitigation plans that was articulated in the 2010 Update has been implemented, even if in a limited sense that will become more functional and more usable in increasing "versions" of the CHAMP System.

The 2010 Update's approved method, schedule, and processes for monitoring, evaluating, and updating Kentucky's hazard mitigation plans, then, has worked. Even if some of the functions of CHAMPS are limited, localities trained in the system can use it in the methods described in the 2010 Update. CHAMPS is functional for monitoring, evaluating, and updating hazard mitigation plans.

However, changes to the method, schedule, and processes involved in monitoring, evaluating, and updating Kentucky's hazard mitigation plans have been made in planning and writing this 2013 update of the Commonwealth of Kentucky's hazard mitigation plan that are more general, more organizational than those specified to CHAMPS.

As described above, CHAMPS is not the sole system by which plan monitoring, evaluation, and updating will occur. CHAMPS is an important system and it is making and will make monitoring, evaluating, and updating more efficient and more transparent for localities and the Commonwealth. But, in articulating the focus that statewide hazard mitigation is largely an administrative function where the Commonwealth of Kentucky (through its executive agencies and relevant coordinating organizations) simply aims to facilitate and coordinate hazard mitigation activities for the localities that experience the hazards, it is necessary to include and to articulate that bureaucratic systems (i.e. the successful administration of agencies involved in hazard mitigation) primarily ensure monitoring, evaluation, and updating of hazard mitigation plans and subsequent mitigation activities. Again, as abovementioned, such monitoring et al. mechanisms rely upon frequent reporting requirements (both formal and informal) and the quotidian actions of project grant and planning grant managers, i.e., the results of local outreach (which keep project grant/planning grant managers apprised and updated of mitigation plan compliance and mitigation activity), the increase of mitigation options that results from “deductive planning,” and geographic specialization of staff (i.e., one person has responsibility as an expert in all mitigation activity for a region).

CHAMPS certainly better facilitates such quotidian activities, but people (agency employees, local mitigation managers, stakeholders, and individuals affected by hazards) comprise the primary mechanism for monitoring, evaluation, and improvements necessary for updates.

PLAN MAINTENANCE

PART II:
Monitoring the Progress of Mitigation Activities

REQUIREMENT §201.4 (C)(5)(II):

The Commonwealth of Kentucky must include a system for monitoring implementation of mitigation measures and project closeouts.

A. Describing How Mitigation Measures and Project Closeouts Will Be Monitored

Monitoring mitigation measures and project closeouts are obviously connected to the monitoring of the Commonwealth of Kentucky's hazard mitigation plan as a whole. A state's hazard mitigation plan can only formulate and describe administrative capacity. Such a statewide effort can only plan for and describe *how* it will facilitate the needs of the localities that comprise the actual state. Its goals can only be administrative goals; its actions are limited to the actions of the localities comprising the state. Thus, if mitigation actions and projects are the primary method for a locality to protect itself from future hazards, then the state properly monitoring and evaluating those actions implies that the state is properly monitoring and evaluating its hazard mitigation plan.

Consequently, the previous discussion of monitoring the Commonwealth of Kentucky's hazard mitigation plan applies here: Frequent reporting, local outreach through "deductive planning" and geographic specialization, and Kentucky's CHAMP System all are the primary mechanisms by which localities' mitigation actions and projects will be monitored.

To be sufficiently thorough, the mitigation measure monitoring through frequent reporting, local outreach, and CHAMPS will occur as follows:

Frequent Reporting Requirements:

Frequent reporting (whether through formal vehicles such as Quarterly Reports or through informal vehicles such as KYEM staff member accountability to a specific geographic area along with the internal document referred to as the "Project Tracker") is, by definition, about mitigation measure/project management. KYEM, UK-HMGP, CHR, KYMC, FEMA et al. all request and require and submit themselves to reporting about mitigation measures. This was the connection between frequent reporting and monitoring of the Commonwealth of Kentucky's plan itself: The argument is conveyed that monitoring mitigation measures *is* monitoring the Commonwealth's hazard mitigation plan.

The following list specific reports that KYEM uses to monitor mitigation measure and project closeout activity:

1) FEMA's Quarterly Report requirement
2) KYEM "Project Tracker" (***Appendix 6-1***)
3) KYEM "Individual Project Progress Report" (***Appendix 6-7***)
4) Period of Performance Extension Deadline Reminders (***Appendix 6-8*** and ***Appendix 6-9***)
5) Final Invoice Reminder (***Appendix 6-10***)
6) Periodic Site Visits

The FEMA Quarterly Report

The FEMA Quarterly Report monitors mitigation measures and project closeouts through its being the single mechanism that can formally compel localities to report about the status of their projects (as discussed previously). The FEMA Quarterly Report compels individual local project managers ("sub-applicants") to report how much money has been spent toward a project in a given quarter, to specify the progress made on such a project, to project future progress toward the next quarter, and to consider project closeout dates.

KYEM "Project Tracker"

Kentucky Emergency Management's (KYEM's) "Project Tracker" is an internal document centrally held and administered by the State Hazard Mitigation Officer (SHMO). Using formal power within the agency, the SHMO is able to compel KYEM (and UK-HMGP) staff to report on the status of projects over which they manage. The "Project Tracker" is interactive and is updated regularly.

TERMINOLOGY:

PROJECT MANAGER
VS.
SUB-APPLICANT

PROJECT MANAGER:
As its name implies, an approved mitigation project will be administered (managed) by one or more project managers. This is a general term, then.

SUB-APPLICANT:
*Approved mitigation projects in Kentucky, though, typically have two (2) project managers: The local jurisdiction initially applies for a mitigation project. It applies first to Kentucky Emergency Management (KYEM) which, if approved by KYEM, is sent to the Federal Emergency Management Agency (FEMA) for approval (which allows for the funds used to partially reimburse the local jurisdiction for the project). This process means that an approved mitigation project will have a local project manager and a state-level (KYEM) project manager. As it is the state who formally submits a mitigation project to FEMA, it becomes the **applicant**. This makes the local jurisdiction's project manager the **sub-applicant**.*

KYEM “Individual Project Progress Report”

The “Individual Project Progress Report” (IPPR) is another internal document to KYEM (and UK-HMGP and CHR, where applicable). It is similar in function to the FEMA Quarterly Report. The main difference between FEMA’s Quarterly Report and the KYEM “Individual Project Progress Report” lies with who is responsible for completing the reports. FEMA Quarterly Reports are to be completed by “sub-applicants.” “Individual Project Progress Reports” are to be completed by KYEM/UK-HMGP “project managers.” The link between the IPPR and the “Project Tracker” involves the IPPR simultaneously being a redundancy system and the individual data points that, in aggregate, comprise the “Project Tracker.”

Period of Performance Extension Deadline Reminders

The Period of Performance Extension Deadline Reminders (POP-EDR) simply are form statements sent from KYEM Project Managers to Sub-Applicants reminding the Sub-Applicants to request an extension of the Period of Performance (POP) if they think they will need it. The reminders are sent 180 and 90 days prior to the Period of Performance deadlines. One hundred eighty (180) days begins the timeline within which Project Managers can formally request extensions. Sixty (60) days before POP is the deadline after which POP extensions cannot be requested. Thirty (30) days before the 60-day deadline allows Project Managers ample time to fill out and submit a POP Extension Request Form (ERF) if the Sub-Applicant wishes to request a project POP extension.

Final Invoice Reminder

Like the POP-EDR, the Final Invoice Reminder (FIR) simply is a form statement sent from KYEM Project Managers to Sub-Applicants reminding the Sub-Applicants, essentially, of the Period of Performance deadline. The FIR is sent forty (40) days prior to the Period of Performance deadline. The purpose of the form statement is to remind Sub-Applicants to pay any remaining invoices from subcontractors (where relevant) so that the Sub-Applicant can prepare its final invoice for reimbursement that is sent to Kentucky Emergency Management to be paid using money awarded by FEMA. The 40-day prior to POP deadline is in acknowledgement that, while technically the Sub-Applicant has 90 days past the POP deadline to complete invoicing Kentucky Emergency Management for reimbursement of funds spent toward the mitigation measure, the Sub-Applicant cannot ask for reimbursement for work that was performed by subcontractors (that would then be partially reimbursed by KYEM through FEMA) past the Period of Performance deadline.

Local Outreach

Local outreach is and will be focused upon mitigation measures, projects, and subsequent project closeouts: “Deductive planning” involves presenting localities with a wider array of mitigation options, mainly mitigation measures and projects. Geographic specialization means a KYEM (or UK-HMGP) staff expert in one area, accountable to all mitigation measures, projects, and project closeouts in one area of Kentucky. Again, monitoring mitigation measures *is* monitoring the Commonwealth of Kentucky’s hazard mitigation plan.

CHAMPS:

The Community Hazard Assessment and Mitigation Planning System (CHAMPS) began as a means to monitor mitigation measures. This is still the System’s animus. Using the current system implemented at the time of this writing, specifically, CHAMPS simplifies, streamlines, and creates transparency for mitigation measure monitoring by allowing the:

- Reporting of damage amounts, number of affected communities, and hazard types for specific incidents and disasters;
- Reporting of threshold information for counties during and after a disaster;
- Reporting of project grant timelines for each federally-declared disaster;
- Reporting of mitigation funds available by project type for each disaster;
- Coordination of briefings before, during, and after disasters and project applications;
- Reviewing and tracking of Mitigation Action Forms (MAFs), project applications, and project work in a streamlined manner;
- Tracking of the cost-effectiveness of projects at both the state and community levels;
- Rendering of geospatial projects across the Commonwealth of Kentucky;
- Tracking of fund-usage and cost-effectiveness of mitigation funds and or losses avoided due to mitigation funding.

B. ***Identifying a System for Reviewing Progress on Achieving the <u>Goals</u> Articulated in the Commonwealth of Kentucky's Hazard Mitigation Strategy***

Kentucky Emergency Management (KYEM) and, thus, the Commonwealth of Kentucky as an entity separate from the localities which comprise it is (necessarily) directed by one goal regarding the mitigation of hazards that affect Kentucky's localities: To facilitate and coordinate the individual mitigation activities of the localities that comprise the Commonwealth of Kentucky. The above discussion identifies the system for reviewing progress on achieving this overarching administrative goal: Through frequent reporting both from the localities themselves and through project managers overseeing locality mitigation measures via the abovementioned mechanisms, through local outreach where deductive planning is performed and in recognition of the efficiency of "unity in the executive" whereby project managers are assigned, accountable, and specialize in one geographic area of Kentucky, and through the CHAMP System progress toward effective facilitation and coordination of the mitigation goals of Kentucky's localities will continually be reviewed.

With a mitigation goal defined broadly as facilitating and coordinating the mitigation actions of Kentucky's local jurisdictions, one particularly useful method for reviewing the progress toward achieving that goal involves eliciting feedback.

Two examples of such feedback solicitation are provided in ***Appendix 6-11*** and ***Appendix 6-12***. ***Appendix 6-11*** shows screenshots of an electronic survey sent via e-mail to a local project manager (sub-applicant) who has recently completed and closed out a Hazard Mitigation Grant Program (HMGP)-funded mitigation action.

Appendix 6-12 shows a similar survey soliciting feedback regarding the HMGP program from sub-applicants with open HMGP-funded projects. This survey is administered annually and, again, usually administered via e-mail to the local project manager/sub-applicant.

D. *Identifying a System for Reviewing Progress on Implementing Activities and Projects of the Commonwealth of Kentucky's Hazard Mitigation Strategy*

The 2013 Update of the Commonwealth of Kentucky's hazard mitigation plan does contain a mitigation strategy that aids in its overarching goal of facilitating and coordinating the mitigation strategies and subsequent measures of the localities that comprise the seemingly separate entity known as "the state." Such a statewide strategy involves *Public Good-Type projects*.

The *Public Good-Type project* refers to those measures whose results provide better tools and mechanisms to benefit mitigation activity universally. The *Public Good-Type project* is a local example of a general theory: The public good.

The public good is generally defined as a good that individuals desire but is not purchased by an individual because the individual cannot exclude others from using the good and because the good may be able to be used by more than one person without consumption of that good being affected. Thus, if the good, naturally, is consumable by more than one person and one person cannot exclude another person from using the good that can be consumed by more than one person simultaneously, then there is little to no incentive for one person to purchase that good.

The same concept underlies the *Public Good-Type project*: Better hazard data, better hazard assessment methodology, universal planning and reporting mechanisms, et al. benefit all of the localities within Kentucky. Better hazard data et al. can be consumed simultaneously by multiple localities without the effects being diminished and a locality cannot (feasibly) exclude other localities from the better hazard data et al. Thus, why should one locality take sole responsibility for information and process improvement that benefits all localities?

So, the Commonwealth of Kentucky (through KYEM) can offer strategies that will result in these *Public Good-Type projects* which are beneficial for all of Kentucky's localities.

Implementation and progress-review of *Public Good-Type projects* is conducted by KYEM. The nature of the *Public Good-Type project* ensures that KYEM track its progress: Essentially an *Public Good-Type project* is a mitigation project applied for *other Commonwealth agencies* through FEMA and administered by KYEM. For example, listed in Mitigation Strategy section of this 2013 update of Kentucky's hazard mitigation plan is an *Public Good-Type project* toward better identifying karst. Karst identification benefits all localities within Kentucky and, thusly, no one locality has the incentive to unitarily take responsibility for all karst identification. Consequently, a Kentucky agency—the Kentucky Geological Society (KGS)—will apply to FEMA to obtain resources that would allow KGS (and, thus, the Commonwealth of Kentucky) to implement a karst identification initiative. If FEMA approves the application, KYEM will oversee the mitigation project as it would oversee a mitigation measure project undertaken by a sub-applicant within a Kentucky locality.

It is implied, then: All mechanisms described above apply to the review of progress of the *Public Good-Type project* which, in essence, comprises the Commonwealth of Kentucky's Mitigation Strategy.

C. *Addressing Modifications That Have Been Made to the System of Mitigation Activity Initiation, Status, and Completion Described in the 2010 Update*

As previously stated, the 2010 update of the Commonwealth of Kentucky's hazard mitigation plan (2010 Update) relied solely upon the potential of the CHAMP System to monitor, evaluate, and update mitigation planning and to track the initiations, status, and completion of mitigation activities.

As aforementioned, while a hypothetical for the 2010 Update, all that was promised from CHAMPS in the 2010 Update is, at least in a limited sense, implementable. In other words, there is no change from the 2010 Update to this 2013 update about the intent and role of CHAMPS in monitoring the progress and completion of mitigation activity.

Rather, what has been modified for this 2013 update of Kentucky's hazard mitigation plan is the rhetorical relegation of CHAMPS to a role *within* the overall and explicitly articulated administrative structure of Kentucky Emergency Management (KYEM). CHAMPS is a tool that will provide efficiency and transparency to the overarching mitigation goal of KYEM (and, hence, the Commonwealth of Kentucky) to facilitate and coordinate the mitigation activity of the localities that comprise the Commonwealth.

E. *Addressing That Mitigation Actions Defined in the 2010 Update Were Implemented As Planned*

One relevant criticism of the 2010 update of the Commonwealth of Kentucky's hazard mitigation plan (2010 Update) involves its lack of clarity in distinguishing between mitigation actions over which Kentucky Emergency Management (KYEM) (and, hence, Kentucky) had direct control and, thus, could be directly accountable and those mitigation actions over which KYEM could only provide indirect aid.

This 2013 update of Kentucky's hazard mitigation plan limits the scope (and, hence, the imaginary locus of control over its localities) of Kentucky's direct mitigation activity role to implementing *Public Goods-Type* mitigation actions and providing direction, facilitation, and coordination to support to the localities that actually experience the natural hazards that affect Kentucky.

Provided in ***Appendix 4-1*** is a tabular assessment of the 2010 Update mitigation actions.

The gist of the assessment is that, generally and accounting for areas where KYEM would have had little direct authority or control, the 2010 Update's mitigation actions were implemented as planned.

ENHANCED PORTION

ENHANCED PORTION

PART I:
Compliance with Standard State Plan Requirements

REQUIREMENT §201.5(B):

To be "Enhanced" the Commonwealth of Kentucky must include all elements of the Standard State Mitigation Plan identified in §201.4.

The Kentucky State Hazard Mitigation Plan was approved by the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) in a letter from the Regional Administrator dated **10/17/2013**, thus affirming compliance with "Standard" State plan requirements.

ENHANCED PORTION

PART II:
Integration with Other Planning Initiatives

REQUIREMENT §201.5(B)(1):

To be "Enhanced," the Commonwealth of Kentucky must demonstrate that its plan is integrated to the extent practicable with other State and/or regional planning initiatives (e.g., comprehensive, growth management, economic development, capital improvement, land development, and/or emergency management plans) and FEMA mitigation programs and initiatives that provide guidance to State and regional agencies.

A.*: Demonstrating Integration with other State-level and Regional Planning Initiatives*

The Commonwealth of Kentucky has demonstrated that throughout its 2010 – 2013 planning cycle, it has successfully integrated with other planning initiatives both generally and through the specific implementation and for future implementation of its Community Hazard Assessment and Mitigation Planning System (CHAMPS). Thus, this section is subdivided into two subsections: The first subsection readdresses a discussion from the Standard Portion of this *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* (*CK-EHMP 2013*). Within the "Program Integration" subsection of *CK-EHMP 2013*'s "Planning Process" section relevant plans, programs, and initiatives that had been integrated with the Commonwealth of Kentucky's overall planning process were detailed[145]. However, a significant component of general program integration with Kentucky's planning process involved the *integration of other planning initiatives* with the goals and objectives that had been outlined in Kentucky's *2010* update of its hazard mitigation plan. This first subsection serves as an evaluation of the following: Was Kentucky fulfilling the objectives that it had expressed that it would accomplish when it submitted and had approved its 2010 "enhanced" state-level hazard mitigation plan?

The second subsection focuses on CHAMPS. CHAMPS, of course, is one planning initiative within the first subsection that shows Kentucky's 2010 – 2013 achievement of integration with overall planning initiatives. However, the importance of CHAMPS expressed in Kentucky's 2010 hazard mitigation plan and to a lesser extent[146], reemphasized in this 2013 update, compels a more detailed discussion of its implementation during Kentucky's 2010 – 2013 planning cycle.

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[145] See Standard Portion of *CK-EHMP 2013*, pp. 48 – 68. It is Part III (Program Integration) of the *CK-EHMP 2013*'s Planning Process section.

[146] The *CK-EHMP 2013* did not so much *de-emphasize* CHAMPS as it did *re-emphasize* the past and future role of Kentucky's successful administration of its hazard mitigation program. CHAMPS is software. It is Kentucky's decentralized and locally-focused mitigation strategy, its staff and its leadership, and its proactive and highly integrative administration that has allowed Kentucky its considerable mitigation successes in the past and will continue those successes in the future. CHAMPS has been and is intended to enhance administration, especially at the local and regional levels.

I. Plans, Programs, and Initiatives That Integrated the 2010 Commonwealth of Kentucky Hazard Mitigation Plan During the 2010 – 2013 Planning Cycle

For reference, this section begins with a listing of the mitigation goals and objectives from Kentucky's 2010 hazard mitigation plan update:

Table E-2-1: 2010 Kentucky Hazard Mitigation Goals and Objectives

GOAL	OBJECTIVE NUMBER	OBJECTIVE DESCRIPTION
Reduce or eliminate injuries or risks to people from natural hazard events	1.1	Promote the use of early alert systems to warn citizens of all natural hazard events
	1.2	Reduce the impacts of hazards on vulnerable populations
	1.3	Train public officials regarding natural hazard preparedness
	1.4	Promote the installation of tornado safe-rooms in homes and construction of community tornado shelters
Reduce or eliminate damages or risks to property from natural hazard events	2.1	Reduce property losses from flooding
	2.2	Reduce "severe repetitive-loss" and "repetitive-loss" properties, thus reducing the amount of being paid from the National Flood Insurance Program (NFIP) fund
	2.3	Increase the number of communities participating in the National Flood Insurance Program (NFIP) and promote compliance with the NFIP for communities already participating
	2.4	Promote involvement of local governments in the Community Rating System (CRS) program to promote better floodplain management while offering incentive of lower flood insurance premiums
	2.5	Reduce the vulnerabilities of state-owned facilities and infrastructure to natural hazards
	2.6	Reduce the vulnerability of Kentucky's structures and infrastructure to the effects of geologic hazards including landslides, earthquakes, sinkhole collapse, other natural subsidence, and subsidence caused by coal mining
	2.7	Encourage the enforcement of Kentucky's building codes as related to the construction of engineered and residential structures
	2.8	Make existing manufactured housing more resistant to movement from their sites by high winds and swift floodwaters
	2.9	Improve the safety of high-hazard dams to minimize the threats associated with dam failure

GOAL	OBJECTIVE NUMBER	OBJECTIVE DESCRIPTION
Promote sustainable communities	3.1	Provide incentives for mitigation planning and actions
	3.2	Form partnerships to leverage and share resources
	3.3	Support efforts which will assist with the continuity of critical and business operations
Enhance state capability to implement a statewide comprehensive hazard mitigation strategy	4.1	Determine if existing state agency programs, plans, and policies are efficient in reducing risk and vulnerability to natural hazards
	4.2	As a means of enhancing intra- and inter-governmental coordination, establish and support an ongoing liaison between federal, state, regional, and local governments, as well as the private sector and general public through the State Hazard Mitigation Team[147]
	4.3	Integrate the pre- and post-disaster mitigation functions with the response and recovery functions of the state
	4.4	Review and update the state risk and vulnerability assessment at a minimum of every three (3) years
	4.5	Coordinate funding resources and opportunities among state agencies to assist both state and local sub-grantees to meet the non-federal match requirements for federal mitigation-related funding sources
	4.6	Support the development and use of disaster loss reduction-related building codes and standards designed to reduce vulnerability and risk to all hazards
	4.7	Support the development and enhancement of local capability to practice hazard mitigation
	4.8	Promote new policies to enhance hazard mitigation initiatives
Increase public and private sector awareness of and support for hazard mitigation education practices as a means of developing a culture of hazard mitigation in Kentucky	5.1	Develop a hazard mitigation information dissemination tool
	5.2	Develop and promote outreach strategies designed to educate about Kentucky's hazards, risks, vulnerabilities, and the applicable mitigation actions
	5.3	Identify and encourage the incorporation of available hazard mitigation education and outreach programs/products
	5.4	Improve public knowledge of hazards and protective measures so individuals can appropriately respond during hazard events

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[147] State Hazard Mitigation Team (SHMT) has been renamed the Kentucky Hazard Mitigation Council (KYMC).

GOAL	OBJECTIVE NUMBER	OBJECTIVE DESCRIPTION
Conduct scientific research to promote hazard mitigation	6.1	Leverage existing relationships with the University of Louisville's Center for Hazards Research (CHR) and the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) in addition to continuing to establish partnerships with other public and private research universities in Kentucky to enhance and support efforts to secure funding, contracts, and opportunities; enhance research infrastructure; and to assess Kentucky's vulnerability to natural hazards
	6.2	Collaborate with FEMA's Emergency Management Institute (EMI) and Kentucky's public and private universities in the development of higher education curriculums primarily designed to educate professionals in emergency management, as well as to integrate hazard mitigation curricula into existing career programs
	6.3	Foster the continued development and improvement of existing research centers and laboratories within Kentucky's public research universities by supporting efforts to secure funding and research contract opportunities to enhance in-state capabilities for conducting hazard mitigation-related research
	6.4	Improve hazard information, including databases and maps

The following is a table of the planning initiatives highlighted as demonstrating Kentucky's successful integration of its 2010 hazard mitigation plan with its planning initiatives.

Table E-2-2: Planning Initiatives with which Kentucky's 2010 Hazard Mitigation Plan Integrated

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Long-Term Recovery Plan	Department for Local Governments (DLG)	This was and is a collaborative effort between KYEM, DLG, CHR, and the EDA[148]. It is an ongoing planning project that has created and will continue to create and update mitigation and long-term economic redevelopment strategies. The current plan deliverables evaluate past losses and best practices regarding economic and social recovery. It serves the need for statewide planning to better include consideration for the socio-economic impacts of hazards. Further, the deliverables are linked with CHAMPS and will help populate the CHAMPS database. This plan integrated the following 2010 Objectives: 1.2, 2.3, 2.4, 3.1, 3.2, 3.3, 4.2, 4.3, 4.5, 4.7, 4.8, 5.1, 5.2, 5.3, 5.4, and 6.4
Dam Safety Program	Kentucky Division of Water (KDOW)	Kentucky maintains a Dam Safety Section within KDOW. Dam failure repeatedly has been identified as a potential hazard for Kentucky. However, many mitigation specialists do not work directly with dam safety regularly. KDOW through this program has educated mitigation specialists and stakeholders on the recognition of and mitigation measures toward dam safety. This program was obviously integrated with Kentucky's 2010 mitigation plan in its partnership with KYEM to provide information and guidance to mitigation specialists and government officials related to FEMA mitigation programs. Specifically, this program integrated the following2010 Objectives: 1.2, 1.3, 2.1, 2.5, 2.9, 3.1, 3.2, 3.3, 4.1, 4.2, 4.4, 4.5, 4.7, 4.8, 5.2, 5.3, 5.4, and 6.4

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[148] KYEM = Kentucky Emergency Management; DLG = Kentucky Department for Local Governments; CHR = University of Louisville Center for Hazards Research; EDA = Federal Economic Development Administration

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Dam Failure Mitigation Plan	Kentucky Division of Water (KDOW)	During the 2010 – 2013 statewide planning cycle KDOW was approved for funding for and completed a plan that explores methodological improvements to assessing the risk of dam failure as a mitigation hazard. Such a plan – applied through and approved by KYEM and FEMA – had obvious integration with the following 2010 Objectives: 1.2, 1.3, 2.1, 2.5, 2.9, 3.1, 3.2, 3.3, 4.1, 4.2, 4.4, 4.7, 4.8, 5.4, and 6.4
Business Plan	Kentucky Division of Water (KDOW)	The KDOW Business Plan addressed issues related to floodplain management and dam safety. It is a working document and was (and is) updated annually. This working plan is overtly a joint planning project between Kentucky Emergency Management and KDOW. It focused and focuses on planning and projects to mitigate flood-related damages. This plan integrated the following 2010 Objectives: 2.1, 2.2, 2.3, 2.4, 2.5, 2.9, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.5, 4.7, 4.8, 5.3, 5.4, and 6.4
Community Assistance Program (CAP) Grants	Kentucky Division of Water (KDOW)	KDOW continually applied for (and applies for) and continually received (and receives) CAP Grants. During Kentucky's 2010 – 2013 planning cycle, the application and awarding of these grants were directly integrated with the 2010 hazard mitigation plan: CAP Grants are used to further the NFIP program and educate about floodplain management. Specifically, CAP Grants were integrated with the following 2010 Objectives: 1.3, 2.3, 2.4, 3.1, 3.2, 3.3, 4.2, 4.5, 4.7, 5.2, 5.3, 5.4, and 6.4

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
RiskMAP	Kentucky Division of Water (KDOW)	KYEM and KDOW collaborated on mapping, assessment, and planning due to RiskMAP activities. RiskMAP activities also were linked to CHAMPS software development and data collection. RiskMAP has transformed the traditional flood-identification and mapping efforts into a more-integrated process of accurately identifying, assessing, planning for, and mitigating risk. RiskMAP activities integrated the following 2010 Objectives: 1.3, 2.1, 2.2, 2.5, 2.6, 2.9, 3.1, 3.3, 4.1, 4.2, 4.3, 4.4, 4.7, 4.8, 5.1, 5.2, 5.3, 5.4, 6.1, and 6.4
Cooperating Technical Partners (CTP) Grants	Kentucky Division of Water (KDOW)	CTP Grants were applied for (and continue to be applied for) and were funded (and continue to be funded) for scoping, production, and post-preliminary processing and mapping of Kentucky's county's floodplains. These activities were obviously integrated into 2010 statewide planning: It was (and is) data collection and risk analysis that is so important to successful planning. CTP Grants integrated the following 2010 Objectives: 1.2, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.2, 3.3, 4.1, 4.4, 4.7, 4.8, 5.4, and 6.4
Map Modernization Management and Support (MMMS) Grants	Kentucky Division of Water (KDOW)	MMMS Grants were applied for (and continue to be applied for) and were funded (and continue to be funded) for management, outreach, and public information distribution regarding the continued and continual mapping and subsequent risk analysis that results from said mapping that KDOW performs and KYEM supports. MMMS Grants integrated the following 2010 state planning Objectives: 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.3, 4.1, 4.2, 4.4, 4.7, 4.8, 5.1, 5.2, 5.3, 5.4, 6.1, and 6.4

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
National Flood Insurance Program (NFIP) Participant Initiatives	Kentucky Division of Water (KDOW); Kentucky Emergency Management (KYEM)	KDOW and KYEM proactively and regularly entered communities to gather data on, update stakeholders on, and attempt to increase NFIP participation. Conducting this planning outreach was integrated with the following 2010 Objectives: 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.3, 4.2, 4.3, 4.7, 4.8, 5.2, 5.3, and 5.4
Repetitive-Loss Property Buyout Initiative	Kentucky Division of Water (KDOW); Kentucky Emergency Management (KYEM); University of Kentucky, Martin School of Public Policy and Administration (UK-HMGP)	Similar to the NFIP Participant Initiative, KYEM/UK-HMGP and KDOW worked together to educate on, identify, incentivize, and provide assistance in applying for buyouts of "repetitive-loss" and "severe repetitive-loss" properties. KDOW maintained (and still maintains) a list of properties which have experienced severe and repetitive losses due to flooding. KYEM and UK-HMGP went into communities, held presentations on, and notified relevant local officials regarding these affected properties and the availability of buyout opportunities. Through this proactive administration, KYEM has mitigated numerous RL and SRL properties using FEMA mitigation funds in communities that otherwise would not have sought such buyout opportunities. When buyouts and subsequent demolitions occur, KYEM and UK-HMGP informed KDOW after which the RL and SRL property list was updated and disseminated. This initiative was integrated with the following 2010 Objectives: 1.2, 2.1, 2.2, 2.5, 3.2, 4.2, 4.3, 4.5, 4.7, 4.8, 5.2, 5.3, 5.4, 6.1, and 6.4

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Kentucky Building Code	Kentucky Department of Housing, Buildings, and Construction Division of Building Codes Enforcement (K-DBCE)	The Kentucky Building Code proactively addresses issues concerning seismic and severe wind construction in response to Kentucky's potential earthquake and wind threats. This planning program's mission alone integrates it with the goals and objectives of Kentucky's 2010 mitigation plan. Beyond that, K-DBCE regulated (and regulates) the Building Code. Kentucky's Building Code is, essentially, the International Building Code published by the International Code Council, Inc. Enforcement of the Code is shared by K-DBCE and local government building departments. K-DBCE reviewed (and reviews) architectural plans prior to construction and conducted (and conducts) field inspections to ensure compliance. Building codes supported (and support) the overall mitigation goals of both Kentucky and FEMA by helping to ensure that new construction statewide is resistant to damages from severe winds, tornadoes, and seismic activity. The Building Code was updated in October of 2013. Specifically, this planning-aid initiative was integrated with the following 2010 Objectives: 1.2, 2.5, 2.6, 2.7, 3.3, 4.1, 4.6, 4.7, 5.3, and 6.4.

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Wildfire Mitigation Program	Kentucky Division of Forestry (KDF)	Otherwise known as "Firewise," this program encouraged (and encourages) local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, et al. in the effort to protect people and property from the risk of wildfire. The 2010 state-level mitigation plan, then, was integrated into "Firewise" through both the plan having as its goal and "Firewise" being able to implement increased awareness and a more developed and localized mitigation strategy regarding wildfires. Further, "Firewise" works intimately with KYEM to promote wildfire mitigation. The Wildfire Mitigation Program was integrated with the following 2010 Objectives: 1.1, 1.2, 1.3, 2.5, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 4.4, 4.7, 4.8, 5.2, 5.3, 5.4, 6.1, and 6.4
Mine Subsidence Insurance Fund (KMSIF)	Kentucky Department of Insurance (K-DOI)	The KMSIF provided (and provides) insurance to property owners in 34 coal-producing counties so that those properties are protected against mine-related subsidence. Further, K-DOI and Kentucky's Energy and Environment Cabinet, Department of Natural Resources Division of Abandoned Mine Lands trained mitigation specialists on hazards caused by mines at the Kentucky Association of Mitigation Managers (KAMM) conferences that occurred annually during the 2010 – 2013 statewide planning cycle. The 2010 Kentucky hazard mitigation plan clearly was integrated with this planning-aid program. KMSIF was integrated with the following 2010 Objectives: 1.2, 1.3, 2.5, 2.6, 3.2, 3.3, 4.7, 4.8, 5.2, 5.3, and 5.4

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
The Purpose and Function of Kentucky Heritage Council	Kentucky Heritage Council (KHC)	The KHC assisted (and assists) individuals, communities, and local governments with making historic preservation an important and well-understood component of mitigation planning. KYEM coordinated with KHC to ensure historic properties were not negatively impacted by proposed or then-underway mitigation actions and projects toward which FEMA's funding was designated. This purpose certainly represents a clear link with the 2010 Kentucky hazard mitigation plan. Specifically, the purpose and function of KHC was integrated with the following 2010 Objectives: 4.2, 4.7, 4.8, and 6.4
Applicant Agent Certification Program	Kentucky Emergency Management (KYEM)	KYEM implemented the first Applicant Agent Certification program in the United States. The certification enabled newly-designated "Applicant Agents" to maximize federal disaster-related funding associated with FEMA programs. Further, as "certification" incentivized a wider variety of mitigation stakeholder participation than would have if it instead were simply "training" or softly mandated, this project/planning program succeeded in outreach to communities, as well. The Applicant Agent Certification integrated the following 2010 Objectives: 1.3, 2.3, 2.4., 2.7, 2.9, 3.1, 3.2, 3.3, 4.1, 4.2, 4.6, 4.7, 4.8, 5.2, 5.3, 5.4, and 6.4
Public Assistance 406 Hazard Mitigation Initiative	Kentucky Emergency Management (KYEM)	Kentucky has received three (3) disaster declarations since approval of the 2010 plan. During these disasters, KYEM has required FEMA to assess every Public Assistance project for mitigation opportunities and funding. The 2010 Plan was integrated through this initiative's incorporating 2010 Objectives 2.1, 2.2, 2.5, 2.6, 3.1, and 3.3

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Kentucky Weather Preparedness Committee (KWPC)	Regional; Kentucky Emergency Management (KYEM)	Generally, KWPC operated (and operates) under the support of KYEM. It was (and is) dedicated to raising awareness regarding in what ways weather events can impact Kentucky and with what preparations Kentuckians can protect themselves from these impacts. Specifically and during this 2010 – 2013 statewide planning cycle, KWPC applied for, was approved for, and successfully completed a FEMA HMGP-funded educational initiative which included the purchase and distribution of weather radios and general educational materials. KWPC also attended Kentucky's state fair to further educational and planning initiatives. In these ways, KWPC furthered the educational objectives of Kentucky's 2010 hazard mitigation plan. The KWPC integrated the following 2010 Objectives: 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.5, 2.6, 2.8, 2.9, 3.1, 3.2, 3.3, 4.2, 4.6, 4.7, 4.8, 5.2, 5.3, and 5.4
Governor's Emergency Management Workshop (GEMW)	Regional; Kentucky Emergency Management (KYEM)	Kentucky statute requires an annual training conference intended to better prepare local elected officials and emergency managers for hazard events. Each year throughout the 2010 – 2013 statewide planning process, the GEMW provided disaster preparation, response, and recovery training; outreach; "roundtable discussions; and presentations from nationally-renowned mitigation experts. In 2012 and 2013 GEMW also served as a forum for training with CHAMPS. GEMW integrated the following 2010 Objective: 1.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.1, 3.2, 3.3, 4.1, 4.2, 4.5, 4.7, 4.8, 5.2, 5.3, 5.4, and 6.3

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Kentucky Association of Mitigation Managers (KAMM)	Regional	KAMM was formed to promote floodplain management and mitigation in Kentucky. During the 2010 – 2013 statewide planning cycle, KAMM provided a means for state and local floodplain managers and mitigation specialists to join with others regarding floodplain management policies and activities. Additionally, KAMM advanced the study, research, and exchange of information on the technical aspects of floodplain management. KAMM also served as an outreach tool, with its membership yearly expanding "vertically" (i.e. more locally) and "horizontally" (i.e. bringing in a wider variety of mitigation stakeholder. KYEM Mitigation staff and UK-HMGP and CHR employees have a history of serving on KAMM's board and as its members so as to ensure that mitigation was interwoven into floodplain management activities. KAMM integrated the following 2010 Objectives: 1.2, 1.3, 2.1, 2.2, 2.3, 2.4, 2.5, 2.9, 3.1, 3.2, 3.3, 4.1, 4.2, 4.5, 4.7, 4.8, 5.2, 5.3, 5.4, 6.1, 6.3, and 6.4
National Earthquake Hazards Reduction Program Implementation (NEHRP)	Regional	Implementing NEHRP during the 2010 – 2013 statewide planning cycle meant KYEM and partnering organizations coordinating with FEMA, the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the United States Geological Survey (USGS) so that understanding, characterization, and prediction of seismic hazards and vulnerabilities were improved; building codes and land-use practices were improved; mitigation capacity was improved; improvements in design and construction techniques were developed, and risk was reduced. NEHRP implementation integrated the following 2010 Objectives: 1.2, 1.3, 2.5, 2.6, 2.7, 3.3, 4.6, 4.7, 4.8, 5.3, and 5.4

PLANNING INITIATIVE, PROGRAM	AGENCY INTEGRATING PLAN	DESCRIPTION OF INTEGRATION
Abandoned Mine Land Program Implementation (AML)	Regional	In each year of the 2010 – 2013 statewide planning cycle, Kentucky received an annual AML federal grant averaging around $14 million. AML funds were expended toward projects to reduce hazards caused by mines, e.g. landslides, “high-walls,” mine drainage, sedimentation-and-flooding, impoundments, open portals-and-shafts, open pits, piles and embankments, refuse piles, refuse fires, mine fires, and general effects from pollution and hazards from facilities/equipment. Further, Kentucky (primarily through KAMM and using AML professionals) trains mitigation specialists regarding mine-related hazards and strategies for them. AML integrated the following 2010 Objectives: 1.2, 1.3, 2.1, 2.2, 2.5, 2.6, 2.7, 3.2, 3.3, 4.1, 4.2, 4.6, 4.7, 5.2, 5.3, 5.4, and 6.4
Community Hazard Assessment and Mitigation Planning System (CHAMPS)	Regional; Kentucky Emergency Management (KYEM)	See the following CHAMPS description. CHAMPS integrated the following 2010 Objectives: 1.2, 1.3, 3.1, 3.2, 4.5, 5.1, 5.4, 6.1, and 6.4

II. Community Hazard Assessment and Mitigation Planning System (CHAMPS) Discussion/Elaboration

The Community Hazard Assessment and Mitigation Planning System (CHAMPS) is a web-based software tool available for use by local jurisdictions, executive branch agencies, and other stakeholders that are involved in hazard mitigation.

Entities involved with CHAMPS development include:

- Federal Emergency Management Agency (FEMA)
- Kentucky Emergency Management (KYEM)
- Kentucky Department for Local Government (DLG)
- University of Louisville's Center for Hazards Research and Policy Development (CHR)
- University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP)
- Stantec

The purpose of CHAMPS is to:

- assist local jurisdictions with their hazard assessments;
- highlight mitigation efforts and allocated funds that can be used toward such efforts;
- guide local jurisdictions through hazard mitigation planning, funding, and project management; and
- Store information relevant to hazard mitigation and risk assessment in one centralized location that thusly can be more readily accessed.

CHAMPS is a web-based software program which has been upgraded twice since inception. Since the 2010 planning cycle, a "version 1" (v1) has been developed and implemented with all official training completed. As of this writing, a "version 2" (v2) has also been developed and has been partially implemented (via training and data collection).

The difference and improvements between CHAMPS version 1 (v1) versus its version 2 (v2) is presented below:

Table E-2-3: Differences Between "version 1" (v1) and "version 2" (v2) of CHAMPS

CHAMPS v1	*CHAMPS v2*
Completely mitigation-based	Involves all areas of emergency management
Templates cannot be changed or altered from original design.	New customizable modules were added.
The Planning Module includes FEMA's "Plan Review Tool/Crosswalk." However, there is little option available to adjust the "Plan Review Tool"-guided Planning Module if FEMA makes any changes to it.	New templates guiding plan-writing can be used to create custom plans. While hazard mitigation planning still is guided by FEMA's "Plan Review Tool," the ability to create new templates allows for the ability to make changes to the "Plan Review Tool" as FEMA makes such changes.
Disaster damage assessment data must be submitted to Frankfort where it is manually input into the system	Applications ("apps") have been created that allow data to be input into the CHAMP System in real time by damage assessors at impacted sites

***<u>CHAMPS v1 (Version I) Description</u>*:**

The Community Hazard Assessment and Mitigation Planning System (CHAMPS) is a web-based system designed to help communities in the Mitigation Planning process assist in securing funding through FEMA's Hazard Mitigation Program. CHAMPS v1 was brought online in the fall of 2012 and was used mainly to assist Area Development Districts (regional organizations supporting the administration for Kentucky's 120 counties) in understanding the need and purpose of CHAMPS and in planning for data collection and project applications.

CHAMPS v1 contains five (5) modules:

1. *<u>Disaster Management</u>* – This module captures state and federal disaster information, including incident types, counties affected, damages reported, declaration status of affected communities and Hazard Mitigation funds available as a result of the incident.
2. *<u>Briefings</u>* – This module is a calendaring module that lists post-disaster briefings, award briefings, project meetings (such as quarterly inspections), and close-out briefings. Documents, maps, and contact information related to the briefings are housed in this module.
3. *<u>Planning</u>* – Local communities, Area Development Districts (ADDs), and the Commonwealth of Kentucky use this module to develop the FEMA-mandated local and Commonwealth hazard mitigation plans. This module is designed based on FEMA's Plan Review Tools ("Crosswalks"). The hazard mitigation plan can be updated in the system at any time and can be cloned from one version to another when submitting for renewal. This module includes an extensive state and federal review process to ensure that only quality plans are submitted to FEMA.
4. *<u>Mitigation Action Forms</u>* – This module is the "warehouse for good mitigation ideas" and draws from the Planning Module. As the local and state Hazard Plans are created and updated, mitigation actions are formed and moved into a proposal status. This module contains basic project information including project description, points of contact, scope of work, project timelines, project budget, and project location. These project proposals can be updated at any time and are housed in the system even after submission to FEMA for funding. As of the submission date of this plan, there are over 600 Mitigation Action Forms housed in this module.
5. *<u>Projects</u>* – This module migrates the chosen and abovementioned "good mitigation ideas" into projects for FEMA's consideration. Kentucky's State Hazard Mitigation Team chooses mitigation projects for FEMA funding consideration and the applicants, with support from KYEM Grant Managers, complete the application process to FEMA. During this time, the application is fine tuned in the system and submitted to FEMA for approval. Upon approval, work relating to the project is tracked in the Projects Module using a project time tracking system until the project is completed and closed out.

CHAMPS v2 (Version II) Description/Improvements:

CHAMPS Version I was intended to be a stepping stone to a system that was far more interactive and far more user-friendly. CHAMPS v1 was akin to a "beta" version of CHAMPS.

CHAMPS v2 emphasizes the *real-time* advantages that an interactive, connected, web-based tool can offer to disaster management. The program has become "app-based" with intuitive and aesthetically-pleasing designs provided by the University of Louisville's Center for Hazards Research and Policy Development (CHR).

CHAMPS generally, but v2 especially, is intended to enhance communication, collaboration, standardization, and the overall planning process:

CHAMPS v2 attempts to accomplish enhancing communication through its current ability to coordinate interaction between interdependent agencies. In a sense, federal, regional, state, and local agencies can all "talk" to each other through CHAMPS v2. This is because CHAMPS v2 acts a common or community room for all of the players involved in a certain mitigation project and/or planning project. CHAMPS v2 provides a forum to host meetings, provide all of the material before the meetings, and post debriefings and results post-meetings.

CHAMPS v2 is intended to enhance collaboration amongst mitigation stakeholders by providing an easy mechanism to include any relevant party to a mitigation project or plan.

CHAMPS v2 intends to enhance standardization by providing its users multiple projects and planning templates by which to organize, revise, and keep information current regarding projects and plans.

Finally, related to its "common-" or "community-room" design, CHAMPS intends enhance the overall planning process by offering, essentially, one-stop mitigation shopping and a common place by which any mitigation stakeholder within any level of government or within the private sector can inform, update, prepare, and submit project and planning materials.

Like CHAMPS v1, CHAMPS v2 contains "modules" divided between two sub-categories (risk and mitigation).

Under the "risk" sub-category, CHAMPS houses modules related to building a "community profile," performing "assessments," and constructing or organizing "plans."

Specifically, the *Community Profile* module records ("provides a snapshot") of a community's assets and hazard events. Under this module, points-of-contact, critical facilities, a community's support agencies, hazard occurrences and losses, and other relevant information is collected and housed. The idea is to be able to construct a community-specific "risk profile" and have on-hand a history of hazard events and

effects, a record of prioritized threats, and information about property and government functions possibly endangered by hazard threats.
The *Assessments* module provides a guided process to create and conduct standardized assessments for comparing community capabilities. Using data from the *Community Profile* and elsewhere, users of CHAMPS eventually will be able to construct hazard, health, and resiliency risk assessments.

The *Plans* module likewise provides a guided process to develop, review, maintain, and update customized planning policy documents. It also provides functionality as a collaborative tool. Again, using data collected in the *Community Profile* and within other housed banks of raw data, this *Plans* module eventually will allow one to develop and organize a planning document that later can be customized and formatted according to the community’s preferences.

Under the “mitigation” sub-category, CHAMPS comprises modules related to finding and applying for “funding” and applying for, submitting, and maintaining mitigation “projects.”

Specifically, the *Funding* module centrally provides information on possible funding opportunities for mitigation projects. It also houses FEMA presidential-disaster declaration information.

The *Projects* module guides a community in the process to applying for, submitting, and managing funded mitigation projects. Like the *Plans* module, it also is functional for collaboration.

Unlike CHAMPS v1, these modules in v2 operate together: An individual using CHAMPS will see community-specific hazard and property/demographic information while also being able to access further data from a central source.

Appendix E-2-1 provides a (commonly distributed) visual of the “modules” that comprise CHAMPS v2 and the relationship they form to the ideal of “community resilience.”

Commonwealth of Kentucky Enhanced Hazard Mitigation Plan's Integration with CHAMPS: Implementation of CHAMPS

Within the Commonwealth of Kentucky's *2010* hazard mitigation plan, it was never discussed nor implied that the Community Hazard Assessment and Mitigation Planning System (CHAMPS) would substitute for well-governed administration. However, it cannot be denied that CHAMPS was prominent within that 2010 plan. The Standard Portion of this 2013 update of Kentucky's hazard mitigation plan emphasized this importance of CHAMPS within its predecessor in its "Plan Maintenance" section.

CHAMPS always has been intended to *enhance administration*. This is especially so at the local and regional level: Kentucky geographically, in terms of natural hazard vulnerability and socio-economically, is highly diverse and, thus, regionally situated. Hazard mitigation is an important value for all of the population of Kentucky and this is demonstrated through the dedication, knowledge, and expertise of local- and regional-level mitigation administration. While it is true that – through the work of Kentucky Emergency Management (KYEM), its numerous state-level partners, and its universities – Kentucky at the *state-level* has conveyed consistently well-governed and proactive administration, this dedication, knowledge, and expertise of Kentucky's local- and regional-level mitigation administration primarily is responsible for Kentucky's repeated and continued mitigation successes. Consequently, CHAMPS primarily is intended to make easier and more efficient the mitigation administration at local and regional levels of governance. The Commonwealth of Kentucky has the data and analytical capability that it needs to make informed and proactive mitigation decisions. Local and regional mitigation programs likewise possess similar types of data and capability. The fundamental asset of CHAMPS is its ability to provide access and coordination with, and to contribute to the data and analytical capabilities of Kentucky's localities.

The focus on CHAMPS within the 2010 plan achieved its administrative intent. Kentucky's 2010 – 2013 planning update cycle and the subsequent maintenance of its 2010 mitigation plan simultaneously was intended to direct time and resources toward implementing CHAMPS (i.e. having a product) *and* directing administration. The implementation of CHAMPS, throughout the 2010 – 2013 planning update cycle, achieved its intent of integrating its 2010 plan with CHAMPS. The 2013 update was able to abate the number of pages that CHAMPS had used in the past and replace them with clarification of the administration that now accompanies and supports CHAMPS. With the web-based software in its development infancy at the time of the approval of Kentucky's 2010 mitigation plan update, it was not then possible to articulate the specific and underlying administration that would support it. It is evidence that CHAMPS has been completed, implemented, and integrated into past, present, and future statewide planning initiative that Kentucky can elaborate on this supporting administration.

The above discussion provided the context to support that CHAMPS has become a developed and implementable program, beginning in 2012, through data entry and through training.

The data entry and training are intended to continue to work in tandem. It is not a substitute for administration. Its primary purposes involve efficiency, transparency, and communication/information. This efficiency, transparency, and communication from the existence of a go-to system that houses exhaustive hazard data for analysis, applications, and planning; funding sources; templates; mitigation options; program details; etc. serves as a pipeline for application and plan-building and storage during transitory funding periods. It is open to all mitigation stakeholders from all state agencies and from any local jurisdiction.

CHAMPS Need for Raw Data

Throughout the 2010 – 2013 planning update cycle, both before and during official implementation in 2012, Kentucky Emergency Management (KYEM) was inputting raw mitigation project and application data into the CHAMP System via the "Mitigation Action Form."

Throughout this plan document, the "Mitigation Action Form" (MAF) has been compared to a "Letter of Intent" (LOI). Though similar in form and information provided, the MAF is a more fundamental unit of data than the LOI that has a specific purpose after which its relevance is diminished. Both the MAF and the LOI can be used for the same specific purpose (pre-application for a desired mitigation project). Beyond that purpose, the LOI's usefulness is less obvious, whereas the MAF serves as the basic unit of information-gathering and organization for much of the functions for which CHAMPS is intended. The MAF drives the numerous other types of data that CHAMPS houses and can analyze.

The Mitigation Action Form (MAF) is the data storage unit for the following (raw) information:

- A potential, an ongoing, or a completed mitigation project's funding source;
- A narrative description of that funding source;
- Narratives regarding general description of the (potential) mitigation project, the reasons for its submission, and/or the purpose of the ongoing/completed project;
- A (potential) project's actual or estimated cost, and the breakdown of actual or estimated cost into federal, state, and local shares;
- Problems which the proposed project is intended to address or which the actual project addresses;
- Solutions for these problems either proposed by the potential project or confronted with an approved project.

The MAF records the hazards to be mitigated by either the proposed or approved project. The MAF collects binary (yes/no) information on whether these hazards for which the project is proposed or was intended affect critical facilities, existing buildings, and/or future buildings; affect repetitive-loss and/or severe repetitive-loss properties; and/or affect impoverished areas. It collects binary (yes/no) data regarding whether the community for which the proposed or approved project is intended is a Community Rating System (CRS) participant, is within the 100-year floodplain, and/or is within a floodway. The MAF collects this community's current National Flood Insurance Program (NFIP) status and its subsequent NFIP standing. The basic MAF records narrative description of the proposed or approved mitigation project's location, including under which Area Development District (ADD) the community for whom the project is intended resides, the county within which this community is housed, the jurisdiction of this community, and the decimally-conveyed longitude and latitude coordinates of the project's location. Finally, the basic MAF records thumbnail map visuals to accompany the narrative description of the proposed or approved mitigation project's location and collects the basic information about the sub-applicant and jurisdiction either proposing a project or implementing an approved one.

A printed copy/example of the basic Mitigation Action Form (MAF) is provided in ***Appendix E-2-2.***

Before and during the implementation of CHAMPS (v1) in 2012, Kentucky Emergency Management (KYEM) had manually entered in the raw data for over 600 MAFs. KYEM also manually input data regarding public infrastructure and civic agencies that surrounded many of locations of the 600+ MAFs manually entered so that future data analysis could imbed mitigation projects within their environments.

The University of Louisville's Center for Hazards Research (CHR) and Kentucky Emergency Management (KYEM) have written a fully-illustrated "CHAMPS Navigational Tutorial" that is used in and to guide trainings with CHAMPS. This full document spans over 600 pages. Provided as ***Appendix E-2-3*** is a portion of this "Navigational Tutorial" that lays out how users of CHAMPS see and subsequently use the Mitigation Action Form (MAF) to collect data related to potential and current projects.

The Link Between Training and Raw Data Collection

Before and during the 2012 implementation of CHAMPS v1, KYEM was manually inputting data into the MAFs regarding some of the environment surrounding mitigation project sites. One purpose of the training in both CHAMPS v1 completed in March 2013 and in CHAMPS v2 that began in June 2013, was to show how local and regional mitigation stakeholders would incentivize local jurisdictions to provide the raw data required for CHAMPS to be a useful analytical and informational tool.

The Standard Portion of *CK-EHMP 2013* includes, as Appendix 6-6, a report detailing the dates of, attendance to, and results of survey feedback about CHAMPS v1 training. This report is provided here as ***Appendix E-2-4***.

This Enhanced Portion of *CK-EHMP 2013* updates the results of CHAMPS implementation-via-training. From June 2013 to the publishing of this section of the Updated Enhanced Plan in March of 2014, CHAMPS v2 has been implemented through sixteen (16) specific training sessions. These training sessions were conducted in one of two formats: either through "direct" ("hands-on") training (e.g. workstations and seminars at a conference, via classrooms) or as a "Webinar." As CHAMPS v1 was never intended to be the finalized program, CHAMPS v1 training was targeted toward Kentucky's Area Development Districts (ADDs): In another example of integration with other state planning initiatives, Kentucky's ADDs typically represent the source of information and best practices toward which many local mitigation stakeholders turn to first. Training ADDs in what was essentially a "beta version" of CHAMPS allowed the ADDs simultaneously to express the mitigation opportunities and efficiencies that resulted from CHAMPS to the local jurisdictions over which the ADDs preside and was able to help with implementation of CHAMPS v2 as it was targeted toward local stakeholders equally with ADDs and other stakeholders.

In the Table below, the recreation of Appendix 6-6 of the Standard Portion to ***Appendix E-2-4***) are the dates, locations, foci, recorded attendance, and format (whether direct/hands-on or webinar) of *both* CHAMPS v1 and CHAMPS v2 trainings.

Table E-2-4: Completed CHAMPS Implementation-via-Trainings, 2012 - 2014

DATE OF TRAINING	LOCATION	PORTION OF CHAMPS FOCUSED UPON	ATTENDANCE	FORMAT OF PRESENTATION
December 18, 2012	Bluegrass Area Development District (BGADD)	CHAMPS v1	7	Direct
January 10, 2013	Pennyrile (PeADD) and Purchase (PADD) Area Development Districts	CHAMPS v1	8	Direct
January 15, 2013	Lake Cumberland Area Development District (LCADD)	CHAMPS v1	20	Direct
January 17, 2013	Lincoln Trail Area Development District (LTADD)	CHAMPS v1	21	Direct
January 23, 2013	Northern Kentucky Area Development District (NKADD)	CHAMPS v1	12	Direct
February 5, 2013	KIPDA[149]	CHAMPS v1	9	Direct
February 6, 2013	Buffalo Trace Area Development District	CHAMPS v1	24	Direct
February 7, 2013	Kentucky River Area Development District (KRADD)[150]	CHAMPS v1	17	Direct
February 13, 2013	Barren River Area Development District (BRADD)	CHAMPS v1	24	Direct
February 14, 2013	Green River Area Development District (GRADD)	CHAMPS v1	23	Direct
February 27, 2013	Gateway (GWADD) and FIVCO Area Development Districts	CHAMPS v1	22	Direct
March 15, 2013	Pennyrile Area Development District (PeADD)	CHAMPS v1	8	Direct
June 13, 2013	Office of Mine Safety and Licensing @ KAMM Region 11 Quarterly Meeting	CHAMPS v2: Plans and Assessments	4	Direct
August 6, 2013	Lexington Armory	CHAMPS v2: Introduction	15+	Direct
November 21, 2013	Boone National	Comprehensive	12	Direct

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[149] KIPDA = Kentuckiana Regional Planning and Development Area

[150] Members of the Big Sandy Area Development District (BSADD) and Cumberland Valley Area Development District (CVADD) attended this training held at KRADD.

Date of Training	Location	Portion of CHAMPS Focused Upon	Attendance	Format of Presentation
	Guard Center/EOC	CHAMPS v2 Intended for KYEM Employees		
November 22, 2013	Boone National Guard Center/EOC	Comprehensive CHAMPS v2 Intended for KYEM Employees	9	Direct
December 17, 2013	Governor's Emergency Management Workshop (GEMW) @ Capital Plaza Hotel	CHAMPS v2 One-on-One Tutorials at Workstations	20+	Direct
January 2, 2014	GoTo Webinar	CHAMPS v2: Introduction/Overview	21	Webinar
January 16, 2014	GoTo Webinar	CHAMPS v2: Introduction/Overview	20	Webinar
January 23, 2014	GoTo Webinar	CHAMPS v2: Community Profile	20	Webinar
January 30, 2014	GoTo Webinar	CHAMPS v2: Assessments and Plans	12	Webinar
February 19, 2014	GoTo Webinar	CHAMPS v2: Introduction/Overview	8	Webinar
February 20, 2014	GoTo Webinar	CHAMPS v2: Community Profile	7	Webinar
February 21, 2014	GoTo Webinar	CHAMPS v2: Funding and Projects	14	Webinar
February 27, 2014	Boone National Guard Center/EOC	CHAMPS v2: Comprehensive with Emphasis on Simulation	13	Direct

From the table above, it should be noticed that CHAMPS v2 has been implemented-via-training both comprehensively (as overviews and/or as simulations) and focused upon individual components of the program ("modules"). The individual modules within CHAMPS v2 are introduced above. Attached, then, as ***Appendix E-2-5,*** are the agendas that guided the presentations for each of the CHAMPS v2 session types: Introduction/Overview ("Introductory Training"), Community Profile, Funding and Projects, and Plans and Assessments.

Future CHAMPS v2 trainings are scheduled as follows:

Table E-2-5: Future CHAMPS Implementation-as-Trainings Scheduled, March 2014 – October 2014[151]

DATE OF TRAINING	LOCATION	PORTION OF CHAMPS FOCUSED UPON	FORMAT TYPE
March 12, 2014	GoTo Webinar	CHAMPS v2: Assessment and Plans	Webinar
March 13, 2014	Pennyrile Area Development District (PeADD)	CHAMPS v2: Comprehensive/Overview with Emphasis on Simulation	Direct
March 18, 2014	GoTo Webinar	CHAMPS v2: Funding and Projects	Webinar
April 10, 2014	Maysville Community and Technical College	CHAMPS v2: Comprehensive/Overview with Emphasis on Simulation	Direct
May 8, 2014	Kentucky River Area Development District (KRADD)	CHAMPS v2: Comprehensive/Overview with Emphasis on Simulation	Direct
August 13, 2014	GoTo Webinar	CHAMPS v2: Funding and Projects	Webinar
October 6, 2014	GoTo Webinar	CHAMPS v2: Assessments and Plans	Webinar

Both CHAMPS v1 and CHAMPS v2 “direct” training, typically were conducted using a “tag-team” approach: One trainer presented the topics and information that were the focus of that day’s training while another trainer either navigated the CHAMPS software as illustration or provided one-on-one tutorial support.

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[151] Further trainings may also be scheduled within these dates.

KAMM Trainings

The Kentucky Association of Mitigation Managers (KAMM) with its previously-discussed diverse and ever-expanding membership also has conducted general training for its members that included the implementation of CHAMPS as part of its curriculum. The CHAMPS training typically involved introducing and overview CHAMPS, conducting one-on-one tutorials, and focusing CHAMPS on flood hazard event management (as KAMM primarily is devoted to flooding). KAMM trainings last from 9:00 AM to 4:00 PM and have been held on the following dates and at the following sites:

Table E-2-6: KAMM Training with CHAMPS Implementation Dates and Locations

Date	*Location*	*Attendance*
February 6, 2014	City Hall of Calvert City, Calvert City, Marshall County	26
February 7, 2014	Barren River Area Development District (BRADD), Bowling Green, Warren County	24
February 18, 2014	Kentucky River Area Development District (KRADD), Hazard, Perry County	18
February 19, 2014	Northern Kentucky Area Planning Commission (NKAPC), Crestview Hills, Kenton County	13
February 24, 2014	Bluegrass Area Development District (BGADD), Lexington, Fayette County	42
February 25, 2014	Augusta Community Center, Augusta, Bracken County	13
March 20, 2014	Lincoln Trail Area Development District (LTADD), Elizabethtown, Hardin County	14
March 21, 2014	Kentuckiana Regional Planning and Development Agency (KIPDA), Louisville, Jefferson County	21

B.: ***Demonstrating Integration with FEMA Mitigation Programs and Initiatives that Provide Guidance to State-Level and Regional Agencies***

As discussed in the updated section of the Standard Plan of this *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* (*CK-EHMP 2013*) under its “Mitigation Strategy” section (Part V, Element C.), FEMA typically offers five (5) grant programs that fund mitigation projects and planning documents. These are the following:

1) Hazard Mitigation Grant Program (HMGP)
2) Pre-Disaster Mitigation (PDM)
3) Flood Mitigation Assistance (FMA)
4) Repetitive Flood Claims (RFC)
5) Severe Repetitive-Loss (SRL)

Two (2) of programs no longer exist as individual grant programs (RFC and SRL) and the programs were discussed in detail in the aforementioned Part V, Element C. of the Standard Portion of *CK-EHMP 2013*. These five (5) programs as delineated *did exist* during Kentucky’s 2010 – 2013 planning cycle. Thus, Kentucky did apply for and receive mitigation project funding under these programs and in order to implement its 2010 mitigation strategies and integrate its 2010 plan with the FEMA mitigation program. A brief update on the current status of these programs will follow this discussion.

There are generally two categories of grant funding from FEMA: “disaster” funding and “cyclical” – non-disaster funding. During the 2010 – 2013 planning cycle were referred to as PDM, FMA, RFC, and SRL grants all were under the latter category, “cyclical” funding. PDM, FMA, RFC, and SRL grants were offered by FEMA to fund mitigation projects and plans regardless of whether a natural disaster catastrophic enough to be eligible to be “presidentially-declared” had occurred in that year.

The Hazard Mitigation Grant Program (HMGP) funding is available only after a natural hazard event has been “presidentially-declared”. After local and state-level recovery and assessment teams have accounted for the human and property costs of a particular hazard event, they may appeal to Kentucky’s governor to request from the President of the United States a “declaration” acknowledging the massive effects from the hazard events. When the governor makes a request to the President and if the President agrees with the request for a “declaration,” then grant funding is authorized from FEMA for the purposes of both recovery (public assistance and individual assistance) and to mitigate the effects of future hazard events (mitigation). If a natural hazard event has been “declared” with a subsequent proportion, up to 20% for Enhanced states, of the overall authorized funds resulting from that “declaration” reserved for projects intended to mitigation the effects from *future* hazard events, sub-applicants may apply for portions of the 20% set aside for mitigation projects regardless of whether the local jurisdiction represented was affected by the particular natural hazard that warranted the “presidential declaration.”

Over the past two[152] planning cycles (from 2007 until 2012), Kentucky had suffered not only many natural hazard events, but also hazard events that caused exceedingly heavy financial tolls on Kentucky's communities. This means that the vast majority of the fulfillment of Kentucky's 2010 mitigation plan update objectives that could be fulfilled using FEMA's mitigation programs which were funded using FEMA's Hazard Mitigation Grant Program (HMGP).

Further, the reliance upon HMGP funding implies that the majority of "cyclical" grant program funding (i.e. PDM etc.) *approved* or *managed* during the 2010 – 2013 planning cycle was directed toward planning.

The comprehensive breakdown of mitigation projects funded using all then-available types of FEMA grant funding was provided as an appendix to the Mitigation Strategy section of the updated Standard Plan of *CK-EHMP 2013* (Appendix 4-11-1). That appendix has been recreated here as ***Appendix E-2-6***.

For summative and clarifying purposes, the following synopsis of integration of 2010 plan objectives with FEMA grant funding is offered below:

Table E-2-7: Approved or Completed Mitigation Actions Using FEMA Funding by Type Since 2010

Mitigation Action Type	*Number of Projects[153] Approved or Completed*	*Primary 2010 Objective Addressed*
Ring-down System	3	1.1
Weather Radio	2	1.1
Warning Siren	23	1.1
Safe Room	52	1.4
Acquisition/Demolition	59	2.1; 2.2; 2.5
Drainage/Elevation	40	2.1; 2.2; 2.5
Landslide Acquisition/Soil Stabilization	7	2.6
Burials of Utility Lines	10	1.2
Generator	130	1.2
Planning	29	3.1; 4.1; 4.4; 6.4

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[152] Two planning cycles are referenced here because in applying for mitigation grant funding, approval can take many years. Consequently, during Kentucky's 2010 – 2013 planning cycle, it was overseeing mitigation project grants funded using money authorized from hazards that had affected Kentucky during its 2007 – 2010 planning cycle.

[153] The use of the word "projects" is important: Some individual "projects" had approved or completed multiple of a mitigation action type. For example, one "Weather Radio" Mitigation Action Type project could include the purchase of hundreds of individual weather radios.

The following is a recreation of a table used in “Part V., Element C.” of the “Mitigation Strategy” section of the Standard Plan of *CK-EHMP 2013* that breaks down the number of total mitigation actions (projects) approved or completed since 2010 down by FEMA grant type [p. 398]. This table adds the total amount of money applied for and approved per each funding category and is updated to exclude those mitigation actions (and their applied for or approved budgets) that had been and have been withdrawn since the approval of the Standard Portion of *CK-EHMP 2013*.

Table E-2-8: Approved or Completed Mitigation Actions Using FEMA Funding by FEMA Grant Program Since 2010

Funding Source[154]	*# of Mitigation Actions Funded*[155] *Through the Listed Funding Source, 2010-2012*	*Total Budgets Applied for or Approved*
Hazard Mitigation Grants Program (HMGP)	311 Mitigation Actions	$ 115,104,886
Pre-Disaster Mitigation (PDM) Competitive Program	23 Mitigation Actions	$ 4,330,553
Flood Mitigation Assistance (FMA) Competitive Program	5 Mitigation Actions	$ 1,818,527
Severe Repetitive-Loss (SRL) Program	3 Mitigation Actions	$ 1,300,944
Legislative Pre-Disaster Mitigation Program/Congressional Provision (L-PDM)[156]	7 Mitigation Actions	$ 3,371,316
Section “406”	283 Mitigation Actions	$ 420,283
Total Funding		$ 126,346,510

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[154] During the 2010 – 2013 planning cycle, Kentucky did not have approved any mitigation actions funded with Repetitive Flood Claims (RFC) grant funding.

[155] This list has been updated from the Standard Portion of *CK-EHMP 2013* to exclude projects that had and have been withdrawn.

[156] The “Legislative Pre-Disaster Mitigation Program” (L-PDM) is not technically a separate grant program offered by FEMA. However, mitigation actions funded as L-PDMs should be separated from the PDM program from which it derives its name. L-PDMs represent actions funded as a result of collaboration between the state legislature and/or Congress, FEMA, and the local jurisdiction receiving the grant for mitigation purposes.

The following is the breakdown of mitigation action type by FEMA grant program funding source since 2010:

Table E-2-9: Approved or Completed Mitigation Actions Using FEMA Funding by Mitigation Action Type and by FEMA Grant Program Since 2010

Funding Source	*Mitigation Action Type*	*# of Mitigation Actions Funded Through the Listed Funding Source, 2010-2012*
Hazard Mitigation Grant Program (HMGP)	Ring-down System	3
	Weather Radio	2
	Warning Siren	19
	Safe Room	47
	Acquisition/Demolition	47
	Drainage/Elevation	39
	Landslide Acquisition/Soil Stabilization	7
	Burial of Utility Lines	9
	Generator	129
	Planning	9
Pre-Disaster Mitigation (PDM) Competitive Program	Ring-down System	0
	Weather Radio	0
	Warning Siren	0
	Safe Room	1
	Acquisition/Demolition	3
	Drainage/Elevation	0
	Landslide Acquisition/Soil Stabilization	0
	Burial of Utility Lines	1
	Pump Station Upgrade[157]	1
	Planning	17
Flood Mitigation Assistance (FMA) Competitive Program	Ring-down System	0
	Weather Radio	0
	Warning Siren	0
	Safe Room	0
	Acquisition/Demolition	1
	Drainage/Elevation	1
	Landslide Acquisition/Soil Stabilization	0
	Burial of Utility Lines	0
	Generator	0
	Planning	3

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[157] This is obviously an outlier.

Funding Source	*Mitigation Action Type*	*# of Mitigation Actions Funded Through the Listed Funding Source, 2010-2012*
Severe Repetitive-Loss (SRL) Competitive Program	Ring-down System	0
	Weather Radio	0
	Warning Siren	0
	Safe Room	0
	Acquisition/Demolition	3
	Drainage/Elevation	0
	Landslide Acquisition/Soil Stabilization	0
	Burial of Utility Lines	0
	Generator	0
	Planning	0
Legislative Pre-Disaster Mitigation Program/Congressional Provision (L-PDM)	Ring-down System	0
	Weather Radio	0
	Warning Siren	1
	Safe Room	1
	Acquisition/Demolition	0
	Drainage/Elevation	2
	Landslide Acquisition/Soil Stabilization	0
	Burial of Utility Lines	0
	Generator	2
	Planning	1

FEMA also funds mitigation actions using a portion of the funds devoted toward Public Assistance (PA) and Individual Assistance (IA). This program is informally referred to as FEMA “Section 406” mitigation funding. This program is explained in further detail throughout the Standard Portion of *CK-EHMP 2013*[158]. A more focused discussion on FEMA “Section 406” mitigation funding is provided in this Enhanced Portion under the “Commitment to a Comprehensive Mitigation Program” section. Appendix E-7-6 breaks down what types of mitigation actions were funded using FEMA’s “Section 406” grant funding. This Appendix has been reproduced here as ***Appendix E-2-7***.

Kentucky has funded 283 mitigation actions using the FEMA “Section 406” grant funding program.

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[158] See especially the “Program Integration” subsection of the “Planning Process” section of the Standard Portion of *CK-EHMP 2013*, pp. 70-74.

Conclusion:
Present and Future Integration with Other Planning Initiatives

The *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* (*CK-EHMP 2013*) ensures that integration with other planning initiatives continues currently and will continue throughout Kentucky's future planning processes.

This will be partially achieved through Kentucky's 2013 mitigation strategy that clearly delineates the role of Kentucky vis-à-vis its local jurisdictions and their planning processes. This update clarifies that Kentucky will focus on three interrelated goals:

1) That it will be conducting outreach and training;
2) That it will expand the variety of mitigation options available and considered by its local jurisdictions; and
3) That it will pursue "public goods," i.e. mitigation actions that benefit the entire Commonwealth rather than one or more jurisdictions.

All other mitigation actions will derive from the bottom-up, i.e. the mitigation actions of Kentucky's local jurisdictions will be prioritized as Kentucky's mitigation actions. Thus, by definition, the *CK-EHMP 2013* is integrated with most planning initiatives at all levels of state governance.

Currently, integration is and will be achieved through the local planning process: Throughout both this upcoming state-level planning cycle and the one that will follow it, all of Kentucky's local jurisdictions will be updating their hazard mitigation plans. It is during these present and upcoming local planning processes that Kentucky will conduct its mitigation strategy of outreach, training, and the prompting of consideration of an increased array of mitigation options. It is during these local planning processes that Kentucky and its partners will further integrate the CHAMP System and other initiatives from its state-level and regional agencies.

The present and continued implementation of CHAMPS will focus on data collection. Indirectly, this will further link local jurisdictions and planning initiatives to Kentucky's overall mitigation planning process. To populate the databases that animate CHAMPS will require much outreach, much training, much cooperation, and great participation by all of Kentucky's mitigation stakeholders.

Finally, an update to funding information within the Standard Portion of *CK-EHMP 2013* needs to be addressed: At the time of the approval of the Standard Portion, it was unclear the future of FEMA's cyclical, competitive grant programs (i.e. PDM, FMA, RFC, and SRL). Since the approval, FEMA has been able to clarify the future of these programs: RFC and SRL no longer exist. They have been incorporated into Flood Mitigation Assistance (FMA) grant funding. Further, FMA grant funding can be utilized toward the development of flood-specific planning *that can be incorporated into overall hazard mitigation plans*. The Pre-Disaster Mitigation (PDM) grant will be funded for the foreseeable future. However, it will be funded at lower levels, but can be applied for repeatedly. Kentucky has already applied for local planning funding to update four of its regional (multi-jurisdictional) hazard mitigation plans that will be expiring within the next year. At the time of this writing and approval, Kentucky still is awaiting approval of these funds.

ENHANCED PORTION

PART III: Project Implementation Capabilities

A. Demonstrating Established Eligibility Criteria for Multi-Hazard Mitigation Measures

B. Describing Cost-Effectiveness Determinations (Consistent with OMB Circular A-94)

C. Describing the System to Rank Mitigation Measures According to Established Eligibility Criteria

REQUIREMENT §201.5(B)(2)(i-ii):

To be "Enhanced," the Commonwealth of Kentucky must document its project implementation capability, identifying and demonstrating the ability to implement the plan, which includes:

- *Establishing eligibility criteria for multi-hazard mitigation measures;*
- *A system to determine the cost effectiveness of mitigation measures, consistent with OMB Circular A-94, guidelines and Discount Rates for Benefit- Cost Analysis of Federal Programs; and*
- *A system to rank the measures according to the State's eligibility criteria.*

Hazard Mitigation Grant Program (HMGP) Administration

The Hazard Mitigation Grant Program (HMGP) is administered according to the guidelines of the HMGP State Administrative Plan. FEMA's Hazard Mitigation Grant Program has typically offered the following programs resulting in grant-types: Hazard Mitigation Grant Program (a.k.a. "disaster funding"), Pre-Disaster Mitigation (PDM) grants, Flood Mitigation Assistance (FMA) grants, and Repetitive Flood Claims (RFC) grants. The details and statuses of these programs have changed since 2010. Please see the "Standard Portion" of this plan for details.

The Hazard Mitigation Grants Program State Administrative Plan is the plan that is updated and submitted to the Federal Emergency Management Agency (FEMA) following a presidentially-declared disaster. The purpose of the HMGP State Administrative Plan is to describe the program and financial management procedures implemented by Kentucky Emergency Management (KYEM) that will administer the Hazard Mitigation Grant Program that is authorized through Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288 as amended). KYEM complies with all applicable federal statutes and regulations in effect with respect to the administration of the HMGP as authorized.[44 CFR §13.11(c)].

The KYEM Recovery Branch Mitigation Section is designated to administer the Section 404 HMGP. As specified in 44 CFR §206.436, the Governor's Authorized Representative (GAR) is the program administrator. Typically, the Governor designates the Director of Kentucky Emergency Management to serve as the GAR. The State

Hazard Mitigation Officer (SHMO), an employee of the KYEM Recovery Branch, is designated to coordinate activities of the Commonwealth of Kentucky State Hazard Mitigation Council (KYMC) and to serve as the responsible individual for project management and administration of the funds. KYMC members are selected either by designated Directors, Commissioners, or Cabinet Secretaries of state agencies, or by heads of non-state agencies that have hazard mitigation expertise and responsibilities. An Executive Order by the Governor or Memorandum of Understanding with KYEM may be used as needed to define the authority and responsibility of team members. The SHMO is assisted in project management and administration of awarded funds by up to seven (7) full-time mitigation specialists and two (2) part-time specialists. These employees work under the supervision of the SHMO.

Dissemination of Available HMGP Funding Information

Because it is critical to a project's success that projects have state and local support and interest, it is imperative that information regarding the Hazard Mitigation Grants Program (HMGP) be disseminated widely using multiple methods to access potential applicants. An announcement letter is sent to potential applicants via e-mail to provide basic information on the application process, program and project eligibility, available funds, and key deadlines. The e-mail also includes an example of a pre-application Mitigation Action Form (MAF). The e-mail is sent to each Emergency Management Area Manager, each Area Development District (ADD) Executive Director or ADD mitigation point of contact, the Kentucky Association of County Officials, and the Kentucky League of Cities for dissemination. In addition, the package is e-mailed to individuals who have previously requested to receive information. The information also is posted on the Kentucky Emergency Management (KYEM) website.

Two (2) distinct types of applicant briefings are conducted by KYEM. The first immediately follows a presidential disaster declaration: The KYEM Recovery Branch delivers applicant briefings in which the main emphasis is on reaching potential applicants to FEMA's Public Assistance (PA) Program. Each of these types of briefings is located in a facility that is easily accessible to 10 to 12 impacted counties. The final briefing of this type is conducted in Frankfort, Kentucky for state agency applicants and for local applicants who were unable to attend the briefing previously held in their locale. While the main focus of these briefings is Public Assistance, a portion of the presentation involves both 404 and 406 mitigation opportunities.

The second type of applicant briefing occurs several weeks later and after disaster recovery activities are well underway. In this type of applicant briefing, the KYEM Mitigation staff provides mitigation-specific applicant briefings. The eleven (11) KYEM Regional Response Managers – who are the local points of contact for emergency management activities and are knowledgeable of the people and issues within their designated areas – are used to disseminate information about the hazard mitigation program. Kentucky's Area Development Districts (ADDs) – which, as described in the Standard Portion of this plan, are the primary link between state and local governments for grant programs and economic development at the local level – also disseminate program information and encourage potential applicants to identify projects.

Project Identification

The “Mitigation Strategy” section of a FEMA-approved Hazard Mitigation Plan is the first source of identification of mitigation issues and potential projects. In Kentucky’s unique case, its mitigation strategies derive primarily from Kentucky’s local multi-jurisdictional hazard mitigation plans. (This is described thoroughly in the Standard Portion of the 2013 update of the Commonwealth of Kentucky’s hazard mitigation plan.) These strategies have been reviewed and prioritized by the participating jurisdictions according to the jurisdictions’ analysis of its risks and vulnerabilities. There is further prioritization at the state/agency level. This process, again, is described exhaustively within the Standard Portion of this 2013 update of Kentucky’s hazard mitigation plan.

Information acquired during preliminary damage assessments is one source for identification of mitigation issues and potential projects. Damage assessment teams are briefed as to the availability and requirements of the Hazard Mitigation Grants Program (HMGP) so that potential projects can be identified for follow-up by the State Hazard Mitigation Officer (SHMO).

Mitigation measures not eligible for funding through the Public Assistance (PA) Program may be eligible for Hazard Mitigation Grant Program funding. The Public Assistance “joint preliminary damage assessment teams” (consisting of federal, state, and local representatives) may also identify broad or comprehensive projects potentially impacting multiple sites.

NOTE ON:

APPLICANTS (“SUB-APPLICANTS”) VS. GRANTEES (“SUB-GRANTEES”) USED THROUGHOUT ENHANCED PORTION

This Enhanced Portion of the 2013 update of Kentucky’s hazard mitigation plan (as opposed to the Standard Portion) consistently differentiate between Applicant and Grantee and, subsequently, “sub-applicant” and “sub-grantee.”

The difference between being an Applicant (“Sub-Applicant”) and Grantee (“Sub-Grantee”) only involves time related to mitigation project implementation process: An Applicant (“Sub-Applicant”) becomes a Grantee (“Sub-Grantee”) when a mitigation project is awarded funding via a grant, i.e. the grant deriving from the Hazard Mitigation Grant Program (HMGP).

Thus, when this Enhanced Portion alternates between using Applicant (“Sub-Applicant”) and Grantee (“Sub-Grantee”), it is acknowledging this difference in project implementation status.

Interagency Hazard Mitigation Reports from previous disasters are reviewed to identify potential projects for funding. Issues and recommendations of the Interagency Hazard Mitigation Team or the Hazard Mitigation Survey Team are reviewed to identify potential projects.

Potential projects also can be identified during the preparedness phase of emergency management from a variety of sources which may not be apparent until a disaster occurrence or recovery effort is underway. Applicants currently are encouraged to develop projects in Kentucky’s Community Hazard Assessment and Mitigation Planning

System (CHAMPS[159]) in advance of disaster declarations, so that when funds become available applications will be readily available for submittal to Kentucky Emergency Management (KYEM).

Grant managers also work with sub-applicants statewide to determine mitigation needs and local priorities for potential projects. Sub-applicants are encouraged to submit Mitigation Action Forms (formerly known as Letters of Intent) for all potential projects under HMGP disaster funding or Pre-Disaster Mitigation (PDM) programs as appropriate. Developing potential mitigation projects is an ongoing effort at KYEM. Potential projects detailed in Mitigation Action Forms (MAFs) are assessed by KYEM mitigation staff for eligibility, feasibility, and cost effectiveness before advancing to the application phase.

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[159] CHAMPS is elaborated upon in the Standard Portion of the 2013 update of Kentucky's hazard mitigation plan.

HMGP Eligibility for Multi-Hazard Mitigation Measures

To be considered eligible for funding, a project must meet the following minimum criteria:

1. That it comply with federal project requirements as specified in 44 CFR §206.434(c).
2. That it is located in a community participating with good standing in the National Flood Insurance Program (NFIP) if that community is mapped and has an identified special flood hazard area(s).
3. That it meet all applicable federal, state, and local permit and regulatory requirements.
4. That it be cost effective and that it substantially reduce the risk of future damage, hardship, loss, and/or suffering resulting from a major disaster. Further, applicants must provide a comparison of the cost of the project against the anticipated value of future damage reduction by demonstrating and documenting that the project:
    a. Addresses a problem that has been repetitive or is one that poses a significant risk to lives, health and safety, essential services, critical facilities, or the local economy if left unsolved.
    b. Does not cost more than the anticipated value of the reduction in damages to the area if future disasters were to occur (i.e. benefits exceed the cost of the proposal). Both costs and benefits shall be computed on a net present value basis.
    c. Is the most practical, effective, and environmentally-sound alternative after consideration of a range of alternatives and has the greatest potential impact on reducing future disaster losses.
    d. Contributes to a permanent or long-term solution (to the extent practicable) to the problem it is intended to address.
    e. Considers long-term changes to the project area and has manageable future maintenance and modification requirements.
    f. Benefits the community rather than a small number of people and best fits within an overall plan for development or hazard mitigation for the community and the Commonwealth of Kentucky.
    g. Is consistent with any applicable local- and state-level hazard mitigation plans.
    h. Solves a problem independently, or constitutes a functional portion of the solution where there is assurance that the project, as a whole, will be completed.

Eligible projects indicate that a determination that the minimum project criteria identified in the HMGP regulations (44 CFR §206.434) have been met. Project proposals within declared disaster areas are given priority; proposals then are selected according to mitigation effectiveness, population served, facilities protected, and Kentucky Hazard Mitigation Council priorities for maximizing available funding. The general system for prioritization is detailed in the Standard Portion of this plan. While the eligibility criteria listed above generally refers to all FEMA grant programs operating under its Hazard Mitigation Grant Program, sub-applicants whose eligible “regular” (read “disaster-funded”) project proposals are not selected for post-disaster funding are encouraged to apply for PDM grant-funding or FEMA’s other cyclical grant programs funding, specifically.

Generally, eligibility criteria has not changed since 2010. The prioritization process detailed in the Standard Portion of *CK-EHMP 2013* has changed, however.

HMGP Project Application Procedures/Selection Process

The Commonwealth of Kentucky notifies FEMA of its intent to participate in the HMGP by specifically including a request for Hazard Mitigation funding in its request to the President for a major disaster declaration [44 CFR §206.436; §206.36(a)].

A Mitigation Action Form (MAF) for a proposed project is submitted to the State Hazard Mitigation Officer (SHMO) within 30 days of the notification of the availability of funds and the request for MAFs by Kentucky Emergency Management (KYEM). All approvals for MAF submission timeframe extensions are at the discretion of the SHMO.

The MAF includes the following:

a. Geographical and statistical information which describes the applicant's jurisdiction;
b. A brief description and location of the proposed project;
c. An approximate cost (if possible to determine) for the proposed project;
d. Indication of participation with good standing in the National Flood Insurance Program (NFIP); and
e. Applicability and conformance with a local hazard mitigation plan.

If all required information is not provided, the SHMO may request supplemental information depending upon the scope of the project and timeframe.

Mitigation Action Forms and applications must be submitted by the Applicant's Agent or Chief Executive Officer of the responsible state or local government (city/county/merged governments) or private non-profit organization. The letters and applications are submitted within CHAMPS to the State Hazard Mitigation Officer at KYEM.

After all MAFs for the Hazard Mitigation Grant Program have been received, the State Hazard Mitigation Office reviews them for the preliminary eligibility determination. Then, the Kentucky Mitigation Council (KYMC) meets approximately 30 days after the MAF due date to review and act upon initiative and planning Mitigation Action Forms. If necessary, the council may meet more than once to take action on the proposed projects. The application for HMGP funding should be submitted by the communities recommended for application development by the KYMC within 90 days after notification of the council's recommendation.

During the KYMC selection review process, it is sometimes the case that additional project information is needed by the KYMC or FEMA. The State Hazard Mitigation Officer and mitigation staff are responsible for obtaining the needed information from the Applicant's Agent.

The State Hazard Mitigation Council is responsible for reviewing, ranking, and selecting projects for submission to FEMA for HMGP funding. Each application is reviewed for eligibility in accordance with criteria contained in Section IV (A) & (B) of the State

Administrative Plan, 44 CFR §206.434 and 44 CFR §206.435, and the strategy and criteria contained in the State Hazard Mitigation Plan.

Selection criteria include, but are not limited to:

- Measures that best fit within an overall plan for development or hazard mitigation in the community, disaster area, or within the Commonwealth more generally;
- Measures that, if not taken, will have severe and detrimental impacts on the applicant or "sub-applicant," including: potential loss of life, loss of essential services, damage to critical facilities, and/or economic hardship on the community;
- Measures that have the greatest potential impact for reducing future disaster losses (44 CFR §206.435 (b))

In addition to the selection criteria noted above, consideration will be given to measures that are designed to accomplish multiple objectives including damage reduction, environmental enhancement, and economic recovery, when appropriate (44 CFR §203.436 (c)).

It is the responsibility of the KYMC to select and prioritize initiative and planning projects to be recommended to FEMA for funding. The State Hazard Mitigation Officer serves as the coordinator and chair of the KYMC. The KYMC also provides technical advice and assistance to the SHMO and applicants in preparing detailed or technical information that may be required by FEMA, and for the administration of the program.

Project applications are reviewed, ranked, and prioritized according to the system articulated in the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* in the *Mitigation Strategy* section. Briefly synopsizing: Mitigation Action Forms/potential applications will be placed into separate review categories: Reviews for Acquisitions/Demolitions/Relocations, reviews for education campaigns/initiatives/et al., and reviews for all other types of mitigation actions. Of the latter category (i.e. actions that are not acquisitions et al. and education campaigns et al.), these projects are sub-categorized/ranked into *A-Projects* and *B-Projects*. *A-Projects* are those actions that protect critical facilities. *B-Projects* are those actions that do not protect critical facilities and only protect populations. Within *A-Projects* and *B-Projects*, mitigation actions are further prioritized and ranked according to whether they address "high," "medium/moderate," or "low" hazard-type risk as articulated in the local mitigation plan under which the sub-applicant is justifying its submission of mitigation action. Acquisitions et al. and education campaigns et al. are prioritized and ranked only through Benefit-Cost Analysis (BCA).

All project applications are submitted to the Department for Local Government's (DLG) Kentucky State Clearinghouse for historical and environmental impact reviews. The Kentucky State Clearinghouse has been designated as the state's Single Point of Contact (SPOC) and is charged with providing state and local input to the appropriate federal agency. At the state level, this task is accomplished by identifying those state agencies that should be involved in the planning and development of activities by Executive Order (EO) 12372, and providing these agencies with the opportunity to evaluate proposals in a timely and effective manner. All federal applications are subject to the EO 12372 Intergovernmental Review Process unless the application specifically states that it is not subject to EO 12372.

Eligible MAFs for the regular program proceed to the Benefit-Cost Analysis (BCA) and grant application phases. Applications which require a BCA for project approval complete a project-specific Data Documentation Template (DDT) and submit it to the assigned grant manager for analysis. Once a positive (1.0 or higher) Benefit-Cost Ratio is reached, the actual project application process can begin. This process is discussed further below.

Following the reviewing, ranking, and prioritization process by the KYMC and the project selection, each applicant is contacted by the assigned grant manager with results of said reviewing, ranking, and prioritization process. An application can either be reviewed “favorably” or “unfavorably.” Applicants whose applications were reviewed and subsequently ranked/prioritized “unfavorably” according to the selection and prioritization process described in the Standard Portion of this 2013 update of Kentucky’s hazard mitigation plan are classified into two groups: Those whose applications are “suspended” and those whose applications are “denied.” A “suspended” application will be followed with a request to “revise and resubmit.” As the term makes obvious, the sub-applicant has the option to revise the project application addressing the points the reviewer cited that lead to the application being reviewed “unfavorably.” A “denied” application may appeal the decision. If an appeal on an “unfavorably” reviewed and “denied” application is not made, then the application is removed from the selection process. Usually a “denied” application results from the “unfavorable” review primarily citing as reason that the goal and/or objective of a mitigation project is superfluous or irrelevant to the general mitigation goal and objectives of the Commonwealth of Kentucky and/or to specific goals and objectives of the local (multi-jurisdictional) hazard mitigation plan under which the application presumably is justified. All remaining applications are ranked again and accordingly at the end of the appeal period.

If an appeal is made, it is reviewed by a HMGP Appeals Review Board. The board consists of three (3) members (nominated by the State Hazard Mitigation Officer and approved by the Governor’s Authorized Representative) from state, local, and private/ non-profit agencies who are not Applicant Agents for the current declaration. One (1) member is appointed from Kentucky Emergency Management (KYEM). The State Hazard Mitigation Officer (SHMO) then serves as coordinator and secretary for the board, but does not have any input into the board’s decisions. Current members of the KYMC are not eligible to serve on the board.

An appeal must be submitted in writing to the SHMO within 15 working days from the date the applicant receives notification of the council's decision regarding review and subsequent ranking and prioritization of an application. Appeals may only address the criteria which were not met by the project application cited as reason for its unfavorable review and subsequent low(er) ranking and prioritization. Applications are not opened for supplemental information unrelated to the reasons the application did not meet the criteria.

Upon receipt of an appeal, the SHMO has 10 working days to prepare it for the HMGP Appeals Review Board. Once received, the board then has 10 working days to review the appeal and conduct an open meeting on the tenth day to review the appeal and make its decisions. An applicant whose appeal is being reviewed will be invited to attend the meeting of the board.

Based on the application and appeal, the board may make one of the following decisions:

- The application should be reviewed, ranked, and prioritized again;
- The application continues to remain "denied" (and, hence, non-eligible for funding) as currently reviewed. Following this decision, a "revise and resubmit" request will be issued: The applicant has 10 working days to revise the application and resubmit to the KYMC.
- The application remains "denied" and non-eligible for funding and cannot be revised. This usually coincides with the application being superfluous to the mitigation priorities of the Commonwealth of Kentucky and/or the local hazard mitigation plan under which the application is presumed to be justified.

Following the meeting of the board, the SHMO makes the adjustments as specified and makes final notifications to applicants.

Submission of Selected Projects to FEMA

The State Hazard Mitigation Officer (SHMO) prepares a project application package for each project selected by the Commonwealth of Kentucky for submission to FEMA. The project application package contains:

- A prioritized list of project titles;
- A cover letter attached to each application identifying the specific mitigation measure for which funding is requested that:
  - describes the anticipated project benefits,
  - provides justification for team recommendations and a rationale for project selection,
  - contains pertinent project management information not included in the Hazard Mitigation Grants Program State Administrative Plan, and
  - provides a certification from the Governor's Authorized Representative (GAR) that the project meets all eligibility requirements of the plan.

Project applications must be submitted to FEMA no later than 365 days following the date of the disaster declaration. The Commonwealth of Kentucky can apply to FEMA for up to two (2) 90-day extensions to the application period.

Upon notification from FEMA of a decision regarding Kentucky's selected projects, the State Hazard Mitigation Officer (SHMO) notifies applicants of FEMA's determinations. If a project was approved, then the implementation process begins with the execution of the Commonwealth of Kentucky PON2 contract. An award briefing is provided for the sub-applicant that discusses among other relevant project-specific topics:

Quarterly reporting requirements
Funding/reimbursement requests
Eligible project costs
Project cost documentation and administrative procedures
The Period of Performance
Close-out

If the sub-applicant's project is suspended by FEMA, then the project's grant manager will supply the reasons for the suspended status and detail to the sub-applicant the supplemental information required for FEMA to proceed with its review.

If the sub-applicant's project id denied by FEMA, then the grant manager will provide the sub-applicant with the reasons the project was denied. Sub-applicants are then informed of the following appeal process:

Appeal Process for FEMA-Denied Project Applications

State Action

- The Governor's Authorized Representative (GAR) may appeal, on behalf of an applicant or the Commonwealth of Kentucky, any FEMA denial of federal assistance.
- The appeal shall be submitted in writing by the sub-applicant (local community) to the SHMO within 45 days after receipt of the notice of the denial from FEMA.
- The State's appeal shall be in writing and submitted to FEMA within 60 days from the date the denial was received from FEMA.

FEMA Regional Administrator

The FEMA Regional Administrator shall review the appeal and notify the GAR within 90 days from the receipt of the appeal.

FEMA Associate Director

- If the appeal is denied by the Regional Administrator, the GAR may appeal to the FEMA Associate Director. This appeal shall be made in writing through the Regional Administrator and shall be submitted no later than 60 days following receipt of the Regional Administrator's denial.
- The Associate Director shall decide on the GAR's appeal within 90 days from the receipt of all related information.
- The Associate Director may refer technical appeals to independent scientific or technical advisors for review.

FEMA Director

- If the appeal is denied by the Associate Director, the GAR may appeal to the FEMA Director. Appeals shall be submitted in writing through the Regional Administrator no later than 60 days after receipt of the Associate Director's denial.
- The Director shall decide on the GAR's appeal within 90 days following receipt of the appeal or shall make a request for supplemental information. Within 90 days following receipt of the supplemental information, the Director shall notify the applicant of the decision.
- The Director may refer technical appeals to independent scientific or technical advisors or to FEMA personnel for review and recommendations. Within 90 days after receipt of the recommendations the Director shall notify the applicant of the decision [44 CFR §206.440 (3(d))].
- If supplemental information is requested by the Regional Administrator, Associate Director, or Director, the applicant shall have 20 working days from the receipt of the request to submit the information to the GAR.

Scope of Work and Completion of an Approved Project

Traditionally, work on an approved project began within 30 days of the executed contract and was to be completed by the Period of Performance date as established by FEMA. From this hazard mitigation plan and presumably onward, this has changed subtly: Work on an approved project still must begin within 30 days of the executed contract; but, there no longer are Period of Performance dates specific to individual projects. A project's Period of Performance coincides with the date that the final project to be funded using money designated for a specific presidentially-declared disaster is approved.

Traditionally, if a time extension was needed, the applicant could request up to a one (1) year extension to the State Hazard Mitigation Officer (SHMO). The State would, in turn, request the extension from FEMA's Regional Director. A second one (1) year extension could be requested through FEMA Headquarters. Whether or not this process for securing an extension on the amount of time a sub-applicant possesses to complete the Scope of Work of a FEMA-approved project is relevant given the new conceptualization of the Period of Performance remains ambiguous.

An eligible HMGP project which is part of a larger undertaking may be declared complete for final federal and state payment if it meets the eligible FEMA Scope of Work (SOW), even if the larger undertaking is not yet complete [CFR §206.438 (d)]. If a project is not completed and there is not adequate justification for non-completion, no federal funding is provided [CFR §206.438 (d)]. There is no Commonwealth funding for non-completed projects if FEMA does not provide funding. Project monitoring identifies and FEMA is notified through Quarterly Tracking Reports of the existence of such projects.

The Commonwealth of Kentucky's Hazard Mitigation office tracks the completion of work using the following tools:

- Quarterly Reports to be sent out for the quarters ending March 31, June 30, September 30, and December 31.
- E-mails, phone calls, and site visits as conducted by the grants manager, Kentucky Emergency Management (KYEM) Regional Managers, KYEM Internal Auditors, and the State Hazard Mitigation Officer (SHMO).
- Internal documents such as the "Project Tracker," "Period of Performance Extension Reminders," "Final Invoice Reminder," and "Individual Project Progress Reports." These are described in the Standard Portion of this 2013 update of Kentucky' hazard mitigation plan in its *Plan Maintenance* section.

Grantees or sub-grantees must obtain prior approval of the State Hazard Mitigation Office and in some cases FEMA, whenever any of the following actions is anticipated [44 CFR §13.30 (d)]:

- Any revision to the Scope of Work (SOW) of the project (regardless if there is an associated budget revision requiring prior approval),
- Any expenditure of funds exceeding the approved project budget,
- A need to extend the Period of Performance,
- Changes in key personnel who were specified in the application or grant award

If a sub-grantee wishes to make modifications to the Scope of Work (SOW) or to the cost of the project, the State Hazard Mitigation Officer (SHMO) submits the revised SOW to FEMA Region IV for determination of eligibility. The request must be made within the application period. Depending on how significant the project modifications are, FEMA's review shall lead to eligibility or denial of the modifications. If denied, the applicant has three (3) options:

1. Proceed with the original eligible project;
2. Withdraw the original project, "de-obligate" project funds, and submit a new project application, if within the allowable application submission window; or
3. Follow the appeal process described above.

Budget revisions which involve the obligation of additional Hazard Mitigation Grants Program (HMGP) funding must be submitted to FEMA for prior approval. Submissions to FEMA are made after the Governor's Authorized Representative (GAR) reviews the proposed modifications and determines them to be justified. Additional HMGP funds may only be obligated if there are enough unobligated funds remaining in the presidential disaster declaration to cover the request.

State and Local Program Administration

A project file is maintained by the State Hazard Mitigation Officer (SHMO) for each project submitted to the Commonwealth of Kentucky. Those applications not completed by the applicant or denied by the State Hazard Mitigation Council (KYMC) or FEMA are maintained in hard copy or in the hazard mitigation program database for possible future use by the local jurisdiction. All Mitigation Action Forms (MAFs) not followed by an application shall also be maintained in the Community Hazard Assessment and Mitigation Planning System (CHAMPS) for future consideration.

In accordance with 44 CFR §13.42, OMB Circular A-102, and OMB Circular A-110, all financial records, supporting documents, statistical records, and all other records pertinent to the eligible project must be retained by the State and applicant for three (3) years after the completion date of the project for purposes of examination and audit. State and local governments may also impose additional record retention and maintenance requirements.

The retention requirement extends to books of original entry, source documents, supporting and supplemental accounting transactions, general ledger, subsidiary ledgers, personnel and payroll records, canceled checks, and related documents and records. Source documents include copies of all agreements, sub-agreements, applications, and financial and narrative reports submitted by the grantee and "sub-grantee." Personnel and payroll records must include the time and attendance reports for all individuals reimbursed under the project, whether they are employed full-time or part-time. Time and labor reports are required for consultants who are reimbursed.

The three-year retention period begins on the date of the official FEMA close-out letter. Exceptions to the three-year requirement apply to situations such as equipment and real property acquired with federal funds, audits, litigation, claims, negotiations, or other actions involving the records as stipulated in 44 CFR §13.14, OMB A-102, and A-110.

A management system is implemented by the local jurisdiction for the duration of the project (44 CFR §13.20 (b) (2); 44 CFR §13.24 (b) (6); 44 CFR §13.36 (b) (2); CPG 1-.32; page 2-8 (14); OMB A-110, Attachment F). Quarterly Progress Reports must be submitted by the Applicant's Agent to the State Hazard Mitigation Office beginning at the end of the first full federal fiscal year quarter after FEMA notification of award and continue until project closeout.

The SHMO submits a quarterly Hazard Mitigation Program Tracking Report ("Project Tracker") on each project to FEMA. The report indicates the status and completion date for each measure funded. Any problems or circumstances affecting completion dates, the approved scope of work or project costs which are expected to result in non-compliance with approved grant conditions, is described in the report. Final inspection of work completed and documentation of costs contain a complete assessment of project accomplishment.

Selection of Applicant's Agent

During development of the HMGP application, the sub-applicant appoints and documents an Applicant Agent to serve as project manager. If a new Applicant Agent is appointed during the eligibility or project implementation process, documentation of the appointment must be submitted to the State Hazard Mitigation Officer (SHMO).

The responsibilities of the Applicant Agent include:

- Monitoring project completion and submission of Quarterly Progress and Financial Reports to the State Hazard Mitigation Office as directed at the time of the grant award;
- Maintaining original financial records, documentation, and receipts necessary to document all expenditures connected with the project (44 CFR §13.20 (b) (1); (14)).
- Ensuring the eligible scope of work approved by FEMA and the State as specified in the project application is completed in accordance with all applicable standards of safety, decency, and sanitation, and in conformity with applicable codes, specifications, laws, regulations, and grant management requirements.

The State Hazard Mitigation Officer's project management responsibilities include:

- Reviewing Quarterly Progress and Financial Reports submitted by "sub-grantees;"
- Monitoring and evaluating project accomplishments and adherence to the approved Scope of Work, work schedule, and program and financial procedures;
- Submitting HMGP funding balance and status reports to FEMA as required;
- Reviewing requests for interim and final payments and making recommendations to the Governor's Authorized Representative (GAR);
- Maintaining the necessary financial documentation and progress reports to support funds disbursed to sub-grantees;
- Reviewing claims, certification of costs, cost overruns, changes in scope, audits, and appeals, and forwarding such information to the GAR;
- Coordinating hazard mitigation project actions with the GAR and FEMA as necessary;
- Providing assistance as required in administering the Hazard Mitigation Grant Program and serving as the coordinator and chair of the State Hazard Mitigation Council;
- Performing any administrative actions necessary for the normal function of the Hazard Mitigation Grant Program; and
- Notifying sub-grantees of actions taken in response to applications.

The Governor’s Authorized Representative (GAR) management responsibilities include:

- Overall grant management;
- Providing technical assistance to sub-grantees as necessary;
- Certifying that all claims and costs are eligible and compliant with provisions of the FEMA-State (Commonwealth) Agreement and submit claims to the FEMA Region IV Director;
- Serving as a member of the State Hazard Mitigation Council (KYMC);
- Providing technical, administrative, and financial management advice to the State Hazard Mitigation Officer (SHMO).

Financial Administration

Kentucky Emergency Management (KYEM), as the grantee, provides financial management for all projects in accordance with 44 CFR Part 13. Sub-grantees are accountable to the grantee for funds that are awarded. The funding period as defined in 44 CFR §13.23 is the time period from date of the FEMA award until the end of the Period of Performance.

Sub-grantees must comply with procurement procedures mandated by applicable state and local laws and regulations, provided that the procurements conform to applicable federal laws, regulations, and standards. All procurement transactions are to be conducted in a manner providing full and open competition consistent with the standard in the federal regulations as contained in the Common Rule. Any local public agency may adopt the provisions of the Kentucky Model Procurement Code and no other statutes governing purchasing shall apply upon adoption of the code. If the Model Procurement Code or other procurement code is not adopted, the state’s procurement code applies.

General policies for determining allowable costs are established in 44 CFR §13.22, 2 CFR 225 (Cost Principles for State and Local Governments, i.e. Common Rule, Office of Management and Budget), Circular No. A-122 (Cost Principles for Non-Profit Organizations), and CPG 1-32 (Financial Assistance Guidelines, FEMA). Exceptions to those policies are allowed by 44 CFR §13.4 and §13.6.

Generally, sub-grantees must adhere to the Kentucky Prevailing Wage Law if the total project cost exceeds $250,000. There are no exemptions for a city, county, urban-county government, or school district. It is the responsibility of the sub-applicant to obtain the prevailing wage rates prior to advertising the project for bid. The notification form included in the application is used to receive notification from the Labor Cabinet. After notification of a prevailing wage project, the Labor Cabinet assigns a project number and sends the correct wage rates to the applicants. These rates must be used in the project’s budget to calculate the cost of the project.

It is the responsibility of the sub-applicant to ensure that the wage rates are included in the bid documents and are made a part of each contract awarded for the construction of the specific public work. The Applicant’s Agent must include in the project’s cost documentation that this procedure was followed and that the correct rates were paid.

Interim payments of federal funds can be issued by the Governor's Authorized Representative (GAR) upon recommendation of the State Hazard Mitigation Officer (SHMO) based upon proper completion, proper documentation, eligible work accomplishment, and the need for funds. In the event circumstances warrant, the amount of interim payment requested by the applicant may be adjusted. Such circumstances include the:

- Sub-applicant's history of providing adequate cost documentation for this and other declared disasters;
- Failure to properly complete the eligible scope of work for disaster programs or disaster declarations; and/or
- Need to establish a project reserve fund to cover unforeseen future cash flow problems.

Requests for interim payment of funds with justification and supporting documentation must be submitted in writing to the SHMO. Required documentation consists of the following:

- Master Agreement Invoice;
- Summary of Documentation;
- Daily Activity Reports for labor, equipment, and materials;
- Time sheets showing pay period, employee name, job classification, hours worked each day by application number, total hours worked for the pay period, rate of pay (regular or overtime), total earnings, and paycheck number;
- Canceled checks for materials purchased and contract work;
- Delivery tickets for materials;
- Copy of contract award;
- Invoices and all billing documentation;
- Bid advertisements from news media, website, etc.;
- List of bidders and bid amounts of each;
- If the low bid was not accepted, a statement by chief executive of the jurisdiction as to why; and
- Other documentation required by the SHMO or GAR for proper program administration and also state and federal grant management and audit requirements.

In addition to the required documentation listed above, the following is required for property acquisition and relocation projects:

- Map indicating properties acquired and relocated;
- Documentation of purchase price and other costs associated for each property purchased;
- Specific (by name of owner) addresses of purchased property;
- Deed, containing green space requirement clause, for each property purchased;
- Appraisal for each property purchased, by address;
- Voluntary Transaction Agreement;
- Purchase Closing Worksheet or Settlement Statement for each property; and
- Other documentation deemed necessary by the SHMO and GAR for proper program management and also state and federal audit requirements.

If the request for an interim payment of federal funds is denied, the State Hazard Mitigation Officer (SHMO) notifies the Applicant's Agent in writing of the denial reasons. Additional documentation and explanation to support the request may be requested.

If the request for an interim payment of federal funds is approved, the SHMO reviews and signs the Master Agreement Invoice (MAI) and submits it to the appropriate Kentucky Emergency Management (KYEM) Recovery Branch transaction specialist for processing.

In the event of a documented serious cash flow problem, an interim payment of funds may be made on the basis of unpaid invoices. Except for the requirements of canceled checks, all other documentation must be provided. This type of interim payment is administered based upon invoices. Copies of canceled checks for payments must be provided to the SHMO as soon as they clear the bank. An Advanced Funding Agreement must be signed by the Applicant's Agent and the Governor's Authorized Representative (GAR) before any advanced payments are processed.

Final payment of the federal and state shares is made after project completion when all eligible costs have been determined, documented, and a final inspection of the project has been performed by KYEM. The applicant's claim and completed documentation for reimbursement must be submitted within 60 days of the completion of work. Upon written justification from the sub-applicant, the SHMO may grant an extension of 30 days. Final project closeout will be in compliance with 44 CFR §13.50.

Final federal and state share payments are disbursed in a single sum after final inspection and documentation review by the SHMO as part of the project close-out. Required supporting documentation for final payment is the same as for interim payments.

During project completion and prior to the final payment, the SHMO, KYEM Regional Managers, Internal Auditors, and State Mitigation Staff may inspect the work accomplished or the completed project and review cost documentation. Inspections and reviews determine if all eligible work is accomplished according to the approved scope of work and that all costs are allowable and properly documented. State and federal inspectors and auditors may also document completion as deemed necessary by FEMA, the GAR, and the SHMO.

If the final inspection(s) and documentation review(s) do not indicate any irregularities, the SHMO calculates the final payments based on the federal and state cost shares as specified in the federal regulations, taking into consideration any interim payments made to the applicant.

If interim or final documentation, inspections, or other reviews reveal irregularities in performance of work or documentation, the SHMO coordinates with the sub-applicant to correct the deficiencies. If deficiencies noted by the SHMO are not corrected, interim and final payments are not made. 44 CFR §206.438 (d) states that if a HMGP project is not completed and there is inadequate justification for non-completion, there will be no federal funding for that project. State policy is the same as the federal regulation. The applicant will be required to return any and all interim funding received for the project.

The SHMO (or, generally, designee) may conduct a random number of applicant inspections of completed projects to ensure record-keeping procedures are adequate. The SHMO uses the eligible application, State Administrative Handbook, federal and state grant management regulations and procedures, and standard operating procedures to conduct documentation reviews and to prepare a report for the GAR and project file. The SHMO also briefs the Applicant's Agent of any findings and conducts a follow-up assessment to ensure that required corrective action has occurred.

All federal funds disbursements are made using FEMA Letter of Credit procedures. When the Master Agreement Invoice (MAI) is approved by the Governor's Authorized Representative (GAR) for interim and final payments, the State Hazard Mitigation Officer (SHMO) submits the MAI, eMARS invoice, and Local Match packet to the FEMA Administrative Branch which then draws down funds from the FEMA "SmartLink" Payment System. Payments are made by Electronic Funds Transfer (EFT) to the sub-grantee. A notice of payment is provided to the Applicant's Agent for inclusion in the sub-grantee's project file.

Immediately following a Presidential Disaster Declaration, the Governor's Authorized Representative (GAR) provides the appropriate Kentucky Emergency Management (KYEM) Administrative Branch with a copy of the Governor's request for federal disaster assistance, the Executive Order, and a copy of the President's Disaster Declaration. The KYEM Administrative Branch ensures the establishment of separate accounts for federal and state disaster funds. These funds are accounted by pay-in vouchers and payment documents and maintained by the Administrative Services Accountant and by project files maintained by the SHMO. The SHMO will ensure sufficient funds are budgeted for grant closeout.

KYEM Administrative Services submits a quarterly report to FEMA on program withdrawals using SF 425 within 90 days after completion of all HMGP projects and completes quarterly PMS 272, Federal Cash Transactions, and Status of Federal Cash Reports, and submits them to the United States Department for Health and Human Services. Copies of Quarterly Reports are provided to the GAR. A separate SF 425 is required for each disaster.

Every effort is made to avoid instances where sub-grantees are paid more funds than can be supported by work completion, inspection, review, or audit. If an excessive interim payment is discovered prior to final payment of the federal and state shares, the GAR would withhold final payment pending corrective actions. If an interim payment exceeds final payment of the federal and state shares due, the GAR requests reimbursement of the balance from the sub-grantee. If the applicant refuses to repay an “over” interim payment, the GAR would then refer the case to the State Controller for initiation of collection efforts. The GAR also informs the SHMO and FEMA of the status of each case of over payment.

During the execution of work on an approved mitigation measure, the GAR may discover that actual project costs exceed the approved estimates. A cost overrun is defined as an unanticipated increase in the cost of performing the specified scope of work as defined in the project grant. When cost overruns occur, the applicant may request approval of additional funding by providing written justification (invoices, daily activity reports, progress reports, etc.) for evaluation by the SHMO and GAR.

All requests, documentation, and responses must be in writing and become part of the sub-grantee’s project file. Sub-grantees must prepare a cost overrun explanation which details the actual costs and work associated with the overruns. Overruns are each considered individually. The SHMO evaluates and prepares a recommendation for consideration by the GAR on each cost overrun. The approved scope of work on any project with a cost overrun must still be met. The request is submitted to FEMA for review and approval. For cost overruns which exceed federal obligated funds and require additional federal funds, the GAR evaluates each cost overrun and submits a request with a recommendation to the Regional Administrator for a determination. The sub-grantee’s justification for additional funding and other pertinent material accompanies the request. FEMA’s Regional Administrator notifies the GAR in writing of the determination and processes a supplement, if necessary. The total amount obligated to the state will never exceed the funding limits of the Stafford Act. Any such problems or circumstances affecting project costs are identified through the aforementioned Quarterly Progress Reports made to the State Hazard Mitigation Officer (SHMO). Cost overruns must be in compliance with 44 CFR §13.30. All requests to change the scope of work must be requested before the change has begun.

Records of projects and funding provided under the Hazard Mitigation Grant Program to state and local governments are subject to the Kentucky Open Records Law (i.e., KRS Chapter 61). A written request for information is reviewed by the Governor's Authorized Representative (GAR). A response is provided within three (3) working days from receipt of the request. Requests must be specific and in writing. Blanket requests for information are not honored. A copy of the original letter of request is sent to the Executive Director of FEMA immediately and the proposed response is forwarded as soon as possible.

When copies of records are requested, a written request describing the records to be copied is required. Kentucky Emergency Management (KYEM) will make copies at a charge of $0.10 per page. KYEM does not copy records that have not been inspected. Original copies of records are not removed from KYEM facilities. Requests for statistical data or for information which has not been compiled are not honored.

It is the sub-grantee's responsibility to be aware of and comply with OMB Circular A-133 Single Audit requirements. All sub-grantees expending in excess of $500,000 in federal funds during a fiscal year must provide KYEM with a copy of an OMB Circular A-133 audit. Notice of this requirement is included in the PON2 contract. Recipients have nine (9) months after the close of their fiscal year to complete and submit the audit.

Prior to expiration of the nine (9) month period, a KYEM internal auditor sends a notice to all sub-recipients (sub-grantees and sub-applicants), reminding them of OMB Circular A-133 Single Audit requirements. The notice requests information as to whether the sub-recipient was subject to an OMB Circular A-133 Audit, if there were any findings or anticipated findings, and the estimated completion date for audits in progress. The KYEM internal auditor maintains a tracking report of the above information to ensure sub-recipient notification and proper follow up on audit submission is completed in a timely fashion.

The submitted audit report is reviewed by the KYEM auditor primarily for the following components:

- Schedule of Expenditures of Federal Awards;
- Findings, recommendations, and questioned costs noted in the audit report;
- Inclusion of a corrective action plan for any findings noted in the Audit report detailing the sub-recipient's corrective action plan for cited deficiencies; and
- Schedule of prior audit findings to determine if prior findings have been corrected or carry over to the current audit period

The KYEM auditor will issue a management decision regarding any audit findings within six (6) months after receipt of the audit report and ensure that the sub-grantee takes appropriate timely and corrective action.

After a final site visit has been completed and final payment has been made, a project is ready for project close-out. The Commonwealth of Kentucky project manager will examine the project file and complete the appropriate close-out forms. The package will then be submitted to the State Hazard Mitigation Officer (SHMO) for review.

The Governor’s Authorized Representative (GAR) will sign a Request to Close Letter which has been reviewed by both the SHMO and the KYEM Pre-Audit Section prior to submission to FEMA regarding final claim amounts. FEMA will then issue a Final Claim Letter which will serve as the closeout date of the project. This is the final correspondence of the project.

When all projects resulting from a Presidential Disaster Declaration have been completed, all disbursements have been made, all documentation completed, and all audits performed, the SHMO requests, through the GAR, that the grant program be closed. The GAR conducts the necessary reviews of project accomplishment and submits the necessary documentation to FEMA to support the request for closeout. Records will be retained for a period of three (3) years after the date of FEMA program closeout notification.

Establishing Cost Effectiveness for Regular Mitigation Projects

Upon selection of a Mitigation Action Form (MAF) for regular mitigation projects, the next step is to establish cost effectiveness for the project through Benefit-Cost Analysis (BCA) prior to completing and submitting an application to FEMA. Applicants (sub-applicants) are sent a Data Documentation Template (DDT) specific to the project type. The DDT is in an Excel format and required data for the BCA can be easily entered into the cells. A supplemental DDT-completion instruction document accompanies the template, and grant managers, if necessary, offer assistance in gathering relevant data and answering questions regarding the analysis. The documents are transmitted via e-mail. A reasonable deadline is established for the submission of the data to the grant manager. See ***Appendix E-3-1*** for Data Documentation Templates and their instructions.

Upon receipt of BCA data, grant managers conduct the analyses using (currently) FEMA BCA 4.8 or the most recent version of the software. A detailed methodology is written by the grant manager to accompany the BCA report and BCA file upon submission of the completed application to FEMA.

In addition to data provided in the DDT, sub-applicants provide supporting documentation, which includes justification of cost estimates, relevant maps, photographs of all four (4) sides of the structure(s) and project site(s) as applicable, and documentation of past hazard events. Additional information may also include project-specific documentation such as:

- RE: *Acquisition/Demolition, Acquisition/Relocation, Structural Elevation Projects*
    - Property appraisal and/or Property Valuation Administrator (PVA) records
    - Documentation for “Full Data Analysis[160],” which includes:
        - Flood hazard data and flood profiles,
        - Flood Insurance Study and Digital Flood Insurance Rate Maps (DFIRMs),
        - Building Replacement Values,
        - Displacement Costs,
        - Loss of Rents,
        - Values of utilities (if any) in crawlspace or basement.

- RE: *Structural Elevation Projects*
    - Elevation Certificates.

- RE: *Structural Elevation and Detention Basin Projects*
    - Articulation of the number of feet the structure is being raised, or
    - Articulation of the amount of water surface decrease result from elevation.

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[160] A Benefit-Cost Analysis (BCA) using FEMA’s software and methodology can be performed using different “models.” The “models” are differentiated by the amount and type of information that is input into the model. One such model is the “Full Data Analysis” model, which, as its name implies requires the most varied and most (in terms of quantity) data input. The additional information described elsewhere in this section usually is required to comply with certain other types of “models” that provide the most accurate Benefit-Cost Analysis (BCA).

- RE: *Drainage and Detention/Retention Projects*
  - Types of infrastructure for loss of function assessment
  - Number of customers served
  - Number of hours/days of lost service per event
  - Related to roads and bridges: number of one-way traffic trips per day, detour lengths, and time required for detours of traffic
  - Annual budgets for public agencies associated with hazard event damages.

- RE: *Tornado Safe Rooms Projects*
  - Map showing ranges and number of target populations, with structures identified,
  - Distributions of population occupancy over three (3) time periods during a typical day.

Upon completion of the BCA, projects with positive ratios (Benefit-Cost Ratios, or BCRs) of 1.0 or greater are considered cost effective and advance to application. The application process is described in detail in preceding sections.

Additional Considerations Related to Benefit-Cost Analysis (BCA)

The BCA process frequently is stalled due to the lack of local data regarding hazard events. To improve hazard event data records, Kentucky Emergency Management (KYEM) mitigation staff, in each training, presentation, and briefing event, includes a detailed section on the BCA process, emphasizing the importance of ongoing data archiving at the local level. This is an example of *deductive planning* described in the Standard Portion of this 2013 update of Kentucky's hazard mitigation plan.

Technical assistance for a BCA may be requested by any jurisdiction statewide at any time and KYEM mitigation staff is available to assist with these processes. Additionally, a two-day BCA training session was provided by FEMA for interested parties statewide in 2012 which included 15 participants from various communities and agencies. KYEM has received overwhelmingly positive feedback from its mitigation partners across the Commonwealth regarding enhanced efforts to provide education and assistance on FEMA's BCA process during this cycle of the plan.

A Note on Changes to Enhanced Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* from the 2010 Update of Kentucky's Hazard Mitigation Plan

The major innovation regarding the Project Implementation Capability of Kentucky and Kentucky Emergency Management concerns project selection: As elaborated upon in the Standard Portion of *The Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*, the Commonwealth of Kentucky has devised a project selection mechanism that prioritizes projects based upon whether or not they protect critical facilities and based upon their relevance to individual local hazard mitigation plans.

This represents a change from what had been a less systematic (though no less rigorous) project selection process implemented before. The mechanism developed for 2013 also allows project selection at the state-/agency-level to coincide with project selection mechanisms at the federal level: Kentucky now has a systematic way of ranking and prioritization that allows it to present "favorable" and "unfavorable" reviews and allow it to "suspend" or "deny" "unfavorably-reviewed" applications much as FEMA will "suspend" or "deny" state-approved project applications sent to it.

ENHANCED PORTION:

PART V: Assessment of Mitigation Actions

REQUIREMENT §201.5 (B) (2) (IV):

To be "Enhanced," the Commonwealth of Kentucky must document the system and strategy by which it will conduct an assessment of its completed mitigation actions and include a record of the effectiveness (actual cost avoidance) of each mitigation action.

A. *Describing the System and Strategy by Which the Commonwealth of Kentucky Will Conduct an Assessment of the Completed Mitigation Actions*

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B. *Including a Record of Effectiveness of Each Mitigation Action (Including How Assessments Were Completed)*

The National Research Council (NRC) in a 1999 report intended to specifically deal with loss estimation methodology for natural disasters concluded that there was no widely-accepted framework for estimating the losses resulting from natural hazards [National Research Council 1999[161]].

It is assumed here that the conclusion to the NRC report remains valid; that as yet there is no one universally-accepted method to performing a Loss Avoidance study.

Acknowledging such, Kentucky's hazard mitigation plan will use FEMA's current and general guidance and past precedent in conducting its assessment of mitigation actions: Using FEMA's conception of Loss Avoidance (detailed below) as a guide, ultimately, the method used in Kentucky's assessment of mitigation actions to evaluate past mitigation projects relies upon using 1) the "presidentially-declared" disasters that affected the Commonwealth of Kentucky throughout its 2010 – 2013 planning cycle and 2) benefit-cost analysis reports for those assessed projects.

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[161] National Research Council. [1999]. "The Impact of Natural Disasters: A Framework for Loss Estimation."

However, also included in this assessment of mitigation actions (as **Appendix E-5-1**) is a separate assessment study of twenty-two properties acquired and demolished in Shepherdsville (in Bullitt County), Kentucky using FEMA grant funds. The inclusion of this study represents an alternative and perhaps more ideal (and certainly more qualitative and deductive) methodology for estimating “losses avoided” from completed mitigation actions. It represents a type of study that the Commonwealth would like to pursue in the future given the environment (i.e. availability of a similar post-disaster quasi-experiment) and resources to conduct such a time-intensive and thorough study.

It is relevant to begin this assessment of completed mitigation actions by discussing *how* disasters are presidentially declared and *how* and *for what* federal assistance is implemented. This background information will assist in project selection for this assessment of mitigation actions.

A Discussion of Disaster Declaration and Federal Assistance

The federal government offers states disaster-related assistance through the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. §5121-5207, referred to informally as the "the Stafford Act." The Stafford Act's intent is limited to adding *supplemental* disaster assistance to states: In other words (and relevant for this Loss Avoidance methodology), federal assistance only arrives (is requested) when disasters occur of such severity as to overwhelm state-level emergency response mechanisms.

The general response to a disaster is as follows: A disaster hits and community-level emergency teams respond. If these community-level emergency teams decide that help is necessary beyond the boundaries of their communities, then requests for said help are made to the *state*. The Governor of a state, then, decides on the use of state-level emergency response forces, the National Guard, State Police, etc. If the Governor decides that the extent of the effects of the disaster are too great for state-level emergency response, then the Governor requests that the President of the United States "declare a major disaster," which authorizes federal funds and assistance to be used within the state.

Two (2) common vehicles for federal assistance immediately following a federal "disaster declaration" involve the Public Assistance Program (PA) and the Individuals and Households Assistance Program (IA). PA and IA provide assistance to eligible applicants within counties (typically) included in the "presidential declaration."

Eligibility for Public Assistance (PA) is dependent upon four (4) interrelated and hierarchical considerations. The first asks if the county is eligible as an "Applicant," thusly able to apply for PA grants. Eligible "Applicants" include: State government agencies, local governments and special districts, private nonprofit organizations that own or operate facilities open to the general public and/or serve functions/provide services that would or could otherwise be performed by a government agency. Following, then, the second question asks if the facilities for which PA grants would assist are eligible. A facility is eligible if it is the responsibility of an eligible applicant, if it is located in the designated disaster area, if it is not under the authority of another federal agency, and was in active use during the time of the disaster. The third and related question asks if the work to be done to the facility or if the emergency protective measures via the PA grant are eligible. Eligible disaster recovery work to be performed on an eligible facility or the emergency measures of an eligible "Applicant" must be the result of a major disaster event, must be located within the designated disaster area, and must be the legal responsibility of said eligible "Applicant." The final question asks if costs for the eligible work to the eligible facility of the eligible "Applicant" are, indeed, eligible. Eligible costs must be tied to the performance of eligible work. Eligible costs are: reasonable and necessary to perform the work; compliant with federal, state, and local government procurement requirements; and reduced to the amount needed *minus* applicable credits such as insurance payouts and salvage values [FEMA 2012[162]].

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[162] Federal Emergency Management Agency (FEMA). 2012. "Public Assistance: Eligibility." *See:* http://www.fema.gov/public-assistance-eligibility. [Last updated: 6/21/2012; Last Accessed: 9/29/2013].

Of most relevance to the assessment of mitigation actions, however, is that Public Assistance (PA) grants are intended for assistance in recovery operations such as: replacement or repair to publicly-owned buildings and infrastructure; replacement or repair to eligible private nonprofit organizations; debris removal; assistance with protective measures used by local communities; etc.

The Individuals and Households Assistance Program, on the other hand, surrounds the eligibility of *impacted citizens* for assistance with (most relevantly) housing needs, legal matters, crisis counseling, etc. that resulted from or were necessary due to the declared disaster event.

The Presidentially-Declared Disasters to Affect Kentucky from 2010 – 2013

During its 2010 – 2013 planning cycle, the Commonwealth of Kentucky suffered from four (4) "presidentially-declared" disasters:

FEMA-1925-DR: Severe Storms; Flooding; Mudslides (Declared July 23, 2010)

On July 21, 2010, Governor Steven L. Beshear requested a major disaster declaration due to *severe storms*, *flooding*, and *mudslides* that occurred between the dates July 17 – 30, 2010. Governor Beshear requested Hazard Mitigation assistance for the entire Commonwealth of Kentucky. He requested 100% federal funding for Public Assistance (PA) and direct federal-level assistance for the first 14 days of the disaster.

From July 20 – 21, 2010, federal, Commonwealth, and local representatives conducted Joint Preliminary Damage Assessments (JPDAs) in the impacted counties toward which a "presidential-declaration" was requested. JPDAs estimate damages immediately after a disaster event and are considered (along with other factors) in determining whether or not a disaster is of such severity and magnitude as to overwhelm state-level and local-level emergency response and to thusly warrant federal assistance.

President Obama "declared" the disaster: Direct federal assistance was authorized; Governor Beshear's request for Hazard Mitigation Grant Program assistance was authorized for the entire Commonwealth; and Public Assistance was granted where requested.

Following is a tabular summary of the Joint Preliminary Damage Assessment (JPDA) used to determine whether President Obama would "declare" a major disaster:

Table E-5-1: Summary of JPDA Used to Determine Whether to "Declare" a Disaster

RE: Individual Assistance (IA)		
Total Number of Residences Impacted		217
	Destroyed[163]	120
	Major Damage[164]	38
	Minor Damage[165]	42
	Affected[166]	17
Percentage of Insured Residences		14%
Percentage of Low-Income Households		11%
Percentage of Elderly Households		N/A
Total IA Cost Estimate		$2,221,985
RE: Public Assistance (PA)		
Primary Impact		Damage to Roads and Bridges
Total PA Cost Estimate		$8,603,621
	Statewide Per-Capita Impact[167]	$2.13
	Statewide Per-Capita Impact Indicator[168]	$1.29
	Countywide Per-Capita Impact[169]	$125.17
	Countywide Per Capita Impact Indicator[170]	$3.23

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[163] "Destroyed" = "total loss of structure; structure is not economically feasible to repair, or complete failure to major structural components (e.g., collapse of basement walls/foundation, walls, roof, etc.)"

[164] "Major Damage" = "substantial failure to structural elements of residence (e.g., walls, floors, foundation, etc.), or damage that will take more than 30 days to repair

[165] "Minor Damage" = home is damaged and uninhabitable, but may be made habitable in a short period of time with repairs

[166] "Affected" = some damage to the structure and contents; but, structure is still habitable

[167] Based on 2000 Census data

[168] *See* Statewide Per Capita Impact Indicator for FY10, *Federal Register*, October 1, 2009

[169] The county to which this applies is Pike County.

[170] *See* Countywide Per Capita Impact Indicator for FY10, *Federal Register*, October 1, 2009

With the above justification and understanding that all counties within the Commonwealth of Kentucky were eligible to apply for Hazard Mitigation Grant Program assistance, the following counties were deemed by the President of the United States as being directly affected by the severe storms, flooding, and mudslides that would become FEMA-1925-DR. Further, whether each county was eligible for assistance through IA, PA, or both is listed.

Table E-5-2: FEMA-1925-DR: Severe Storms; Flooding; Mudslides

County Affected	IA	PA
Carter	✓	✓
Elliott		✓
Lewis	✓	✓
Madison	✓	✓
Mason	✓	
Pike	✓	✓
Rowan	✓	
Shelby		✓

FEMA-1976-DR: Severe Storms; Tornadoes; Flooding (Declared May 4, 2011)

On April 28, 2011, Governor Steven L. Beshear requested a major disaster declaration due to *severe storms*, *tornadoes, and flooding* that began April 22, 2011. Governor Beshear requested Hazard Mitigation assistance for the entire Commonwealth of Kentucky. He requested Individuals and Households Assistance (IA) and Public Assistance (PA) for 48 counties.

Starting April 28, 2011, federal, Commonwealth, and local representatives conducted Joint Preliminary Damage Assessments (JPDAs) in the counties toward which "presidential-declaration" was requested. JPDAs verify the amount of damages reported by impacted counties immediately after a disaster event and are considered (along with other factors) in determining whether or not a disaster is of such severity and magnitude as to overwhelm state-level and local-level emergency response and to thusly warrant federal assistance.

President Obama "declared" the disaster: Direct federal assistance was authorized; Governor Beshear's request for Hazard Mitigation Grant Program assistance was authorized for the entire Commonwealth; and Individuals and Households and Public Assistance was granted where requested. The declaration provided for 75% funding for Public Assistance.

Following is a tabular summary of the Joint Preliminary Damage Assessment (JPDA) used to determine whether President Obama would "declare" a major disaster:

Table E-5-3: Summary of JPDA Used to Determine Whether to "Declare" a Disaster

RE: Individual Assistance (IA)		
Total Number of Residences Impacted		N/A[171]
	Destroyed[172]	N/A
	Major Damage[173]	N/A
	Minor Damage[174]	N/A
	Affected[175]	N/A
Percentage of Insured Residences		N/A
Percentage of Low-Income Households		N/A
Percentage of Elderly Households		N/A
Total IA Cost Estimate		N/A
RE: Public Assistance (PA)		
Primary Impact		Damage to Roads and Bridges
Total PA Cost Estimate		$5,767,281
	Statewide Per-Capita Impact[176]	$1.43
	Statewide Per-Capita Impact Indicator[177]	$1.30
	Countywide Per-Capita Impact[178]	Varies: From $3.75 - $67.22[179]
	Countywide Per Capita Impact Indicator[180]	$3.27

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[171] Presumably, given the nature of the destruction this disaster caused, there was little need to justify "presidential declaration" using Individual Assistance-related determinants.

[172] "Destroyed" = "total loss of structure; structure is not economically feasible to repair, or complete failure to major structural components (e.g., collapse of basement walls/foundation, walls, roof, etc.)"

[173] "Major Damage" = "substantial failure to structural elements of residence (e.g., walls, floors, foundation, etc.), or damage that will take more than 30 days to repair

[174] "Minor Damage" = home is damaged and uninhabitable, but may be made habitable in a short period of time with repairs

[175] "Affected" = some damage to the structure and contents; but, structure is still habitable

[176] Based on 2000 Census data

[177] *See* Statewide Per Capita Impact Indicator for FY11, *Federal Register*, October 1, 2010

[178] The county to which this applies is Pike County.

[179] For: Boone County ($5.24); Bracken County ($15.96); Campbell County ($3.75); Carroll County ($49.38); Carter County ($22.17); Fleming County ($21.03); Gallatin County ($36.07); Kenton County ($11.25); Lawrence County ($15.30); Morgan County ($12.99); Nicholas County ($67.22); Oldham County ($5.83); Owen County ($10.53); Washington County ($20.04)

[180] *See* Countywide Per Capita Impact Indicator for FY11, *Federal Register*, October 1, 2010

With the above justification and understanding that all counties within the Commonwealth of Kentucky were eligible to apply for Hazard Mitigation Grant Program assistance, the following counties were deemed by the President of the United States as being directly affected by the severe storms, flooding, and mudslides that would become FEMA-1976-DR. Further, whether each county was eligible for assistance through IA, PA, or both is listed.

Table E-5-4: FEMA-1976-DR: Severe Storms; Tornadoes; Flooding

County Affected	IA	PA
Anderson		✓
Ballard	✓	✓
Bath		✓
Boone		✓
Boyd	✓	✓
Bracken		✓
Breathitt		✓
Breckinridge		✓
Butler		✓
Caldwell		✓
Calloway		✓
Campbell		✓
Carlisle	✓	✓
Carroll	✓	✓
Carter		✓
Christian		✓
Clay		✓
Crittenden	✓	✓
Daviess	✓	✓
Edmonson		✓
Elliott		✓
Estill		✓
Fleming		✓
Floyd	✓	✓
Franklin		✓
Fulton	✓	✓
Gallatin		✓
Grant		✓
Graves	✓	✓
Grayson		✓
Green		✓
Greenup		✓
Hancock		✓
Hardin	✓	
Harlan		✓
Henderson	✓	✓

County Affected	IA	PA
Henry		✓
Hickman	✓	✓
Hopkins		✓
Jefferson	✓	
Johnson	✓	✓
Kenton		✓
Knott		✓
Lawrence	✓	✓
Lee		✓
Lewis		✓
Livingston	✓	✓
Logan		✓
Lyon		✓
Magoffin		✓
Marion		✓
Marshall	✓	✓
Martin		✓
Mason		✓
McCracken	✓	✓
McLean	✓	✓
Meade		✓
Menifee		✓
Mercer		✓
Monroe		✓
Morgan		✓
Nelson		✓
Nicholas		✓
Oldham		✓
Owen		✓
Owsley		✓
Pendleton		✓
Perry		✓
Pike	✓	
Robertson		✓
Rowan		✓
Spencer		✓
Todd		✓
Trigg		✓
Trimble		✓
Union	✓	✓
Washington		✓
Webster	✓	✓
Wolfe		✓

FEMA-4008-DR: Severe Storms; Tornadoes; Flooding (Declared July 25, 2011)

On July 13, 2011, Governor Steven L. Beshear requested a major disaster declaration due to *severe storms*, *tornadoes*, and *flooding* that occurred between the dates July 19 – 23, 2011. Governor Beshear requested Hazard Mitigation assistance for the entire Commonwealth of Kentucky.

From June 23 – July 10, 2011, federal, Commonwealth, and local representatives conducted Joint Preliminary Damage Assessments (JPDAs) in the counties toward with “presidential-declaration” was requested. JPDAs verify the amount of damages reported by impacted counties immediately after a disaster event and are considered (along with other factors) in determining whether or not a disaster is of such severity and magnitude as to overwhelm state-level and local-level emergency response and thusly to warrant federal assistance.

President Obama “declared” the disaster: Governor Beshear’s request for Hazard Mitigation Grant Program assistance was authorized for the entire Commonwealth and Public Assistance was granted where requested.

Following is a tabular summary of the Joint Preliminary Damage Assessment (JPDA) used to determine whether President Obama would “declare” a major disaster:

Table E-5-5: Summary of JPDA Used to Determine Whether to “Declare” a Disaster

RE: Individual Assistance (IA)		
Total Number of Residences Impacted		369
	Destroyed[181]	29
	Major Damage[182]	86
	Minor Damage[183]	169
	Affected[184]	85
Percentage of Insured Residences		4%
Percentage of Low-Income Households		87%
Percentage of Elderly Households		13.5%
Total IA Cost Estimate		$3,840,560
RE: Public Assistance (PA)		
Primary Impact		Damage to Roads and Bridges
Total PA Cost Estimate		$5,744,719
	Statewide Per-Capita Impact[185]	$1.32
	Statewide Per-Capita Impact Indicator[186]	$1.30
	Countywide Per-Capita Impact[187]	Varies: From $9.73 - $75.75[188]
	Countywide Per Capita Impact Indicator[189]	$3.27

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[181] “Destroyed” = “total loss of structure; structure is not economically feasible to repair, or complete failure to major structural components (e.g., collapse of basement walls/foundation, walls, roof, etc.)”

[182] “Major Damage” = “substantial failure to structural elements of residence (e.g., walls, floors, foundation, etc.), or damage that will take more than 30 days to repair

[183] “Minor Damage” = home is damaged and uninhabitable, but may be made habitable in a short period of time with repairs

[184] “Affected” = some damage to the structure and contents; but, structure is still habitable

[185] Based on 2000 Census data

[186] *See* Statewide Per Capita Impact Indicator for FY11, *Federal Register*, October 1, 2010

[187] The county to which this applies is Pike County.

[188] For: Bell County ($65.90); Breathitt County ($75.75); Knott County ($9.73); Knox County ($23.68); Lee County ($69.32); Magoffin County ($13.13); Perry County ($40.65)

[189] *See* Countywide Per Capita Impact Indicator for FY11, *Federal Register*, October 1, 2010

With the above justification and understanding that all counties within the Commonwealth of Kentucky were eligible to apply for Hazard Mitigation Grant Program assistance, the following counties were deemed by the President of the United States as being directly affected by the severe storms, flooding, and mudslides that would become FEMA-4008-DR. Further, whether each county was eligible for assistance through IA, PA, or both is listed.

Table E-5-6: FEMA-4008-DR: Severe Storms; Tornadoes; Flooding

County Affected	IA	PA
Lee		✓
Breathitt		✓
Magoffin		✓
Knott		✓
Perry	✓	✓
Knox	✓	✓
Bell	✓	✓

FEMA-4057-DR: Severe Storms; Tornadoes; Straight-Line Winds; Flooding (Declared March 6, 2012)

On March 4, 2012, Governor Steven L. Beshear requested an (expedited) major disaster declaration due to *severe storms*, *tornadoes*, *straight-line winds*, and *flooding* that occurred between the dates February 29 – March 3, 2012. Governor Beshear requested Hazard Mitigation assistance for the entire Commonwealth of Kentucky.

What would become FEMA-4057-DR was so severe in effects that federal assistance was authorized *before* the federal, Commonwealth, and local Joint Preliminary Damage Assessments (JPDAs) were conducted in the counties toward which “presidential-declaration” was requested. According to federal regulation[190], JPDAs can be waived for those hazard events of such unusual severity and magnitude that formal field damage assessments are superfluous.

President Obama “declared” the disaster: Governor Beshear’s request for Hazard Mitigation Grant Program assistance was authorized for the entire Commonwealth and Individual Assistance was granted where requested.

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[190] 44 C.F.R. §206.33(d) and §206.36(d)

Following is a tabular summary of the Joint Preliminary Damage Assessment (JPDA) used to determine whether President Obama would “declare” a major disaster:

Table E-5-7: Summary of PDA Used to Determine Whether to “Declare” a Disaster

RE: Individual Assistance (IA)		
Total Number of Residences Impacted		N/A[191]
	Destroyed[192]	N/A
	Major Damage[193]	N/A
	Minor Damage[194]	N/A
	Affected[195]	N/A
Percentage of Insured Residences		N/A
Percentage of Low-Income Households		N/A
Percentage of Elderly Households		N/A
Total IA Cost Estimate		N/A
RE: Public Assistance (PA)		
Primary Impact		N/A[196]
Total PA Cost Estimate		N/A
	Statewide Per-Capita Impact[197]	N/A
	Statewide Per-Capita Impact Indicator[198]	$1.35
	Countywide Per-Capita Impact[199]	N/A
	Countywide Per Capita Impact Indicator[200]	$3.39

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[191] The disaster event was of such unusual severity and magnitude that no Individual Assistance justification was necessary.

[192] “Destroyed” = “total loss of structure; structure is not economically feasible to repair, or complete failure to major structural components (e.g., collapse of basement walls/foundation, walls, roof, etc.)”

[193] “Major Damage” = “substantial failure to structural elements of residence (e.g., walls, floors, foundation, etc.), or damage that will take more than 30 days to repair

[194] “Minor Damage” = home is damaged and uninhabitable, but may be made habitable in a short period of time with repairs

[195] “Affected” = some damage to the structure and contents; but, structure is still habitable

[196] The disaster event was of such unusual severity and magnitude that no Public Assistance justification was necessary.

[197] Based on 2000 Census data

[198] *See* Statewide Per Capita Impact Indicator for FY11, *Federal Register*, October 1, 2010

[199] The county to which this applies is Pike County.

[200] *See* Countywide Per Capita Impact Indicator for FY11, *Federal Register*, October 1, 2010

With the above justification and understanding that all counties within the Commonwealth of Kentucky were eligible to apply for Hazard Mitigation Grant Program assistance, the following counties were deemed by the President of the United States as being directly affected by the severe storms, flooding, and mudslides that would become FEMA-4057-DR. Further, whether each county was eligible for assistance through IA, PA, or both is listed.

Table E-5-8: FEMA-4057-DR: Severe Storms; Tornadoes; Straight-Line Winds; Flooding

County Affected	IA	PA
Adair		✓
Ballard		✓
Bath	✓	✓
Campbell	✓	
Carroll	✓	
Grant	✓	✓
Grayson	✓	
Johnson	✓	✓
Kenton	✓	✓
Larue	✓	✓
Laurel	✓	✓
Lawrence	✓	✓
Magoffin	✓	✓
Martin	✓	✓
Menifee	✓	✓
Montgomery	✓	
Morgan	✓	✓
Ohio	✓	
Pendleton	✓	✓
Rowan	✓	
Russell	✓	
Trimble	✓	✓
Wolfe	✓	✓

The Loss Avoidance Methodology Used

FEMA's Articulation of Loss Avoidance (Assessment of Mitigation Actions)

The basic, fundamental component of the Loss Avoidance Study methodology is the "Loss Estimation Analysis." The Loss Estimation Analysis (and its limitations) completely drives the rest of any methodology used in the Loss Avoidance Study. FEMA frequently (if not always) includes in its Loss Avoidance Study both a written and graphical breakdown of the Loss Avoidance Study Methodology. The published methodology is generally divided into three (3) phases:

Phase 1 emphasizes the mitigation action/project selection that will comprise the focus of the Loss Avoidance Study

Phase 2 collects the data that ultimately will be input into the Loss Estimation model.

Phase 3 uses the project selection and the data corresponding to the selected projects to derive the prescribed Loss Avoidance.

In other words, because all methodology prior to the Loss Estimation Analysis is performed in order to use the Loss Estimation Analysis technique, then the inverse is assumed to be true, as well: The Loss Estimation Analysis drives the rest of a FEMA Loss Avoidance Study's methodology.

Throughout, then, FEMA Loss Avoidance Studies, the Loss Estimation model is simplified to the following conceptual equation:

$$MP_A - MP_C = LA,$$

where MP_A is "Mitigation Project Absent," MP_C is "Mitigation Project Complete," and LA is "Losses Avoided."

Further, a Return on Investment (ROI) is calculated from the Loss Estimation Analysis:

$$\frac{\$LA}{\$PI} = \%ROI,$$

where

- "LA" is "Losses Avoided,"
- "PI" is "Project Investment," and
- "ROI" is "Return on Investment."

"Project Investment" ("PI") here refers to the amount of money *FEMA actually paid* for the completed mitigation project. The Return on Investment ultimately refers to *FEMA's* return on *its* investment, which, generally (and for all of the projects selected by

Kentucky to be assessed) amounts to 75% of the amount of money *actually spent* (as opposed to budgeted) to complete the mitigation action being assessed.

Phase I: Project Selection Methodology

The assessment of mitigation actions (i.e. the Loss Avoidance Report) for this Enhanced Portion of the Commonwealth of Kentucky's hazard mitigation plan uses the abovementioned "presidentially-declared" disasters that occurred throughout Kentucky's 2010 – 2013 planning cycle to guide project selection. The idea is to attempt to imagine what might have been had presently completed mitigation projects not been completed in the areas when and where FEMA-1925-DR, FEMA-1976-DR, FEMA-4008-DR, and FEMA-4057-DR occurred.

Ultimately, relevant past completed mitigation projects' Benefit-Cost Analysis (BCA) reports will be used to establish "losses avoided" calculated according to FEMA's proscribed Loss Avoidance formula (described below).

However, the natures of the completed projects and the federal declaration statuses of the locations in which relevant mitigation projects were completed will aid in project selection. Other considerations will, of course, involve feasibility and data constraints.

Limiting Project Selection by Quarterly Report and by Obvious Exclusion

Potential project selection was limited to those completed mitigation actions that could have been affected by FEMA-1925-DR through FEMA-4057-DR and that were accounted for on Kentucky Emergency Management's (KYEM's) and FEMA's Quarterly Reports. This means that completed-project selection did not include any completed projects funded under "presidentially-declared" disasters prior to FEMA-1407-DR.

The use of the Quarterly Report as a limiting tool was justified by reasons of relevance: A (arguably) primary purpose of a Loss Avoidance Report is the Return on Investment (ROI) that results from the report. A potential mitigation project's pre-approval Benefit-Cost Analysis (BCA) predicts an ROI (i.e. the "benefits") for what would or might be a completed mitigation project. However, such benefits/ROIs rely upon a number of mainly historical and statistical-aggregate assumptions. A Loss Avoidance Report's usefulness extends to its insight as to the true nature of benefits/ROIs *within a short period of time*. A pre-approved project's BCA may predict that a would-be completed mitigation project will pay for itself in 30-plus years based upon a number of historical assumptions and assumptions about the statistically aggregated and averaged level of flooding. This is the project's *expected benefit (*or *expected value* or *expected ROI)*. But, it is only after events that have occurred (i.e. events that are outliers to the average) relatively shortly after a project's completion that insight into the true nature or the true magnitude of "benefits"/Returns-on-Investment are provided or justified.

That completed mitigation projects funded under FEMA mitigation programs *that are too old to be included on FEMA's Quarterly Report* are excluded, then, is assumed justified from the time-constrained usefulness of performing Loss Avoidance: FEMA-1407-DR was presidentially declared in March of 2002. Projects funded under FEMA-1407-DR, then, have been completed for around ten years.

Here it is assumed that after ten years, the expected benefits calculated in the FEMA-approved Benefit-Cost Analysis (BCA) can be considered *nearly* equal to any result deriving from a Loss Avoidance study. Such an assumption derives from FEMA's default discount rate used in its Benefit-Cost Analysis: At a 7% discount rate, a project's expected *annual* benefit should equal its expected *total* benefits in about fourteen (14) years for a project whose useful life is 50 or 100 years, or in about twelve (12) years for a project whose useful life is 30 years[201].

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[201] The general process from which these numbers (14 and 12 years) derive is explained in the discussion of calculating Expected Annual Benefits within "Phase III: Kentucky's Methodology for Calculating Losses Avoided." FEMA's calculation of a project's "benefits" (B) is a function of the project's "expected annual benefits" (EAB) multiplied by a formula using the project's expected useful life (T) and the default discount rate used by FEMA (r), which is 7%. Though introduced below, FEMA's formula used to calculate benefits is:

$$B = EAB[\frac{1-(1+r)^{-T}}{r}]$$

This formula can be converted algebraically to:

$$EAB = \frac{B}{[\frac{1-(1+r)^{-T}}{r}]}$$

Expected Annual Benefits (EAB), then, is an *average*: The total value of benefits divided by a *number of years.*

Using FEMA's discount rate (r) of 7%, and assuming a project's useful life (T) of 100 years (for acquisition projects), to derive "Expected Annual Benefits" means dividing the total value of benefits (B) by just over 14 years. Assuming a project's useful life (T) is 50 years means dividing the value of total benefits (B) by just shy of 14 years. Finally, assuming a project's useful life (T) is 30 years means dividing the value of total benefits (B) by approximately 12 years.

In other words, within 12 to 14 years, a project's annual benefits is expected to equal its total benefits. Consequently, worrying about selecting projects begun from presidentially-declared disasters that occurred before FEMA-DR-1407 (in 2002) is trivial. At the time of this writing, it has been eleven years (and will be close to twelve) years since the occurrence of FEMA-DR-1407 and the beginning of mitigation actions applied for and funded from FEMA's grant programs deriving from it.

Appendix E-5-2 lists *all* of the past completed mitigation actions that had been hit by FEMA-1925-DR through FEMA-4057-DR found on Quarterly Reports throughout Kentucky's 2010 – 2013 planning cycle. This full list includes (primarily for illustration) the generator and siren projects that automatically are excluded from project selection in this "loss avoidance" report. That generator, siren, etc. projects are excluded solely is a function of feasibility: While their importance to mitigation is logically obvious, the monetary benefits to generator, siren, etc. projects are indirect. Assuming that a generator or siren project's benefits are synonymous to its "losses avoided" is not justifiable. To imagine a hypothetical, i.e. what *could have occurred in a different state of nature if the generator, siren, etc. had NOT been purchased/placed* prior to FEMA-1925-DR through FEMA-4057-DR involves too many variables that are, at this time, infeasible to monetize in a "loss avoidance" setting. Further, even with a methodology that relies upon an individual project's FEMA-approved Benefit-Cost Analysis as this "loss avoidance" report does, the link between a generator or siren's expected benefits and its actual "losses avoided" is assumed here to be a far more tenuous link than the link between, for example, an acquisition's expected benefits and its actual "losses avoided."

The one "obvious exclusion" (DR-1703-0006) is highlighted in red.

Table E-5-9: Completed Projects "Hit" by FEMA-1925-DR through FEMA- DR-4057 I: Excluding Siren and Generator Projects; One Obvious Exclusion

FEMA Disaster #	Completed Action #	Action Type	County	Approved Budget	IA	PA
1925	1454-0004	Landslide Acquisition	Lewis	$147,200	✓	✓
	1523-0006	Acquisition	Rowan	$162,736	✓	
	PDM-2007-0002	Lift Station Relocation	Shelby	$578,550		✓
1976	1407-0002	Acquisition	Harlan	$928,895		✓
	1407-0009	Acquisition	Christian	$309,405		✓
	1407-0010	Acquisition	Boyd	$448,899	✓	✓
	1454-0004	Landslide Acquisition	Lewis	$147,200		✓
	1454-0008	Acquisition	Fleming	$129,027		✓
	1454-0010	Detention Basin	Calloway	$806,812		✓
	1454-0011	Acquisition	Jefferson	$728,731	✓	
	1454-0012	Lift Station Relocation	Ballard	$439,687	✓	✓
	1523-0004	Acquisition	Nelson	$154,650		✓
	1523-0005	Acquisition	Jefferson	$178,785	✓	
	1523-0006	Acquisition	Rowan	$162,736		✓
	1523-0010	Acquisition	Martin	$262,800		✓
	1537-0003	Safe Room	Franklin	$84,640		✓
	1703-0004	Drainage	Christian	$229,870		✓
	1703-0006	Acquisition	Christian	N/A[202]		✓
	1746-0007	Soil Stabilization	Jefferson	$740,279.41	✓	
	1818-0008	Acquisition	Hardin	$215,400	✓	
	1818-0105	Acquisition	Boyd	$976,837	✓	✓
	PDM-2006-0003	Acquisition	Christian	$335,400		✓
	PDM-2006-0004	Safe Room	Marion	$295,000		✓
	PDM-2007-0005	Acquisition	Jefferson	$98,125	✓	
	PDM-2007-0008	Acquisition	Hardin	$149,415	✓	
4008	1407-0005	Acquisition	Bell	$850,185	✓	✓
4057	1523-0006	Acquisition	Rowan	$162,736	✓	
	1523-0010	Acquisition	Martin	$262,800	✓	✓

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[202] DR-1703-0006 was withdrawn and resubmitted under DR-1912-0016. The project only recently has been closed out. Thus, as a hypothetical, it would not have been hit by any of Kentucky declared disasters.

<u>Further Limiting Project Selection by Date Completed</u>

In order for the methodology that uses "presidentially-declared" disasters that affected Kentucky to guide the project selection, the project that we are hypothesizing may not have existed ("Mitigation Project Absent") but in fact was completed ("Mitigation Project Complete") *has to have been hit* by the "presidentially-declared" disaster. In other words, the completed mitigation action being assessed has to have been completed by the time either FEMA-1925-DR through FEMA-4057-DR struck Kentucky.

FEMA-4057-DR struck Kentucky in March of 2012. Kentucky has not suffered a "presidentially-declared" disaster since. Thus, any mitigation project completed after March 2012 is excluded from assessment using this methodology.

One final consideration: Though it records a mitigation action's "completion date" where available, this project selection methodology excludes based upon a mitigation action's "close-out" date[203]. The "close-out" date refers to the date after which the project not only is structurally complete, but is administratively complete as well. That a mitigation action would be "administratively complete" refers to that action having been audited by the Commonwealth of Kentucky and confirmed by FEMA for regulatory compliance and adherence to the approved scope-of-work.

Tabulated below is a revised list of completed mitigation projects to be assessed emphasizing their "closeout dates" (and, for illustration, "project completion" dates) that displays the exclusion of those projects closed out after March of 2012. Where available, project completion dates also are included. Those projects to be excluded will be highlighted in red.

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[203] There is one exception to this, where "project completion" is the exclusionary criterion. The reasoning is elaborated in a footnote below.

Table E-5-10: Completed Projects "Hit" by FEMA-1925-DR through FEMA-4057-DR II: Excluding Those Projects Completed/Closed after FEMA-1925-DR through FEMA-4057-DR

FEMA Disaster #	Completed Action #	Action Type	County	Approved Budget	Completion Date	Close-Out Date
1925	1454-0004	Landslide Acquisition	Lewis	$147,200	7/22/2005	10/26/2006
	1523-0006	Acquisition	Rowan	$162,736	1/27/2007	1/7/2008
	PDM-2007-0002	Lift Station Relocation	Shelby	$578,550	Not Available	3/28/2011
1976	1407-0002	Acquisition	Harlan	$928,895	Not Available	10/19/2006
	1407-0009	Acquisition	Christian	$309,405	2/13/2005	9/18/2006
	1407-0010	Acquisition	Boyd	$448,899	Not Available	1/8/2007
	1454-0004	Landslide Acquisition	Lewis	$147,200	7/22/2005	10/26/2006
	1454-0008	Acquisition	Fleming	$129,027	2/28/2008	1/22/2009
	1454-0010	Detention Basin	Calloway	$806,812	Not Available	12/7/2011
	1454-0011	Acquisition	Jefferson	$728,731	10/31/2006	3/20/2007
	1454-0012	Lift Station Relocation	Ballard	$439,687	12/8/2008	4/29/2009
	1523-0004	Acquisition	Nelson	$154,650	11/28/2006	10/23/2007
	1523-0005	Acquisition	Jefferson	$178,785	2/5/2007	10/22/2007
	1523-0006	Acquisition	Rowan	$162,736	1/27/2007	1/7/2008
	1523-0010	Acquisition	Martin	$262,800	6/13/2008	2/25/2010
	1537-0003	Safe Room	Franklin	$84,640	5/24/2009	3/31/2011
	1703-0004	Drainage	Christian	$229,870	7/29/2011	6/12/2012
	1746-0007	Soil Stabilization	Jefferson	$740,279.41	11/4/2011	3/19/2013
	1818-0008	Acquisition	Hardin	$215,400	12/5/2011	5/14/2012
	1818-0105	Acquisition	Boyd	$976,837	Not Available	2/15/2013
	PDM-2006-0003	Acquisition	Christian	$335,400	Not Available	12/9/2011
	PDM-2006-0004	Safe Room	Marion	$295,000	Not Available	1/6/2012
	PDM-2007-0005[204]	Acquisition	Jefferson	$98,125	5/19/2010	5/24/2011
	PDM-2007-0008	Acquisition	Hardin	$149,415	1/13/2009	3/5/2010
4008	1407-0005	Acquisition	Bell	$850,185	Not Available	3/11/2010
4057	1523-0006	Acquisition	Rowan	$162,736	1/27/2007	1/7/2008
	1523-0010	Acquisition	Martin	$262,800	6/13/2008	2/25/2010

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[204] This project should be excluded based upon its "close-out" date: May 24, 2011 occurred after FEMA-1976-DR was declared on May 4, 2011. However, it will be included based upon that we know that the project was completed and audited nearly a year earlier.

Finally Limiting Project Selection by County Affected by Presidentially-Declared Disaster

Again, relating to the need to isolate completed mitigation actions that addressed structures and populations *that would have been affected by a "presidentially-declared" disaster had they been "absent,"* it is relevant to finally limit project selection to projects residing *within counties* affected by a "presidentially-declared" disaster within the year the disaster hit.

This is already displayed above in "Table: Completed Projects 'Hit' by FEMA-1925-DR through FEMA-4057-DR I": Each of the counties listed in this table also is accompanied by whether the county was eligible for "Individuals and Households Assistance (IA)" or "Public Assistance (PA)" grants.

A Brief Discussion of Individual Assistance (IA) versus Public Assistance (PA) and Project Selection

Remember from the discussion above that "Individuals and Households Assistance (IA)" and "Public Assistance (PA)" funding are directed toward different sources for mitigation actions.

IA funding is intended to address *individuals*: Individuals and Household Assistance (IA) funding and the eligibility for them surrounds individual eligibility for assistance in (most relevantly) housing needs, legal matters, crisis counseling, etc.

Meanwhile, PA funding addresses *public* effects: Public Assistance (PA) grants are intended for assistance in recovery operations such as the replacement or repair to publicly-owned buildings and infrastructure, the replacement or repair to eligible private nonprofit organizations, debris removal, and the assistance with protective measures used by local communities, etc.

It may, then, have been relevant to exclude actions using Individuals and Households Assistance (IA) versus Public Assistance (PA) designation as a tool. It could be argued that if FEMA-1976-DR (declared in 2011) hit a county declared only as *"PA"* but affected a completed *acquisition/demolition* type of mitigation action, which is considered an *individual* mitigation action, then perhaps this particular action in this PA-declared county should be excluded: A PA designation without an accompanying IA designation might imply that individual properties were not dramatically affected by the hazard event. Only public properties primarily were affected by the hazard.

Considering the above situation was deemed *too exclusionary*, however. And the logic cannot be wholly justified: A county's declaration as "PA" without "IA" may be as much about success in completed *acquisition/demolition* mitigation actions as implying any measure of severity of the hazard event within the county. As more acquisition/demolition mitigation actions are completed within a county (and as the county's individual properties become less vulnerable to flooding), the less likely that county will garner an “Individuals and Households Assistance” designation upon being hit by a “presidentially-declared” disaster event.

Below is the Commonwealth of Kentucky’s *final* list of selected mitigation actions that will be assessed according to the “losses-avoided” methodology detailed below.

Table E-5-11: Completed Projects “Hit” by FEMA-1925-DR through FEMA-4057-DR III: FINAL Table

FEMA Disaster #	Completed Action #	Action Type	County	Approved Budget	Completion Date	Close-Out Date	IA	PA
1925	1454-0004	Landslide Acquisition	Lewis	$147,200	7/22/2005	10/26/2006	✓	✓
	1523-0006	Acquisition	Rowan	$162,736	1/27/2007	1/7/2008	✓	
1976	1407-0002	Acquisition	Harlan	$928,895	Not Available	10/19/2006		✓
	1407-0009	Acquisition	Christian	$309,405	2/13/2005	9/18/2006		✓
	1407-0010	Acquisition	Boyd	$448,899	Not Available	1/8/2007	✓	✓
	1454-0004	Landslide Acquisition	Lewis	$147,200	7/22/2005	10/26/2006		✓
	1454-0008	Acquisition	Fleming	$129,027	2/28/2008	1/22/2009		✓
	1454-0011	Acquisition	Jefferson	$728,731	10/31/2006	3/20/2007	✓	
	1454-0012	Lift Station Relocation	Ballard	$439,687	12/8/2008	4/29/2009	✓	✓
	1523-0004	Acquisition	Nelson	$154,650	11/28/2006	10/23/2007		✓
	1523-0005	Acquisition	Jefferson	$178,785	2/5/2007	10/22/2007	✓	
	1523-0006	Acquisition	Rowan	$162,736	1/27/2007	1/7/2008		✓
	1523-0010	Acquisition	Martin	$262,800	6/13/2008	2/25/2010		✓
	1537-0003	Safe Room	Franklin	$84,640	5/24/2009	3/31/2011		✓
	PDM-2007-0005[205]	Acquisition	Jefferson	$98,125	5/19/2010	5/24/2011	✓	
	PDM-2007-0008	Acquisition	Hardin	$149,415	1/13/2009	3/5/2010	✓	
4008	1407-0005	Acquisition	Bell	$850,185	Not Available	3/11/2010	✓	✓
4057	1523-0006	Acquisition	Rowan	$162,736	1/27/2007	1/7/2008	✓	
	1523-0010	Acquisition	Martin	$262,800	6/13/2008	2/25/2010	✓	✓

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[205] Per the rule of this methodology (i.e. to rely upon FEMA’s conception of “complete,” i.e. the action is administratively complete, accounted for, and paid for), this project should be excluded based upon its “close-out” date: May 24, 2011 occurred after FEMA-1976-DR was declared on May 4, 2011. However, it will be included based upon that we know that the project was completed and audited nearly a year earlier. Though “administratively incomplete,” Jefferson County would have seen losses avoided between 2010 and 2011.

Phase II: Data Collection

All data used in this Loss Avoidance study derives from the following sources:

1) Benefit-Cost Analyses Conducted During Application of a Project;
2) "Close-Out" Documents;
3) Project-Specific Correspondence Recorded and Maintained in Project Files;
4) Interviews from Project Managers and Area Development Districts.
5) The Community Hazard Assessment and Mitigation Planning System (CHAMPS)

A completed mitigation action's Benefit-Cost Analysis reveals the benefits that here are interpreted synonymously with "losses avoided" and from which this methodology will calculate Expected Annual Benefits (EAB).

"Close-out" documents provide a completed mitigation action's approved budget and the amount that was *actually spent* to complete the project. These documents provide "close-out" dates that determine by how many "times" the Expected Annual Benefit of a project is multiplied in order to more accurately convey "losses avoided." (This is explained below.) They further and many times provide project-specific narrative and context that can prove relevant to a report such as this.

The main sources of data used in the Loss Avoidance Report derived, of course, from a project's Benefit-Cost Analysis conducted during its application phase and from its "close-out" documents. However, especially regarding cases dealing with acquisitions, reading through the e-mails and correspondence between local project managers, Kentucky Emergency Management (KYEM), and FEMA that took place throughout the approval and implementation stages of a project were necessary in order to better comprehend and validate any discrepancies between what was approved and what was finally completed.

In those rare instances where the wealth of information and context provided in project files still allowed for pieces requiring comprehension and information still needing validation, personal interviews with local project managers and/or Area Development Districts (ADDs) who either were directly responsible for the management of the mitigation project or who could provide more specific context than what was provided in the projects' files were relevant and extremely helpful.

Finally, though still in its infancy regarding implementation, Kentucky's Community Hazards Assessment and Mitigation Planning System (CHAMPS) – its core function being a data warehouse – was able to provide important and illustrative information, especially concerning locations of mitigation projects being assessed and the values of surrounding infrastructure.

Phase III:
Part I, Kentucky’s General Methodology for Determining Losses Avoided:
MPA – MPC = Expected Annual Benefits[206] = Losses Avoided

To derive a value for the “Losses Avoided,” the same basic premise as used in Kentucky’s 2010 assessment of its mitigation actions remains: Kentucky will use a mitigation project’s Benefit-Cost Analysis report (where available) to derive what would be the difference between MP_A and MP_C.

However, when compared to the 2010 mitigation action assessment, the methodology does differ significantly while representing an evolution from 2010’s methodology (as opposed to a deviation from it).

This assessment of mitigation actions will do the following in order to calculate $MP_A - MP_C$ = Losses Avoided:

One: Calculate Expected Annual Benefits

Where FEMA benefit-cost analyses were required in application for the mitigation project that is being assessed, this loss avoidance report will calculate “Expected Annual Benefits” for the project.

FEMA established the following formula to calculate overall benefits that will be algebraically reconfigured to calculate an assessed mitigation project’s “Expected Annual Benefits”:

$$B = EAB[\frac{1-(1+r)^{-T}}{r}]$$

Where:

- “B” is Total Benefits,
- “r” is FEMA’s default discount rate (which is 7%),
- “T” is the useful life of the mitigation project, and
- “EAB” is Expected Annual Benefits.

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[206] Expected Annual Benefits multiplied by the number of years between a project’s completion and it being hit by a presidentially-declared disaster. Obviously, this is too lengthy to serve as a subtitle. The process is explained in this section.

Of course, because this formula is being applied to *completed* mitigation projects, Total Benefits ("B") are known. FEMA once had to approve what is now a completed mitigation project. This approval (in most cases) required a Benefit-Cost Analysis that supplied the Total Benefits ("B") used here. In order, then, to isolate Expected Annual Benefits, the above formula is reconfigured:

$$EAB = \frac{B}{[\frac{1-(1+r)^{-T}}{r}]}$$

Further, "r" is known: It is 7%.

"T" is known: It is 100 (years) for acquisition projects and assumed 30 (years) for all other types of projects assessed in this section.

METHODOLOGY NOTE:

EXPECTED ANNUAL BENEFITS AND ITS RELATION TO YEARS UNTIL TOTAL BENEFITS ARE ACHIEVED

From the formula above, one notices that Expected Annual Benefits (EAB) is an *average*: The total value of benefits divided by a *number of years.*

By using FEMA's discount rate (r) of 7%, and assuming a project's useful life (T) of 100 years (for acquisition projects), deriving "Expected Annual Benefits" means dividing the total value of benefits (B) by just over 14 years (14.26925071 years).

Assuming a project's useful life (T) is 50 years means dividing the value of total benefits (B) by just shy of 14 years (13.80074629 years).

Finally, assuming a project's useful life (T) is 30 years means dividing the value of total benefits (B) by approximately 12 years (12.40904118 years).

In other words, within 12 to 14 years, a project's annual benefits are expected to equal to its total benefits. Consequently, worrying about selecting projects begun from presidentially-declared disasters that occurred before FEMA-1407-DR (in 2002) is trivial. At the time of this writing, it has been eleven years (and will be close to twelve) years since the occurrence of FEMA-1407-DR and the beginning of mitigation actions applied for and funded from FEMA's grant programs deriving from it.

Two: Determine the Number of Years between an Assessed Mitigation Project's Completion by FEMA (i.e., Closeout Date) and the Year that It Suffered under FEMA-1925-DR through FEMA-4057-DR (i.e. 2010-2012)

Having calculated a mitigation project's *annual* benefit that ultimately will serve as the "losses avoided," it is relevant to determine the number of years in between FEMA's conception of the completion of the mitigation project[207] being imagined as not ever having been pursued and the year in which this hypothetical project was affected by one of the "presidentially-declared" disasters covered under this 2013 enhanced portion of Kentucky's hazard mitigation plan (i.e. FEMA-1925-DR through FEMA-4057-DR).

The point of this step is to determine by how many times the Expected Annual Benefit (EAB) calculated above will be multiplied to derive the benefits presumed to have accrued from completing the project which would have been "lost" if said project indeed had never been pursued (i.e. was a "Mitigation Project Absent").

For example, we know from above that FEMA-1925-DR through FEMA-4057-DR "hit" certain counties within Kentucky in years 2010, 2011, and 2012. We know that an acquisition project whose properties *would have been affected* by FEMA-1925-DR in 2010 had the project not been pursued was, in fact, completed in 2006. It is important, then, to consider that these now-acquired properties *had they not been acquired in 2006* would have been susceptible to varying degrees of effects from hazards during the four (4) years leading up to and including the hypothetical properties being hit by FEMA-1925-DR. Thus, in this example, we have four (4) years of Expected Annual Benefits (EABs) that can be considered accrued due to the completion of this acquisition project in 2006. These are benefits that would have been "lost" had the acquisition project been "absent."

However, before we multiply the Expected Annual Benefits (EABs) of an assessed mitigation project by the number of years between its completion and its being hit by FEMA-1925-DR through FEMA-4057-DR, one more step is important:

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[207] The individual mitigation action reports will record "project completion" dates where available. There can be a significant time lag in between when construction (or acquisition and demolition) of a mitigation action is completed and when that action is "closed-out" administratively by FEMA. For the sake both of providing the most conservative results and adhering to FEMA's definition of "complete" (i.e. "close-out"), loss avoidance calculations will rely upon the year in which the mitigation action was "closed out" as opposed to its recorded completion.

Three: Inflate (Deflate) Expected Annual Benefits

The Expected Annual Benefits need to be inflated before they can be summed the appropriate number of times between a mitigation project's completion and its being hit by FEMA-1925-DR through FEMA-4057-DR.

The use of the verb "summed" is relevant: If, for example, Expected Annual Benefits (EABs) to a mitigation project completed in 2006 is calculated at $10,000 and if this project – had it been absent – would have been hit by FEMA-1925-DR in 2010, it is incorrect simply to *multiply* $10,000 by four (4) years (i.e. $40,000).

Rather, the "benefits" or "losses avoided" need to be displayed in constant dollar amounts. $10,000 in 2006 is *not the same* as $10,000 in 2010.

Given that the last "presidentially-declared" disaster to strike Kentucky before the publication of its most recent (2013) hazard mitigation plan occurred in March 2012, the "losses avoided" being reported here will be reflected in constant 2012 dollars.

Consequently, the need for summation: From the above example, $10,000 in 2007 is inflated to 2012 dollars added to $10,000 in 2008 that is inflated to 2012 dollars added to $10,000 in 2009 that is inflated to 2012 dollars added to $10,000 in 2010 that is inflated to 2012 dollars gives the "losses avoided" for a mitigation project completed in 2006 with Expected Annual Benefits of $10,000 that was hit by FEMA-1925-DR in 2010.

One final consideration related to inflating the value of Expected Annual Benefit: There are actually two (2) rounds of inflation that occur. First, a project's Benefit-Cost Analysis is conducted *during the application stage* of that project. A mitigation project, once approved, can take two to three years to complete. This implies that there are differences between the monetary value calculated at the *beginning* of a mitigation project's life versus what would have been the monetary value if benefits had been calculated *upon completion* of the mitigation project two to three years later. This, then, counts as the "first round" of inflation: We will (for illustration) first calculate the present value of Expected Annual Benefits in the constant dollar terms of the *date in which a mitigation project is completed*.

Consider the above example: A mitigation project was completed in 2006 with Expected Annual Benefits (EABs) of $10,000. If the 2006 completion date for this project represents the end of a three-year project, then the Expected Annual Benefit of $10,000 actually was calculated in 2003 with the project's application. The $10,000 will first be adjusted to 2006 dollars from 2003.

The "second round" of inflation occurs as discussed above: Adjust the adjusted Expected Annual Benefits to constant 2012 dollars per year and sum by the number of years in between project completion and its being affected by one of the "presidentially-declared" disasters to strike Kentucky between the years 2010 – 2012.

Finally, keeping in mind that only *benefits* are inflated here, costs for the mitigation actions are not adjusted for inflation. Costs are not adjusted because FEMA does not practice inflation-adjustment in reimbursement (project investment) of mitigation actions. FEMA approves a budget for a mitigation action and pays according to that nominal amount regardless the years between project approval and project completion[208]. Benefits are rarely “paid” explicitly. The monetary value of benefits is symbolic. Thus, in order to accurately convey that symbol, the monetary value of benefits should be inflation-adjusted.

All inflation calculations are performed using the United States Department of Labor’s Bureau of Labor Statistics’ “CPI Inflation Calculator.” The tool can be found at the following web address: *http://www.bls.gov/data/inflation_calculator.htm*.

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[208] This payment of a nominal amount is, of course, justified because FEMA is paying for materials, labor, and fees whose prices are *quoted* at the time of project approval. FEMA allows for inflation-adjustment to the budget after FEMA has approved a project. But, the adjustment has to be pre-approved.

Phase III:
Part II, Kentucky’s Methodology for Determining Losses Avoided:
Mitigation Action Idiosyncrasies

Above describes generally the methodology the Commonwealth of Kentucky uses to assess the final list of completed mitigation actions below.

However, there exist instances where the data available for a mitigation action will not allow strict adherence to the above general methodology. Further assumptions were necessary. The individual “losses avoided” reports below detail these assumptions and slight changes to the methodology when they arise.

Presented here is a brief overview of those mitigation action-specific changes. The changes will fall into the following three (3) categories:

Category I:
That a Mitigation Action Upon Application Had No Benefits Calculated

FEMA policy before and during 2007 did not require Benefit-Cost Analyses to be conducted during the application phase of a now-completed mitigation action if that then-proposed action involved properties located within an NFIP[209]-designated (100-year) floodplain. Such then-proposed mitigation actions were deemed “cost-effective,” thus negating the need for a formal Benefit-Cost Analysis[210].

Without a formal Benefit-Cost Analysis, there are no recorded “benefits” for the mitigation actions from which this methodology would derive Expected Annual Benefits and subsequently derive a “losses-avoided” estimate.

In such cases, this methodology assumes, then, “cost-effectiveness” in the most minimal and conservative sense: The benefits from which Expected Annual Benefits will be calculated is equal to the costs recorded at the time of application for the mitigation action. In other words, this methodology assumes a Benefit-Cost Ratio (BCR) of 1.0.

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[209] National Flood Insurance Program

[210] FEMA, beginning in 2013, has implemented a similar policy of assuming “cost-effectiveness” for proposed mitigation actions whose properties are located within an NFIP-designated floodway. However, now the “cost-effectiveness” assumption is based upon newly-available data about trends in calculated benefits nationwide that provide evidence for the assumption of “cost-effectiveness” within an NFIP-designated floodplain.

Category II:
<u>That the Properties Covered Under a Mitigation Action Were "Substantially Damaged"</u>

Related to the above category, one completed mitigation action assessed not only did not possess a formal Benefit-Cost Analysis (from which to derive Expected Annual Benefits and subsequent "losses avoided"), but the properties for which the mitigation action was completed also were all declared "substantially damaged."

"Substantially damaged" is a specifically-defined term: From a hazard event (usually flooding), damages to a property are valued at 50% of the assessed value of that property. Thus, the property is considered "substantially damaged."

In this case, this methodology uses the above definition of "substantially damaged" to assume the benefits from which this methodology's "loss avoidance" estimates ultimately derive. It will assume a Benefit-Cost Ratio (BCR) of 1.5 *based upon the assessed values of the properties*.

Category III:
<u>That Two Loss Avoidance Estimates Will Be Calculated</u>

Further related to the above two categories, it will be relevant to calculate two estimates for "losses avoided" in order to be able to choose which one represents the most accurate estimate of "losses avoided" according to this methodology.

A mitigation action that involves multiple properties may or may not have benefits calculated for the action as a whole while the individual properties for which the mitigation action is being conducted do have benefits calculated. Alternatively, the benefits calculated for a mitigation action as a whole may have been calculated at a different time than the benefits calculated for individual properties for which that mitigation action is being implemented.

Consequently, it is relevant to look at "losses avoided" from the perspective of the mitigation action as a whole *and* using benefits calculated from individual properties in order to (subjectively) determine the most accurate "losses avoided" estimate.

FEMA-DR-1407-0002

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Harlan County*
Year Mitigation Action Was Applied For	*2002*
Approval Date	*January 1, 2003*
Project Completion Date	*Not Available*
"Close-Out" Date	*October 19,2006*
Approved Amount to Spend for Mitigation Action	*$1,040,960.00*
Actual Amount Spent for the Mitigation Action	*$928,894.72*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*5 Years*

Scope of Work

FEMA-DR-1407-0002 acquired and demolished twenty (20) properties that all were (a) located within a 100-year floodplain and (b) declared "substantially damaged."

Justification for the Mitigation Action

The twenty (20) properties acquired and demolished had been deemed "substantially damaged" from the effects of a previous flood event.

Note on Methodology

FEMA-DR-1407-0002 (and its individual properties) will have no Benefit-Cost Ratio (BCR) because each of the twenty (20) properties that were acquired under this mitigation action was deemed "substantially damaged." Benefit-Cost Analyses were and are not required for "substantially-damaged" structures.

The definition of "substantially damaged" is relevant for this analysis: "Substantially damaged" refers to damages that amount to 50% of the value of a property or structure.

This analysis uses this definition to infer a Benefit-Cost Ratio (BCR) from which benefits will be calculated and subsequently leading to the calculation of "Expected Annual Benefits" that will result in "losses avoided."

The logic used is as follows: This analysis assumes a Benefit-Cost Ratio (BCR) of 1.5 for the entire project. A BCR of 1.5 implies that the total benefits amount to 150% of the properties' values. This analysis assumes not only "cost-effectiveness" (i.e. a Benefit-Cost Ratio of 1.0), but also assumes avoidance from what made these properties “substantially damaged,” i.e. that damages amounted to 50% of the properties’ assessed values.

A further point must be emphasized: That the definition of “substantially damaged” is being used to infer a Benefit-Cost Ratio means the definition must be used correctly. “Substantial damage” is damage amounting to 50% of *the assessed value* of a property. Normally, however, BCRs of acquisition-type mitigation actions are calculated using amounts that exceed *the assessed value* of a property (i.e. including the net present value of the cost of annual maintenance and the costs associated with demolishing the property once acquired).

The BCR for this analysis is the Benefit-Cost Ratio considering only the *assessed values* of the properties under this project. Keep in mind, however, that FEMA would have approved a budget and reimbursed for expenses that exceed simply the assessed values of the properties being acquired.

Tabulated below, then, is the list of twenty (20) properties acquired under FEMA-DR-1407-0002, their assessed values, and their benefits assuming a BCR of 1.5 using assessed values as the “costs” to a Benefit-“Cost” Analysis:

Table E-5-12: FEMA-DR-1407-0002 Assessed Values of Properties and Their Benefits Assuming "Substantial Damage" Benefit-Cost Ratio (BCR) of 1.5

Property	*Assessed Value (in $ 2002)*	*Benefit-Cost Ratio*	*Benefits Calculated (in $ 2002)*
1	$24,500.00	1.5	$36,750.00
2	$72,000.00	1.5	$108,000.00
3	$67,500.00	1.5	$101,250.00
4	$16,500.00	1.5	$24,750.00
5	$16,000.00	1.5	$24,000.00
6	$76,500.00	1.5	$114,750.00
7	$59,500.00	1.5	$89,250.00
8	$34,000.00	1.5	$51,000.00
9	$32,500.00	1.5	$48,750.00
10	$42,000.00	1.5	$63,000.00
11	$34,500.00	1.5	$51,750.00
12	$35,000.00	1.5	$52,500.00
13	$67,500.00	1.5	$101,250.00
14	$56,500.00	1.5	$84,750.00
15	$61,500.00	1.5	$92,250.00
16	$47,500.00	1.5	$71,250.00
17	$18,500.00	1.5	$27,750.00
18	$30,000.00	1.5	$45,000.00
19	$35,000.00	1.5	$52,500.00
20	$12,500.00	1.5	$18,750.00
Totals	*$839,500.00*	*1.5*	*$1,259,250.00*

FEMA-DR-1407-0002

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action

Year Mitigation Action Was Applied For	*2002*
Benefit-Cost Ratio (BCR) at Time of Application	*1.5* *(of Assessed Value)* *(Substantially Damaged)*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$839,500.00*
Mitigation Action Benefits Calculated at Time of Application	*$1,259,250.00*
Year Mitigation Action was “Closed Out”	*2006*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2002) (i.e. EAB at Time of Mitigation Action Application)	*$88,249.20*
Expected Annual Benefits (EAB) (in $ 2006) (i.e. EAB at Time of Mitigation Action “Close Out”)	*$98,894.05*
Expected Annual Benefits (EAB) (in $ 2007)	*$101,710.76*
Expected Annual Benefits (EAB) (in $ 2008)	*$105,616.00*
Expected Annual Benefits (EAB) (in $ 2009)	*$105,240.24*
Expected Annual Benefits (EAB) (in $ 2010)	*$106,966.47*
Expected Annual Benefits (EAB) (in $ 2011)	*$110,342.89*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$696,671.04*

Losses Avoided (LA) = EAB in 2007 + EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011

LA =

LA = $529,876.36

Return on Investment (ROI) = $529,876.36/$696,671.04

ROI = 0.76 (76%)

FEMA-DR-1407-0002

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1407-0002 was hit by one (1) “presidentially-declared” disaster (FEMA-1976-DR) about five years after “close out” of the acquisitions in 2006. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit. This analysis is further assuming that in the four (4) years prior to FEMA-1976-DR, less severe but no less costly damages had occurred, thus justifying the addition of four additional years of inflation-adjusted Expected Annual Benefits.

Within five (5) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped just over three-quarters (76%) of its investment in FEMA-DR-1407-0002. Stated differently, for an investment of approximately $697,000 intended to last 100 years, in five (5) years we can assume that this investment has already saved Harlan County approximately $530,000 in damages.

FEMA-DR-1407-0005

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Bell County*
Year Mitigation Action Was Applied For	*2002*
Approval Date	*November 21, 2003*
Project Completion Date	*Not Available*
"Close-Out" Date	*March 11, 2010*
Approved Amount to Spend for Mitigation Action	*$850,185.00*
Actual Amount Spent for the Mitigation Action	*$417,396.55*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-4008-DR, Declared July 25, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*1 Year*

Scope of Work

FEMA-DR-1407-0005 ultimately would acquire thirteen (13) properties located along the Cumberland River in Bell County, Kentucky and all located within a National Flood Insurance Program (NFIP)-designated floodway. The original scope of work involved thirty (30) properties. That seventeen (17) properties were excluded is discussed below.

Justification for the Mitigation Action

The thirty (30) properties from the original scope of work and the thirteen (13) properties eventually acquired were all justified as being within an NFIP-designated floodway. (As discussed below, some of the original thirty (30) properties later were deemed to not exist within such a floodway.)

Information About the Properties Acquired

The original scope-of-work for FEMA-DR-1407-0005 included thirty (30) properties. FEMA eventually would approve and approve budgets for only thirteen (13). Seventeen (17) properties were excluded for one or more of the following reasons:

1. Kentucky's Heritage Council (KHC) had determined that some of the properties may have needed to be included on the National Register of Historic Places.
2. The United States Army Corps of Engineers (USACE) found properties whose first-floor elevations (FFEs) were above the ten-year flood elevation mark.
3. While it was presumed at the time of application that all thirty (30) original properties were located within an NFIP-designated floodway, then-new Flood Insurance Rate Maps (FIRMs) were used for this project that found that some of the properties were located just outside such designated floodways.

Note on Methodology

FEMA-DR-1407-0005 (and its individual properties) will have no Benefit-Cost Ratio (BCR) because each of the final thirteen (13) properties that were acquired under this mitigation action was located within an NFIP-designated floodway.

Prior to and throughout 2007, FEMA maintained a policy that properties located within an NFIP-designated floodway did not require a Benefit-Cost Analysis (BCA) (from which the calculations for "losses avoided" would derive).

In order to ensure the most conservative analysis, then, the benefits and "losses avoided" will reflect only "cost-effectiveness." "Cost-effectiveness" here is defined as having a Benefit-Cost Ratio (BCR) of 1.0.

Tabulated below, then, is the list of the final thirteen (13) properties approved to be and acquired under FEMA-DR-1407-0005, their assessed values, their amount from the project's file assumed to derive a BCR of 1.0, and their subsequent "benefits" (which will be equal to the amount assumed to derive the BCR of 1.0):

Table E-5-13: FEMA-DR-1407-0005: Final 13 Properties Acquired and Their Benefits Assuming "Cost-Effectiveness"

Property	*Assessed Value*	*Benefit-Cost Ratio (BCR)*	*Amount Used to Determine BCR*	*Benefits Deriving from BCR*
1	$28,000.00	1.0	$32,000.00	$32,000.00
2	$14,500.00	1.0	$31,000.00	$31,000.00
3	$2,000.00	1.0	$34,000.00	$34,000.00
4	Not Available	1.0	$6,500.00	$6,500.00
5	$1,500.00	1.0	$6,500.00	$6,500.00
6	$24,400.00	1.0	$33,000.00	$33,000.00
7	Not Available	1.0	$18,500.00	$18,500.00
8	$3,900.00	1.0	$18,000.00	$18,000.00
9	$17,000.00	1.0	$25,000.00	$25,000.00
10	$21,000.00	1.0	$52,000.00	$52,000.00
11	$8,000.00	1.0	$25,000.00	$25,000.00
12	$20,000.00	1.0	$22,000.00	$22,000.00
13	Not Available	1.0	$65,000.00	$65,000.00
Totals	*N/A*	*1.0*	*$368,500.00*	*$368,500.00*

FEMA-DR-1407-0005

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action

Year Mitigation Action Was Applied For	*2002*
Benefit-Cost Ratio (BCR) at Time of Application	*1.0* *(Cost-Effectiveness)*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$368,500.00*
Mitigation Action Benefits Calculated at Time of Application	*$368,500.00*
Year Mitigation Action was "Closed Out"	*2010*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2002) (i.e. EAB at Time of Mitigation Action Application)	*$25,824.76*
Expected Annual Benefits (EAB) (in $ 2010) (i.e. EAB at Time of Mitigation Action "Close Out")	*$31,302.08*
Expected Annual Benefits (EAB) (in $ 2011)	*$32,290.14*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$313,047.41*

Losses Avoided (LA) = EAB in 2011
LA = $32,290.14
LA = $32,290.14

Return on Investment (ROI) = $32,290.14/$313,047.41
ROI = 0.10 (10%)

FEMA-DR-1407-0005

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1407-0005 was hit by one (1) "presidentially-declared" disaster (FEMA-4008-DR) just outside one (1) year after "close out" of the acquisitions in March of 2010. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-4008-DR hit.

For one (1) year, then, from a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 10% of its investment in FEMA-DR-1407-0005. Stated differently, for an investment of approximately $313,000 intended to last 100 years, in one (1) year we can assume that this investment has already saved Bell County approximately $32,000 in damages.

Further, bear in mind that this "losses avoided" estimate (and its subsequent return on investment) represents a very conservative interpretation of this mitigation action's benefits. Assuming mere "cost-effectiveness" (i.e. a Benefit-Cost Ratio of 1.0) allowed benefits that did not equal what FEMA in the end spent on the mitigation action, much less the more than double the amount that FEMA initially approved for the action. The "losses avoided" likely is an underestimation.

FEMA-DR-1407-0009

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Christian*
Year Mitigation Action Was Applied For	*2002*
Approval Date	*November 21, 2003*
Project Completion Date	*February 3, 2005*
"Close-Out" Date	*September 18, 2006*
Approved Amount to Spend for Mitigation Action	*$382,395*
Actual Amount Spent for the Mitigation Action	*$309,405.25*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*5 Years*

Scope of Work

FEMA-DR-1407-0009 mitigated flood hazard to six residences located within a FEMA designated floodway by acquiring and demolishing six residential structures.

Justification for the Mitigation Action

The six properties were determined to be within a floodplain according to FEMA information.

Note on Methodology

FEMA-DR-1407-0009 (and its individual properties) will have no Benefit-Cost Ratio (BCR) because each of the six (6) properties that were acquired under this mitigation action was located within an NFIP-designated floodway at a time when FEMA policy did not require Benefit-Cost Analyses (BCAs) to be conducted for properties in these locations.

For the sake of providing the most conservative "loss avoidance" that can be justified without being arbitrary, this analysis assumed only "cost-effectiveness." "Cost-effectiveness" is defined here as a Benefit-Cost Ratio of 1.0.

Tabulated below, then, is the list of six (6) properties acquired under FEMA-DR-1407-0009, their assessed values, and their benefits assuming a BCR of 1.0:

Table E-5-14: FEMA-DR-1407-0002 Assessed Values of Properties and Their Benefits Assuming "Substantial Damage" Benefit-Cost Ratio (BCR) of 1.5

Property	*Assessed Value (in $ 2002)*	*Value Used to Determine BCR*	*Benefit-Cost Ratio*	*Benefits Calculated (in $ 2002)*
1	$46,350.00	$50,400	1.0	$50,400
2	$45,180.00	$46,500	1.0	$46,500
3	$61,020.00	$42,500	1.0	$42,500
4	$61,335.00	$49,300	1.0	$49,300
5	$43,200.00	$44,500	1.0	$44,500
6	$54,000.00	$45,100	1.0	$45,100
Totals	*$311,085*	*$278,300*	*1.0*	*$278,300*

FEMA-DR-1407-0009

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action

Year Mitigation Action Was Applied For	*2002*
Benefit-Cost Ratio (BCR) at Time of Application	*1.0* *(Cost-Effectiveness)*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$278,300*
Mitigation Action Benefits Calculated at Time of Application	*$278,300*
Year Mitigation Action was “Closed Out”	*2006*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2002) (i.e. EAB at Time of Mitigation Action Application)	*$19,503.48*
Expected Annual Benefits (EAB) (in $ 2006) (i.e. EAB at Time of Mitigation Action “Close Out”)	*$21,856.04*
Expected Annual Benefits (EAB) (in $ 2007)	*$22,478.55*
Expected Annual Benefits (EAB) (in $ 2008)	*$23,341.62*
Expected Annual Benefits (EAB) (in $ 2009)	*$23,258.58*
Expected Annual Benefits (EAB) (in $ 2010)	*$23,640.08*
Expected Annual Benefits (EAB) (in $ 2011)	*$24,386.29*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$232,053.94*

Losses Avoided (LA) = EAB in 2007 + EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011

LA = ***$22,478.55+$23,341.62+$23,258.58+$23,640.08+$24,386.29***

LA = $117,105.12

Return on Investment (ROI) = $117,105.12/$232,053.95

ROI = 0.51 (51%)

FEMA-DR-1407-0009

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1407-0009 was hit by one (1) "presidentially-declared" disaster (FEMA-1976-DR) about five (5) years after "close out" of the acquisitions in 2006. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-DR-FEMA-1976-DR hit. This analysis is further assuming that in the four (4) years prior to FEMA-1976-DR, less severe but no less costly damages had occurred, thus justifying the addition of four additional years of inflation-adjusted Expected Annual Benefits.

Within five (5) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped just over half (51%) of its investment in FEMA-DR-1407-0009. Stated differently, for an investment of approximately $232,000 intended to last 100 years, in five (5) years we can assume that this investment has already saved Christian County approximately $117,000 in damages.

FEMA-DR-1407-0010

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Boyd County*
Year Mitigation Action Was Applied For	*2002*
Approval Date	*May 30, 2004*
Project Completion Date	*Not Available*
"Close-Out" Date	*January 8, 2007*
Approved Amount to Spend for Mitigation Action	*$543,000.00*
Actual Amount Spent for the Mitigation Action	*$448,899.43*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*4 Years*

Scope of Work

FEMA-DR-1407-0010 acquired, demolished, and cleared nine (9) properties in Boyd County, Kentucky that had been flooded repeatedly.

Justification for the Mitigation Action

The properties included in FEMA-DR-1407-0010 had experienced repeated and damaging instances of flooding in 1996, 1997, 2000, 2001, and 2002.

Note on Methodology

This analysis will derive two (2) separate estimates of "losses avoided" for FEMA-DR-1407-0010: It will calculate the "losses avoided" (and subsequent return on investment) for the mitigation action as a whole and it will calculate the "losses avoided" using Benefit-Cost Ratios (BCRs) and costs broken down by the individual properties involved in this project.

Losses Avoided for the Mitigation Action as a Whole

Year Mitigation Action Was Applied For	*2002*
Benefit-Cost Ratio (BCR) at Time of Application	*3.14*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$543,000.00*
Mitigation Action Benefits Calculated at Time of Application	*$1,705,020.00*
Year Mitigation Action was "Closed Out"	*2007*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2002) (i.e. EAB at Time of Mitigation Action Application)	*$119,489.11*
Expected Annual Benefits (EAB) (in $ 2007) (i.e. EAB at Time of Mitigation Action "Close Out")	*$137,716.01*
Expected Annual Benefits (EAB) (in $ 2008)	*$143,003.69*
Expected Annual Benefits (EAB) (in $ 2009)	*$142,494.91*
Expected Annual Benefits (EAB) (in $ 2010)	*$144,832.23*
Expected Annual Benefits (EAB) (in $ 2011)	*$149,403.90*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$336,674.57*

Losses Avoided (LA) = EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011
LA = $143,003.69 + $142,494.91 + $144,832.23 + $149,403.90
LA = $579,734.73

Return on Investment (ROI) = $579,734.73/$336,674.57
ROI = 1.72 (172%)

Alternate Losses Avoided: Per Acquired Structure

Given that FEMA-DR-1407-0010 is an acquisition/demolition, the value of “losses avoided” and FEMA’s subsequent “return on investment (ROI)” may look differently if we evaluate the properties individually.

Table E-5-15: FEMA-DR-1407-0010 Losses Avoided Using Individual Property Data

Property	*Assessed Value*	*Amount Expected*[211] *to Acquire (in 2002)*	*Benefit-Cost Ratio (BCR)*	*Total Benefits (in $ 2002)*	*Expected Annual Benefits (EAB) (in $ 2002)*	*EAB (in $ 2007)*	*FEMA’s Project Investment (PI)*
1	$97,500.00	$107,050.00	2.05	$219,452.50	$15,379.40	$17,725.38	$80,287.50
2	$54,600.00	$64,150.00	0.39	$25,018.50	$1,753.32	$2,020.77	$48,112.50
3	$125,450.00	$135,000.00	2.05	$276,750.00	$19,394.85	$22,353.35	$101,250.00
4	$35,750.00	$45,300.00	6.72	$304,416.00	$21,333.71	$24,587.96	$33,975.00
5	$40,690.00	$50,240.00	3.83	$192,419.20	$13,484.88	$15,541.87	$37,680.00
6	$48,880.00	$58,430.00	1.66	$96,993.80	$6,797.40	$7,834.28	$43,822.50
7	$70,200.00	$79,750.00	1.00	$79,750.00	$5,588.94	$6,441.48	$59,812.50
8	$150,800.00	$160,350.00	1.19	$190,816.50	$13,372.57	$15,412.43	$120,262.50
9	$32,240.00	$41,790.00	2.54	$106,146.60	$7,438.83	$8,573.55	$31,342.50
				FEMA’s Project Investment Total			$556,545.00

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[211] The use of the word “expected” is purposeful: These were the costs to acquire used in order to calculate the Benefit-Cost Ratio (BCR). Multiplying the BCR by these numbers gives the total benefits for the property “expected.” Further, this expected amount to be paid to acquire the nine (9) properties is what was actually paid for the acquisitions. Thus, FEMA’s project investment (PI) is 75% of these values.

Table E-5-15 (Cont.): FEMA-DR-1407-0010 Losses Avoided Using Individual Property Data

Property	I: EAB (in $ 2008)	II: EAB (in $ 2009)	III: EAB (in $ 2010)	IV: EAB (in $ 2011)	V: Losses Avoided (I + II + III + IV)	ROI: VI/PI
1	$18,405.95	$18,340.47	$18,641.30	$19,229.72	$74,618.44	0.93
2	$2,098.36	$2,090.90	$2,125.19	$2,192.27	$8,508.72	0.18
3	$23,211.61	$23,129.03	$23,508.41	$24,250.46	$94,102.51	0.93
4	$25,532.03	$25,441.19	$25,858.50	$26,674.73	$103,510.45	3.05
5	$16,138.61	$16,081.19	$16,344.96	$16,860.90	$65,430.66	1.74
6	$8,135.08	$8,106.14	$8,239.10	$8,499.17	$32,985.49	0.75
7	$6,688.80	$6,665.01	$6,774.33	$6,988.16	$27,123.30	0.45
8	$16,004.19	$15,947.25	$16,208.83	$16,720.47	$64,888.74	0.54
9	$8,902.74	$8,871.06	$9,016.57	$9,301.18	$36,100.55	1.15
			Total Losses Avoided		$507,268.86	0.91 (91%)

FEMA-DR-1407-0010

III: Loss Avoidance Interpretation

Of the two displays of loss avoidance results, in this specific case, the method calculating the losses avoided from the project as a whole is the most accurate.

This is rare that looking at the project as a whole would provide more accurate losses avoided than looking at individual projects. The usual problem with calculating losses avoided using the methodology of this report and acquisition projects as a whole involves the sometime dramatic changes that occur in between the approval of an acquisition mitigation action and the implementation of it. Benefits for the overall acquisition project are calculated *before approval* of the project. However, if during the implementation of the project, owners of their homes decide not to sell, or a different grant funds the acquisitions of properties originally included in the FEMA-approved project, or different properties are added (while other subtracted), the *overall* project does not get a new Benefit-Cost Analysis performed. Rather, the individual properties are assessed for their benefits minus their costs.

In FEMA-DR-1407-0010's case, however, any changes to the amount or distribution of properties occurred *before* FEMA approved the project. In other words, the approved budget and the amount FEMA finally spent reflect the acquisitions that actually occurred.

Correspondence within the FEMA-DR-1407-0010 file recorded that, *prior to approval* a couple of the nine (9) properties were excluded. What is not clear from the file is whether those excluded properties were acquired or demolished using other sources of funds.

Thus, the interpretation of the loss-avoidance results:

FEMA-DR-1407-0010 was hit by one "presidentially-declared" disaster (FEMA-1976-DR) about four (4) years after "close out" of the acquisition in 2007. We know, then, that we can expect the inflated Expected Annual Benefit to apply 2011 when FEMA-1976-DR hit. This analysis is further assuming that between 2008 and 2011, less severe but no less costly damages were occurring yearly, thus justifying the addition of three (3) more years of inflation-adjusted Expected Annual Benefits.

Within four (4) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped over 100% of its investment in FEMA-DR-1407-0010. Stated differently, for an investment of approximately $337,000 intended to last 100 years, in just four (4) years we can assume that this investment has already saved Boyd County almost double that investment at approximately $580,000.

FEMA-DR-1454-0004

I: Summary of Mitigation Action

Mitigation Action Type	*(Landslide) Acquisition/Demolition*
County in which Completed	*Lewis County*
Year Mitigation Action Was Applied For	*2004*
Approval Date	*May 3, 2004*
Project Completion Date	*July 22, 2005*
"Close-Out" Date	*October 26, 2006*
Approved Amount to Spend for Mitigation Action	*$147,200.00*
Actual Amount Spent for the Mitigation Action	*$145,274.54*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1925-DR, Declared July 23, 2010* • *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*5 Years*

Scope of Work

FEMA-DR-1454-0004 acquired, demolished, and cleared four (4) homes in Lewis County, Kentucky that had been consistently and adversely affected by landslides

Justification for the Mitigation Action

The four (4) properties had been considered by the United States Geological Survey (USGS) to be within a "moderate landslide area." Further, at the time of mitigation action application, the properties had been affected by two (2) previous "presidentially-declared" disasters that had occurred within six (6) months of each other.

FEMA-DR-1454-0004

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action as a Whole

Year Mitigation Action Was Applied For	*2004*
Benefit-Cost Ratio (BCR) at Time of Application	*1.67*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$147,200.00*
Mitigation Action Benefits Calculated at Time of Application	*$246,480.00*
Year Mitigation Action was “Closed Out”	*2006*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2004) (i.e. EAB at Time of Mitigation Action Application)	*$17,273.51*
Expected Annual Benefits (EAB) (in $ 2006) (i.e. EAB at Time of Mitigation Action “Close Out”)	*$18,861.72*
Expected Annual Benefits (EAB) (in $ 2007)	*$19,398.95*
Expected Annual Benefits (EAB) (in $ 2008)	*$20,143.78*
Expected Annual Benefits (EAB) (in $ 2009)	*$20,072.11*
Expected Annual Benefits (EAB) (in $ 2010)	*$20,401.35*
Expected Annual Benefits (EAB) (in $ 2011)	*$21,045.32*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$108,955.91*

Losses Avoided (LA) = EAB in 2007 + EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011

LA = $19,398.95 + $20,143.78 + $20,072.11 + $20,401.35 + $21,045.32

LA = $101,061.51

Return on Investment (ROI) = $101,061.51/$108,955.91

ROI = 0.93 (93%)

Alternate Losses Avoided: Per Acquired Structure

Table E-5-16: FEMA-DR-1454-0004 Losses Avoided Using Individual Property Data

Property	*Assessed Value*[212]	*Amount Expected*[213] *to Acquire (in 2004)*	*Benefit-Cost Ratio (BCR)*	*Total Benefits (in $ 2004)*	*Expected Annual Benefits (EAB) (in $ 2004)*	*FEMA's Project Investment (PI)*
1	$20,000.00	$26,000.00	2.94	$76,440	$5,356.97	$19,500.00
2	$30,300.00	$37,300.00	1.51	$56,323	$3,947.16	$27,975.00
3	$11,000.00	$15,000.00	3.40	$51,000	$3,574.12	$11,250.00
4	$45,000.00	$51,500.00	1.22	$62,830	$4,403.17	$38,625.00
			FEMA's Project Investment Total			$97,350.00

Table E-5-16 (Cont.): FEMA-DR-1454-0004 Losses Avoided Using Individual Property Data

Property	*EAB (in $ 2006)*	*I: EAB (in $ 2007)*	*II: EAB (in $ 2008)*	*III: EAB (in $ 2009)*	*IV: EAB (in $ 2010)*	*V: EAB (in $ 2011)*	*VI: Losses Avoided (I + II + III + IV + V)*	*ROI: VI/PI*
1	$5,717.13	$5,879.96	$6,105.73	$6,084.00	$6,183.80	$6,378.99	$30,632.48	1.57
2	$4,212.53	$4,332.51	$4,498.86	$4,482.86	$4,556.39	$4,700.21	$22,570.83	0.81
3	$3,814.41	$3,923.06	$4,073.68	$4,059.19	$4,125.77	$4,256.00	$20,437.70	1.82
4	$4,699.20	$4,833.04	$5,018.61	$5,000.76	$5,082.78	$5,243.22	$25,178.41	0.65
				Total Losses Avoided			*$98,819.42*	*0.91 (91%)*

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[212] The assess values of these four (4) properties would be reassessed during the implementation of this mitigation action. The reassessed values became, respectively: $32,000; $18,000; $7,500; $66,000. The reassessed values were reflected in FEMA-DR-1454-0004's "close-out" documents

[213] The use of the word "expected" is purposeful: These were the costs to acquire used in order to calculate the Benefit-Cost Ratio (BCR). Multiplying the BCR by these numbers gives the total benefits for the property "expected." Further, this expected amount to be paid to acquire the four (4) properties is what was actually paid for the acquisitions. Thus, FEMA's project investment (PI) is 75% of these values.

FEMA-DR-1454-0004

III: Loss Avoidance Interpretation

Of the two displays of loss avoidance results, in this specific case, the method calculating the losses avoided from the project as a whole is the most accurate: More imputation and assumption-making was involved in calculating the losses avoided for the individual properties.

This is rare that looking at the project as a whole would provide more accurate losses avoided than looking at individual projects. The usual problem with calculating losses avoided using the methodology of this report and acquisition projects as a whole involves the sometime dramatic changes that occur in between the approval of an acquisition mitigation action and the implementation of it. Benefits for the overall acquisition project are calculated *before approval* of the project. However, if during the implementation of the project, owners of their homes decide not to sell, or a different grant funds the acquisitions of properties originally included in the FEMA-approved project, or different properties are added (while other subtracted), the *overall* project does not get a new Benefit-Cost Analysis performed. Rather, the individual properties are assessed for their benefits minus their costs.

FEMA-DR-1454-0004 acquired the same properties approved from the overall mitigation action. Granted, per the footnote, the assessed values of the properties changed; but, this did not affect overall benefits. FEMA approved $147,200 and paid 75% of $145,274.54. The benefits were based on the effects from four (4) properties that were indeed acquired from this FEMA-funded mitigation action. In this case, it was far less clear the situation with individual payments (and thus the distribution of benefits and costs) for the individual properties.

Thus, the interpretation of the loss-avoidance results:

FEMA-DR-1454-0004 was hit by two (2) “presidentially-declared” disasters (FEMA-1925-DR and FEMA-1976-DR) in less than four (4) years after “close out” of the acquisition in 2006. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2010 and 2011 when FEMA-1925-DR and FEMA-1976-DR hit. This analysis is further assuming that between 2007 and 2010, less severe but no less costly damages were occurring yearly, thus justifying the addition of three (3) more years of inflation-adjusted Expected Annual Benefits.

Within five (5) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 93% of its investment in FEMA-DR-1454-0004. Stated differently, for an investment of approximately $108,000 intended to last 100 years, in just five years we can assume that this investment has already saved Lewis County approximately $101,000 in damages.

FEMA-DR-1454-0008

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Fleming County*
Year Mitigation Action Was Applied For	*2004*
Approval Date	*June 2, 2005*
Project Completion Date	*February 28, 2008*
“Close-Out” Date	*January 22, 2009*
Approved Amount to Spend for Mitigation Action	*$129,027.00*
Actual Amount Spent for the Mitigation Action	*$125,078.00*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between “Close-Out” and Presidentially-Declared Disaster(s)	*2 Years*

Scope of Work

FEMA-DR-1454-0008 acquired and demolished one (1) flood-prone critical facility, a volunteer firehouse.

Justification for the Mitigation Action

The property acquired under FEMA-DR-1454-0008 was a volunteer fire department’s building that had been flooded six (6) times between 1989 and the time of application. Further, the building that was acquired represented a critical facility. This assumed that any amount of flooding or general detriment to functionality had dramatic consequences for Fleming County. Anytime it flooded, the fire department in Fleming County was unable to provide its services effectively.

Information about the Property that Was Acquired

Property Acquired	*Assessed Value*
Muses Mill Fire Department	$124,283.00

FEMA-DR-1454-0008

Losses Avoided for the Mitigation Action

This acquisition project involved only one (1) property. Thus, the losses avoided for the mitigation action "as a whole" is equivalent to looking at the mitigation action from the standpoint of its individual properties.

Year Mitigation Action Was Applied For	*2004*
Benefit-Cost Ratio (BCR) at Time of Application	*1.06*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$129,027.00*
Mitigation Action Benefits Calculated at Time of Application	*$138,210.00*
Year Mitigation Action was "Closed Out"	*2009*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2004) (i.e. EAB at Time of Mitigation Action Application)	*$9,731.41*
Expected Annual Benefits (EAB) (in $ 2009) (i.e. EAB at Time of Mitigation Action "Close Out")	*$11,052.13*
Expected Annual Benefits (EAB) (in $ 2010)	*$11,233.42*
Expected Annual Benefits (EAB) (in $ 2011)	*$11,588.00*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$93,808.50*

Losses Avoided (LA) = EAB in 2010 + EAB in 2011
LA = $11,233.42 + $11,588.00
LA = $22,821.42

Return on Investment (ROI) = $22,821.42/$93,808.50
ROI = 0.24 (24%)

FEMA-DR-1454-0008

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1454-0008 was hit by one (1) “presidentially-declared” disaster (FEMA-1976-DR) approximately two (2) years after “close out” of the acquisition in 2009. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-DR-FEMA-1976-DR hit. This analysis is further assuming that in the year before FEMA-1976-DR, less severe but no less costly damages were occurring yearly, thus justifying the addition of one (1) more year of inflation-adjusted Expected Annual Benefits.

Within two (2) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 24% of its investment in FEMA-DR-1454-0008. Stated differently, for an investment of approximately $94,000 intended to last 100 years, in two years we can assume that this investment has already saved Fleming County approximately $23,000 in damages.

FEMA-DR-1454-0011

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Jefferson County*
Year Mitigation Action Was Applied For	*2004*
Approval Date	*November 18, 2005*
Project Completion Date	*October 31, 2006*
"Close-Out" Date	*March 20, 2007*
Approved Amount to Spend for Mitigation Action	*$728,731.00*
Actual Amount Spent for the Mitigation Action	*$726,827.33*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*4 Years*

Scope of Work

FEMA-DR-1454-0011 acquired six (6) properties located in Jefferson County, Kentucky.

Justification for the Mitigation Action

Four (4) of the six (6) properties acquired and demolished were located within the 100-year floodplain. The remaining two (2) properties were near wetlands and were characterized by extremely flat topography with no drainage system.

Information About the Properties That Were Acquired and Note on Methodology

FEMA-DR-1454-0011 as a whole will have no Benefit-Cost Ratio (BCR) because, per FEMA policy at the time, a Benefit-Cost Analysis would not have been required at the time of application for this acquisition/demolition project located within a floodway.

Consequently, this mitigation action assessment will assume only "cost-effectiveness." "Cost-effectiveness" is defined here by a BCR of 1.0.

However, FEMA-DR-1454-0011 is unique in that, while the project as a whole did not require Benefit-Cost Analyses, two (2) of the four (4) properties within the project *did* require Benefit-Cost Analyses because they were not within Jefferson County's floodway. Consequently, these two (2) properties *will have* Benefit-Cost Ratios (BCRs).

From this, the analysis of FEMA-DR-1454-0011 will be conducted in two (2) ways: The first analyzes the project as a whole; the second looks at the individual properties.

Losses Avoided for the Mitigation Action as a Whole

FEMA-DR-1454-0011 acquired six (6) properties; four (4) of which were located within a 100-year floodplain. Mitigation actions funded from Hazard Mitigation Grant Program (HMGP) grants deriving from “presidentially-declared” disasters that occurred before declaration of FEMA-DR-1703 in May of 2007 did not require Benefit-Cost Analyses to be conducted for mitigation actions protecting structures and populations within a 100-year floodplain. In other words, per FEMA policy, mitigation actions pursued in order to protect structures and populations within a 100-year floodplain did not require Benefit-Cost Analyses before 2007. This mitigation action was approved in 2004. Consequently, for the overall project, and to convey the most conservative losses-avoided calculation, only “cost-effectiveness” was assumed. “Cost-Effectiveness” is synonymous with a Benefit-Cost Ratio (BCR) of 1.0.

Year Mitigation Action Was Applied For	*2004*
Benefit-Cost Ratio (BCR) at Time of Application	*1.0 (Cost-Effectiveness)*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$728,731.00*
Mitigation Action Benefits Calculated at Time of Application	*$728,731.00*
Year Mitigation Action was Completed	*2007*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2004) (i.e. EAB at Time of Mitigation Action Application)	*$51,070.03*
Expected Annual Benefits (EAB) (in $ 2007) (i.e. EAB at Time of Mitigation Action “Close Out”)	*$56,055.91*
Expected Annual Benefits (EAB) (in $ 2008)	*$58,208.21*
Expected Annual Benefits (EAB) (in $ 2009)	*$58,001.12*
Expected Annual Benefits (EAB) (in $ 2010)	*$58,952.50*
Expected Annual Benefits (EAB) (in $ 2011)	*$60,813.35*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$545,120.50*

Losses Avoided (LA) = EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011
LA = $56,055.91 + $58,001.12 + $58,952.50 + $60,813.35

LA = $233,822.88

Return on Investment (ROI) = $233,822.88/$545,120.50

ROI = 0.43 (43%)

Alternate Losses Avoided: Per Acquired Structure

Table E-5-17: FEMA-DR-1454-0011 Losses Avoided Using Individual Property Data

Property	*Assessed Value*	*Amount Approved to Acquire (in 2004)*	*Benefit-Cost Ratio (BCR)*	*Total Benefits (in $ 2004)*	*Expected Annual Benefits (EAB) (in $ 2004)*	*FEMA's Project Investment (PI)*[214]
1	$153,000.00	$166,350	1.0 (Cost-Effectiveness)	$166,350.00	$11,657.94	$124,762.50
2	$108,000.00	$118,475	1.0 (Cost-Effectiveness)	$118,475.00	$8,302.82	$88,856.25
3	$108,000.00	$117,163	1.0 (Cost-Effectiveness)	$117,163.00	$8,210.87	$87,872.25
4	$104,000.00	$111,818	1.0 (Cost-Effectiveness)	$111,818.00	$7,836.29	$83,863.50
5	$105,000.00	$114,900	1.44	$165,456.00	$11,595.28	$86,175.00
6	$81,000.00	$100,025	1.09	$109,027.25	$7,640.71	$75,018.75
			FEMA's Project Investment Total			$546,548.25

Table E-5-17 (Cont.): FEMA-DR-1454-0011 Losses Avoided Using Individual Property Data

Property	*I: EAB (in $ 2008)*	*II: EAB (in $ 2009)*	*III: EAB (in $ 2010)*	*IV: EAB (in $ 2011)*	*V: Losses Avoided (I + II + III + IV)*	*ROI: V/PI*
1	$13,287.40	$13,240.13	$13,457.30	$13,882.08	$53,866.91	0.43
2	$9,463.32	$9,429.65	$9,584.32	$9,886.86	$38,364.15	0.43
3	$9,358.52	$9,325.22	$9,478.18	$9,777.37	$37,939.29	0.43
4	$8,931.59	$8,899.81	$9,045.79	$9,331.33	$36,208.52	0.43
5	$13,215.98	$13,168.96	$13,384.97	$13,807.47	$53,577.38	0.62
6	$8,708.67	$8,677.69	$8,820.02	$9,098.43	$35,304.81	0.47
			Total Losses Avoided		*$255,261.06*	*0.47 (47%)*

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[214] These amounts technically will be inaccurate: FEMA's Project Investment here ends up being 75% of the amount *approved* to acquire the properties rather than 75% of the amount that *was actually spent*. However, it is assumed here that using these values causes little harm: Overall, there was a $1,903.67 difference between the amount approved for the mitigation action and the amount spent. Further, the difference was an "under-run." Consequently, using values based upon the higher approved amount only makes the Loss Avoidance results more conservative.

FEMA-DR-1454-0011

III: Loss Avoidance Interpretation

Of the two results in calculating “losses avoided,” the second result is the most accurate: In order to derive a value for “losses avoided” as a whole, this analysis had to assume a very conservative set of benefits from which to derive Expected Annual Benefits that would be inflated and summed to provide a conception of “losses avoided” thus far within the project’s useful life. This analysis assumed only “cost-effectiveness,” or a Benefit-Cost Ratio of 1.0.

However, that when this mitigation action is broken down into the properties that it covered, two (2) of the six (6) properties required a Benefit-Cost Analysis to be conducted. This means, that the “losses avoided” results deriving from this is more accurate: This analysis only had to assumed a Benefit-Cost Ratio of 1.0 for four (4) of the six (6) properties; we actually had data for two (2) of the six (6).

Thus, the interpretation of the loss-avoidance results:

FEMA-DR-1454-0011 was hit by one (1) “presidentially-declared” disaster (FEMA-1976-DR) approximately four (4) years after “close out” of the acquisition in 2007. We know, then, that we can expect the inflated Expected Annual Benefit to apply 2011 when FEMA-1976-DR hit. This analysis is further assuming that between 2008 and 2011, less severe but no less costly damages were occurring yearly, thus justifying the addition of three more years of inflation-adjusted Expected Annual Benefits.

Within four (4) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped almost 50% of its investment in FEMA-DR-1454-0011. Stated differently, for an investment of approximately $547,000 intended to last 100 years, in just four (4) years we can assume that this investment has already saved Jefferson County about $255,000.

FEMA-DR-1454-0012

I: Summary of Mitigation Action

Mitigation Action Type	*Sewer Lift Station Relocation*
County in which Completed	*Ballard County*
Year Mitigation Action Was Applied For	*2004*
Approval Date	*September 28, 2006*
Project Completion Date	*December 8, 2008*
“Close-Out” Date	*April 29, 2009*
Approved Amount to Spend for Mitigation Action	*$439,687*
Actual Amount Spent for the Mitigation Action	*$439,686.31*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between “Close-Out” and Presidentially-Declared Disaster(s)	*2 Year*

Scope of Work

FEMA-DR-1454-0012 acquired and demolished a sewer lift station in the City of Wickliffe that was prone to flooding. FEMA-DR-1454-0012 designed and constructed a replacement sewer lift station and replaced 1,000 linear feet of sanitary sewage line and sewage mains. The mitigation action also installed a grinder system.

Justification for the Mitigation Action

Several high-water events had occurred within the City of Wickliffe in Ballard County that had left the sewer lift station unable to operate. To illustrate the extent of high-water events to have occurred in the City of Wickliffe prior to completion of FEMA-DR-1454-0012, the City of Wickliffe historically has been hit by almost every “presidentially-declared” disaster in Kentucky since at least 2007.

FEMA-DR-1454-0012

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action

Year Mitigation Action Was Applied For	*2004*
Benefit-Cost Ratio (BCR) at Time of Application	*4.86*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$400,000.00*
Mitigation Action Benefits Calculated at Time of Application	*$1,943,823.00*
Year Mitigation Action was “Closed Out”	*2009*
Mitigation Action Years of Useful Life (T)	*50 Years*[215]
Expected Annual Benefits (EAB) (in $ 2004) (i.e. EAB at Time of Mitigation Action Application)	*$140,849.12*
Expected Annual Benefits (EAB) (in $ 2009) (i.e. EAB at Time of Mitigation Action “Close Out”)	*$159,964.78*
Expected Annual Benefits (EAB) (in $ 2010)	*$162,588.65*
Expected Annual Benefits (EAB) (in $ 2011)	*$167,720.81*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$329,764.73*

Losses Avoided (LA) = EAB in 2010 EAB in 2011
LA = $162,588.65 + $167,720.81
LA = $330,309.46

Return on Investment (ROI) = $330,309.46/$329,764.73
ROI = 1.00 (100%)

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[215] See ***Appendix E-5-3***

FEMA-DR-1454-0012

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1454-0012 was hit by one (1) "presidentially-declared" disaster (FEMA-1976-DR) just two (2) years after "close out" of the acquisition, demolition, and replacement of a sewer lift station. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit. This analysis is further assuming that in the year before FEMA-1976-DR, less severe but no less costly damages were occurring yearly, thus justifying the addition of one more year of inflation-adjusted Expected Annual Benefits.

Within just two (2) years, then, of a project whose useful-life is 50 years, Kentucky concludes that FEMA already has recouped its total investment (i.e. 100% of its investment) in FEMA-DR-1454-0012. Stated differently, for an investment of approximately $329,000 intended to last 50 years, in just two (2) years we can assume that this investment has already saved the City of Wickliffe in Ballard County approximately over $330,000 in damages.

There is one final caveat to introduce specific to FEMA-DR-1454-0012: The "losses avoided" displayed here very probably ***underestimates*** *the actual losses avoided by pursuing this project. While from 2010-2012, the City of Wickliffe in Ballard County and its sewer lift station were hit by only one "presidentially-declared" disaster, before 2010, the city suffered almost every disaster presidentially declared in Kentucky from at least 2007 to 2010.*

FEMA-DR-1523-0004

I: Summary of Mitigation Action

Mitigation Action Type	*(Landslide) Acquisition/Demolition*
County in which Completed	*Nelson County*
Year Mitigation Action Was Applied For	*2005*
Approval Date	*January 9, 2006*
Project Completion Date	*November 28, 2006*
“Close-Out” Date	*October 23, 2007*
Approved Amount to Spend for Mitigation Action	*$154,650.00*
Actual Amount Spent for the Mitigation Action	*$145,369.00*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between “Close-Out” and Presidentially-Declared Disaster(s)	*4 Years*

Scope of Work

FEMA-DR-1523-0004 acquired and demolished one (1) residential structure and its surrounding lot in order to eliminate inevitable future landslide damages.

Justification for the Mitigation Action

Multiple landslides had caused repeated damage to the foundation of the residential property acquired under this mitigation action. At the time of application, the Kentucky Geological Survey (KGS) had conducted further inspections of the site and had concluded that future damage to the property was highly likely to occur as the land under and around the property had continued to erode down a nearby hill.

Information about the Property that Was Acquired

Property Acquired	*Assessed Value*
1	$145,000.00

FEMA-DR-1523-0004

Losses Avoided for the Mitigation Action

This acquisition project involved only one (1) property. Thus, the losses avoided for the mitigation action "as a whole" is equivalent to looking at the mitigation action from the standpoint of its individual properties.

Year Mitigation Action Was Applied For	*2005*
Benefit-Cost Ratio (BCR) at Time of Application	*1.27*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$154,650.00*
Mitigation Action Benefits Calculated at Time of Application	*$195,770.00*
Year Mitigation Action was "Closed Out"	*2007*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2005) (i.e. EAB at Time of Mitigation Action Application)	*$13,719.71*
Expected Annual Benefits (EAB) (in $ 2007) (i.e. EAB at Time of Mitigation Action "Close Out")	*$14,565.65*
Expected Annual Benefits (EAB) (in $ 2008)	*$15,124.91*
Expected Annual Benefits (EAB) (in $ 2009)	*$15,071.10*
Expected Annual Benefits (EAB) (in $ 2010)	*$15,318.31*
Expected Annual Benefits (EAB) (in $ 2011)	*$15,801.83*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$109,026.75*

Losses Avoided (LA) = EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011
LA = $15,124.91 + $15,071.10 + $15,318.31 + $15,801.83
LA = $61,316.15

Return on Investment (ROI) = $61,316.15/$109,026.75
ROI = 0.56 (56%)

FEMA-DR-1523-0004

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1523-0004 was hit by one (1) "presidentially-declared" disaster (FEMA-1976-DR) about four years after "close out" of the acquisition in 2007. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit. This analysis is further assuming that in the three (3) years before FEMA-1976-DR, less severe but no less costly damages were occurring yearly, thus justifying the addition of three more years of inflation-adjusted Expected Annual Benefits.

Within four (4) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 56% of its investment in FEMA-DR-1454-0008. Stated differently, for an investment of approximately $109,000 intended to last 100 years, in four years we can assume that this investment has already saved Nelson County approximately $61,000 in damages.

FEMA-DR-1523-0005

I: Summary of Mitigation Action

Mitigation Action Type	*(Landslide) Acquisition/Demolition*
County in which Completed	*Jefferson County*
Year Mitigation Action Was Applied For	*2005*
Approval Date	*January 31, 2006*
Project Completion Date	*February 5, 2007*
"Close-Out" Date	*October 22, 2007*
Approved Amount to Spend for Mitigation Action	*$178,785.00*
Actual Amount Spent for the Mitigation Action	*$138,355.49*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*4 Years*

Scope of Work

FEMA-DR-1523-0005 acquired and demolished one residential structure and its surrounding lot in order to eliminate inevitable future landslide damages.

Justification for the Mitigation Action

Multiple landslides had caused repeated damage to the foundation of the residential property acquired under this mitigation action. The foundation damage had resulted in leaks in the basement of the property and general dilapidation of the structural integrity of the home. There had also been several instances of nearby trees being uprooted due to erosion and consequently falling onto the property.

Information about the Property that Was Acquired

Property Acquired	*Assessed Value*
1	$134,220.00

Losses Avoided for the Mitigation Action as a Whole

This acquisition project involved only one (1) property. Thus, the losses avoided for the mitigation action "as a whole" is equivalent to looking at the mitigation action from the standpoint of its individual properties.

Year Mitigation Action Was Applied For	*2005*
Benefit-Cost Ratio (BCR) at Time of Application	*1.25*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$178,785.00*
Mitigation Action Benefits Calculated at Time of Application	*$223,481.25*[216]
Year Mitigation Action was "Closed Out"	*2007*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2005) (i.e. EAB at Time of Mitigation Action Application)	*$15,661.74*
Expected Annual Benefits (EAB) (in $ 2007) (i.e. EAB at Time of Mitigation Action "Close Out")	*$16,627.43*
Expected Annual Benefits (EAB) (in $ 2008)	*$17,265.85*
Expected Annual Benefits (EAB) (in $ 2009)	*$17,204.42*
Expected Annual Benefits (EAB) (in $ 2010)	*$17,486.62*
Expected Annual Benefits (EAB) (in $ 2011)	*$18,038.59*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$103,766.62*

Losses Avoided (LA) = EAB in 2008 + EAB in 2009 + EAB in 2010 + EAB in 2011
LA = $17,265.85 + $17,204.42 + $17,486.62 + $18,038.59
LA = $69,995.48

Return on Investment (ROI) = $69,995.48/$103,766.62
ROI = 0.67 (67%)

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[216] The benefits expressed here were not recorded in the project file: We do know from the file that the project involved one acquisition and that the one property had a Benefit-Cost Ratio (BCR) of 1.25. Using the approved budget as the "cost" that would be input into FEMA-DR-1523-0005's application Benefit-Cost Analysis (BCA), 1.25 * Approved Budget = Total Benefits.

FEMA-DR-1523-0005

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-DR-1523-0005 was hit by one (1) "presidentially-declared" disaster (FEMA-1976-DR) about four years after "close out" of the acquisition in 2007. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit. This analysis is further assuming that in the three years before FEMA-1976-DR, less severe but no less costly damages were occurring yearly, thus justifying the addition of three (3) more years of inflation-adjusted Expected Annual Benefits.

Within four (4) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 67% of its investment in FEMA-DR-1523-0005. Stated differently, for an investment of approximately $103,000 intended to last 100 years, in four years we can assume that this investment has already saved Jefferson County approximately $70,000 in damages.

FEMA-DR-1523-0006

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Rowan County*
Year Mitigation Action Was Applied For	*2005*
Approval Date	*January 31, 2006*
Project Completion Date	*January 27, 2007*
"Close-Out" Date	*January 7, 2008*
Approved Amount to Spend for Mitigation Action	*$162,736.00*
Actual Amount Spent for the Mitigation Action	*$162,736.00*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1925-DR, Declared July 23, 2010* • *FEMA-1976-DR, Declared May 4, 2011* • *FEMA-4057-DR, Declared March 6, 2012*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*4 Years*

Scope of Work

FEMA-DR-1523-0006 acquired and demolished one residential structure in Rowan County, Kentucky.

Justification for the Mitigation Action

The residential structure acquired and demolished had been located within a 100-year floodplain in Rowan County.

Information about the Property that Was Acquired and Note on Methodology

Property Acquired	*Assessed Value*	*Cost That Would Have Been Used in BCA*	*Assumed Benefit-Cost Ratio (BCR)*
1	$141,580.00	$162,736.00	1.0 (Cost-Effectiveness)

The property (and the project as a whole) will have no Benefit-Cost Ratio (BCR) because, per FEMA policy at the time, a Benefit-Cost Analysis would not have been required at the time of application for this acquisition/demolition project located within a floodway.

Consequently, this mitigation action assessment will assume only "cost-effectiveness." "Cost-effectiveness" is defined by a BCR of 1.0.

FEMA-DR-1523-0006

Losses Avoided for the Mitigation Action as a Whole

This acquisition project involved only one (1) property. Thus, the losses avoided for the mitigation action "as a whole" is equivalent to looking at the mitigation action from the standpoint of its individual property.

Year Mitigation Action Was Applied For	*2005*
Benefit-Cost Ratio (BCR) at Time of Application	*1.0* *(Cost-Effectiveness)*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$162,736.00*
Mitigation Action Benefits Calculated at Time of Application	*$162,736.00*
Year Mitigation Action was "Closed Out"	*2008*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2005) (i.e. EAB at Time of Mitigation Action Application)	*$11,404.66*
Expected Annual Benefits (EAB) (in $ 2008) (i.e. EAB at Time of Mitigation Action "Close Out")	*$12,572.75*
Expected Annual Benefits (EAB) (in $ 2009)	*$12,528.02*
Expected Annual Benefits (EAB) (in $ 2010)	*$12,733.51*
Expected Annual Benefits (EAB) (in $ 2011)	*$13,135.45*
Expected Annual Benefits (EAB) (in $ 2012)	*$13,407.28*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$122,052.00*

Losses Avoided (LA) = EAB in 2009 + EAB in 2010 + EAB in 2011 + EAB in 2012
LA = $12,528.02 + $12,733.51 + $13,135.45 + $13,407.28

LA = $51,804.26

Return on Investment (ROI) = $51,804.26/$122,052.00

ROI = 0.42 (42%)

The interpretation of the loss-avoidance results:

FEMA-DR-1523-0006 was hit by three (3) "presidentially-declared" disasters (FEMA-1925-DR, FEMA-1976-DR, and FEMA-4057-DR) about four years after "close out" of the acquisition in 2008. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2010, 2011, and 2012 when FEMA-1925-DR, FEMA-DR-FEMA-1976-DR, and FEMA-4057-DR hit, respectively. This analysis is further assuming that in the one (1) year before FEMA-1925-DR, less severe but no less costly damages were had occurred thus justifying the addition of one (1) more years of inflation-adjusted Expected Annual Benefits.

Within four (4) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 42% of its investment in FEMA-DR-1523-0006. Stated differently, for an investment of approximately $122,000 intended to last 100 years, in four (4) years we can assume that this investment has already saved Rowan County approximately $52,000 in damages.

Finally, as mentioned above, because this project (and the one property that it covered) was acquired from within a floodway during a point in FEMA's history when it did not require Benefit-Cost Analyses (BCAs) to be conducted for such scenarios, the "losses avoided" calculated relied upon a very conservative assumption that ***had*** *the project required a BCA, the results would have shown only minimal "cost-effectiveness" (i.e. the Benefit-Cost Ratio = 1.0). That BCR is 1.0 arguably implies that any result deriving from this assumption (i.e. "benefits" or "losses avoided" calculations) will be highly under-representative.*

Especially that the property acquired under FEMA-DR-1523-0006 was hit three (3) years in a row by "presidentially-declared" disasters further implies that due to those events alone, it can be argued (and expected) that FEMA already has recouped near 100% of its "project investment."

FEMA-DR-1523-0010

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Martin County*
Year Mitigation Action Was Applied For	*2005*
Approval Date	*July 12, 2007*
Project Completion Date	*June 13, 2008*
"Close-Out" Date	*February 25, 2010*
Approved Amount to Spend for Mitigation Action	*$262,800.00*
Actual Amount Spent for the Mitigation Action	*$186,750.16*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011* • *FEMA-4057-DR, Declared March 6, 2012*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*2 Years*

Scope of Work

FEMA-DR-1523-0010 originally intended to acquire six (6) properties located in Martin County, Kentucky. FEMA-DR-1523 would end up acquiring only two (2) of those six (6) properties.

Justification for the Mitigation Action

The proposed and approved acquisition of all six (6) properties was justified through their repeated exposure to and damage from flooding. All were located within a floodway, though Benefit-Cost Analyses (BCAs) were conducted for the project as a whole and for the individual properties.

Note on Methodology

This particular "losses avoided" analysis of FEMA-DR-1523-0010 will be conducted in two ways: The first analyzes the project as a whole; the second looks at the individual properties: The project was approved (and thus initial "benefits" – later to be interpreted as "losses avoided") assuming FEMA would be (partially) reimbursing for the acquisition of six (6) structures. In the end, only two (2) properties were acquired using FEMA's funds. Thus, it is relevant to look at "losses avoided" for both the project as a whole and for the individual properties (partially) purchased by FEMA.

FEMA-DR-1523-0010

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action as a Whole

Year Mitigation Action Was Applied For	*2005*
Benefit-Cost Ratio (BCR) at Time of Application	*4.05*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$262,800.00*
Mitigation Action Benefits Calculated at Time of Application	*$1,064,340.00*
Year Mitigation Action was Completed	*2010*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2005) (i.e. EAB at Time of Mitigation Action Application)	*$74,589.76*
Expected Annual Benefits (EAB) (in $ 2010) (i.e. EAB at Time of Mitigation Action “Close Out”)	*$83,582.28*
Expected Annual Benefits (EAB) (in $ 2011)	*$86,220.58*
Expected Annual Benefits (EAB) (in $ 2012)	*$88,004.87*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$140,062.62*

Losses Avoided (LA) = EAB in 2011 + EAB in 2012
LA = $86,220.58 + $88,004.87
LA = $174,225.45

Return on Investment (ROI) = $174,225.45/$140,062.62
ROI = 1.24 (124%)

Alternate Losses Avoided: Per Acquired Structure

Table E-5-18: FEMA-DR-1523-0010 Losses Avoided Using Individual Property Data

Property	*Assessed Value*	*Amount Spent to Acquire (in 2010)*	*Benefit-Cost Ratio (BCR)*	*Cost Amount Used to Determine BCR*	*Total Benefits[217] (in $ 2005)*	*Expected Annual Benefits (EAB) (in $ 2005)*	*FEMA's Project Investment (PI)[218]*
1	$63,600.00	$116,000.00	3.41	$69,050.00	$235,460.50	$16,501.25	$87,000.00
2	$79,200.00	$46,900.00	2.41	$84,650.00	$204,006.50	$14,296.93	$35,175.00
3	Not Available	$0.00	1.41	Not Available	N/A[219]	N/A	$0.00
4	Not Available	$0.00	8.66	Not Available	N/A	N/A	$0.00
5	Not Available	$0.00	1.79	Not Available	N/A	N/A	$0.00
6	Not Available	$0.00	4.58	Not Available	N/A	N/A	$0.00
				FEMA's Project Investment Total			$122,175.00[220]

Table E-5-18 (Cont.): FEMA-DR-1523-0010 Losses Avoided Using Individual Property Data

Property	*EAB (in $ 2010)*	*I: EAB (in $ 2011)*	*II: EAB (in $ 2012)*	*III: Losses Avoided (I + II)*	*ROI: III/PI*
1	$18,423.95	$19,005.50	$19,398.81	$38,404.31	0.44
2	$9,463.32	$9,429.65	$9,584.32	$19,013.97	0.54
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
		Total Losses Avoided		*$57,418.28*	*0.41[221] (41%)*

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[217] Total Benefits are imputed here: BCR * Cost Amount Used to Determine the BCR = Total Benefits.
[218] FEMA's Project Investment (PI) is 75% of the "Amount Spent to Acquire"
[219] N/A = Not Applicable. "Not Available" is always spelled out in this study.
[220] The "Project Investment Total" calculated here was not used to derive the "Total Losses Avoided" from the individual properties: From "close-out" reports, we know that FEMA spent $140,062.62.
[221] This "total" ROI derives from dividing the "Total Losses Avoided" by the PI of the project as a whole (i.e. $140,062.62)

FEMA-DR-1523-0010

III: Loss Avoidance Interpretation

Of the two methods used to calculate the “losses avoided” above, obviously, the method looking at individual properties provides the most accurate conception of “losses avoided”: All of the data that was used to calculate “losses avoided” and the subsequent “return on investment (ROI)” looking at the project as a whole derived from an initial mitigation action that intended to acquire six (6) properties but that ended up acquiring only two (2).

So, in one sense, the following interpretation of the losses avoided results:

FEMA-DR-1523-0010 was hit by two (2) “presidentially-declared” disasters (FEMA-1976-DR and FEMA-4057-DR) two (2) years after “close out” of the acquisitions in 2010. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 and 2012 when FEMA-1976-DR and FEMA-4057-DR hit, respectively.

Within two (2) years, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 41% of its investment in FEMA-DR-1523-0010. Stated differently, for an investment of approximately $140,000 intended to last 100 years, in two (2) years we can assume that this investment has already saved Martin County approximately $57,000 in damages.

Unique to this mitigation action, however, is one other possible interpretation: If the original project was to acquire and demolish six (6) properties and in the end six (6) properties were indeed acquired and demolished, then the benefits calculated for the project as a whole and subsequent Benefit-Cost Ratio of 4.05 remains valid. The difference between application and completion/close-out, then, involves *only* what FEMA ended up having to pay. In other words, FEMA may have gotten a deal, of sorts. FEMA was willing to pay for and demolish six (6) properties for $262,800 because the benefits were expected to be 4.05 times that amount ($1,064,340). Instead, FEMA may only have been required to pay for two (2) of those properties while all six (6) were actually acquired and demolished (by another party, presumably). FEMA may have experienced the bureaucratic version of “consumer surplus.”

It arguably can be interpreted that FEMA paid $140,062.62 (75% of $186,750.16, or the actual amount paid for the project as recorded at “close-out”) for $1,064,340 worth of benefits. This, of course, argues for the validity of the method of “losses avoided” that looked at the project as a whole, in which case the alternate interpretation:

Within two (2) years of a project whose useful-life is 100 years, FEMA has recouped almost a quarter more than their total project investment (124% return on investment) in benefits from funding FEMA-DR-1523-0010. Stated differently, for an investment of approximately $140,000 intended to last 100 years, in two (2) years we may be able to assume that this investment already has saved Martin County approximately $174,000 in damages (i.e. almost as much as the value of the entire project paid by FEMA, Kentucky, and Martin County).

FEMA-DR-1537-0003

I: Summary of Mitigation Action

Mitigation Action Type	*Safe Rooms*
Jurisdiction in which Completed	*Kentucky State University (KSU)/Franklin County*
Year Mitigation Action Was Applied For	*2006*
Approval Date	*August 7, 2006*
Project Completion Date	*May 24, 2009*
"Close-Out" Date	*March 31, 2011*
Approved Amount to Spend for Mitigation Action	*$84,640.00*
Actual Amount Spent for the Mitigation Action	*$88,844.95*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*2 Years*[222]

Scope of Work

FEMA-DR-1537-0003 installed two (2) safe rooms on Kentucky State University's (KSU's) campus located in Franklin County, Kentucky. One safe room was installed at an aquaculture research center; the other safe room was installed on a research "farm." The former safe room was constructed to protect 50 people; the latter was constructed to protect fifteen (15) people.

Justification for the Mitigation Action

Employees and students working on the two research sites were considered at risk of being affected by high wind and tornadoes because the aquaculture research center and research "farm" facilities were not considered to provided adequate protection.

Note on Methodology

Two difference to this analysis to point out:

1. The individual safe room sites recorded Benefit-Cost Ratios (BCRs) and the amounts used to derive the BCRs. This analysis will use those individual BCRs.
2. This analysis is not using the "close-out" date as the point in which "losses" first are avoided. The safe rooms were completed in 2009. It took two years beyond 2009 to "close out" the project. Presumably, the two-year lag had to do with a need for a budget increase at the last minute to pay for the two rooms. But, per conversation with the project manager at the time, the safe rooms were fully functional by 2009.

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[222] This analysis will use "project completion" date instead of the "close-out" date. The explanation for this change is above. The use of "project completion" date was validated through conversation with the manager of the project at the time.

Losses Avoided for the Mitigation Action

	Aquaculture Research Center Site	*Research "Farm" Site*
Year Mitigation Action Was Applied For	*2006*	*2006*
Benefit-Cost Ratio (BCR) at Time of Application	*1.10*	*1.03*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$65,110.00*	*$19,530.00*
Mitigation Action Benefits Calculated at Time of Application	*$71,621*	*$20,115.90*
Year Mitigation Action was Completed	*2009*	*2009*
Mitigation Action Years of Useful Life (T)	*30 Years*	*30 Years*
Expected Annual Benefits (EAB) (in $ 2006) (i.e. EAB at Time of Mitigation Action Application)	*$5,771.68*	*$1,621.07*
Expected Annual Benefits (EAB) (in $ 2009) (i.e. EAB at Time of Mitigation Action Completion)	*$6,142.06*	*$1,725.10*
Expected Annual Benefits (EAB) (in $ 2010)	*$6,242.80*	*$1,753.39*
Expected Annual Benefits (EAB) (in $ 2011)	*$6,439.86*	*$1,808.74*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$33,316.86*[223]	*$33,316.86*

Losses Avoided$_1$ (LA_1) = EAB_1 in 2010 + EAB_1 in 2011
LA_1 = \$6,242.80 + \$6,439.86
LA_1 = $12,682.66

Losses Avoided$_2$ (LA_2) = EAB_2 in 2010 + EAB_2 in 2011
LA_2 = \$1,753.39 + \$1,808.74
LA_2 = $3,562.13

Total Losses Avoided (TLA) = LA_1 + LA_2
TLA = \$12,682.66 + \$3,562.13
TLA = $16,244.79

Return on Investment (ROI) = $16,244.79 (TLA)/$66,633.71
ROI = 0.24 (24%)

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[223] This amount simply is 75% of the actual amount paid for *both* safe rooms *divided by two (2)*. Bear in mind that a higher amount was actually spent than was budgeted.

The interpretation of the loss-avoidance results:

FEMA-DR-1537-0003 was hit by one (1) "presidentially-declared" disaster (FEMA-1976-DR) within two years after completion of the mitigation action in 2009. We know, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit. This analysis is further assuming that in the one year before FEMA-1976-DR, less severe but no less costly damages were had occurred the previous year, thus justifying the addition of one more year of inflation-adjusted Expected Annual Benefits.

Within two (2) years, then, of a project whose useful-life is 30 years, Kentucky concludes that FEMA has recouped nearly one quarter (24%) of its investment in FEMA-DR-1537-0003. Stated differently, for an investment of approximately $67,000 intended to last 30 years, in two (2) years we can assume that this investment has already saved Kentucky State University (KSU) and Franklin County approximately $16,200 in damages.

FEMA-PDM-2007-0005

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Jefferson County*
Year Mitigation Action Was Applied For	*2007*
Approval Date	*February 1, 2007*
Project Completion Date	*May 19, 2010*
"Close-Out" Date	*May 24, 2011*
Approved Amount to Spend for Mitigation Action	*$98,125.00*
Actual Amount Spent for the Mitigation Action	*$98,125.00*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*1 Year*[224]

Scope of Work

FEMA-PDM-2007-0005 acquired and demolished one (1) property in Jefferson County, Kentucky. The area where the property once stood would serve as "open/green space."

Justification for the Mitigation Action

Due to its repeated flooding, the United States Army Corps of Engineers (USACE) conducted a study on the sewer system and water table surrounding the property. The study showed at the time that the area indeed was "flood-prone."

Information about the Property that Was Acquired and Note on Methodology

Property Acquired	*Assessed Value*	*Benefit-Cost Ratio (BCR)*	*Cost Used to Calculate BCR*
1	$79,000.00	1.262	$100,979.00

If using the "close-out" date, this mitigation action technically would not be included in this assessment of Kentucky's mitigation actions. However, it is included based upon the assumption that the acquisition was fully completed in 2010. Unlike FEMA-DR-1537-0003 – which assumed similarly – this assumption was not validated in any way. That "project completion" date was used entirely is subjective: The "presidentially-declared" disaster that hit FEMA-PDM-2007-0005 occurred so near the "close-out" date (within a couple of weeks), that it just seemed wrong to exclude the project.

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[224] Like FEMA-DR-1537-0003, this analysis also assumes completion of the project before its "close-out" date.

FEMA-PDM-2007-0005

II: Loss Avoidance of Mitigation Action

Losses Avoided for the Mitigation Action

Year Mitigation Action Was Applied For	*2007*
Benefit-Cost Ratio (BCR) at Time of Application	*1.262*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$100,979.00*
Mitigation Action Benefits Calculated at Time of Application	*$127,435.50*
Year Mitigation Action was Completed	*2010*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2007) (i.e. EAB at Time of Mitigation Action Application)	*$8,930.78*
Expected Annual Benefits (EAB) (in $ 2010) (i.e. EAB at Time of Mitigation Action Completion)	*$9,392.26*
Expected Annual Benefits (EAB) (in $ 2011)	*$9,688.73*
FEMA's Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$73,593.75*

Losses Avoided (LA) = EAB in 2011
LA = $9,688.73
LA = $9,688.73

Return on Investment (ROI) = $9,688.73/$73,593.75
ROI = 0.13 (13%)

FEMA-PDM-2007-0005

III: Loss Avoidance Interpretation

The interpretation of the loss-avoidance results:

FEMA-PDM-2007-0005 was hit by one (1) “presidentially-declared” disaster (FEMA-1976-DR) within one year after the assumed completion of the acquisition in mid-May 2010. We assume, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit.

Within one (1) year, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 13% of its investment in FEMA-PDM-2007-0005. Stated differently, for an investment of approximately $74,000 intended to last 100 years, in shy of one (1) year we can assume that this investment has saved Jefferson County approximately $9,700 in damages.

FEMA-PDM-2007-0008

I: Summary of Mitigation Action

Mitigation Action Type	*Acquisition/Demolition*
County in which Completed	*Hardin County*
Year Mitigation Action Was Applied For	*2007*
Approval Date	*February 1, 2007*
Project Completion Date	*January 13, 2009*
"Close-Out" Date	*March 5, 2010*
Approved Amount to Spend for Mitigation Action	*$149,415.00*
Actual Amount Spent for the Mitigation Action	*$149,415.00*
Mitigation Action Was Hit by the Following 2010-2012 Presidentially-Declared Disaster(s) to Affect Kentucky	• *FEMA-1976-DR, Declared May 4, 2011*
Length (Approximately) of Time Between "Close-Out" and Presidentially-Declared Disaster(s)	*1 Year*

Scope of Work

FEMA-PDM-2007-0008 acquired and demolished one (1) property in the City of Elizabethtown in Hardin County, Kentucky.

Justification for the Mitigation Action

The area surrounding the property had experienced repeated flooding generally. However, in 2006 a storm hit the area with 100-year intensity. Flooding in the area was severe enough that this property and surrounding properties experienced a water line that was eight feet (8') high. Further, the property had lain within a floodway.

Information about the Property that Was Acquired and Note on Methodology

Property Acquired	*Assessed Value*
1	$79,000.00

The application of FEMA-PDM-2007-0008 was submitted in 2007. Consequently, a Benefit-Cost Analysis (BCA) would have been conducted in 2007. Until and throughout 2007, FEMA had maintained a policy that acquisition projects mitigating the effects of flooding within a floodway did not require a Benefit-Cost Analysis (BCA).

The methodology for this analysis, then, simply will assume "cost-effectiveness" in order to ensure the most conservative analysis. "Cost-effectiveness" is defined here as a Benefit-Cost Ratio (BCR) of 1.0. The inflation-adjusted Expected Annual Benefits will be calculated from a BCR of 1.0.

Losses Avoided for the Mitigation Action

Year Mitigation Action Was Applied For	*2007*
Benefit-Cost Ratio (BCR) at Time of Application	*1.0* *(Cost Effectiveness)*
Mitigation Action Costs Used to Calculate BCR at Time of Application	*$149,415.00*
Mitigation Action Benefits Calculated at Time of Application	*$149,415.00*
Year Mitigation Action was “Closed Out”	*2010*
Mitigation Action Years of Useful Life (T)	*100 Years*
Expected Annual Benefits (EAB) (in $ 2007) (i.e. EAB at Time of Mitigation Action Application)	*$10,471.10*
Expected Annual Benefits (EAB) (in $ 2010) (i.e. EAB at Time of Mitigation Action Completion)	*$11,012.17*
Expected Annual Benefits (EAB) (in $ 2011)	*$11,359.78*
FEMA’s Project Investment (i.e. 75% of Actual Amount Spent for Mitigation Action)	*$112,061.25*

Losses Avoided (LA) = EAB in 2011
LA = $11,359.78
LA = $11,359.78

Return on Investment (ROI) = $11,359.78/$112,061.25
ROI = 0.10 (10%)

FEMA-PDM-2007-0008

The interpretation of the loss-avoidance results:

FEMA-PDM-2007-0008 was hit by one (1) "presidentially-declared" disaster (FEMA-1976-DR) a little over one year after the "close out" of the acquisition in early March of 2010. We assume, then, that we can expect the inflated Expected Annual Benefit to apply for 2011 when FEMA-1976-DR hit.

Within one (1) year, then, of a project whose useful-life is 100 years, Kentucky concludes that FEMA has recouped approximately 10% of its investment in FEMA-PDM-2007-0008. Stated differently, for an investment of approximately $112,000 intended to last 100 years, in a little over one (1) year we can assume that this investment has saved the City of Elizabethtown and Hardin County approximately $11,000 in damages.

Further, due to the conservative assumption that this mitigation action only would have been deemed "cost-effective" (i.e. with a Benefit-Cost Ratio of 1.0) at the time of application, the "losses avoided" calculated from this assumption are equally conservative and very likely underestimate the value of "losses avoided" resulting from this mitigation action.

Summary of Results

Loss Avoidance

Below is a tabular summary of the result of the individual assessments of mitigation actions analyzed above.

FEMA Disaster #	*Completed Action #*	*Action Type*	*County*	*Approved Budget*	*Amount Paid for Completed Action #*	*FEMA's Project Investment (PI)*	*Benefit-Cost Ratio (BCR) Used*	*Losses Avoided to Date*	*Return-on-Investment (ROI) to Date*
1925; 1976	1454-0004	Landslide Acquisition	Lewis	$147,200.00	$145,274.54	$108,955.91	1.67	$101,061.51	93%
1925; 1976; 4057	1523-0006	Acquisition	Rowan	$162,736.00	$162,736.00	$122,052.00	1.0	$51,804.26	42%
1976; 4057	1523-0010	Acquisition	Martin	$262,800.00	$186,750.16	$140,062.62	4.05	$57,418.28	41%
1976	1407-0002	Acquisition	Harlan	$1,040,960.00	$928,894.72	$696,671.04	1.5	$529,876.00	76%
1976	1407-0009	Acquisition	Christian	$382,395.00	$309,405.25	$232,053.94	1.0	$117,105.12	51%
1976	1407-0010	Acquisition	Boyd	$543,000.00	$448,899.43	$336,674.57	3.14	$579,734.73	172%
1976	1454-0008	Acquisition	Fleming	$129,027.00	$125,078.00	$93,808.50	1.06	$22,821.42	24%
1976	1454-0011	Acquisition	Jefferson	$728,731.00	$726,827.33	$546,548.25	1.0	$255,261.06	47%
1976	1454-0012	Lift Station Relocation	Ballard	$439,687.00	$439,686.31	$329,764.73	4.86	$330,309.46	100%
1976	1523-0004	Acquisition	Nelson	$154,650.00	$145,369.00	$109,026.75	1.27	$61,316.15	56%
1976	1523-0005	Acquisition	Jefferson	$178,785.00	$138,355.49	$103,766.62	1.25	$69,995.48	67%
1976	1537-0003	Safe Room	Franklin	$84,640.00	$88,844.95	$66,633.72	1.10; 1.03[225]	$16,244.76	24%
1976	PDM-2007-0005	Acquisition	Jefferson	$98,125.00	$98,125.00	$73,593.75	1.262	$9,688.73	13%
1976	PDM-2007-0008	Acquisition	Hardin	$149,415.00	$149,415.00	$112,061.25	1.0	$11,359.78	10%
4008	1407-0005	Acquisition	Bell	$850,185.00	$417,396.55	$313,047.41	1.0	$32,290.14	10%
			Totals		$4,511,057.73	$3,384,721.06	1.744[226]	*$2,246,286.88*	*55.07%*[227]

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[225] FEMA-DR-1537-0003 involved two (2) safe rooms with separate Benefit-Cost Ratios (BCRs) that were both used in the analysis.

[226] Average Benefit-Cost Ratio of completed mitigation actions used

[227] Average Return-on-Investment (ROI) of completed mitigation actions used (as percentage)

ENHANCED PORTION

PART VI:
Effective Use of Available Mitigation Funding

REQUIREMENT §201.5(B)(3):

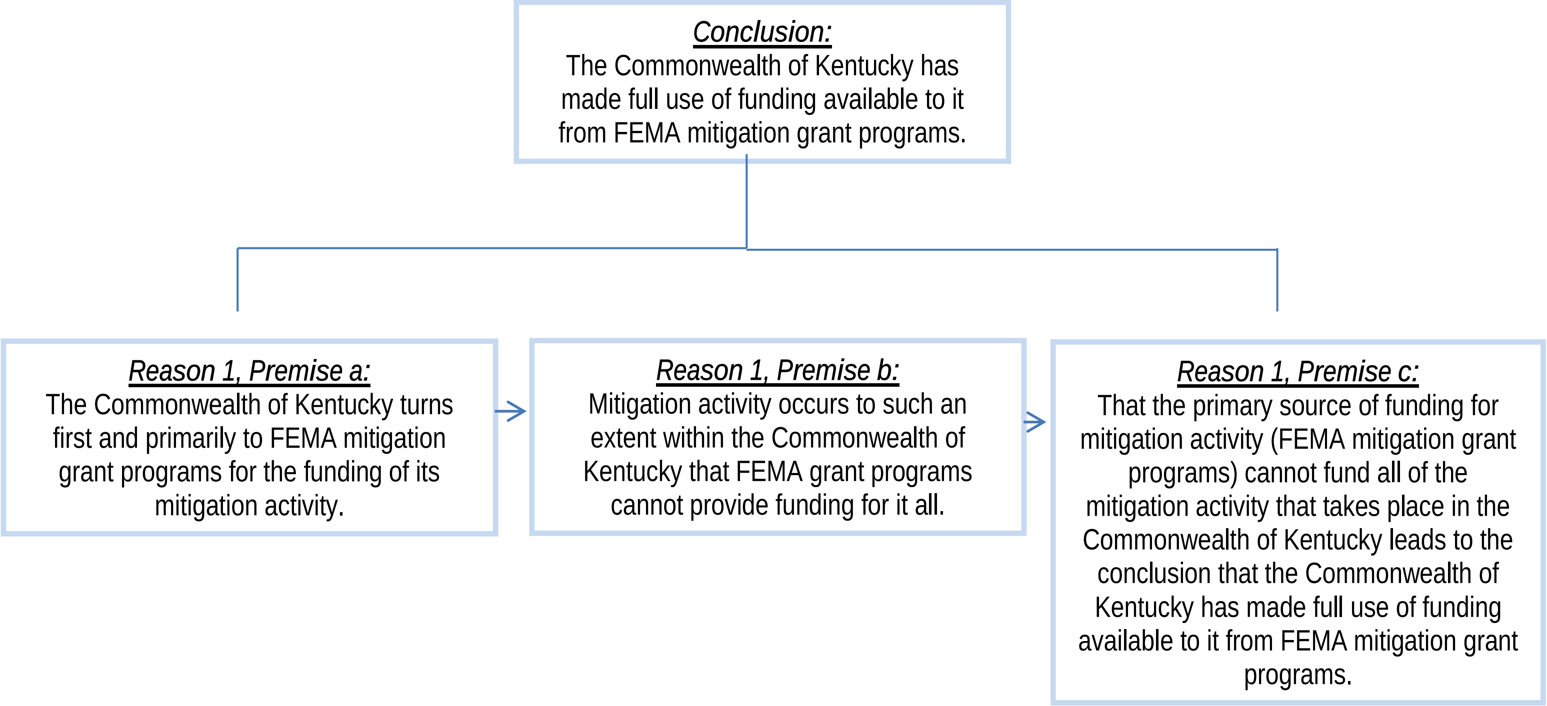
The Commonwealth of Kentucky must demonstrate that it effectively uses existing mitigation programs to achieve its mitigation goals.

A. Documenting That the Commonwealth of Kentucky Has Made Full Use of Funding Available from FEMA Mitigation Grant Programs

The Commonwealth of Kentucky concludes that it has, indeed, made full use of funding available from FEMA mitigation grant programs. It supports this conclusion primarily using two (2) reasons: 1) That the exception proves the rule, and, 2) that the Commonwealth of Kentucky habitually "over-submits" applications for available funding under FEMA mitigation grant programs.

The Exception Proves the Rule

The “rule” is that the Commonwealth of Kentucky has made full use of funding available to it from FEMA mitigation grant programs. One way to support this claim is to show the “rule’s” negative: That the Commonwealth of Kentucky has used significant levels of funding for mitigation projects that *do not* derive from FEMA mitigation grant programs. The premises are: a) FEMA grant programs are the primary source of mitigation activity funding in the Commonwealth of Kentucky, and b) that there is *so much* mitigation activity throughout the Commonwealth of Kentucky that FEMA mitigation grant programs *are not able* to address it all. Thus, the exceptions (those projects *not funded* by FEMA mitigation grant programs) prove the “rule” that the Commonwealth of Kentucky has to have made full use of funding available from FEMA mitigation grant programs: FEMA could not provide Kentucky with enough funds! Below is the argument visually:



Conclusion:
The Commonwealth of Kentucky has made full use of funding available to it from FEMA mitigation grant programs.

Reason 1, Premise a:
The Commonwealth of Kentucky turns first and primarily to FEMA mitigation grant programs for the funding of its mitigation activity.

Reason 1, Premise b:
Mitigation activity occurs to such an extent within the Commonwealth of Kentucky that FEMA grant programs cannot provide funding for it all.

Reason 1, Premise c:
That the primary source of funding for mitigation activity (FEMA mitigation grant programs) cannot fund all of the mitigation activity that takes place in the Commonwealth of Kentucky leads to the conclusion that the Commonwealth of Kentucky has made full use of funding available to it from FEMA mitigation grant programs.

The Commonwealth of Kentucky, then, provides the following “exceptions”:

1) Between 2010 and 2012, Kentucky’s Office of Homeland Security (KOHS) funded $680,750 worth of mitigation activity. ***Appendix E-6-1*** details the mitigation projects funded by KOHS.

2) Between 2011 and 2012, Kentucky’s Department of Local Government (DLG) funded nearly $16 million[228] in mitigation activity. ***Appendix E-6-2*** details the mitigation projects funded by DLG.

3) Between 2010 and 2012, Kentucky’s Division of Forestry (KDF) funded close to a half of one million dollars[229] in wildfire- and fire-related mitigation activity directed toward Kentucky community fire departments. ***Appendix E-6-3*** details to which fire departments in which communities and to what amounts specifically KDF-funded fire-related mitigation activities.

4) Likely one of the better examples of the “exception proving the rule” argument discussed above involves the City of Hopkinsville in Christian County, Kentucky (a member of the Pennyrile Area Development District). The city focuses to such an extent on drainage-related mitigation activity that it would have to add its own local financing to any financing that could be done through the federal government via FEMA hazard mitigation grant programs. Throughout the Commonwealth of Kentucky’s 2010 – 2013 planning cycle, then, the City of Hopkinsville has locally financed 333 separate drainage projects. In 2010, 104 of these drainage projects were locally financed at a total cost of $51,765. In 2011, a further 160 drainage projects were locally financed at a total cost of $108,020. Another 69 drainage projects were financed by the City of Hopkinsville (totaling $120,731) in 2012 and 2013. The 333 total drainage projects locally financed by the City of Hopkinsville during the 2010 – 2013 statewide planning cycle does not tell the whole story, however: The 333 drainage projects were locally financed *on top of* a major, three-phase drainage project involving three drainage basins within Hopkinsville’s Woodmont Watershed that, so far, has resulted in over $1.9 million in citywide investment!

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[228] $15,729,155 precisely

[229] $417,822 precisely

5) The Louisville Metropolitan Sewer District (Louisville MSD) in Jefferson County (and a member of the Kentuckiana Regional Planning and Development Agency, a.k.a. KIPDA), from 2010 to 2012, had locally financed over $13.5 million[230] in mitigation activity beyond the significant funding that it received from FEMA mitigation grant programs. ***Appendix E-6-4*** lists the mitigation projects that have been locally financed by Louisville MSD.

6) The Lexington-Fayette Urban County Government (LFUCG) (a member of the Bluegrass Area Development District) has locally financed close to $4 million[231] in storm-water improvement projects between 2010 and 2012. A further approximate $2.5 million[232] was locally invested though LFUCG's Division of Engineering toward eleven (11) more sanitary sewer and storm-water facility construction mitigation projects between the same years. Like the City of Hopkinsville, LFUCG's local commitment to strictly storm-water- and sanitary sewer-related mitigation projects reflects a demand for mitigation activity that exceeds the supply of funding that could derive from federal (i.e. FEMA) mitigation grant programs. This pronounced demand for mitigation activity must derive funding *beyond* the maximum that FEMA mitigation grant programs could provide is further evidenced with the success that LFUCG consistently has had in applying for and being awarded FEMA mitigation grant program funds. ***Appendix E-6-5*** lists the storm-water- and sanitary sewer-related mitigation projects locally financed by LFUCG.

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[230] $13,517,405 precisely
[231] $3,995,300 precisely
[232] $2,436,810 precisely

“Over-Submission”

Another way to argue that it has effectively used available mitigation funding is to argue that the Commonwealth of Kentucky generally “does not leave money on the table.” Granted, the term “leaving money on the table” applies to negotiation: If one purchases for $100 what he or she could have purchased for $80, then $20 is “left on the table.” But a looser interpretation of the idiom applies here: The Commonwealth of the Kentucky not only applies for the funding *available* from FEMA hazard mitigation programs. This would be analogous to accepting the “price” FEMA (in this case) stipulated without negotiation, thus potentially “leaving money on the table.” However, the Commonwealth of Kentucky “negotiates.” “Negotiation” simply is a means by which one ensures that he or she is receiving the minimum price (and, conversely, the maximum value) for a product in a given situation. The “product” here is FEMA grant funding to be targeted toward mitigation. And the Commonwealth of Kentucky attempts to ensure that it receives the “maximum value” in FEMA grant funding to be targeted toward mitigation by applying *beyond* the funding available from FEMA. This is termed “over-submission.” And, very loosely, it is a form of “negotiation”: Allowing FEMA to take away funding because applications were limited to the amount that FEMA was offering to finance mitigation activity throughout the Commonwealth is akin to paying more, or paying a higher price for, the mitigation activity toward which FEMA is offering funding. It is “leaving money on the table.” So, generally, the Commonwealth of Kentucky “over-submits” mitigation projects (or, in essence, asks for more than what is being offered) with the intention that should a mitigation project intended to be funded through FEMA grant programs is denied or must be withdrawn, Kentucky still is attempting to ensure that it maximizes the amount of funding being offered.

Throughout this 2010 – 2013 planning cycle (with one exception), the Commonwealth of Kentucky consistently has “over-submitted” eligible mitigation projects for funding from FEMA’s Hazard Mitigation Grant Program in order to ensure (“negotiate”) the maximum value of project funding being offered by FEMA.

FEMA’s Hazard Mitigation Grant Program (HMGP) is available to local jurisdictions after a disaster that has befallen a state is deemed severe enough to warrant a “presidential declaration.” The now “presidentially-declared disaster” is assigned a four-digit number. Once the Individual Assistance and Public Assistance for the jurisdictions directly affected by the presidentially-declared disaster has been addressed, FEMA’s HMGP goes into effect: FEMA offers a predetermined amount of funding toward which *all* local jurisdictions – regardless of whether they were directly affected by the presidentially-declared disaster under which the HMGP is offered – can apply to be used toward hazard mitigation activity that is intended to protect against the ruinous effects of *future* disasters, wherever they may occur throughout the Commonwealth of Kentucky.

The amount offered by FEMA for each HMGP that coincides with a presidentially-declared disaster is termed the “lock-in amount.”

During Kentucky's 2010 – 2013 planning cycle, it suffered from five (5) presidentially-declared disasters. They were numbered by FEMA, in chronological order by date of declaration, as DR-1912, DR-1925, DR-1976, DR-4008, and DR-4057[233]. Tabulated below is a list of Kentucky's 2010 – 2013 disaster declarations, followed by the date each was "declared," the number of counties affected (includes any county eligible for either or both Public and/or Individual Assistance), and the "lock-in amounts" offered by FEMA that represent the maximum amount of funding for which all local jurisdictions within the Commonwealth of Kentucky could apply under FEMA's Hazard Mitigation Grant Program:

Table E-6-1: Disaster "Declarations" and "Lock-In Amounts" for 2010-2013 Hazard Events

Declared Disaster (DR)	*Date "Declared"*	*Number of Kentucky Counties Affected*	*"Lock-In Amount"*
1912	May 11, 2010	83	$9,884,338
1925	July 23, 2010	8	$4,118,251
1976	May 4, 2011	79	$8,319,661
4008	July 25, 2011	7	$1,498,346
4057	March 6, 2012	23	$5,363,974

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[233] There is an important, yet tangential, consideration to be made here: While five (5) disasters were "presidentially-declared" during Kentucky's 2010 – 2013 planning cycle, the first disaster in the list (DR-1912) occurred early enough in 2010 (May 11, 2010) to have been included in some relevant parts of Kentucky's 2010 update of its hazard mitigation plan (e.g. its Loss Avoidance reports). Thus, this 2013 update of Kentucky's hazard mitigation plan focuses on DR-1925 to DR-4057 for most elements of this hazard mitigation plan. However, DR-1912 should be included within the 2010 – 2013 planning cycle for arguments such as this one: While DR-1912 and its effects could be used as data points for Loss Avoidance studies and the like, the Commonwealth of Kentucky's 2010 update of its hazard mitigation plan would have had to have been approved and adopted (i.e. its 2007 update would have lapsed) before projects submitted under the HMGP program under DR-1912 would have been eligible.

Having seen what was the maximum amount that FEMA could offer through its HMGP program, following is tabulated the 2010 – 2013 disaster declaration accompanied by FEMA's HMGP "Lock-In Amount" and the total amount of funding requested by the Commonwealth of Kentucky by "over-submitting" project applications. The total number presented represents *all* projects submitted under each disaster-declared HMGP program. This means that projects whose current official status either is "denied," or "withdrawn," or "pending approval," "approved," or "closed out" is rightfully included:

Table E-6-2: Amounts and Percentages of "Over-Submission"

Declared Disaster (DR)	*"Lock-In Amount" (I)*	*Amount Requested by Kentucky Via "Over-Submission" (II)*	*"Over-Submission" Amount (II – I)*	*Percentage (%) "Over-Submitted" [((II/I) – 1) x 100]*
1912	$9,884,338	$11,112,666	$1,228,328	12.4%
1925	$4,118,251	$4,927,600	$809,349	19.7%
1976	$8,319,661	$10,522,102	$2,202,441	26.5%
4008	$1,498,346	$1,821,624	$323,278	21.6%
4057	$5,363,974	$5,460,072[234]	$96,098	17.9%
Totals	$29,184,570	$33,844,064	$4,659,494	19.6%

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[234] This amount requested under DR-4057 represents the inclusion of *attempts at* over-submission: Three (3) projects (for the City of Paintsville in Johnson County, Kentucky) were approved by Kentucky Emergency Management for attempted submittal to FEMA under DR-4057. These three (3) projects later would be withdrawn from consideration, however: They could not pass a Benefit-Cost Analysis (BCA). Still, the point of this argument is to show that Kentucky has a habit of "over-submitting." Thus, these three (3) projects should be considered. It was only by circumstance that they were not officially submitted: Had the three (3) Johnson County/Paintsville projects passed its BCA, they would have been included as officially submitted to FEMA. The three (3) Johnson County/Paintsville projects attempted to have approved $900,000 collectively ($187,000; $370,000; and $343,000, individually.)

If these three (3) projects are not included, the table showing amounts and percentages of "over-submission" looks like this:

Declared Disaster (DR)	*"Lock-In Amount" (I)*	*Amount Requested by Kentucky Via "Over-Submission" (II)*	*"Over-Submission" Amount (II – I)*	*Percentage (%) "Over-Submitted" [1 - (II/I) x 100]*
1912	$9,884,338	$11,112,666	$1,228,328	12.4%
1925	$4,118,251	$4,927,600	$809,349	19.7%
1976	$8,319,661	$10,522,102	$2,202,441	26.5%
4008	$1,498,346	$1,821,624	$323,278	21.6%
4057	$5,363,974	$4,560,072	($803,902)	(15%)
Totals	$29,184,570	$32,944,064	$3,759,494	12.9%

Of course, the following interpretation results: The Commonwealth of Kentucky only was able to submit up to 85% (100% – 15%) of what was available from the FEMA HMG Program under the DR-4057 disaster declaration.

Thus, from 2010 to 2013, FEMA offered the Commonwealth of Kentucky over $29 million dollars toward which its local jurisdictions could apply to fund eligible mitigation activity. And from 2010 to 2013, the Commonwealth of Kentucky submitted applications for FEMA Hazard Mitigation Grant Program funding totaling over $33 million. This represented close to an average and overall 20% "over-submission" rate for Kentucky's entire 2010 – 2013 planning cycle. This implies that close to 20% of Kentucky's submitted projects could have been (or still could be[235]) "withdrawn" or "denied" and it still would have maximized (i.e. made full use of) available hazard mitigation grant program funding from FEMA[236].

"Over-Submission" Addendum: "406" Mitigation Opportunities

For a more general audience, FEMA's "406" mitigation program will be discussed in detail in the following section, i.e. in talking about Kentucky's commitment to a comprehensive hazard mitigation program. However, it should be noted here that in the spirit of "over-submission" in order to effectively use available mitigation funding, from 2011, Kentucky Emergency Management (KYEM) has formalized administrative policy that requires that all projects assessed for Public Assistance (PA) purposes also be assessed for eligibility to FEMA's "406" mitigation program. In taking advantage of this administrative economy-of-scale, Kentucky (via KYEM) has successfully had funded an additional $420,283.62 in mitigation projects that had fallen into the FEMA "406" mitigation category. The fact that had not KYEM implemented its administrative policy to formalize assessment of potential Public Assistance projects for FEMA "406" mitigation project eligibility this extra $420,284 likely would not have been funded represents an "over-submission" of sorts for Public Assistance (PA) funding that resulted in additional hazard mitigation projects.

In other words, in order to effectively use available mitigation funding, the Commonwealth of Kentucky not only "over-submitted" under FEMA's Hazard Mitigation Grant Program (HMGP), but – de facto – "over-submitted" and used Kentucky's and FEMA's Public Assistance (PA) program to provide funding for additional hazard mitigation projects.

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[235] The project approval process can be a long one: Certainly not all projects submitted under DR-1912 through DR-4076 maintain a decisive status.

[236] To further argue that the Commonwealth of Kentucky possesses a "trend" in "over-submitting" eligible project applications under FEMA's Hazard Mitigation Grant Program and using only self-reporting from Quarterly Reports, one can find that the 2010 – 2013 tendency of Kentucky to "over-submit" is a continuation of a similar tendency recognizable during Kentucky's 2007 – 2010 planning cycle: Five (5) mitigation project applications, totaling $8,171,868, were "over-submissions" under HMG Program opportunities offered under disasters that affected Kentucky during its 2007 – 2010 planning cycle. These five (5) mitigation projects (and over $8 million) all were withdrawn from 2007 – 2010 disaster-funded HMGP grants to the grant that was offered under DR-1912, declared in early May of 2010. The details are tabulated below:

Disaster and Project Number Under Which "Over-Submitted" Project Applied (DR-)	*County from Which Project Application Derived*	*Type of Project for Which Applied*	*Budget for Which Project Applied*	*Project Withdrawn and Submitted to Which 2010 – 2013 Disaster (DR-)*
1841-0008	Allen County	Safe Room	$73,978	1912
1855-0009	Jefferson County	Acquisition	$3,180,886	1912
1855-0017	Whitley County	Safe Room	$196,706	1912
1855-0021	Jefferson County	Acquisition	$3,760,908	1912
1855-0022	Jefferson County	Acquisition	$959,390	1912

The conclusion that the Commonwealth of Kentucky effectively used available mitigation funds was supported by, first, assuming that FEMA mitigation programs are the cardinal means by which mitigation activity is funded throughout the state, and, secondly, by showing that demand for mitigation activity was to such an extent that other agencies and local jurisdictions also invested significantly in mitigation activity.

Thirdly, one FEMA mitigation program was analyzed in detail: FEMA's Hazard Mitigation Grant Program (HMGP). It was shown that throughout Kentucky's 2010 – 2013 planning cycle, Kentucky showed its tendency to ensure maximization of available FEMA funding by "over-submitting" eligible project applications as insurance against the occasional-yet-inevitable withdrawal or denial of a project application. Further, it was argued through a footnote that this tendency for "over-submission" is not a new habit, i.e. a habit seen uniquely throughout this planning cycle. Rather, through over $8 million in "over-submitted" mitigation activity (mostly acquisitions) self-reported through quarterly reports for mitigation project application submissions under HMGP programs funding disasters that occurred in Kentucky during its 2007 – 2010 planning cycle, it is implied that Kentucky's tendency to "over-submit" and, hence, to make effective, full use of FEMA mitigation program funds, is indeed a habitual behavior that can be expected to continue in its future planning cycles.

Having used FEMA's Hazard Mitigation Grant Program to argue habitual behavior in favor of effective, full use of FEMA mitigation grant funding, it is expected that such behavior can be extrapolated and generalized toward FEMA's other offered (and cyclical) mitigation grant programs: The Pre-Disaster Mitigation (PDM), the Flood Mitigation Assistance (FMA) and its (now) accompanying Repetitive-Loss (RL) and Severe Repetitive-Loss Properties (SRL) grant programs. Such an extrapolation does not represent any illogical leap or jump to conclusion: For example, though FEMA's PDM program has only recently been re-established after being indefinitely discontinued from 2012 through 2013, the Commonwealth of Kentucky was able to fund most of its local hazard mitigation plans and a few mitigation projects under the program during Kentucky's 2010 – 2013 planning cycle. This would represent an effective and full use of PDM funding (when available). Further, with the re-establishment of the PDM program effective as of July 12, 2013, Kentucky currently is applying for the full amount of fiscal-year 2013 PDM funding due at the end of September of this year: Kentucky will attempt to fund four to five (4 to5) local hazard mitigation plans that are due for update (during their five-year planning cycles) relatively soon.

B. *Documenting How the Commonwealth of Kentucky Is Effectively Using Existing Programs to Achieve Its Mitigation Goals*

The conclusion, argument, and evidence provided above to address “Element A.” applies here, as well: By documenting and providing evidence that the Commonwealth of Kentucky has made effective and full use of FEMA’s hazard mitigation grant funding it is also documenting and providing evidence toward its effective use of FEMA’s existing grant programs as it is from these programs that FEMA mitigation funding derives.

However, as additional evidence to justify the overall conclusion that the Commonwealth of Kentucky has effectively and fully used available mitigation funding from FEMA, this Enhanced Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* refers to the section following this one (i.e. Part VII: “Commitment to a Comprehensive Mitigation Program”). In this section and appended via ***Appendix E-7-6*** is a discussion and elaboration upon the Commonwealth of Kentucky’s presumed effective and full use of FEMA’s “406” mitigation program.

Referring to the brief discussion of FEMA’s “406” mitigation program above and foreshadowing the discussion to follow, the Commonwealth of Kentucky generally has effectively used the existing FEMA “406” mitigation program to achieve its mitigation goals. Of note and specifically, since 2011, Kentucky Emergency Management (KYEM) as formal administrative policy mandated of its relevant staff that all potential projects assessed for Public Assistance (PA) purposes also be assessed for eligibility for “406” mitigation funding. As mentioned above, this recent practice during the Commonwealth’s 2010-2013 planning cycle has resulted already in a near 10% increase in public assistance funding: Since the policy’s formalization, 284 Public Assistance projects have been written, of which $420,283.62 of the total value of those 284 projects consisted of FEMA “406” mitigation additions[237]. This $420,284 in project value represents 9.84% of the total value of all Public Assistance projects written since 2011 and the formalization of administrative policy. This implies that, had not KYEM formalized this policy, that $420,284 would not have been assessed. Thus the argument: Kentucky (through KYEM) effectively uses FEMA’s existing “406” mitigation program to achieve its mitigation goals.

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[237] See ***Appendix E-7-7***.

ENHANCED PORTION

PART VII: Commitment to a Comprehensive Mitigation Program

A. *Demonstrating that the Commonwealth of Kentucky is Committed to a Comprehensive State-Level Mitigation Program*

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B. *Demonstrating Progress in Implementing a Comprehensive State-Level Mitigation Program, Including New Mitigation Initiatives Developed or Implemented by the Commonwealth of Kentucky*

The Commonwealth of Kentucky has been and continues to be committed to a comprehensive state-level mitigation program. To convey this commitment and the Commonwealth's continuing progress in implementing a comprehensive state-level mitigation program, this section of the Enhanced Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* is divided into subsections discretely addressing the components that, in aggregate, define "commitment" as articulated in Requirement §201.5 (b) (4) (i-vi) listed above.

REQUIREMENT §201.5(B)(4)(I-VI):

The Commonwealth of Kentucky is committed to a comprehensive state mitigation program, which might include any of the following:

- *A commitment to support local mitigation planning by providing workshops and training, state-level planning grants, or coordinated capability development of local officials, including Emergency Management and Floodplain Management certifications;*
- *A statewide program of hazard mitigation through the development of legislative initiatives, mitigation councils, formations of public/private partnerships, and other executive actions that promote hazard mitigation;*
- *That a portion of the non-federal match for HMGP and other mitigation projects are provided by the Commonwealth of Kentucky;*
- *Encouragement toward or requirement of local governments to use a current version of a nationally-applicable model building code or standard that addresses natural hazards as a basis for design and construction of Commonwealth-sponsored mitigation projects;*
- *A comprehensive, multi-year plan to mitigate the risks posed to the existing buildings that have been identified as necessary for post-disaster response and recovery operations;*
- *A comprehensive description of how the Commonwealth of Kentucky integrates mitigation into its post-disaster recovery operations.*

I: Commitment to Support Local Mitigation Planning Through Training and Outreach

Listed as ***Appendix E-7-1*** is a summary-via-chart of training programs and outreach conducted by Kentucky Emergency Management (KYEM and its supporting agencies – the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program (UK-HMGP) and the University of Louisville's Center for Hazards Research and Policy Development (CHR) – that occurred during the 2010 – 2013 planning cycle.

The summary is an attempt to be exhaustive; however, it is possible that some instances of training and outreach have been omitted. If so, this is less an oversight then an admission that many of similar types of training and outreach occurred throughout the 2010 – 2013 planning cycle for the Commonwealth of Kentucky and that the results summarized derived from self-reporting with the omission errors that such reporting implies.

The summary-via-chart is organized according to whether the activity was "Training" or "Outreach." This is, per the theme of this overall 2013 update of Kentucky's hazard mitigation plan, an implicit differentiation between *inductive* and *deductive* planning: "Training" is implementation of *inductive* planning, according to the definition repeated throughout Kentucky's 2013 update of its hazard mitigation plan. When mitigation activities categorized as "Training" were held, all relevant stakeholders to the training were invited and encouraged both financially and in terms of appealing to time-constraints to participate. An expected consequence of such inclusive training involved receiving feedback that would later be aggregated "upward" to be included in this plan and in other Commonwealth-wide planning activities.

One notable example of such training has been articulated in the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*, but can be readdressed here: Kentucky, during this 2010 – 2013 planning cycle was the first state to implement an Applicant Agent certification course.

The need for the Applicant Agent certification course stemmed from the following: Kentucky currently ranks seventh (7th) nationwide for frequency of disaster declarations, having received 56 presidential declarations since 1953. Kentucky's value of disaster declaration damages ranks twelfth (12th) nationwide. From 2010-2012[238], Kentucky had five (5) disaster declarations.

In its oversight of its Public Assistance (PA) and hazard mitigation programs during this 2010-2013 planning cycle, Kentucky Emergency Management (KYEM) had become increasingly alarmed at the number of mitigation opportunities lost simply due to applicants and their authorized agents not fully understanding program benefits and requirements. Uncomfortably frequent de-obligated projects, nonparticipation, and compliance issues prompted KYEM to develop an applicant agent certification course.

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[238] From 2012 to the writing of this plan (mid-2013), Kentucky has not experienced a presidential disaster declaration.

This course, launched in May of 2011, is offered quarterly to all applicants and potential applicants of the Public Assistance (PA) and the multiple hazard mitigation programs. The week-long course covers all aspects of the preparation for, response to, and recovery from disaster events. Attendees are encouraged to participate in rigorous mitigation, recovery, and debris removal planning. In addition to the emphasis on the Federal Emergency Management Agency (FEMA) programs, other state and federal agencies deliver instruction on various state and federal disaster grants, services, and opportunities.

Course attendees have included:

- County Judge/Executives, i.e. the elected heads of most county governments in Kentucky
- County Treasurers, i.e. the fiscal officers of county governments
- County Emergency Management Directors
- County Road Foremen
- City Mayors and Managers, i.e. the elected heads of cities in Kentucky
- City Clerks, i.e. the fiscal officers of cities
- KYEM Regional Response Managers (RRM)[239]
- University Emergency Management Staff
- University Fiscal Officers
- State Emergency Management Staff
- Representatives from Kentucky's State Parks
- Employees of the Kentucky Transportation Cabinet representing each of the Kentucky's 12 statewide transportation districts and its central office in Frankfort
- Employees and Representatives of Kentucky's Health and Family Services Cabinet
- Employees and Representatives of Kentucky's Department of Fish and Wildlife
- Employees and Representatives of the Kentucky National Guard
- Employees and Representatives of Kentucky's Office of the Auditor of Public Accounts
- Private sector contracts who specialize in disaster planning, response, and recovery activities

Conversely, the "Outreach" highlighted in ***Appendix E-7-1*** shows implementation of *deductive* planning, according to the definition repeated throughout this 2013 update of Kentucky's hazard mitigation plan. Kentucky Emergency Management (KYEM), along with UK-HMGP and CHR, traveled the Commonwealth making presentations in order to better educate about, encourage further participation in, and generally provide support and technical assistance toward all areas of hazard mitigation. The Commonwealth of Kentucky, through KYEM, UK-HMGP, and CHR, expanded the options and information available related to hazard mitigation in order to offer local jurisdictions a wider array of mitigation options and ways to participate with the expectation that a wider array of preferences would yield increased demand for mitigation activity.

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[239] A Kentucky Emergency Management (KYEM) Regional Response Manager (RRM) is responsible for coordinating emergency disaster preparation, response, and recovery operations for designated "regions" in Kentucky. Each "region" generally is divided into ten (10) counties.

A concrete, narrative example of such outreach was articulated in the previous section of this Enhanced Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* (Part VI: Effective Use of Available Mitigation Funding). This section described the day-to-day activities of UK-HMGP's Esther White, who actively seeks opportunities for mitigation and consistently implements the means by which to bring about such mitigation activity.

Specifically addressing Element B. of this section of the Enhanced Portion of the State Hazard Mitigation Plan Review "Crosswalk," it should be noted that the a demonstration of progress in implementing a comprehensive state-level mitigation program likely is most quantitatively obvious in terms of Kentucky's increased "Training" initiatives, e.g. the development of the abovementioned path-breaking Applicant-Agent Certification Course and in training to utilize the efficiency-enhancing Community Hazard Assessment and Mitigation Planning System (CHAMPS) . However, qualitatively (and, perhaps, more significantly), progress has been made during this 2010-2013 planning cycle in terms of "Outreach": Increased staff, geographic area specialization of such staff, and increased focus of resources on ensuring the ability to travel *to* areas of Kentucky rather than require local representatives to adhere to KYEM/UK-HMGP/CHR locations (which decreases participation and demand for mitigation activity) all demonstrate progress in implementing a comprehensive mitigation program.

II: Development of Mitigation Councils, Legislative Initiatives, Public/Private Partnerships

Commitment to a comprehensive mitigation program via mitigation council, legislative initiative, public/private partnership, et al. largely was covered in the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* in its coverage of Kentucky's planning process and mitigation strategies. This Enhanced Portion elaborates upon some of those examples of mitigation council, legislative initiative, and public/private partnership. However, the Enhanced Portion also reminds that the following discussion is by no means exhaustive; it represents the most obvious examples of mitigation council formation, legislation-creating, and public/private partnership:

Mitigation Council: Kentucky Hazard Mitigation Council (KYMC)

The *Planning Process* section itself describes the Kentucky Hazard Mitigation Council (KYMC): It was developed in 1995. It meets quarterly to advise and consult with Kentucky Emergency Management's (KYEM) Mitigation staff. The official purposes of the Kentucky Hazard Mitigation Council are to:

- Identify and evaluate state and local hazards and vulnerabilities;
- Identify hazard mitigation strategies;
- Coordinate hazard mitigation resources;
- Review, rank, and recommend mitigation actions that have applied for funding under the FEMA Hazard Mitigation Grant Program (HMGP);
- Implement hazard mitigation projects and programs;
- Assist the State Hazard Mitigation Office on interim and final project inspections.
- Provide technical assistance to the State Hazard Mitigation Officer and local officials to reduce the hazard vulnerability of people, property, and infrastructure;
- Survey selected damages following a Presidential Disaster Declaration in order to develop (in conjunction with the Federal Hazard Mitigation Council) an Interagency Hazard Mitigation Report;
- Participate in regular and special business meetings;
- Receive and conduct hazard mitigation training;
- Assist Area Development Districts (discussed below) in developing regional (and oft-times multi-jurisdictional) hazard mitigation plans; and
- Plan for and develop the Commonwealth of Kentucky's hazard mitigation plan.

KYMC consists of up to 25 voting members in addition to technical advisors. Voting members represent: Kentucky Emergency Management (KYEM), the Kentucky Division of Water (DOW), Department of Local Governments (DLG), the Kentucky Office of Homeland Security (KOHS), the Area Development Districts (ADDs), the Kentucky Transportation Cabinet (KYTC), and the National Oceanic and Atmospheric Administration (NOAA).

Membership at the time of this writing includes:

- ***Voting Members:***
  - — Kentucky Emergency Management Director
  - — Stephanie Robey, Kentucky Emergency Management Assistant Director
  - — Kentucky Emergency Management Recovery Branch Manager
  - — State Hazard Mitigation Officer (SHMO)
  - — Mike Hale, Department for Local Governments
  - — Jim McKinney**,** Louisville/Jefferson County Metro Government
  - — Carey Johnson, Kentucky Division of Water
  - — Wendell Lawrence, Lincoln Trail Area Development District
  - — Nancy Price, Kentucky Emergency Management Governmental Liaison
  - — Jerry Rains, Kentucky Emergency Management Regional Response Manager
  - — Angela Satterlee, Hopkinsville Community Development Services
  - — Paul Whitman, Shelby County Emergency Management Director
  - — Noah Taylor, Kentucky Division of Water
  - — Josh Human, University of Louisville Center for Hazards Research
  - — Susan Wilkerson, Kentucky Office of Homeland Security
  - — Joe Sullivan, National Weather Service
  - — Stephen Noe, Kentucky Association of Mitigation Mangers
  - — Kentucky Transportation Cabinet Representative

- ***Technical Advisors:***
  - — Doug Eades, Acting SHMO Kentucky Emergency Management
  - — Geni Jo Brawner, Acting SHMO Kentucky Emergency Management
  - — Ann Culbertson, Kentucky Emergency Management
  - — Ryan Hubbs, Kentucky Emergency Management
  - — Amanda LeMaster, Kentucky Emergency Management
  - — Todd Neal, Kentucky Emergency Management
  - — Brian Gathy, University of Kentucky HMGP
  - — W. Nick Grinstead, University of Kentucky HMGP
  - — Esther White, University of Kentucky HMGP

Kentucky also participates in the “Silver Jackets” program. This is a state-level program which includes participation from the United States Army Corps of Engineers (USACE), FEMA, other Federal agencies, and multiple state agencies. The goal of the program is to create an interagency team to develop and implement solutions to state natural hazard priorities. The Silver Jackets Program provides a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with natural hazards. The program‘s primary goals are to leverage information and resources, improve public risk communication through a united effort, and create a mechanism to collaboratively solve issues and implement initiatives.

The Silver Jackets program provides communities with an opportunity to work with all appropriate state and Federal agencies to develop a comprehensive flood risk management program. The Kentucky Emergency Management (KYEM) State Hazard Mitigation Officer (SHMO) and staff will promote mitigation project development through its representation on the Silver Jackets team, thereby integrating both FEMA and the State’s goals to mitigate flood-related damages and losses statewide. Related to this last statement, the Silver Jackets are one means by which Kentucky shows commitment to a comprehensive mitigation program by implementing mitigation into its post-disaster recovery operations.

From the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*, ***Appendix 2-2*** lists the organizations involved in the Silver Jackets program and proportion of membership organization categories comprise. For convenience, this appendix has been recreated here as ***Appendix E-7-2***.

Mitigation Council: Kentucky Association of Mitigation Managers (KAMM)

The Kentucky Association of Mitigation Managers (KAMM) represents another mitigation council that conveys Kentucky’s commitment to a comprehensive mitigation program.

The Kentucky Association of Mitigation Managers (KAMM) was formed to promote floodplain management and mitigation in Kentucky. Its members represent local floodplain coordinators, planning and zoning officials, engineers, surveyors, GIS specialists, hydrologists, and local emergency managers.

The purpose of KAMM is to provide a means for state and local floodplain managers to join with others regarding floodplain management policies and activities. Additionally, KAMM exists to advance the study, research, and exchange of information on the technical aspects of floodplain management to reduce flood damage within the Commonwealth of Kentucky. KYEM Mitigation staff has a history of serving on the KAMM board, helping to ensure mitigation is interwoven into floodplain management activities.

From the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*, ***Appendix 2-3*** lists the organizations currently participating in KAMM. For convenience, this appendix has been recreated here as ***Appendix E-7-3***.

Legislative Initiatives

Again, the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* addressed what here is implied to be the Commonwealth of Kentucky's commitment to a comprehensive mitigation program via legislative initiative when it addressed state capability to implement and fund an effective mitigation program. In other words, it was pointed out in the Standard Portion[240] how significant a proportion of the mitigation practices articulated in Kentucky's hazard mitigation plan were codified into law. Kentucky is bound to many of its most important mitigation practices and institutions by law. From the Standard Portion, ***Appendix 4-10*** attempts an exhaustive list of Kentucky legislation related to mitigation activity. Kentucky legislation is called a Kentucky Revised Statute (KRS). This list of mitigation-relevant KRS is recreated here as ***Appendix E-7-4***.

Public/Private (Non-Profit) Partnership: Universities

Elaborated upon at length in the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* were the roles of two (2) of Kentucky's most notable universities: The University of Kentucky and the University of Louisville.

First, for purposes here, it should be established how the abovementioned universities are partners to the Commonwealth of Kentucky in mitigation programs:

The Martin School of Public Policy and Administration at the University of Kentucky houses the Hazard Mitigation Grants Program (UK-HMGP) Office. However, UK-HMGP exists entirely to perform the functions designated to it by Kentucky Emergency Management (KYEM). UK-HMGP represents a commitment to a comprehensive mitigation program: KYEM contracts the Martin School of Public Policy and Administration to use its expertise in public administration, its staff, its resources, its historical/institutional knowledge about the state, its graduate assistants, its flexibility with staff travel, and its various technical and facility options that are available in all counties throughout the state. Through this contract, KYEM does not have to support expanded infrastructure: The UK-HMGP Office removes from KYEM the sunk cost of staff recruitment and development, staff maintenance, and the need for recurring budget allocations. This combines flexibility and specialization while reducing custodial and recurring budgetary obligations. Contracting with the UK-HMGP Office and the Martin School of Public Policy and Administration brings efficiency: KYEM can do more and accomplish more in mitigation in less time and expending less money by being able to offload projects and mitigation research to UK-HMGP while it focuses on its other necessary day-to-day agency tasks and pursues other mitigation-related projects manageable by its existing staff and budget. Because UK-HMGP exists solely to support KYEM, UK-HMGP can devote itself entirely to and specialize in mitigation activity and outreach to a degree and an extent that would be unmanageable if operated

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[240] See Standard Portion of *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*, p. 310 under the sub-heading "A Brief Note About Legislation Related to Hazard Mitigation"

from within a state agency tasked (as all state agencies countrywide are) with ever-increasing responsibility and scope. So, for example, through its partnership with UK-HMGP, KYEM is able to offer one-on-one planning services to local jurisdictions; KYEM is able to travel the state educating about and increasing participation in labor-intensive mitigation programs such as those regarding Severe Repetitive-Loss and Repetitive-Loss properties; and KYEM can pursue long-term investment projects that will further increase efficiency and the ability to increase mitigation activity (such as the Community Hazard Assessment and Mitigation Planning System, i.e. CHAMPS) because KYEM can always offload, when needed, tasks and time-consuming work to UK-HMGP.

The University of Louisville's partnership with the Commonwealth of Kentucky operates differently: The Center for Hazards Research and Policy Development (CHR) contracts with the University of Louisville (UofL). CHR does not contract wholly with KYEM. Rather, CHR focuses on developing tools and research and processes that it then "sells" (via individual contracts) with interested mitigation stakeholders. Many times individual contracts are with KYEM: CHR contracts for services related to the abovementioned CHAMP System. CHR contracted with KYEM to produce most of the Risk Assessment section of the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*. However, CHR also contracts with local jurisdictions, such as its contract with the Lexington-Fayette Urban County Government (LFUCG) to implement a streamlined and well-documented planning process and produce renowned risk assessment models. Though the partnership functions differently than the wholly-owned subsidiary-style partnership between UK-HMGP and KYEM, the work of CHR represents Kentucky's commitment to a comprehensive mitigation program. CHR's risk assessment model and subsequent research alone provides an efficiency-enhancement rare to other mitigation programs in other states: There is little that is more time-consuming and resource-consuming in hazard mitigation than accurately defining and graphically conveying vulnerability to the many hazards that affect a state (especially Kentucky). By independently researching (and specializing) in this increasingly technical and thus increasingly specialized task, CHR expands the capacity of the Commonwealth of Kentucky to engage in and be more deeply committed to hazard mitigation programs throughout the Commonwealth.

Public/Private Partnership: Area Development District

Perhaps most uniquely to Kentucky is the existence of its Area Development Districts (ADDs). Again, these were discussed throughout the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version*[241]. For the purposes here, the important thing to note is that ADDs are not state agencies. They are partnerships of local governments/counties: By sharing the ADDs' staffs, counties collectively are able to access the professional expertise which many counties and cities individually could not afford.

The idea that would become the "Area Development District" was conceived for Kentucky in the early 1960s with the creation of Area Development *Councils* that were organized *within* each county comprising "Kentucky." The federal Appalachian Regional Development Act and the Public Works and Economic Development Act (both passed in 1965) allowed for the establishment and authorization of the Area Development *District* which provided an organizational and administrative linking of counties who shared common economic and general development interests[242]. The Appalachian Regional Development Act of 1965 was the vehicle for direct federal aid to Appalachia which spurred the need for ADDs specifically in that region. The Public Works and Economic Development Act established the Economic Development Administration within the U.S. Department of Commerce which would provide federal grants aimed toward employment and industrial policy within economically distressed areas more generally. This, provided impetus to establish the ADD concept state-wide: Professional administration and substantial resources would be required to apply for these grants and manage them. From 1966 to 1972, all fifteen (15) of Kentucky's ADDs were established.

It is also relevant to note that Kentucky's ADDs are not only partners to the Commonwealth of Kentucky's local governments due to their continued usefulness and success in providing the environment and support necessary for Kentucky to increase its commitment to a comprehensive mitigation program. Rather, Kentucky's ADDs are codified into Kentucky's laws: Kentucky Revised Statute (KRS) 147.050 legally establishes all fifteen (15) of Kentucky's Area Development Districts (ADDs).

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[241] See especially the *Planning Process* section, pp. 40-46.

[242] This, of course, implies that most such "Districts" are arranged according to "geographic" commonalities: Geography is assumed to be correlated with economic and development needs. Thus, economic/development commonalities are correlated with geographic commonalities.

Public/Private (Non-Profit) Partnership: Private Sector Work Group (PSWG)

To show its commitment to a comprehensive mitigation program via partnership with the private (and non-profit) sectors, the Commonwealth of Kentucky established a Private Sector Work Group (PSWG) that mirrors the philosophy behind its national counterpart.

From the Standard Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* [p. 33]:

“In March 2010, KYEM established Kentucky’s Private Sector Working Group (PSWG). The PSWG, administered by KYEM, endeavors to build partnerships within the private sector community to help identify and fill gaps in the resources and supply chain during emergency response and recovery efforts. The PSWG is designed to act as a force multiplier between the private and public sectors in order to mitigate the impact of critical incidents, natural disasters, and crisis response events.

The goal in the creation of the program was to draft a comprehensive disaster mitigation, response, and recovery plan that would build upon the strengths, experience, and expanding capabilities of all partners. The resulting group forms a well-organized collaborative network of Commonwealth corporate, business, and industry entities that work in concert with emergency management tasking to protect and re-establish the necessary community infrastructure required to minimize damages and speed the recovery process.

The PSWG meets on a bi-monthly basis, supplemented with conference calls and KYEM annual workshop educational tracks. Meeting agenda items include updates of KYEM mitigation, response, and recovery efforts, member presentations, technology updates, training initiatives, and sector-based workshop sessions.

The primary objective of the program is to build on the strengths, experience, and expanding capabilities of KYEM’s private sector partners. To that end, the PSWG has demonstrated the effectiveness of the program during exercise events and response to Commonwealth disasters. The composition of the PSWG includes membership representing utilities, commodities, transportation, communications, infrastructures, logistics, food, and hospitality. ***Appendix 2-4*** records which organizations currently serve in the PSWG.”

Appendix 2-4 has been recreated here as ***Appendix E-7-5*****.**

In addition to those private sector groups with whom the Commonwealth of Kentucky and Kentucky Emergency Management (KYEM) currently work, in the past (i.e. since 2010), Kentucky also has worked with:

- AEP Kentucky Power
- Al J. Schneider Company
- Baptist Health
- CONTINUUM (Recovery)
- E.ON US[243]
- Kentucky International Convention Center
- Louisville Regional Airport Authority
- National Incident Management System (NIMS) Support Center
- Norton Healthcare
- Toyota
- Transit Authority of River City (TARC)
- University of Louisville Department of Engineering

III. Providing a Portion of the Non-Federal Match for HMGP etc.

Generally, a project applied for using FEMA's Hazard Mitigation Grant Program (HMGP), if approved, is eligible for a 75% reimbursement rate from the federal government. The applicant or sub-applicant must be willing to contribute 25% to an HMGP-approved project. The Commonwealth of Kentucky shows its commitment to hazard mitigation by recognizing that for many local jurisdictions, this 25% contribution still prohibits hazard mitigation projects, or, at the very least, prohibits some of the more costly and capital-intensive projects that many local jurisdictions need to undertake in order to effectively mitigate hazards. Consequently, (and, again, generally), the Commonwealth of Kentucky contributes 12% of the 25% non-federal match for which the sub-applicant to an HMGP-funded project is responsible.

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[243] E.ON US no longer exists: Germany-based E.ON US was the holding company that owned Louisville Gas & Electric (LG&E) when Powergen, LG&E's previous holding company, was purchased by E.ON (with E.ON renaming to E.ON US). In November 2010, PPL (based in Pennsylvania) purchased E.ON US, thus placing LG&E under PPL.

IV. Encouragement to Use Nationally-Applicable Model Building Code

Construction and design in the Commonwealth of Kentucky follows the *Kentucky Building Code*. The *Kentucky Building Code* has been enforced for over thirty (30) years[244]. As of this writing, the most recent version of the *Kentucky Building Code* was implemented in 2007. However, in October 2013, a new version of the *Kentucky Building Code* will be released and implemented. Amendments to the *Kentucky Building Code* always are published as separate documents.

From the 2007 *Kentucky Building Code*:

“The *Kentucky Building Code*…is essentially the *2006 International Building Code* published by the International Code Council, Inc., with the specific Kentucky code…It provides minimum standards to ensure the public safety, health, and welfare insofar as they are affected by building construction and to secure safety to life and property from all hazards incident to the occupancy of buildings, structures, or premises…[The 2007 *Kentucky Building Code*] presents the Code with changes approved by the Kentucky Board of Housing, Buildings, and Construction…

The *Kentucky Building Code* may be amended from time to time by proposals from code enforcement officials, industry and design professionals, and other interested persons and organizations. Changes are discussed in an open meeting of the Board [of Housing, Buildings, and Construction]. Changes approved are printed in the Kentucky Administrative Register and posted on the OHBC [Kentucky Department of Housing, Buildings, and Construction] website.

The *Kentucky Building Code* is a “mini/max” code, meaning that it is a statewide uniform mandatory building code and no local government shall adopt or enforce any other building code[245]…[Kentucky Building Code 2011, p. i[246]]

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[244] The use of a uniform state building code generally is also codified into Kentucky’s state laws (i.e. Kentucky Revised Statutes, or KRS) under Chapter 198B. See ***Appendix E-7-4***.

[245] The exception to this concerns detached single-family dwellings, two-family dwellings, and townhouses. Such structures are governed under the *Kentucky Residential Code*.

[246] Kentucky Board of Housing, Buildings, and Construction. [November 2011]. “Kentucky Information on Code Enforcement.” *The Kentucky Building Code*, 9th edition: Department of Housing, Building, and Construction (OHBC), p. i.

V. Comprehensive Plan to Mitigate the Risks Posed to Existing Buildings That Have Been Identified as Necessary for Post-Disaster Response and Recovery

This Enhanced Portion of the *Commonwealth of Kentucky Enhanced Hazard Mitigation Plan: 2013 Version* here interprets the phrase "existing buildings that have been identified as necessary for post-disaster response and recovery" as generally referring to "critical facilities."

Assuming this interpretation, the Standard Portion of Kentucky's 2013 update of its hazard mitigation plan described as a major component of its mitigation strategy its system for prioritizing, ranking, and selecting hazard mitigation projects that, by its very definition, emphasized mitigating risks to "critical facilities"/"existing buildings that have been identified as necessary for post-disaster response and recovery."

The project prioritization, ranking, and selection system at the level of the state involved first (and, hence, primarily) categorizing all potential projects (Mitigation Action Forms, F/K/A Letters of Intent) into either *A-Projects* or *B-Projects*.

Rather than assign what could only be an arbitrary letter "grading" system, all ranking specific to the project occurred only *after* the project was determined to be an *A-Project* or a *B-Project*. The Commonwealth of Kentucky recognized that all mitigation projects protect populations. Rather, the truly substantial and broad difference between most mitigation projects concerns whether or not they protect "critical facilities" along *with* populations. Consequently, *A-Projects* protect "critical facilities" and populations, while *B-Projects* protect only populations.

That, prima facie, potential mitigation projects (Mitigation Action Forms, F/K/A Letters of Intent) are distinguished between whether or not they protect "critical facilities"/"existing buildings that have been identified as necessary for post-disaster response and recovery" conveys a commitment to a comprehensive mitigation program that partially relies upon a comprehensive (and multi-year) plan to mitigate the risks posed to said "critical facilities."

VI. Integration of Mitigation into Kentucky's Post-Disaster Recovery Operations

The argument that the Commonwealth of Kentucky shows a commitment to a comprehensive mitigation program by integrating mitigation into its post-disaster recovery operations is deemed most adequately made by the Commonwealth of Kentucky's (via Kentucky Emergency Management and the University of Kentucky Martin School of Public Policy and Administration's Hazard Mitigation Grants Program Office) success in implementing "Section 406" mitigation projects.

Included, as ***Appendix E-7-6***, is a list of all of the mitigation projects that have been approved under "Section 406" of the Stafford Act from the years 2010 – 2012, i.e. all "Section 406" mitigation projects approved during the Commonwealth of Kentucky's 2010 – 2013 planning cycle[247]. This list includes under which presidentially-declared disaster the "Section 406" mitigation project was funded, for whom the "Section 406" project was funded, under which "Project Worksheet Number" (abbreviated as PW #) the "Section 406" project was approved, and the cost of the "Section 406" project.

During the Commonwealth of Kentucky's 2010 – 2013 planning cycle, over $4.7 million was approved for "Section 406" mitigation projects.

To clarify for a wider audience: The Robert T. Stafford Disaster Relief and Emergency Assistance Act (i.e. the Stafford Act) under which federally-funded mitigation activity is justified and approved distinguishes between two types of mitigation funding: Those mitigation projects funded under Section 404 of the Stafford Act and those funded under Section 406[248]. Mitigation projects funded under the latter "Section 406" of the Stafford Act can address *only* parts of facilities actually *damaged* by the disaster that, after presidential declaration, becomes the justification for a variable amount of money reserved for mitigation activity of all types (i.e. whether or not the activity addresses the specific presidentially-declared disaster). In contrast, "Section 404" of the Stafford Act allows broader mitigation activity that is not relegated to addressing only the damage wrought from the presidentially-declared disaster under which mitigation funds are justified.

The de facto differentiation between "Section 406" mitigation projects and "Section 404" mitigation projects is placement within time: "Section 404" mitigation projects do not have to address the presidentially-declared disaster under which they are justified and funded. Consequently, project approval is far less timely, far more regulated, and far more technocratic in nature. However, "Section 406 provides discretionary authority to fund mitigation measures in conjunction with the repair of…disaster-damaged facilities. The mitigation measures must be related to eligible disaster-related damages and must

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[247] The list does not contain any "Section 406" mitigation projects approved for 2013 despite Kentucky's 2010 – 2013 planning cycle. This exclusion is due to Kentucky not suffering any presidentially-declared disasters (under which "Section 406" projects would be funded) from 2012 – 2013.

[248] Specifically, Section 406(e): Repair, Restoration, and Replacement of Damaged Facilities…

directly reduce the potential of future, similar disaster damages to the eligible facility[249]…"

The fact that "Section 406" mitigation projects must address "disaster-damaged" facilities, that such projects must be funded "in conjunction with the repair" of said "disaster-damaged" facilities, and that FEMA has "discretionary authority" to release these mitigation funds implies that these projects are the most obvious example of the "integrat[ion of] mitigation into…post-disaster recovery operations" by which the Commonwealth of Kentucky shows its commitment to a comprehensive mitigation program.

To further the above claim, since 2011, Kentucky has made it administrative and mandated policy that all Public Assistance (PA) mitigation actions being assessed must also be assessed for eligibility as a possible "Section 406" mitigation project. Through this policy and since 2011, Kentucky has very explicitly "integrated mitigation into…post-disaster recovery operations": Of $4,272,072 in "post-disaster recovery" (i.e. Public Assistance) operations, $420,284 (nearly 10%) of that total involved incorporating mitigation actions funded through FEMA's "406" mitigation opportunities into 284 Public Assistance (PA) projects. That this $420,284 worth of mitigation was added to "post-disaster recovery operations" is a direct result of Kentucky Emergency Management's administrative policy mandating assessment of all potential PA projects for "406" eligibility. ***Appendix E-7-7*** [250] breaks down the "406" mitigation portions of Public Assistance funding and is meant to work in tandem with ***Appendix E-7-6.***

The Commonwealth of Kentucky, then, argues that it has been very successful in this one obvious measure of mitigation integration into post-disaster recovery. It is assumed, then, that such success is due to significant and effective post-disaster outreach and education and (since 2011) mandated policy, and that such success in this measure is generalizable into all other measures of "mitigation integration into post-disaster recovery operations."

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[249] Federal Emergency Management Agency (FEMA). "Hazard Mitigation Funding Under Section 406 (Stafford Act)." Can be found at the following website: http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/hazard-mitigation-funding-under-section-406-0. [Last accessed: 08/11/2013]

[250] The results of FEMA "406" mitigation incorporation into Public Assistance also briefly is detailed in Section 6 of the Enhanced Portion of the Commonwealth of Kentucky's Hazard Mitigation Plan. However, the Appendix was deemed more suitable for this section.

STANDARD PORTION APPENDICES

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4-7	"Mitigation Ideas: Possible Mitigation Measures by Hazard Type"
4-8	Hazard Ranks by Area Development District (ADD)

Appendix	*Title*
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4-9-2	Local Capabilities Assessment: Barren River Area Development District (BRADD)
4-9-3	Local Capabilities Assessment: Big Sandy Area Development District (BSADD)
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4-9-5	Local Capabilities Assessment: Cumberland Valley Area Development District (CVADD)
4-9-6	Local Capabilities Assessment: FIVCO Area Development District
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4-9-10	Local Capabilities Assessment: Kentucky River Area Development District (KRADD)
4-9-11	Local Capabilities Assessment: Lake Cumberland Area Development District (LCADD)
4-9-12	Local Capabilities Assessment: Lincoln Trail Area Development District (LTADD)
4-9-13	Local Capabilities Assessment: Northern Kentucky Area Development District (NKADD)
4-9-14	Local Capabilities Assessment: (Jackson) Purchase Area Development District (PADD)
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4-10	Kentucky Revised Statutes (KRS) Related to Hazard Mitigation

Appendix	*Title*
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4-11-2	Past and Present Funding Sources II: FEMA Grants – “406” Mitigation Grants
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4-11-7	Past and Present Funding Sources VII: Lexington-Fayette Urban County Government (LFUCG)- Funded Mitigation Actions
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6-3	KYEM Internal Document: Trip Meeting Report + Example
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6-5	Recreation of “Plan Maintenance Process” Section from “Kentucky State Hazard Mitigation Plan: 2010 Edition”
6-6	Recreation of “CHAMPS v1 ADD Training Feedback Final Summary Report”
6-7	Individual Project Progress Report (IPPR)
6-8	KYEM Internal Document: Period of Performance (PoP) Extension Request Reminder: 180-Day
6-9	KYEM Internal Document: Period of Performance (PoP) Extension Request Reminder: 90-Day
6-10	KYEM Internal Document: Period of Performance (PoP): Final Invoice Reminder
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ENHANCED PORTION APPENDICES

Appendix	*Title*
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E-5-3	Data Documentation Template Instructions
E-6-1	Kentucky Office of Homeland Security (KOHS)-Funded Mitigation Actions: 2010-2012
E-6-2	Kentucky Department for Local Government (DLG)-Funded Mitigation Actions: 2011-2012
E-6-3	Kentucky Division of Forestry (KDF) Funding Toward Mitigation Activity: 2010-2012
E-6-4	Louisville Metropolitan Sewer District (Louisville MSD), Emergency Management Agency (EMA)-Funded Mitigation Actions: 2010-2012
E-6-5	Lexington-Fayette Urban County Government (LFUCG)-Funded Mitigation Actions: 2010-2012

Appendix	*Title*
E-7-1	Training For and Outreach Toward Hazard Mitigation Activity: 2010-2012
E-7-2	"Silver Jackets": Organizations Represented and Percentage of Membership Comprised by Each Organization Category
E-7-3	Kentucky Association of Mitigation Managers (KAMM): Organizations Represented
E-7-4	Kentucky Revised Statutes (KRS) Related to Hazard Mitigation
E-7-5	Private Sector Working Group (PSWG) Member Organizations
E-7-6	"Section 406" Mitigation Projects Funded: 2010-2012
E-7-7	"Section 406" Mitigation Projects Funded as Proportion of Public Assistance (PA) Projects: 2011-2012