Jackson County, Ohio

Natural Hazards Mitigation Plan

January 2023

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Executive Summary

The Jackson County Mitigation Plan lays the road map to a safer community by identifying the natural hazards that may affect the county, assessing the impacts of these hazards on community assets – those things that are important to the residents of the county – and developing mitigation actions to lessen or eliminate the impacts on community assets.

Having a current mitigation plan allows the county to apply for mitigation funding – as it may become available. It also provides a mitigation action list for other sources of funding. Further, it provides information that may be used in other planning efforts and future development.

Through a quantitative process of analyzing hazards and impacts on our community, the Mitigation Planning Team identified three mitigation goals and developed twelve mitigation actions achieve the goals. Of these twelve actions, nine actions were carried over from the previous plan, three actions were added, no actions were completed, and no actions were deleted.

The following summarizes these efforts:

- Hazards in Rank Order
  - Flooding
  - Severe Summer Storm
  - Severe Winter Storm
  - Earthquake
  - Tornado
  - Infectious Disease
  - Dam/Levee Failure
  - Wildfire
  - Drought
  - Cyber Attack
  - Land Subsidence
  - Mud/Landslide
  - Hazardous Material Release
- Goals and Mitigation Actions
  - Reduce or eliminate impact to property and loss of life caused by flooding
    - Mitigate flood-prone structures through acquisition, relocation, and/or retrofitting.
    - Mitigate infrastructure problems
    - Update dam Emergency Action Plans, update inundation data for dams without EAPs or current data.
    - Develop and update flood hazard data
    - Mitigate Risks to Publicly Owned Utilities
    - Procure Backup Generators at Critical Facilities
    - Remove Debris and Sediment from Creeks
    - Design and create retention basins
  - Enhance emergency response capability
    - Upgrade the public safety countywide radio communications system.
    - Survey county roads and bridges updating addresses.
  - Provide timely warning
    - Upgrade public warning systems

- Protect future economic development and critical infrastructure from natural hazards
  - Review and update subdivision, zoning, storm water management, flood damage prevention and related regulations.
  - Locate/relocate critical facilities in/to areas not subject to hazards.
  - Promote the construction and use of residential safe rooms.
  - Build community safe rooms.
  - Extend public sewer lines to rural areas.
  - Extend county water to rural areas
- Increase public awareness
  - Develop and implement an all-hazards public education program.

As this plan is an update to the 2017 plan, progress can be measured. While none of the existing actions have been completed, tangible progress has been made to decrease hazard impacts. As for the bulk of the costly mitigation actions, lack of funding has resulted in little progress.

This plan will be reviewed and updated annually and undergo a complete review and rewrite within five years of adoption. Please address any questions, comments, mitigation action status or additional mitigation actions to the Jackson County Emergency Management Agency.

Section I – Introduction

A. Background & Purpose

There are two basic truths about hazards and community assets:

- *Hazards* will occur – there is little, if anything, we can do to prevent natural hazards from occurring.
- *Community assets* will be *impact*ed by the occurrence of hazards to the extent of the assets' *vulnerabilities* to the hazards' *effects.*

Mitigation seeks to lessen or eliminate:

- The impact of hazards
- The vulnerability of assets to hazard impacts

As there are many impacts on community assets, impacts are ranked and mitigation actions cost-estimated using a quantitate analysis approach. Mitigation Actions may then be implemented in a cost-effective manner that resolves the greatest impact.

The purpose of this plan is to document the mitigation planning process conducted in Jackson County, Ohio, and provide that road map to a safer community.

B. Scope

This plan covers Jackson County, Ohio, and all of its political subdivisions and municipalities.

C. The Mitigation Planning Process

The Jackson County Mitigation Planning Team worked together to update the 2017 Plan. The team used the Federal Emergency Management Agency's (FEMA) *Local Mitigation Planning Handbook – March 2013*, as a guide.

Mitigation planning starts with profiling the community and identifying its assets – those things that are important to it. Next, hazards that potentially may affect these community assets are profiled – past and projected future occurrences and impacts. Then, mitigation actions are reviewed and updated and new ones developed that can either lessen or eliminate the impact of a hazard or the vulnerability of a community asset to the impact of a hazard are developed. These mitigation actions form the basis for making the community a safer place to live, work and recreate.

Throughout the process, those who have a stake – elected and appointed government officials, agencies providing services to people, the public – as well as those with pertinent information are advised, consulted and their input incorporated into the plan. *Section II – The Planning Process* describes and summarizes the results of this process.

D. Integration of Results into Other Mechanisms

The county's process to integrate the data, information, and hazard mitigation goals and actions in other planning mechanisms is accomplished through specifically including select positions in the planning process and are members of the Mitigation Planning Team. These include, but are not limited to:

- Jackson County Commissioners – consider incorporating mitigation actions when approving and funding county development projects.
- Jackson County Floodplain Administrator – use the results of flooding hazard analysis and vulnerability assessments in refining floodplain regulations.
- Jackson County Planning Commission – use hazard analysis in approving land use proposals.
- Jackson County Emergency Management Agency – use hazard analysis in focusing preparedness, response and recovery efforts on areas of higher risk.
- Jackson County Sheriff's Office – use hazard analysis targeting response efforts in areas of higher risk for impending or ongoing incidents.
- Jackson County Engineer's Office – use mitigation actions in performing maintenance or making repairs to lessen or eliminate damages caused by future hazard occurrences.
- City and Village Mayors and Councils; Township Trustees – consider incorporating mitigation actions when approving and funding development and maintenance projects.

These individuals take information to their respective organizations that are charged with the development, maintenance, and on occasion, enforcement of rules, regulations, codes, ordinances, policies, plans, procedures and other administrative instruments. Information from the mitigation planning effort is presented to the leadership of these organizations, who then authorize the information to be added, to revise or update current administrative instruments. This allows for oversight, commitment of time, energy, and resources to change actions into projects.

Although the jurisdictions do not have as many representatives to serve on the Planning Team, their representatives follow the same processes as those at County level.

E. Other Uses for This Plan

While this plan focuses on mitigation actions, the results of the information gathered and analysis performed can be used for other purposes including:

- Already-identified mitigation actions for funding through other sources
- Assessing risk for other purposes

F. Sources Consulted

Many sources were consulted in the planning process. The major sources are shown in the following table.

Source	Used to Provide Information on
Federal Emergency Management Agency (FEMA)	National Flood Insurance Program Previous Disasters
National Oceanic and Atmospheric Administration (NOAA)	Hazards U.S. Multi-Hazard Climate, Weather & Drought History and Trends
Ohio Department of Natural Resources (ODNR)	Dams, Waterways & Drought History and Conditions

Source	Used to Provide Information on
	Landslide Characteristics
United States Geological Survey (USGS) & Jackson County Soil & Water Conservation District	Slopes & Soils Affecting Public Safety and County Assets
Ohio Emergency Management Agency (Ohio EMA)	Mitigation Plan State-Wide Hazards History and Trends
Jackson County Emergency Management Agency	Emergency Operations Plan Previous Disasters, Emergencies & Other Incidents
Jackson County Engineer's Office	Impacted Roadways and Cost Estimates
Jackson County Sheriff's Office	Public Safety Impacts: Location, Severity, Frequency
Jackson County Planning Commission	Planning Regulations and Development Trends

G. Plan Organization

This plan is organized into sections and appendices:

Section I – Introduction.

Section II – Planning Process. This section details the planning process; it provides the summary information and conclusions as a result of hazard analysis and details mitigation goals developed.

Section III – Community Profile and Assets. This section provides detailed information about Adams County and its Assets.

Section IV – Hazard Identification and Analysis. This section lists the hazards likely to affect Adams County and details the analysis conducted on each. It also summarizes the rankings of hazards and impacts.

Section V – Hazard Profiles, Analyses and Vulnerable Assets. This section documents profiles and analyses conducted. It then details the impacts to vulnerable community assets.

Section VI – Mitigation Goals and Actions. This section lists and details the mitigation goals and actions updated or developed.

Section VII – Mitigation Action Analysis. This section details each action and its analysis.

Section VIII – Supplemental Information. This section includes information meaningful to the overall plan development but not included in the preceding sections. Note that this section may be published as a separate document.

H. Mitigation Action Changes as a Result of This Update

The following table indicates changes to action status and priority.

Action	Old Priority	New Priority	Status
Mitigate flood-prone structures through acquisition, relocation, and/or retrofitting	1	1	Unchanged
Design and create retention basins		2	New
Mitigate risks to publicly owned utilities	2	3	Unchanged

Action	Old Priority	New Priority	Status
Procure backup generators at critical facilities	3	4	Unchanged
Upgrade the public safety countywide radio communications system		5	New
Mitigate infrastructure problems	4	6	Unchanged
Locate/relocate critical facilities in/to areas not subject to hazards	5	7	Unchanged
Update dam Emergency Action Plans, update inundation data for dams without EAPs or current data	6	8	Unchanged
Upgrade public warning systems	7	9	Unchanged
Develop and update flood hazard data	8	10	Unchanged
Survey county roads and bridges updating addresses		11	New
Remove debris and sediment from creeks	9	12	Unchanged
Develop and implement an all-hazards public education program	10	13	Unchanged
Review and update subdivision, zoning, storm water management, flood damage prevention and related regulations	11	14	Unchanged
Extend county water to rural areas		15	New
Extend public sewer lines to rural areas		16	New
Build/retrofit existing structures to serve as community safe rooms		17	New
Promote the construction and use of residential safe rooms		18	Unchanged

I. Project Management

The Jackson County EMA is the lead agency for this plan.

Section II – The Planning Process

The mitigation planning process for Jackson County is designed to include stakeholders in as many steps as practical to ensure an acceptable and viable plan that leads to eliminating or lessening the impacts of hazards on community assets.

A. Relationship to the 2017 Mitigation Plan

As this is an updated plan, the previously approved plan was the point of departure. All information in it was reviewed and updated as needed. This included the community profile, hazards and analysis and goals and mitigation actions. Status of mitigation actions was assessed, and cost estimates updated.

B. Form the Planning Team

A critical task at the beginning of the planning process was to assemble a planning team of representatives from each jurisdiction and partner organization. These planning partners have the expertise to develop the plan, and their organizations have the authority to implement the mitigation strategy developed through the planning process. This is the core group of people responsible for developing and reviewing drafts of the plan, creating the mitigation strategy, and submitting the final plan for local adoption.

When building the planning team, the Jackson County EMA Director invited representatives to reconvene the team from the previous planning process along with additional individuals or organizations. It was decided that a committee that oversees the comprehensive plan or addresses issues related to land use, transportation, or public facilities would be a good foundation for the mitigation planning team. The team was assembled to consider how threats and hazards impact economic development, housing, health and social services, infrastructure, or natural and cultural resources. Representatives from agencies involved in hazard mitigation activities, agencies with the authority to regulate development, and offices responsible for enforcing local ordinances were important members of the planning team. These agencies are assigned responsibility and have the expertise for implementing mitigation actions.

- Stakeholders were also invited to participate in the plan update process. These stakeholders are individuals or groups that are affected by mitigation actions or policies. Stakeholders include businesses, industry, commercial ventures, private organizations, and citizens. Unlike planning team members, stakeholders may not be involved in all stages of the planning process, but they inform the planning team on a specific topic or provide input from different points of view in the community. As certain stakeholders must be given the opportunity to be on the planning team, some of those invited participated in the planning process, including:
- Local and regional agencies involved in hazard mitigation activities
- Agencies that have the authority to regulate development
- Neighboring jurisdictions
- Businesses, academia, and other private and nonprofit interests

C. Conduct Kick-Off Meeting

The Planning Team conducted their Kick-Off meeting on March 16, 2022, at the Jackson County Health Department Conference Room. An overview of mitigation as well as

requirements and expectations for a successful planning process and approved plan was presented and discussed.

At this meeting, the team developed their mission statement, defined key roles and responsibilities, established their meeting dates, times and locations, identified goals and major items that needed to be addressed, established timelines and reviewed the current plan.

Planning Team members were also tasked to gather specific information and data to update the hazard profiles and formulate the vulnerability assessment for each hazard. This included improved definitions of the hazards, determining locations in the county, using correct scales for the extent, updating historical narratives, and re-calculating the probabilities when such hazards may occur in the future. Current information of NFIP participation, repetitive loss data, public assistance figures and NFIP compliance facts were researched. By compiling all this information, the Hazard Identification & Risk Analysis and the vulnerability assessment was drafted.

D. Planning Team Meetings and Activities

On April 13, 2022, the Planning Team met to review the Hazard Analysis & Vulnerable Community Assets report. The team identified corrections and approved the report for inclusion in the updated plan. The team also started discussion of goals and actions.

The Planning Team met on June 10, 2022. The team reviewed in detail current mitigation goals and actions. All were found to be valid; some clarifications were added. An additional action was also identified and documents.

The team again met on August 31, 2022, to include those who couldn't participate in the previous meeting. Additional actions were identified and included. Also, the team prioritized the identified mitigation actions. Using a qualitative and quantitative approach, the team established priorities based on vulnerabilities of and impacts to community assets.

A draft plan was written and distributed to Planning Team members for their review, comment, and changes. After these items were implemented into the plan, the draft was submitted to Ohio EMA for their review. All recommendations were incorporated.

At this time, a copy was posted on the Jackson County EMA web site for public review and comment. Copies of the plan were made available in the Oak Hill, Jackson and Wellston Libraries for review by the public who did not have access to the web, computers or needed other assistance. After a few weeks, no public comments were received and the plan was submitted for final State and Federal review and adoption. The Village of Coalton did not participate in the planning process and is not considered planning participant

Note that documentation of all meetings is included in *Section VIII – Supplemental Information*.

E. Participants

The following participated in the development of this plan:

Community	Agency	Position	Name	#1	#2	#3	#4	Planning Team
State	Ohio EMA	Field Liaison	Brody Davis		X	X		
County	Jackson Co EMA	Director	Robert Czechlewski	X	X	X	X	X
County		Deputy Director	Samantha Brooks	X	X	X	X	X

Community	Agency	Position	Name	#1	#2	#3	#4	Planning Team
County	Jackson Co Engineer's Office		Mark Davidson		X			X
County			Mark Jenkins	X				X
County		Engineer	Melissa Miller			X		X
County	Jackson Co Health Dept	Sanitarian	David Ramby	X	X	X	X	X
County	Jackson Co Health Dept	Sanitarian	Terry Barr	X	X		X	X
County	Pike Co EMA	Director	Tim Dickerson	X				
County	Scioto Co EMA	Director	Larry Mullins	X	X		X	X
County	Vinton Co EMA	Director	William Faught	X				
Municipality	Jackson		David Swackhammer				X	
Municipality	Jackson Police Dept	Chief	Brett Hinsch	X	X		X	X
Municipality	Oak Hill Police Dept		David Ward				X	
Municipality	Wellston		Anthony Brenner				X	
Municipality			Charlie Hudson				X	
Municipality	Wellston Fire Dept	Chief	Ryan Pelletier		X		X	X
Municipality	Wellston Police Dept		John Robinson				X	
Business	OSCR Railroad		George Andres			X	X	X
Consultant	RDI Solutions	Consultant	David Pollinger	X	X	X	X	X

The following summarizes jurisdictional participation:

Jurisdiction	Kickoff	Hazards	Actions 1	Actions 2
Jackson County	3	2	2	5
Jackson (City)	1	1	2	1
Wellston		1	4	1
Coalton				
Oak Hill				1

F. Inform Chief Elected Officials, Stakeholders and the Public

The Jackson County EMA met with the Board of County Commissioners, advising them of the mitigation plan update project and received their full support. The Jackson County EMA then invited township trustees and city/village mayors to the Planning Team meetings.

Public participation and input to the planning process was first announced on the Jackson County EMA web site as well as through a social media (Facebook) post on March 14, 2015. It directed the attention of the public to review the 2010 Mitigation Plan and provide feedback to the Jackson County EMA. However, no comments were received by the public.

Throughout the plan development phase, the public was invited to attend and participate in the Planning Team meetings with each jurisdiction's regularly scheduled open-to-the-public

meetings. Locations, dates and times were made to the public and announcements were posted at meeting locations.

After the planning process was finished, the public had the opportunity to review and comment on the revised plan. The plan was made available at the Oak Hill, Jackson and Wellston Libraries and on the Jackson County EMA web site. No comments were received.

G. Gather Information

The Planning Team invited each jurisdiction's governing body to its planning meetings to gather information unique to each jurisdiction. The team also contacted agencies that have a mitigation-related role. This included the Jackson County Health Department, Jackson County Soil & Water Conservation District, Jackson County Engineer's Office, Jackson County Auditor's Office, Jackson County Sheriff's Office and Jackson County EMA.

The Planning Team reviewed existing plans and reports including Jackson County's Emergency Operations Plan, Soil Report, plat maps, and Planning Commission regulations.

The Planning Team performed extensive research from online resources such as Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), US and Ohio Departments of Transportation (USDOT/ODOT) and Ohio Department of Natural Resources (ODNR). The source is identified where this information is presented in this plan.

H. Update Community Profile and Assets

The Planning Team updated the community profile and its assets based on data collected and is presented in *Section III – Community Profile and Assets*.

I. Perform Hazard Analysis, Formulate Goals and Mitigation Actions

1. Identification of Hazards

The Planning Team identified hazards considered to be credible threats to Jackson County's assets. These are presented in rank order:

- Flooding
- Severe Summer Storm
- Severe Winter Storm
- Earthquake
- Tornado
- Infectious Disease
- Dam/Levee Failure
- Wildfire
- Drought
- Cyber Attack
- Land Subsidence
- Mud/Landslide
- Hazardous Material Release

Refer to *Section IV – Hazard Identification and Analysis* for details.

2. Hazard Profile, Vulnerability Assessment & Impacts

The Planning Team collected and reviewed hazard information, assessed the impacts and the community's vulnerabilities. Refer to *Section V – Hazard Profiles, Analyses and Vulnerable Assets* for details.

3. Goals & Mitigation Actions

The Planning Team reviewed the vulnerabilities of impacted assets and decided on the following mitigation goals in priority order based on impact resolution.

The Planning Team selected the following goals:

- Reduce or eliminate impact to property and loss of life caused by flooding
- Enhance emergency response capability
- Provide timely warning
- Protect future economic development and critical infrastructure from natural hazards
- Increase public awareness

The Planning Team then reviewed current mitigation actions and added several new ones. Using Cost Benefit Review procedures, the planning team prioritized the actions. The following table depicts the mitigation actions developed and selected and the priority assigned. Note that priorities from the 2017 Plan were modified based on the results of this approach.

- Reduce or eliminate impact to property and loss of life caused by flooding
  - Mitigate flood-prone structures through acquisition, relocation, and/or retrofitting.
  - Mitigate infrastructure problems
  - Update dam Emergency Action Plans, update inundation data for dams without EAPs or current data.
  - Develop and update flood hazard data
  - Mitigate Risks to Publicly Owned Utilities
  - Procure Backup Generators at Critical Facilities
  - Remove Debris and Sediment from Creeks
  - Design and create retention basins
- Enhance emergency response capability
  - Upgrade the public safety countywide radio communications system.
  - Survey county roads and bridges updating addresses.
- Provide timely warning
  - Upgrade public warning systems
- Protect future economic development and critical infrastructure from natural hazards
  - Review and update subdivision, zoning, storm water management, flood damage prevention and related regulations.
  - Locate/relocate critical facilities in/to areas not subject to hazards.
  - Promote the construction and use of residential safe rooms.
  - Build community safe rooms.
  - Extend public sewer lines to rural areas.
  - Extend county water to rural areas

- Increase public awareness
  - Develop and implement an all-hazards public education program.

Refer to *Section VI – Mitigation Goals and Actions* for details on these mitigation actions.

J. Present Plan to the Public

The plan was placed in the Oak Hill, Jackson and Wellston Libraries and on the Jackson County EMA's website and a public notice was placed on the Jackson County EMA web site as well as through a social media (Facebook) post inviting residents to review and comment on the plan.

Additionally, a copy of the updated plan was sent to the Emergency Management Agencies of adjacent counties.

K. Submit Plan to Ohio EMA and FEMA

The plan in its final form was submitted to Ohio EMA in December 2023.

On ***Month Date, 2023,*** FEMA determined this plan meets its requirements.

L. Adopt Plan

On ***Month Date, 2023***, the Jackson County Board of Commissioners adopted this plan.

On ***Month Date, 2023***, the City of Jackson adopted this plan.

On ***Month Date, 2023***, the City of Wellston adopted this plan.

On ***Month Date, 2023***, the Village of Oak Hill adopted this plan.

M. Receive Federal Approval

On ***Month Date, 2023***, FEMA granted federal approval.

N. Monitor Plan Implementation

The Jackson County EMA Director monitors the implementation of this plan by periodic contact with lead agencies and presents status to the Planning Team and commissioners at each annual review.

The Jackson County EMA Director also provides a copy of this plan to all stakeholders and agencies with authorities related to mitigation actions and coordinates with them to assist in integrating mitigation goals and actions into their plans and actions.

O. Keep Plan Up to Date

The Jackson County EMA Director monitors the implementation of this plan by having lead agencies provide updates as the status of their mitigation actions change.

The Jackson County EMA Director convenes the Planning Team annually to review the progress of this plan and propose any needed updates. This meeting is publicly announced and is open to the public; notices are posted on the Jackson County EMA's web site and Facebook page as well as announced in the various newspapers serving Jackson County. At this meeting, the team:

- Reviews the status of all mitigation actions.

- Assesses the progress toward achieving mitigation goals.
- Considers new related information as it becomes available. This includes recent hazard occurrences as well as changes in related planning documents. If this information would have an impact on goals or actions, the team proposes changes such as adding, changing or eliminating goals or mitigation actions.
- Presents proposed changes to the Board of County Commissioners and chief elected officials of affected jurisdictions for concurrence.
- Formally documents the proceedings, provides it to all stakeholders and makes it available with the current plan.

Once every five years, the Jackson County EMA initiates a formal plan update based on then current FEMA requirements and FEMA and Ohio EMA guidance.

The Jackson County EMA may process out-of-cycle updates by submitting changes to the Board of County Commissioners and the Ohio EMA.

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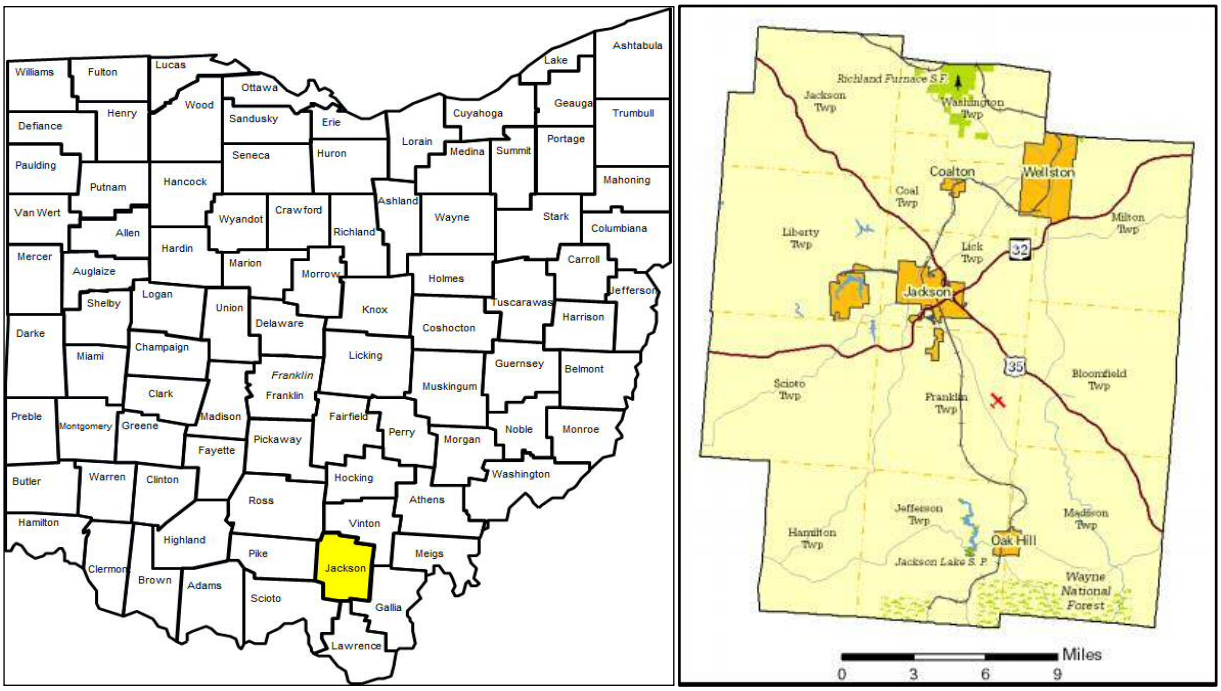
Section III – Community Profile and Assets



A. Location and Geography

Jackson County is located in the southeast quadrant of the State of Ohio. It covers approximately 420.3 square miles. It is bounded by:

- Vinton County to the north
- Gallia County to the east
- Lawrence County to the south
- Scioto County to the southeast
- Pike County to the east
- Ross County to the northeast

It features scenic rolling hills with several major creeks traversing the county.

B. Land Use[1]

1. Land Use/Land Cover

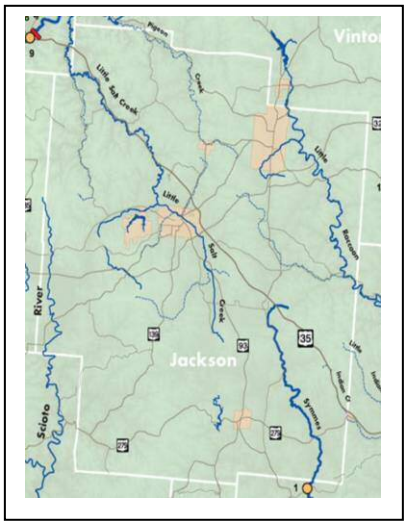
The following chart depicts Jackson County's land use and cover:

Land Use/Land Cover	Percentage
Shrub/Scrub and Grasslands	64.73%
Cultivated Crops	20.71%
Developed, Lower Intensity	6.02%
Pasture/Hay	3.83%
Wetlands	2.16%

[1] https://devresearch.ohio.gov/files/research/C1041.pdf

Land Use/Land Cover	Percentage
Developed, Higher Intensity	1.11%
Barren (strip mines, gravel pits, etc.)	0.67%
Forest	0.45%
Open Water	0.33%

2. Waterways



Little Salt Creek originates near Oak Hill and flows northwesterly through the City of Jackson and into Ross County.

Symmes Creek originates in Madison Twp and flows southerly into Gallia County.

Little Raccoon Creek originates in Vinton County just north of Wellston and flows southerly through Milton and Bloomfield Twps and into Gallia County.

There are numerous tributaries – both continuous and intermittent – feeding into these waterways.

3. Federal Lands

A small portion of *Wayne National Forest*[2] is located in the extreme south part of Jefferson Twp. It has trails but no improved facilities.

4. State Lands

Richland Furnace State Forest is located in northern Washington Twp. It has trails but no improved facilities.

Jackson Lake State Park is located in Jefferson Twp just west of Oak Hill. This pasrk offers a full range of outdoor activities including camping, hiking, swimming, fishing and hunting.

Cooper Hollow Wildlife Area occupies 5421 acres in north central Madison Twp adjacent to US 35. This is popular hunting area.

C. Climate[3]

The following table summarizes climate information for Jackson County:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Annual Total
Average high in °F	38	42	53	65	74	81	84	84	77	65	54	42	63	
Average low in °F	21	22	30	40	49	59	63	61	53	41	33	25	41	
Av. Inch precipitation	3	3	3.9	3.5	4.76	4	4.4	3.27	2.8	2.8	3.39	3.2	3.5	42.1
Av. Inch snowfall	8	7	3	1	0	0	0	0	0	0	1	3		23

[2] https://www.fs.usda.gov/main/wayne/home

[3] https://www.usclimatedata.com/climate/jackson/ohio/united-states/usoh0438

Average temperature is 52.4 degrees.

Average wind is 5-8 miles per hour from the southwest.

D. Jurisdictions and Populations

Jackson County is subdivided into twelve townships, two cities and two incorporated villages. Below are their unique features, and identified vulnerabilities.

1. Townships

Bloomfield Township is located at the east central border of the county adjacent to Gallia County.

Coal Township is located in the north central part of the county and encompasses the Village of Coalton.

Franklin Township is located in the south-central part of the county.

Hamilton Township is located at the southwest corner of the county adjacent to Scioto County.

Jackson Township is located at the northwest corner of the county adjacent to Vinton, Ross and Pike Counties.

Jefferson Township is located at the south-central border of the county adjacent to Lawrence County.

Liberty Township is located along the eastern border of the county adjacent to Pike County.

Lick Township is located in the central part of the county and encompasses most of the City of Jackson.

Madison Township is located at the southeast corner of the county adjacent to Gallia County.

Milton Township is located at the northeast corner of the county adjacent to the City of Wellston and Vinton County.

Scioto Township is located along the eastern border of the county adjacent to Pike County.

Washington Township is located along the north central border of the county adjacent to Vinton County.

2. Cities

Jackson is located in the central part of the county spread out within Lick, Liberty and Franklin Twps. Approximately 20% of the county's population resides here. Much of the city is in a flood plain primarily along Little Salt Creek.

Wellston is located in the northeast part of the county between Milton, Washington and Coal Twps.

3. Villages

Coalton is located in the northern part of the county in the center of Coal Twp.

Oak Hill is located in the southeast part of the county between Madison and Jefferson Twps.

4. Populations[4]

2019 Ohio County Population Estimates

Ohio

	Estimate 7/1/2019	Estimate 7/1/2018	Census 4/1/2010	Net Change '18 to '19	Percent Change '18 to '19	Net Change '10 to '19	Annualized Percent Change '10 to '19
Ohio	11,689,100	11,676,341	11,536,504	12,759	0.11%	152,596	0.14%
Jackson	32,413	32,366	33,225	47	0.15%	-812	-0.27%

Jackson County
2021 Population Estimates For Cities, Villages, and Townships

Name	Population Estimate 7/1/21	Population Estimate 7/1/20	Population Estimates Base 4/1/20 (a)	Average Annual Rate of Change From 2020 (b)
Jackson County	**32,511**	**32,642**	**32,653**	**-0.3%**
Municipalities within the county				
Coalton village	441	444	444	-0.5%
Jackson city	6,209	6,250	6,252	-0.6%
Oak Hill village	1,404	1,409	1,412	-0.5%
Wellston city	5,405	5,410	5,412	-0.1%
Balance of Jackson County	19,052	19,129	19,133	-0.3%
Subcounty areas				
Bloomfield township	1,147	1,147	1,147	0.0%
Coal township	1,959	1,971	1,971	-0.5%
Coalton village	441	444	444	-0.5%
Balance of Coal township	1,518	1,527	1,527	-0.5%
Franklin township	2,286	2,297	2,298	-0.4%
Hamilton township	542	544	545	-0.4%
Jackson city	6,209	6,250	6,252	-0.6%
Jackson township	1,215	1,222	1,222	-0.5%
Jefferson township	3,482	3,496	3,498	-0.4%
Oak Hill village (pt.)	855	858	860	-0.5%
Balance of Jefferson township	2,627	2,638	2,638	-0.3%
Liberty township	1,786	1,793	1,794	-0.4%
Lick township	2,618	2,629	2,631	-0.4%
Madison township	2,102	2,108	2,109	-0.3%
Oak Hill village (pt.)	549	551	552	-0.4%
Balance of Madison township	1,553	1,557	1,557	-0.2%
Milton township	1,037	1,043	1,045	-0.6%
Scioto township	1,939	1,942	1,940	0.0%
Washington township	784	790	789	-0.5%
Wellston city	5,405	5,410	5,412	-0.1%

n.a. - Could not calculate. Division by zero.
(a) Used for calculating average annual rate of change. (b) Average annual rate of change from April 1, 2020 to July 1, 2021.
Source: Population Estimates Division, U.S. Census Bureau. Prepared by: Office of Research, Ohio Development of Development.

[4] https://devresearch.ohio.gov/reports_pop_est.htm

E. Nonresidential Populations

There are activities in Jackson County that attract many people from outside the county.

1. Jackson Lake State Park

Jackson Lake State Park is located on Tommy Been Road in Township. It has camping and picnicking facilities as well as swimming and hiking trails.

2. Hunting

Jackson County is a popular area for deer and wild turkey hunting and attracts many out of county hunters during hunting seasons. State and federal forestlands as well as private land are used for hunting.

F. Demographics

The following information is a summary of information from the US Census Bureau[5:]

Population Trend. While the nation is growing at a .1% rate, Ohio is losing population at a -.2% rate and Jackson County at a -.4% rate.

Diversity. With the exception of ethnicity and primary language (Jackson County is 97% European American), Jackson County's diversity closely matches that of Ohio and the United States. This includes gender, age and family size.

Stability. Jackson County residents tend to stay in the same home about the same as the rest of the state and nation.

Home Ownership. Jackson County's home ownership rate is higher than the national average.

Home Values. The average value of homes in Jackson County is $105,600, 30% less than the state average and less than one-half of the national average.

Education. Jackson County students graduate high school close to the national average. There are 33% fewer residents with post-high school degrees than the state average and 58% fewer than the national average.

Employment. While the state employment rate is growing by 1.3%, Jackson County is growing jobs at a .2% rate.

Income. The per capita income is $25,004, 23% lower than the state average and 29% lower than the national average. 15.9% of Jackson County's population live below the poverty line, 35% higher than the state and national levels.

[5] http://www.census.gov/quickfacts/table/PST045215/39079,39,00

G. Major Transportation Routes

1. Highways

The major crossroads in Jackson County are SR 32 – The Appalachian Highway – traversing the county generally east to west and US 35 traversing southeast to northwest. These highways intersect at the City of Jackson.

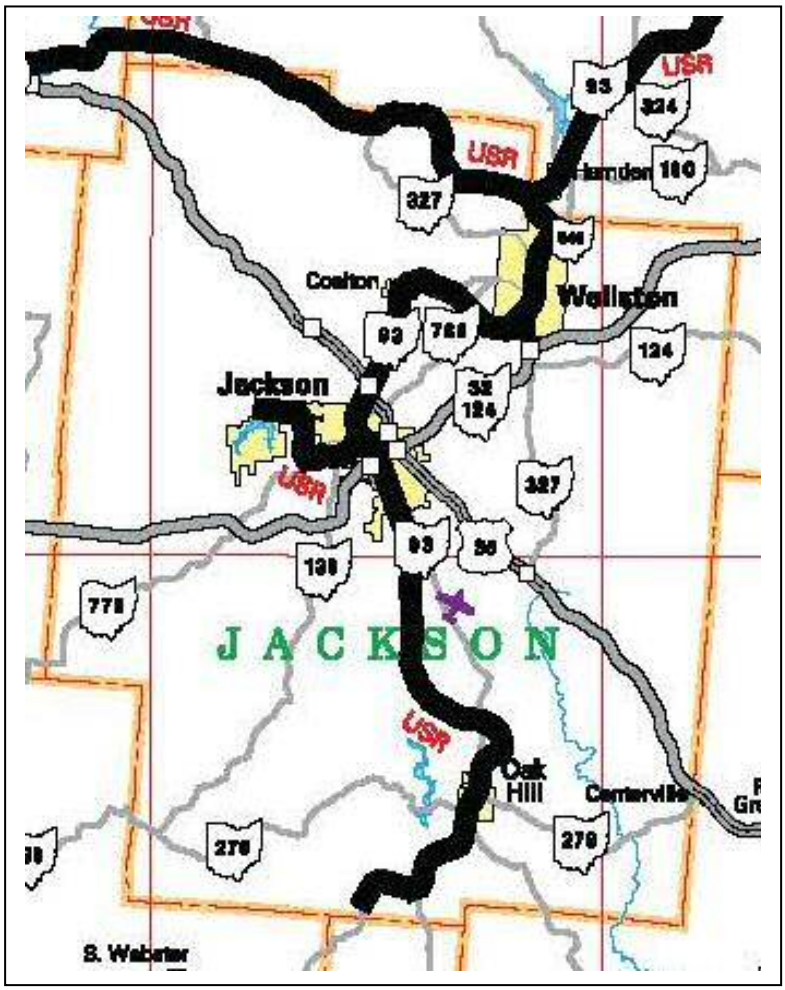
2. Airways

The James A Rhodes Airport – aka the Jackson County Airport – is located to the east of SR 93 between Jackson and Oak Hill.

3. Railways

US Rail operates railways along the eastern Jackson-Vinton County lines through Wellston, Coalton, Jackson, Oak Hill and continuing into Scioto County.

The City of Jackson also owns and operates a short line in the city.



H. Public Warning and Notifications Systems

1. NOAA Weather Radio All Hazards[6]

All county government facilities, local schools, hospitals and nursing homes have weather/all hazard alert radios.

2. Public Safety Location-Based Notification

The City of Jackson Police Department employs a location-based notification system providing the capability to make emergency notifications to city residents via phone, texting and email.

I. Community Events

Jackson County Fair is traditionally held seven weeks prior to Labor Day. The fairgrounds are located in Wellston on Meadow Run Rd.

Apple Festival is an annual street festival located on the downtown streets of Jackson during the third full week of September.

[6] http://www.nws.noaa.gov/nwr/

Wellston Ohio Hill Country (OHillCo) Festival is held Tuesday thru Saturday after Labor Day on the downtown streets to celebrate Wellston's rich Appalachian heritage.

Festival of Flags is a Memorial Day weekend festival that was established to promote Patriotism and respect for the U.S. Flag. Over 2,000 flags are displayed throughout the Village.

J. Development Trends

1. Land Usage

Land usage hasn't changed significantly in recent years.

2. Economic Conditions

According to data from Regional Economic Analysis Project[7], Jackson County is of the 35 Ohio counties classified as "Lagging." While the state's economy is increasing at an average rate of 2.29%, Jackson County is decreasing at a 1.46% rate.

K. Authorities Affecting Mitigation Activities

1. Zoning and Building Regulations

Jackson County and its jurisdictions have limited hazard mitigation capabilities, both in regulation and funding. The county has a Planning Commission and countywide Comprehensive Plan which is and includes all townships and jurisdictions. Jackson County (covering unincorporated areas) as well as all cities and villages have floodplain regulations formally adopted by resolution or ordinance. As of the Spring of 2005, all entities in Ohio now follow the State Building Code. There are no zoning ordinances in Jackson County. All health and safety regulations follow State of Ohio laws. Jackson County and its jurisdictions have very limited financial resources. Jackson County and its jurisdictions have adequate resources to operate and maintain public utilities and public facilities. However, the county and its jurisdictions do not have much flexibility in financial assets to accomplish mitigation tasks on their own. Below is a summary of their capabilities:

Jurisdiction	Planning Commission	Comprehensive Plans	Floodplain Regulations	Building Codes	Zoning Ordinances	Capital Budget for Mitigation	Public Works Budget for Mitigation
Jackson County (Covers Unincorporated Areas)	Yes	Yes	Yes	Ohio Building Codes	None	None	In-Kind Wages
City of Jackson	No	None	Yes		Yes		
City of Wellston	No	None	Yes		Yes		
Village of Coalton	No	None	Yes		Yes		
Village of Oak Hill	No	None	Yes		Yes		

[7] https://ohio.reaproject.org/analysis/lsgl/by_indicator/employment/tools/390079/

2. Floodplain Management

Jackson County floodplain regulations are maintained by the county commissioners and mayors of those cities and villages with such regulations. These regulations are the Special Purpose Flood Damage Reduction Regulations. Section 3.1 designates the position of Floodplain Administrator. Section 3.2 outlines the duties and responsibilities of this position. Duties include, but are not limited to enforcement of the regulations, routine monitoring of the flood zones and providing community assistance such as encouragement of owners to maintain flood insurance.

3. National Flood Insurance Program (NFIP)

The following table reflects participation and compliance with the NFIP[8].

CID	Jurisdiction	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Reg-Emer Date	Sanction Date
390290	Jackson County	01/10/1975	08/19/1985	12/18/2009	08/19/1985	N/A
390292	City of Jackson	05/17/1974	06/01/1984	12/18/2009	06/01/1984	N/A
390293	City of Wellston	02/15/1974	02/01/1994	12/18/2009(M)	02/01/1994	N/A
390291	Village of Coalton	02/01/1974	05/02/1991	12/18/2009	05/02/1991	N/A
390238	Village of Oak Hill	5/2/1991	12/18/2009	(NSFHA)	12/18/2009	N/A

4. Jackson County Health Department

The Health Department monitors and enforces regulations for septic systems and potable wells as well as deals with public health issues.

L. Mitigation Funding Sources

1. Operating Budgets

Funding for routine maintenance and improvements come from normal operating budgets. Mitigation Actions are considered when performing routine maintenance and improvements.

2. Grants

a. Community Development Block Grant Program[9]

The US Department of Housing and Urban Development's (HUD) Community Development Block Grant (CDBG) program is a flexible program that provides communities with resources to address a wide range of unique community development needs.

b. Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) is authorized by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Act, as amended. The key purpose of HMGP is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster. HMGP is available, when authorized under the Presidential major disaster declaration, in areas of the State requested by the Governor.

[8] https://www.fema.gov/national-flood-insurance-program-community-status-book
[9] https://www.hud.gov/program_offices/comm_planning/cdbg

c. Pre-Disaster Mitigation Program

The Pre-Disaster Mitigation (PDM) program is authorized by Section 203 of the Stafford Act, 42 USC 5133. The PDM program is designed to assist States and local communities to implement a sustained pre-disaster natural hazard mitigation program to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding from future major disaster declarations.

d. Flood Mitigation Assistance Program

The Flood Mitigation Assistance (FMA) program is authorized by Section 1366 of the National Flood Insurance Act (NFIA) of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

e. Other Mitigation Grants

Information on other grant programs is available on the Ohio EMA's Mitigation Information Portal (MIP)[10].

[10] https://services.dps.ohio.gov/MIP

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Section IV – Hazard Identification and Analysis

A. Overview

The Jackson County Mitigation Planning Team identified hazards of credible threat and analyzed their impact using qualitative and quantitative methods. The team used the *FEMA Local Mitigation Planning Handbook, March 2013,* as a guide for conducting analysis.

B. Hazard Identification

The Planning Team chose the natural hazards the Ohio EMA identified as those likely to impact the state of Ohio (as documented in the *2019 State of Ohio Hazard Mitigation Plan (SOHMP)*[11], page 2-3) as the starting point for hazard identification. It then, based on a review of the community profile and historical records of hazards affecting south central Ohio, selected the natural hazards it considered to be credible threats to Jackson County's assets. Eight of these hazards were identified for Hazard and Vulnerability Analysis.

Hazard from SOHMP	Significant Impact on Assets
Flooding	Yes
Winter Storms	Yes
Severe Summer Storms*	Yes
Tornado	Yes
Drought	Yes
Earthquake	Yes
Dam/Levee Failure	Yes
Invasive Species	No – Day-to-day operations deal with these
Landslide	Yes
Land subsidence	Yes
Wildfire	Yes
Coastal Erosion	No – No coastline

* The term "Severe Summer Storms" used in this document include:
  - Severe Summer Storms
  - Thunderstorms
  - Windstorms
  - Hail

  events.

The Planning Team identified the following additional hazards that have had or would have significant impact on the county:

- *Infectious Disease*. This type of biological hazard incident would potentially have immeasurable impact. Illness and even deaths would cause a ripple effect all aspects of personal lives – physical, social, economic – as well as the community as a whole – medical assets, economic, policies and procedures, security to name a few. This hazard was included in the ranking of hazards as well as in hazard analysis, hazard profile and action development.
- *Cyber Attack.* This type of man-made hazard incident would have significant impact on operations relying on these systems as well as loss of productivity to restore the systems and

[11] https://www.ema.ohio.gov/mip/planning_sohmp.aspx

to recreate lost information. This hazard was included in the ranking of hazards but not in hazard analysis, hazard profile and action development.

- *Hazardous Materials Release.* This technological hazard has had impact on Jackson County in past with the potential to have major impact. This hazard was included in the ranking of hazards but not in hazard analysis, hazard profile and action development.

C. Hazard and Vulnerability Analysis Methodology

The Planning Team profiled each of the eleven hazards identified. It collected and reviewed hazard information, assessed the impacts and the vulnerabilities of the community's assets.

The Planning Team chose a 30-year lookback period (1992-2021) for occurrences as this this period provided the most consistent records for most hazards. Events recorded in National Centers for Environmental Information (NCEI)[12] data base as well as locally added events were considered occurrences. Criteria for NCEI event inclusion and categorization are contained in the *National Weather Service Instruction 10-1605*[13]

The team assigned risk factor values based on the following criteria and adjusting factors established by the Ohio EMA.

Risk Factor	Criteria
Frequency	If a hazard/event does not apply it is given a value of NA. If a hazard/event resulted in no local disaster declarations, it scored a one. If the hazard/event resulted in one – two local disaster declarations, it has a Low Probability of occurrence and scored a two. If it resulted in three – five declarations, it has a Medium Probability and numerical score of three. If the hazard/event resulted in six – eight local disaster declarations, it has a High Probability and scored a four. If the hazard/event resulted in nine or more declarations, it should receive an Excessive Probability rating and a score of five. It is important to note that frequency was considered a key factor in determining the hazard profile. To that end, an Adjusted Frequency score was added for this factor and multiplied by 1.5 to weight the score more importantly than other factors.
Response	Average Response Duration may be defined as "time on the ground" or the time-period of response to a hazard, or event. Transportation accidents may last a few hours whereas a tire fire may last a week or a flood several weeks. Duration, therefore, may not always be indicative of the degree of damage but it remains an important planning factor.
Onset	Average Speed of Onset may affect all other factors due to lack of warning or time to prepare for impact. The lead-time required protecting lives and property varies greatly with each event. For instance, a winter storm may develop so slowly that there is time to alert crews and emplace plows, but flash floods can occur with no warning.
Magnitude	Average Magnitude is the geographic dispersion of the hazard. For instance, how much of your community would be impacted by a flood or hazardous material incident? Similar to the Frequency, this factor is deemed more important and therefore received a weighted value of 1.25 above the raw score. The score is based on the percent of land area impacted by an event.

[12] http://www.NCEI.noaa.gov/stormevents/

[13] https://www.ncdc.noaa.gov/stormevents/pd01016005curr.pdf

Risk Factor	Criteria
Business	The Impact on Business refers to enduring economic impact of the hazard on the community by an event. A score of one compares to a shutdown of critical facilities for less than 24 hours. Two equals a complete shutdown of critical facilities for one week. A score of three means a complete shutdown of critical facilities for at least two weeks. A score of four equals a complete shutdown of critical facilities for 30 days or more. This factor was developed and in keeping with the hazard analysis in the Ohio Standard Mitigation Plan developed by the Ohio EMA Mitigation Branch.
Human	This factor relates to the number of lives potentially lost to a particular hazard agent. This factor can vary between jurisdictions based on economic, geographic, and demographics of the particular populations. Therefore, some generalization need be inflected on this factor. This factor was developed and in keeping with the hazard analysis in the Ohio Standard Mitigation Plan developed by the Ohio EMA Mitigation Branch.
Property	This factor relates to the amount of property potentially lost to a particular hazard agent. This factor can vary between jurisdictions based on economics, geographic amount owned, and demographics of the particular populations. Therefore, some generalization need be inflected on this factor. This factor was developed and in keeping with the hazard analysis in the Ohio Standard Mitigation Plan developed by the Ohio EMA Mitigation Branch.

For consistency in analysis, the Planning Team used the property inventory and average values from the FEMA HAZUS-MH – Multi-hazard Risk Assessment Program for Analyzing Potential Losses simulations (addressed later in this plan) used in flooding and earthquake hazard analysis.

Structure Type	Inventory	Average Value	Total Value
Residential	15,278	$233,398	$3,565,854,644
Nonresidential	3,248	$1,038,800	$3,374,022,400
Critical	29	$1,038,800	$30,125,200
Totals	18,555		$6,970,002,244

To assist in estimating damage to structure in the absence of actual historical data, the team used the following formulas:

Number (of Structures) At Risk = Inventory x Percent At Risk
Number (of Structures) Damaged = Number At Risk x Percent Damaged
Total (Monetary) Damages = Number Damaged x Percent Damaged x Average Value

The team estimated the percent of total or actual numbers of structures at risk, the percent of these or actual number of damaged in a typical event and the percent of structure or actual structural damage. Knowing the inventory and average value, total damages incurred for a typical event were then calculated. Percentages were used when hard estimates were not available.

D. Hazard and Vulnerability Analysis Results

The following summarizes the analysis results. Details are contained in *Section V – Hazard Profiles, Analyses and Vulnerable Assets*.

1. Hazard Analysis

The following table consolidates and ranks the analysis of each hazard:

Hazard	Frequency	Response	Onset	Magnitude	Business Impact	Human Impact	Property Impact	Adjusted Total
Flooding	6	5	4	2.5	3	2	3	25.5
Severe Summer Storm	4.5	1	3	5	1	2	1	17.5
Severe Winter Storm	4.5	3	1	5	1	2	1	17.5
Earthquake	1.5	5	2	1.25	3	2	1	15.75
Tornado	3	1	4	1.25	2	2	1	14.25
Infectious Disease	3	3	1	0	3	4	0	14
Dam/Levee Failure	3	3	1	1.25	0	1	1	10.25
Wildfire	3	1	4	1.25	0	0	1	10.25
Drought	1.5	5	1	0	1	0	1	9.5
Cyber Attack	1.5	3	4	0	0	0	0	8.5
Land Subsidence	1.5	1	1	1.25	1	0	2	7.75
Mud/Landslide	1.5	1	1	1.25	0	1	1	6.75
Hazardous Material Release	1.5	1	4	0	0	0	0	6.5

2. Vulnerability Analysis

The following table consolidates the estimated property impact analysis of each vulnerability (in millions):

	Structures at Risk				Structural Damage			
Hazard	Res*	Non-Res	Cri-tical	Total	Res	Non-Res	Cri-tical	Total
Flooding	3449	472	10	3931	$2,217	$56,846	$9,474	$68,537
Severe Summer Storm	13280	1212	26	14518	$1,001	$434	$22	$1,458
Severe Winter Storm	13280	1212	26	14518	$2,003	$868	$	$2,871
Earthquake	13280	1212	26	14518	$23,663	$42,901	$108	$66,672
Tornado	13280	1212	26	14518	$501	$217	$11	$729
Infectious Disease	0	0	0	0	$0	$0	$0	$0
Dam/Levee Failure	207	58	2	267	$1,661	$1,885	$65	$3,611
Wildfire	0	10	0	10	$0	$50	$0	$50
Drought	0	0	0	0	$0	$0	$0	$0
Cyber Attack	0	0	0	0	$0	$0	$0	$0
Land Subsidence	1517	66	10	1593	$16,940	$5,859	$8,794	$31,592
Mud/Landslide	266	0	0	266	$40	$0	$0	$40

*Res = Residential

Section V – Hazard Profiles, Analyses and Vulnerable Assets

A. Flooding

1. Description

Flooding is an overflowing of water onto land that is normally dry. Floods can happen during heavy rains, when snow melts too fast, or when dams or levees break. Flooding may happen with only a few inches of water, or it may cover a house to the rooftop. They can occur quickly or over a long period and may last days, weeks, or longer. Floods are the most common and widespread of all weather-related natural disasters.

Flash floods are the most dangerous kind of floods because they combine the destructive power of a flood with incredible speed and unpredictability. Flash floods occur when excessive water fills normally dry creeks or riverbeds along with currently flowing creeks and rivers, causing rapid rises of water in a short amount of time. They can happen with little or no warning.

Areas near rivers are at risk from flash floods. Embankments, known as levees, are often built along rivers and are used to prevent high water from flooding bordering land. In 1993, many levees failed along the Mississippi River, resulting in devastating flash floods. The city of New Orleans experienced massive devastating flooding days after Hurricane Katrina came onshore in 2005 due to the failure of levees designed to protect the city.

Mountains and steep hills produce rapid runoff, which causes streams to rise quickly. Rocks and clay soils do not allow much water to infiltrate the ground. Saturated soil also can lead rapidly to flash flooding. Vacationing or recreating along streams or rivers can be a risk if there are thunderstorms in the area. A creek only 6 inches deep in hilly areas can swell to a 10-foot-deep raging river in less than an hour if a thunderstorm lingers over an area for an extended period of time.

Additional high-risk locations include low water cross, recent burn [or logging] areas in mountains, and urban areas from pavement and roofs which concentrate rainfall runoff.

Ice jams and snowmelt can help cause flash floods. A deep snowpack increases runoff produced by melting snow. Heavy spring rains falling on melting snowpack can produce disastrous flash flooding. Melting snowpack may also contribute to flash floods produced by ice jams on creeks and rivers. Thick layers of ice often form on streams and rivers during the winter. Melting snow and/or warm rain running into the streams may lift and break this ice, allowing large chunks of ice to jam against bridges or other structures. This causes the water to rapidly rise behind the ice jam. If the water is suddenly released, serious flash flooding could occur downstream. Huge chunks of ice can be pushed onto the shore and through houses and buildings.

2. Extent of Hazard

The severity of flooding is measured in terms of inches of rain per hour, total inches per occurrence and the effect on community assets.

Significant events as recorded by NCEI and local sources are considered occurrences.

Major occurrences are those that caused injuries or deaths or total damage $5,000 or greater.

3. Historical Occurrence

The following occurrences caused significant damage to community assets. Available narratives follow the table. Primary Source: NCEI[14]

[14] http://www.NCEI.noaa.gov/stormevents/

Event	Date	Injured	Deaths	Property Damage	Crop Damage
Flash Flood	3/11/1997			$7,000,000	$0
Flash Flood	1/17/1998			$80,000	$0
Flash Flood	6/16/1998			$10,000	$0
Flash Flood	6/29/1998			$900,000	$0
Flash Flood	2/13/2000			$30,000	$0
Flash Flood	2/18/2000			$100,000	$0
Flash Flood	7/10/2000			$30,000	$0
Flash Flood	5/18/2001			$10,000	$0
Flash Flood	5/21/2001			$400,000	$0
Flood	4/21/2002			$30,000	$0
Flood	4/28/2002			$10,000	$0
Flood	5/10/2003			$500,000	$0
Flash Flood	7/10/2003			$100,000	$0
Flood	11/12/2003			$6,000	$0
Flood	1/14/2004			$10,000	$0
Flood	9/18/2004			$20,000	$0
Flood	3/19/2008			$20,000	$0
Flood	6/14/2008			$10,000	$0
Flood	5/12/2010			$150,000	$0
Flash Flood	6/13/2010			$40,000	$0
Flash Flood	8/11/2010			$20,000	$0
Flood	4/12/2011			$10,000	$0
Flood	4/23/2011			$10,000	$0
Flash Flood	5/10/2011			$16,000,000	$0
Flash Flood	5/14/2012			$500,000	$0
Flood	4/30/2014			$20,000	$0
Flash Flood	6/26/2015			$100,000	$0
Flash Flood	7/12/2015			$10,000	$0
Flash Flood	7/13/2015			$1,600,000	$0
Flash Flood	7/14/2015			$20,000	$0
Flash Flood	7/29/2016			$20,000	$0
Flash Flood	5/31/2019			$8,000	$0
Flood	12/16/2019			$8,000	$0

Available narratives of major events can be found in *Section IV – Supplemental Information*.

4. Probability of Future Occurrences

	Years	Events	Average Injuries	Average Deaths	Average Property Damage	Average Crop Damage	Annual Probability	Mean Time Between Occurrences (Months)
All Events	30	43	0	0	$646,721	$0	143%	8
Major Events	30	33	0	0	$841,879	$0	110%	11

5. Affected Locations

Flooding affects the entire county. There are mapped flood plain areas in portions of every township in Jackson County as well as in the City of Jackson, the Village of Coalton, and the City of Wellston. The Village of Oak Hill is the only political subdivision in Jackson County with no flood plain areas. However, areas not identified as being in a flood plain can experience flooding as well. The National Flood Insurance Administration estimates that one-third of the claims that they receive are for structures located outside of a mapped flood plain.

A repetitive loss properties (structures) is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. A severe repetitive loss (SRL) property has had four or more claims of at least $5,000, or at least two claims that cumulatively exceed the building's reported value.

Structures that flood frequently strain the National Flood Insurance Fund. In fact, the repetitive loss properties are the biggest draw on the Fund. Community leaders and residents are also concerned with the repetitive loss problem because residents' lives are disrupted and may be threatened by the continual flooding. The primary objective of the repetitive loss properties strategy is to eliminate or reduce the damage to property and the disruption to life caused by repeated flooding of the same properties.[15]

There are a number of repetitive loss structures in Jackson County[16] and are summarized below (as of April 2022):

Community Name	Residential Single Family Structures	Residential 2-4 Family Structures	Non-Residential Structures	Total Losses
Jackson County (Unincorp.)	9		6	22
Village of Coalton	13			13
City of Jackson	24	2	13	39
City of Wellston	7			7

[15] https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt
[16] FEMA Region 5

6. Analysis

Factor	Ranking
Frequency	High: 6-8 Declarations
Response	> 1 Month
Onset	< 6 Hours
Magnitude	10-25% Land Area
Business	>= 2 Weeks
Human	Some Injuries
Property	25-50% Damaged

7. Vulnerable Community Assets

Asset	Impact
People	Major flooding potentially affects a large portion of the population, either directly or indirectly. This includes structural damages, isolation from essential services, need for relocation or sheltering, injuries and possibly death.
Economy	Flooded businesses would be out of business until clean up can be completed and damaged inventory replaced.
Infrastructure	The primary vulnerable infrastructure assets are roads, culverts and bridges, damaged by erosion. Additionally, water and wastewater treatment plants may inundated and placed out of service.
Structures	Structures in flood plains in the cities of Jackson and Wellston, the village of Coalton and the unincorporated areas of Jackson County are at risk. The Planning Team used the results of FEMA's HAZUS-MH simulation of a 100-year flood for Jackson County. The information in the following tables was extracted from this report; the information was then reformulated into a standard format for this plan.

8. Estimated Structural Damages

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	13	2	25	1	13	3	38	0	0	1	13
Commercial	2	22	6	67	0	0	1	11	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	2	100	0	0	0	0	0	0	0	0
Religion	0	0	2	100	0	0	0	0	0	0	0	0
Residential	19	23	42	50	14	17	4	5	1	1	4	5
Total	**22**		**54**		**15**		**8**		**1**		**5**	

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	8	0	0	0
Hospitals	1	0	0	0
Police Stations	6	0	0	0
Schools	13	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	21.34	7.98	20.78	5.58	55.69
	Content	9.67	22.52	61.09	18.20	111.47
	Inventory	0.00	6.23	13.55	12.40	32.18
	Subtotal	**31.01**	**36.73**	**95.42**	**36.18**	**199.35**
Business Interruption						
	Income	0.31	17.92	3.01	4.92	26.16
	Relocation	6.37	6.82	2.98	2.41	18.57
	Rental Income	2.82	4.35	0.76	0.23	8.16
	Wage	0.74	20.97	3.86	17.01	42.58
	Subtotal	**10.24**	**50.05**	**10.61**	**24.57**	**95.47**
ALL	**Total**	**41.25**	**86.78**	**106.03**	**60.75**	**294.81**

B. Severe Summer Storms/Thunderstorms/Windstorms/Hail

1. Description

A thunderstorm is a rain shower during which you hear thunder. Since thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is the result of convection. Usually created by surface heating, convection is upward atmospheric motion that transports whatever is in the air along with it—especially any moisture available.

Damaging winds are often called “straight-line” winds to differentiate the damage they cause from tornado damage. Strong thunderstorm winds can come from a number of different processes. Most thunderstorm winds that cause damage at the ground are a result of outflow generated by a thunderstorm downdraft. Damaging winds are classified as those exceeding 50-60 mph.

Damage from severe thunderstorm winds account for half of all severe reports in the lower 48 states and is more common than damage from tornadoes. Wind speeds can reach up to 100 mph and can produce a damage path extending for hundreds of miles.

Since most thunderstorms produce some straight-line winds as a result of outflow generated by the thunderstorm downdraft, anyone living in thunderstorm-prone areas of the world is at risk for experiencing this hazard. People living in mobile homes are especially at risk for injury and death. Even anchored mobile homes can be seriously damaged when winds gust over 80 mph.

Severe windstorms can have a devastating effect on a community. Winds can cause trees to fall and structures to fail. These can cascade into other impacts such as downed power lines, interrupting travel and power, and trees blocking roads and causing damage to close-by structures.

Hail is often produced by severe thunderstorms. Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice. Hail can damage aircraft, homes and cars, and can be deadly to livestock and people.

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Hailstorms frequently accompany thunderstorms, so their locations and spatial extents overlap. Hail can cause substantial damage to vehicles, roofs, landscaping, and other areas of the built environment. U.S. agriculture is typically the area most affected by hailstorms, which cause severe crop damage even during minor events.

Hail is usually pea-sized to marble-sized, but big thunderstorms can produce big hail.

2. Extent of Hazard

A thunderstorm is classified as “severe” when it contains one or more of the following: hail one inch or greater or winds gusting in excess of 50 knots (57.5 mph). Additionally, rainfall rates greater than 2 inches per hour or one that produces hail indicates a severe thunderstorm.

The severity of hailstorms is measured in hail size. Hail of .75-inch diameter is considered to be damaging.

Significant events as recorded by NCEI and local sources are considered occurrences.

Major occurrences are those that caused injuries, deaths or total damage $5,000 or greater.

3. Historical Occurrence

The following major occurrences were recorded by the National Centers for Environmental Information (NCEI)[17] and local records.

Event	Date	Injured	Deaths	Property Damage	Crop Damage
Thunderstorm Wind	2/21/1993			$100,000	$0
Thunderstorm Wind	8/17/1993			$10,000	$0
Thunderstorm Wind	4/15/1994			$100,000	$0
Thunderstorm Wind	6/20/1994			$10,000	$0
Thunderstorm Wind	6/21/1994			$100,000	$0
Thunderstorm Wind	7/21/1994	6		$1,000,000	$0
Thunderstorm Wind	7/25/1994			$10,000	$0
Thunderstorm Wind	6/26/1995			$10,000	$0
Thunderstorm Wind	7/13/1995			$10,000	$0
Thunderstorm Wind	4/23/1996			$20,000	$0
Thunderstorm Wind	4/23/1996			$6,000	$0
Thunderstorm Wind	5/14/1996			$100,000	$0
Thunderstorm Wind	6/17/1996			$6,000	$0
Thunderstorm Wind	5/19/1997			$6,000	$0
Thunderstorm Wind	7/12/1997			$12,000	$0
Thunderstorm Wind	8/17/1997			$10,000	$0
Thunderstorm Wind	5/21/1998			$20,000	$0
Hail	5/24/1998			$30,000	$0
Hail	5/31/1998			$150,000	$0
Thunderstorm Wind	5/31/1998			$400,000	$0
Thunderstorm Wind	6/29/1998			$10,000	$0
Thunderstorm Wind	7/19/1998			$6,000	$0
Thunderstorm Wind	7/10/2000			$300,000	$0
Thunderstorm Wind	7/14/2000			$210,000	$0
Hail	7/14/2000			$100,000	$0
Thunderstorm Wind	8/19/2000			$30,000	$0
Thunderstorm Wind	5/21/2001			$92,000	$0
High Wind	3/19/2002			$10,000	$0
Thunderstorm Wind	6/14/2005			$10,000	$0
Heavy Rain	5/31/2006			$30,000	$0
High Wind	1/19/2008			$40,000	$0
Thunderstorm Wind	2/11/2009			$40,000	$0
Thunderstorm Wind	6/12/2010			$22,000	$0
Thunderstorm Wind	10/26/2010			$8,000	$0
Thunderstorm Wind	2/28/2011			$20,000	$0
Thunderstorm Wind	3/23/2011			$150,000	$0
Hail	5/10/2011			$150,000	$0
Thunderstorm Wind	6/17/2011			$10,000	$0
Thunderstorm Wind	6/21/2011			$50,000	$0
Thunderstorm Wind	5/11/2012			$12,000	$0

[17] http://www.NCEI.noaa.gov/stormevents/

Event	Date	Injured	Deaths	Property Damage	Crop Damage
Thunderstorm Wind	5/14/2012			$10,000	$0
Thunderstorm Wind	6/29/2012			$3,000,000	$0
Thunderstorm Wind	7/11/2012			$30,000	$0
Thunderstorm Wind	7/26/2012	2		$10,000	$0
Hail	9/26/2012			$10,000	$0
Strong Wind	11/24/2014			$20,000	$0
Hail	4/19/2015			$20,000	$0
Thunderstorm Wind	4/19/2015			$400,000	$0
Thunderstorm Wind	5/11/2015			$10,000	$0
Thunderstorm Wind	6/26/2015			$40,000	$0
Thunderstorm Wind	7/13/2015			$10,000	$0
Thunderstorm Wind	8/10/2015			$20,000	$0
Strong Wind	3/11/2016			$20,000	$0
Strong Wind	4/12/2016			$100,000	$0
Thunderstorm Wind	4/28/2017			$14,000	$0
Strong Wind	2/24/2019			$50,000	$0
Thunderstorm Wind	4/14/2019			$30,000	$0
Thunderstorm Wind	5/29/2019			$6,000	$0
Thunderstorm Wind	8/20/2019			$8,000	$0
Strong Wind	11/27/2019			$40,000	$0
Thunderstorm Wind	4/18/2020			$6,000	$0
Thunderstorm Wind	6/10/2020			$18,000	$0
Thunderstorm Wind	6/21/2021			$32,000	$0

Available narratives of major events can be found in *Section IV – Supplemental Information*.

4. Probability of Future Occurrences

	Years	Events	Average Injuries	Average Deaths	Average Property Damage	Average Crop Damage	Annual Probability	Mean Time Between Occurrences (Months)
All Events	30	162	0.05	0	$45,870	$0	540%	2
Major Events	30	64	0.12	0	$114,750	$0	213%	6

5. Affected Locations

Severe summer storms affect the entire county.

6. Analysis

Factor	Ranking
Frequency	Medium: 3-5 Declarations
Response	< 1/2 Day
Onset	6-12 Hours
Magnitude	> 50% Land Area
Business	< 24 Hours
Human	Some Injuries
Property	< 10% Damaged

Note: The *Hazards U.S. Multi-Hazard* (HAZUS-MH) scenario of a 100 Ymagnitude 5.0 earthquake with an epicenter in the city of Jackson was used to estimate Vulnerable Community Assets and Estimated Structural Damages. This report may be found in *Section VIII – Supplemental Information*.

7. Vulnerable Community Assets

Asset	Impact
People	The primary impact on people would be isolation and not being able to travel at least on primary routes for several hours – perhaps more on township roads that may be washed out. In some cases county roads, state routes and US highways may also be rendered impassible due to erosion damage. Injuries are possible from hail and other falling objects.
Economy	Loss of power affect businesses both in loss of sales and regrigeration.
Infrastructure	The primary vulnerable infrastructure assets are roads, culverts and bridges, damaged by erosion. Lightning may adversely affect electrical and communications systems.
Structures	All structures are at risk for rain water and hail damage. The Planning Team estimates that in a typical event, 1% of structures at risk would be damaged with an average of 5% damage.

8. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages
			%	Number	%	Number	%	Total
Residential	15,278	$233,398	100	15,278	1	153	5	$1,456,286
Nonresidential	3,248	$1,038,800	100	3,248	1	32	5	$693,918
Critical	29	$1,038,800	100	29	1	0	5	$35,838
Totals	**18,555**					**186**		**$2,186,043**

C. Severe Winter Storms

1. Description

A winter storm is an event in which the main types of precipitation are snow, sleet or freezing rain. Winter Storm hazards include wind chill, ice storms, heavy snow, and blizzard conditions.

Most deaths from winter storms are not directly related to the storm itself.

- People die in traffic accidents on icy roads.
- People die of heart attacks while shoveling snow.
- People die of hypothermia from prolonged exposure to cold.

Everyone is potentially at risk during winter storms. The actual threat to you depends on your specific situation. Recent observations show that:

Of injuries related to ice and snow:

- About 70% occur in automobiles.
- About 25% are people caught out in the storm.
- Majority are males over 40 years old.

Of injuries related to exposure to cold:

- 50% are people over 60 years old.
- Over 75% are males.
- About 20% occur in the home.

Three basic ingredients are necessary to make a winter storm:

- Cold air. Below freezing temperatures in the clouds and near the ground are necessary to make snow and/or ice.
- Lift. Something to raise the moist air to form the clouds and cause precipitation. An example of lift is warm air colliding with cold air and being forced to rise over the cold dome. The boundary between the warm and cold air masses is called a front. Another example of lift is air flowing up a mountainside.
- Moisture. To form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean, is an excellent source of moisture.

The severity may be measured in inches of snow or ice, but it's more the combination of freezing precipitation with the ambient and precipitation conditions just before the storm as well as the duration of freezing temperatures with temperatures hovering around freezing being an enhancer to the severity.

Wet Snow and Freezing Rain can weigh down power lines, tree limbs and roofs of structures. Wet snow compacts and can be difficult to dispose of.

Ice results for rain freezing or snow compacting. In addition to the effects of wet snow and freezing rain, ice can build up over time. As the temperature drops, it becomes harder and difficult to remove with snowplows; heavy equipment is usually needed. As the temperature rises above freezing, ice left on gravel roads, as are most township roads, will melt and seep into the roadbed causing the "bottom to drop out."

Dry Snow is usually not a significant problem as it can be plowed away.

There may also be flooding if the snow/ice accumulation is significant and the temperatures warm quickly.

Severe winter storms are those winter storms that have a significant impact. Source: NOAA[18]

2. Extent of Hazard

The severity of winter storms is measured in terms of snowfall, wind and temperature. Generally, a severe winter storm adds at least 6 new inches of snow, has winds of 40 mph or greater, causes ice accumulation of ½ inch or more or has a wind chill factor or less than 0 degrees.

Any of these are considered occurrences.

Major occurrences are those that caused injuries, deaths or total damage $5,000 or greater.

3. Historical Occurrence

The following major occurrences were recorded by the NCEI and local records.

Event	Date	Injured	Deaths	Property Damage	Crop Damage
Ice Storm	2/16/2003			$1,500,000	$0
Extreme Cold/Wind Chill	1/16/2014			$100,000	$0
Extreme Cold/Wind Chill	1/27/2014			$100,000	$0
Heavy Snow	3/14/2015			$40,000	$0
Winter Weather	1/19/2019			$20,000	$0

Available narratives of major events can be found in *Section VIII – Supplemental Information*.

4. Probability of Future Occurrences

	Years	Events	Average Injuries	Average Deaths	Average Property Damage	Average Crop Damage	Annual Probability	Mean Time Between Occurrences (Months)
All Events	30	80	0	0	$22,050	$0	267%	4
Major Events	30	5	0	0	$352,000	$0	17%	72

5. Affected Locations

Severe winter storms affect the entire county.

6. Analysis

Factor	Ranking
Frequency	Medium: 3-5 Declarations
Response	< 1 Week
Onset	> 24 Hours
Magnitude	> 50% Land Area
Business	< 24 Hours
Human	Some Injuries
Property	< 10% Damaged

7. Vulnerable Community Assets

Asset	Impact
People	The primary impact on people would be isolation and not being able to travel at least on primary routes for about 12 hours after

[18] http://www.nssl.noaa.gov/education/svrwx101/winter/

Asset	Impact
	the storm subsided. People living on township roads may be affected for several days to a week. Injuries may occur from traveling in hazardous conditions, home fires from using auxillary heat sources, lack of heat and building/roof collaspe.
Economy	Loss of power affect businesses both in loss of sales and regrigeration.
Infrastructure	The primary vulnerable infrastructure assets are roads – covered to the point of not being passable and the roadbed being damaged by thawing. Electric and communications lines and poles may be damaged by heavy snow and ice.
Structures	While historical records reflect no structures damaged, older structures and those with flat roofs may be affected by the weight on their roofs. An estimated 1% of the non-critical structures in the county fall into this category potentially receiving 10% structural damage.

8. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages	
			%	Number	%	Number	%	Total
Residential	15,278	$233,398	100	15,278	1	153	10	$2,912,573
Nonresidential	3,248	$1,038,800	100	3,248	1	32	10	$1,387,836
Critical	29	$1,038,800	100	29	1	0		$0
Totals	**18,555**					**185**		**$4,300,410**

D. Earthquakes

1. Description

An earthquake is caused by a sudden slip on a fault. The tectonic plates are always slowly moving, but they get stuck at their edges due to friction. When the stress on the edge overcomes the friction, there is an earthquake that releases energy in waves that travel through the earth's crust and cause the shaking that we feel. Source: USGS[19]

Ohio is located near the New Madrid fault. Jackson County is in the part of Ohio that is designated with a Modified Mercalli Intensity (MMI) of VIII, which anticipates moderate damage. In spite of this, there has been little seismic activity near Jackson County.

2. Extent of Hazard

Earthquakes are typically measured on the Richter scale.

The impact of earthquakes is measured on the Modified Mercalli Scale. The table at the right depicts the sale and its relationship to the Richter Scale.

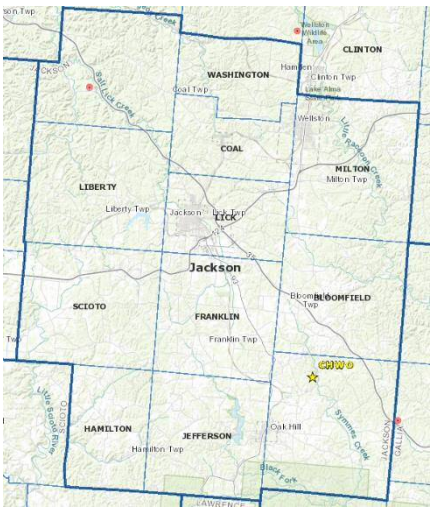
Any recorded earthquake of magnitude 3 or more is considered an occurrence.

Modified Mercalli Scale		Richter Magnitude Scale
I	Detected only by sensitive instruments	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibration like passing truck	2.5
IV	Felt indoors by many, outdoors by few, at night some may awaken; dishes, windows, doors disturbed; autos rock noticeably	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	3.5
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small	4
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos	4.5
VIII	Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed	5
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	5.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	6
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	6.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up in air	7
		7.5
		8

3. Historical Occurrence

This map from the Ohio Department of Natural Resources[20] extends back into the 1800s, showing seismic activity in Jackson County:

- 2015 – 2.6 – Jackson Twp



[19] http://www.usgs.gov/faq/categories/9827/3343
[20] https://gis.ohiodnr.gov/MapViewer/?config=Earthquakes

4. Probability of Future Occurrences

The USGS reports a 2% probability that Jackson County will be faced with a peak ground acceleration (PGA) of .06 within 50 years. While the USGS hasn't drawn a direct correlation between PGA and magnitude, the Laboratorio de Ingeniería Sísmica, Instituto de Investigaciones en Ingeniería, Universidad de Costa Rica[21], published research[22] estimating this relationship. A PGA of 2 to 3 relates to a Modified Mercalli Intensity of II and magnitude of 2, characterized as "Felt only by a few persons at rest, especially on upper floors of buildings." Source: USGS[23].

There is less than a 1% probability of a significant damaging occurrence in any given year.

5. Affected Locations

Earthquakes affect the entire county.

6. Analysis

Factor	Ranking
Frequency	None: No Declarations
Response	> 1 Month
Onset	12-24 Hours
Magnitude	10% Land Area
Business	>= 2 Weeks
Human	Some Injuries
Property	< 10% Damaged

Note: The *Hazards U.S. Multi-Hazard* (HAZUS-MH) scenario of a magnitude 5.0 earthquake with an epicenter in the city of Jackson was used to estimate Vulnerable Community Assets and Estimated Structural Damages. This report may be found in *Section VIII – Supplemental Information*.

7. Vulnerable Community Assets

Asset	Impact
People	Casualities. HAZUS-MH estimates that 159 people would receive minor injuries, 40 people would receive greater non-life-threatening injuries, 6 people would receive life-threating injuries and 10 people would die. Displaced and Sheltered. HAZUS-HM estimates 373 people would be displaced and 214 people would seek shelter in public shelters. Electric Service. HAZUS-MH estimates that 82% of households would lose electricity at onset. After one week, 35% would still be without electricity. 4% would still be without electricty after one month.

[21] http://www.lis.ucr.ac.cr/ index.php?id=Inicio
[22] https://www.semanticscholar.org/paper/RELATIONSHIP-BETWEEN-PEAK-GROUND-ACCELERATION-AND-Linkimer/1cda3fbac2d28338452ae8df70f182af6fede9f0
[23] http://earthquake.usgs.gov/learn/topics/mercalli.php

Asset	Impact
Economy	HAZUS-MH estimates a total economic loss of $1,083.77 million. Loss of rail access to area businesses would severely impact supply of goods.
Infrastructure	HAZUS-HM estimates all infrustructure, except for 3 bridges, would unaffected or operational within one day. It also estimates that 3 wastewater treatment systems would have moderate damage and would be operational within 7 days. Two of 4 communication systems would have similar damage and restoration. Transportation/utility losses of $144.34 million are estimated.
Structures	HAZUS-MH estimates the following structural damages. Subsidence is probable.

8. Estimated Structural Damages

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	502.77	5.93	293.74	6.50	386.38	10.63	213.18	13.92	53.93	13.91
Commercial	374.06	4.41	279.59	6.19	356.42	9.80	185.73	12.13	55.20	14.24
Education	5.13	0.06	3.32	0.07	4.12	0.11	1.86	0.12	0.57	0.15
Government	29.85	0.35	20.19	0.45	26.74	0.74	11.58	0.76	3.64	0.94
Industrial	75.60	0.89	49.88	1.10	69.23	1.90	39.47	2.58	10.82	2.79
Other Residential	1467.04	17.30	1011.26	22.38	1315.37	36.18	656.67	42.89	140.66	36.29
Religion	91.30	1.08	50.41	1.12	48.73	1.34	25.10	1.64	7.46	1.92
Single Family	5935.88	69.99	2810.45	62.19	1428.74	39.30	397.63	25.97	115.30	29.75
Total	**8,482**		**4,519**		**3,636**		**1,531**		**388**	

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	1	0	0
Schools	13	6	0	5
EOCs	1	0	0	1
PoliceStations	6	0	0	5
FireStations	8	1	0	5

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	3.3356	35.8267	2.5388	4.4755	46.1766
	Capital-Related	0.0000	1.4183	29.4772	1.6822	1.7169	34.2946
	Rental	4.7789	5.6442	15.7852	1.1144	1.8438	29.1665
	Relocation	17.1540	8.8918	26.7816	5.7022	18.5878	77.1174
	Subtotal	**21.9329**	**19.2899**	**107.8707**	**11.0376**	**26.6240**	**186.7551**
Capital Stock Losses							
	Structural	29.2324	13.7954	42.2386	21.8092	64.7302	171.8058
	Non_Structural	116.5643	59.3241	110.6586	69.6742	77.3326	433.5538
	Content	47.9969	16.0440	63.1040	51.8927	52.3841	231.4217
	Inventory	0.0000	0.0000	14.6294	11.7646	33.8401	60.2341
	Subtotal	**193.7936**	**89.1635**	**230.6306**	**155.1407**	**228.2870**	**897.0154**
	Total	**215.73**	**108.45**	**338.50**	**166.18**	**254.91**	**1083.77**

E. Tornadoes

1. Description

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust and debris. Tornadoes are the most violent of all atmospheric storms.

Source: NOAA[24]

2. Extent of Hazard

EF 0	65-85 mph
EF 1	86-110 mph
EF 2	111-135 mph
EF 3	136-165 mph
EF 4	166-200 mph
EF 5	Over 200 mph

The severity of tornadoes is measured by the damaged it caused and relates it back to estimated three-second wind speed. The Enhanced Fujita Scale is used to rate tornadoes.

Significant tornadic events as recorded by NCEI and local sources are considered occurrences.

Major occurrences are those that caused injuries, deaths or total damage $5,000 or greater.

3. Historical Occurrence

The following major occurrences were recorded by the National Centers for Environmental Information (NCEI)[25] and local records.

Event	Date	Injured	Deaths	Property Damage	Crop Damage
Tornado	7/26/1992			$500,000	$0
Tornado	4/15/1994			$100,000	$0
Tornado	6/27/2018			$300,000	$0

Available narratives of major events can be found in *Section IV – Supplemental Information*.

4. Probability of Future Occurrences

	Years	Events	Average Injuries	Average Deaths	Average Property Damage	Average Crop Damage	Annual Probability	Mean Time Between Occurrences (Months)
All Events	30	4	0	0	$225,000	$0	13%	90
Major Events	30	3	0	0	$300,000	$0	10%	120

5. Affected Locations

Tornadoes affect the entire county.

6. Analysis

Factor	Ranking
Frequency	Low: 1-2 Declarations
Response	< 1/2 Day
Onset	< 6 Hours
Magnitude	10% Land Area

[24] http://www.nssl.noaa.gov/education/svrwx101/wind/
[25] http://www.NCEI.noaa.gov/stormevents/

Business	1 Week
Human	Some Injuries
Property	< 10% Damaged

7. Vulnerable Community Assets

Asset	Impact
People	People in damaged structures may be injured.
Economy	Businesses damaged would be back in business within one week.
Infrastructure	Little to no impact
Structures	Structures damaged by an EF1 tornado will likely suffer 10% damage. The Planning Team estimates that less than 1% of structures at risk will be damaged by a typical tornado.

8. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages
			%	Number	%	Number	%	Total
Residential	15,278	$233,398	100	15,278	0.2	38	10	$728,143
Nonresidential	3,248	$1,038,800	100	3,248	0.2	8	10	$346,959
Critical	29	$1,038,800	100	29	0.2	0	10	$17,919
Totals	**18,555**					**46**		**$1,093,021**

F. Infectious Disease

1. Description

Disease outbreaks are usually caused by an infection, transmitted through person-to-person contact, animal-to-person contact, or from the environment or other media. Occasionally the cause of an outbreak is unknown, even after thorough investigation.

A number of environmental factors influence the spread of communicable diseases that are prone to cause epidemics. The most important of these are:

- water supply
- sanitation facilities
- food
- climate

A lack of safe water, inadequate excreta disposal facilities, poor hygiene, poor living conditions and unsafe food can all cause diarrheal diseases. These diseases are a major cause of suffering and death in an emergency situation.

Climate can affect disease transmission in a variety of ways. The distribution and population size of disease vectors can be heavily affected by local climate. Flooding after heavy rains can result in sewage overflow and widespread water contamination. In addition, there is some evidence to suggest that pathogens can be spread from one region to another along air streams or by wind.

Occasionally, an outbreak is seen in a population for which the cause is unclear. Such an outbreak may be due to a new or modified pathogen, a natural toxin, or it may be due to an initially undetected release of a chemical agent or over-exposure to ionizing radiation.

Source: World Health Organization[26]

For transmission to occur, there must be a source (typically an infected person), susceptible person and a mode of transmission. Typical modes of transmission are:

- Contact moves germs by touching germs present on surfaces and then carry the germs on their hands and spread to a susceptible person when proper hand hygiene is not performed before touching the susceptible person.
- Sprays and splashes occur when an infected person coughs or sneezes, creating droplets which carry germs short distances (within approximately 6 feet). These germs can land on a susceptible person's eyes, nose, or mouth and can cause infection. Close range inhalation occurs when a droplet containing germs is small enough to breathe in but not durable over distance.
- Inhalation occurs when germs are aerosolized in tiny particles that survive on air currents over great distances and time and reach a susceptible person. Airborne transmission can occur when infected patients cough, talk, or sneeze germs into the air.

[26] https://www.who.int/environmental_health_emergencies/disease_outbreaks/communicable_diseases/en/

- Sharps injuries can lead to infections when bloodborne pathogens enter a person through a skin puncture by a used needle or sharp instrument.

Source: Centers for Disease Control and Prevention[27]

A pandemic is a disease outbreak that spreads across countries or continents. The most common and anticipated is an influenza pandemic. This is a global outbreak of a new influenza A virus that is very different from current and recently circulating human seasonal influenza A viruses. Influenza A viruses are constantly changing, making it possible on very rare occasions for non-human influenza viruses to change in such a way that they can infect people easily and spread efficiently from person to person.

2. Extent of Hazard

A major pandemic is measured by a count of occurrences that result in emergency or disaster declaration.

3. Historical Occurrences

1918-1920 – Spanish Flu. The 1918 Influenza (Spanish Flu) pandemic which lasted globally for two years. There are wildly conflicting estimates about how many people caught the flu and how many people died from it. The lack of records from the time (either due to wartime censorship or shortages) makes it hard to tell. The smallest estimate is that 17 million people died. The highest estimate is that 100 million people died, or 5% of the global population. The flu pandemic is believed to have infected 500 million people, or over a quarter of the world.

1949-1952 - Polio. Over 6,000 people die from polio in the United States, out of a reported 100,000 cases. This, followed by the development of the polio vaccine, prompts one of the first major drives to inoculate children in the U.S.

1957 – Asian Flu. The "Asian Flu," H2N2, comes to the united states from China. It originates from a mutant flu strain carried by ducks. It arrives in the U.S. in June. This influenza pandemic kills 116,000 people in the United States.

1968 – Hong Kong Flu. The "Hong Kong Flu" is the third of the three influenza pandemics of the 1900s. This flu had a much lower mortality rate than the other two, but still resulted in 33,000 deaths in the U.S.

1981-2007 – HIV/AIDS. Human immunodeficiency viruses (HIV) and the symptomatic Acquired Immunodeficiency Syndrome (AIDS) spreads across the country, especially infecting high rates of homosexual people, lower income people, and drug addicts. Treatment for the disease receives little funding and attention due to the groups it affects. The FDA approves new tests that can quickly detect HIV, and new treatments. In 2007, Timothy Ray Brown becomes the first man cured of HIV. By this time, at least 600,000 people have died of HIV/AIDS in the U.S. alone.

2009 – Swine Flu. In April, H1N1, also known as Swine Flu, broke out and quickly spread to more than 150 countries. The CDC reported that between April and October 22 million Americans had contracted the virus, 98,000 required hospitalization, and about 3,900

27 https://www.cdc.gov/infectioncontrol/spread/index.html

people died from H1N1-related causes. The WHO estimated that the final death toll worldwide ending up reaching nearly 300,000.

2020-Current – COVID-19. A new coronavirus, identified just as the novel coronavirus and then the 2019 Corona Virus Disease (COVID-19), claimed its first official victim in China. At least one American traveler returning from Wuhan contracted the disease before the city is isolated. The coronavirus outbreak reached the United States; the first U.S. victim died from the disease, prompting widespread panic. The coronavirus outbreak in the U.S. is officially declared a national emergency. The Director-General of the WHO declared the disease to have grown from epidemic proportions to a pandemic. At the urging of health officials, different states began enforcing restrictions on businesses and public gatherings to contain the disease. The economy came to a virtual standstill and unemployment soared. Local, regional, state and federal health systems and government agencies are being stressed with rapidly changing conditions particularly with the emergence of the Delta variant. The full effects and implications on how this virus will affect community assets will not be known for so time to come.

Of these occurrences, only the Spanish Flu and COVID-19 are considered major events.

4. Probability of Future Occurrences

The estimated risk of the future occurrence of a major infectious disease outbreak is once every 100 years or 1% in a given year.

5. Affected Locations

The entire county would be affected.

6. Analysis

Factor	Ranking
Frequency	Low: 1-2 Declarations
Response	< 1 Week
Onset	> 24 Hours
Magnitude	No Impact
Business	>= 2 Weeks
Human	Multiple Deaths
Property	No Impact

7. Vulnerable Community Assets

Asset	Impact
People	Many people will develop life-threatening conditions; many will also die. Measures to contain the spread the disease may cause emotional hardships for many.
Economy	In a major pandemic, portions or even most all of the economy may be shutdown - even for a short period of time would cause ripple and long-term impacts.
Infrastructure	No direct impact.
Structures	No direct impact.

8. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages	
			%	Number	%	Number	%	Total
Residential	15,278	$233,398		0		0		$0
Nonresidential	3,248	$1,038,800		0		0		$0
Critical	29	$1,038,800		0		0		$0
Totals	**18,555**					**0**		**$0**

G. Dam Failures

1. Description

A dam is defined as an artificial barrier that is usually constructed across a stream channel to impound water. A dam failure is defined as an uncontrolled release of that impounded water. The causes of dam failures can be divided into three groups: dam overtopping, excessive seepage, and structural failure of a component. Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, problems can develop that can lead to failure. While most dams have storage volumes small enough that failures would have little or no consequences, dams with large storage amounts could cause significant flooding downstream.

Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding.
- Inadequate spillway capacity, resulting in excess overtopping flows.
- Internal erosion caused by embankment or foundation leakage or piping.
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments, or maintain gates, valves, and other operational components.
- Improper design, including the use of improper construction materials and construction practices.
- Improper operation, including the failure to remove or open gates or valves during high flow periods.
- Failure of upstream dams on the same waterway that release water to a downstream dam.
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments that can weaken entire structures.

In Ohio, dams are classified by size and potential impact of failure: Class I, II, III and IV. Refer to OAC 1501:21-13-01(A)[28]

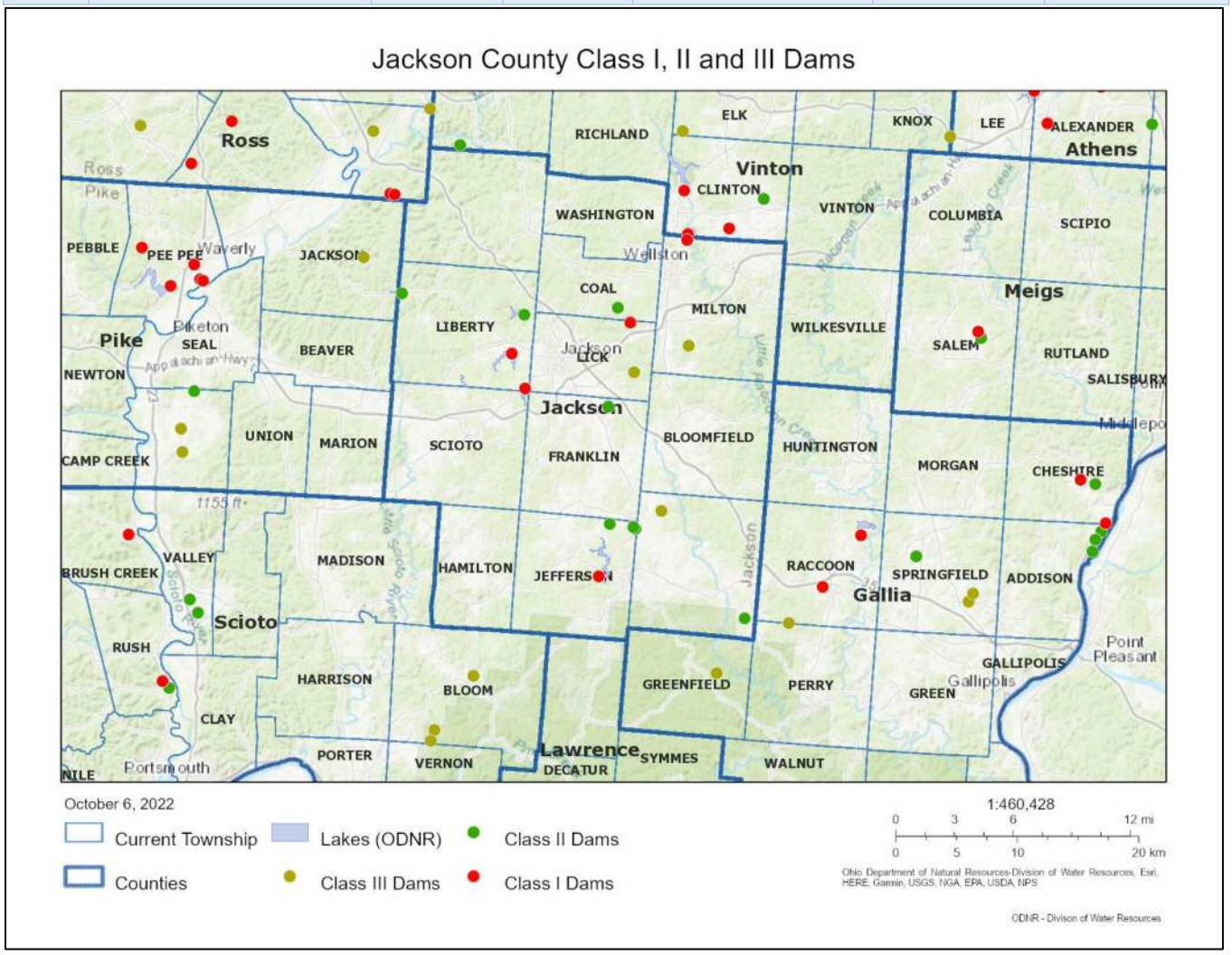
a. Inventory of Dams

The following lists Class I, II and III dams in Jackson County and their hazard ratings as listed in the US Army Corps of Engineers' National Inventory of Dams[29]:

Class	Dam Name	NID ID	Hazard Potential	River	City/ Distance(mi)	Emergency Action Plan Approval Date
I	Fairgreens Golf Club Dam	OH01807	High	Sugar Creek	Petrea (1.9)	No EAP
I	Hammertown Lake Dam	OH00507	High	Buckeye Creek	Sharon (0.9)	10/19/2006
I	Jackson Lake Dam	OH00642	High	Black Fork	Cadmus (15.2)	4/1/2019
I	Jisco Lake Dam	OH00508	High	Givens Run	Jackson (2.3)	10/19/2006
I	Wellston Reservoir Dam	OH00813	High	Little Raccoon Creek	Ratchford (1.9)	No EAP
II	Di-Or Lake Dam	OH00506	Significant	Little Salt Creek	Jackson	6/29/2020
II	Donta Lake Dam	OH00501	Significant	Symmes Creek	Cadmus (12.9)	No EAP
II	Freshwater Cross-Valley Pond 001 Dam	OH01808	Significant	Cackley Swamp	Pyro (2.7)	No EAP

[28] http://codes.ohio.gov/oac/1501:21-13-01
[29] https://nid.sec.usace.army.mil/ords/f?p=105:18:15360365863343::NO:::

Class	Dam Name	NID ID	Hazard Potential	River	City/ Distance(mi)	Emergency Action Plan Approval Date
II	Jackson Lake Dam	OH00511	Significant	Big Run	Limerick (3.8)	No EAP
II	Lake Katharine Dam	OH00510	Significant		Jackson (2.5)	10/23/2020
II	Shady Grove Dam	OH01814	Significant	Symmes Creek	Clay (1.7)	6/25/2020
II	Shire Lake Dam	OH01820	Significant	Horse Creek	Chapman (1.7)	No EAP
II	Waterloo Coal Double-Cell Slurry Dam	OH01824	Significant	Cackley Swamp	Pyro (2.5)	No EAP
III	Lake Milton Dam	OH00504	Low	Flint Run	Buckeye (5.5)	Unknown
III	Waterloo Coal Company Dam	OH01823	Low	Symmes Creek	Cadmus (21.6)	Unknown



Map Source: ODNR[30]

2. Extent of Hazard

An occurrence would be indicated by a failure of a Class I or II dam.

[30] https://gis.ohiodnr.gov/MapViewer/?config=ohiodams

3. Historical Occurrence

There have been no Class I or II dam failures in Jackson County. According to the Stanford University's National Performance of Dam Program (NPDP) Dam Incident database[31], the following eight incidents have occurred:

NPDP ID	Dam Name	Date	Incident Type	Dam Failure
OH00511	Jackson Lake Dam	08/11/1994	Inadequate Spillway Capacity	No
OH00506	Di-Or Lake Dam	02/28/1995	Seepage; Concrete Deterioration	No
OH00511	Jackson Lake Dam	03/01/1997	Inflow Flood - Hydrologic Event	No
OH00505	Morrow Lake Dam	11/23/1998	Reservoir Incident/Overtopping	No
OH00504	Strip Mine Pond Dam	03/30/1999	Concrete Deterioration	No
OH01824	Waterloo Coal Double-Cell Slurry Dam	05/25/2000	Slide	No
OH01823	Waterloo Coal Company Dam	05/25/2000	Inadequate Spillway Capacity	No
OH00510	Lake Katharine Dam	05/25/2000	Inadequate Spillway Capacity	No

4. Probability of Future Occurrences

In the American Society of Civil Engineers *2021 Ohio Infrastructure Report Card – Dams Fact Sheet*[32], Ohio dams received a grade of C-. One third of Ohio's dams were rated Poor or worse and 60% were rated Fair or worse. Based on these high-level ratings, no direct conclusions could be drawn about the failure of Jackson County's Class I and II dams. Because of this report, the probability of a failure in a given year is undetermined but possible.

5. Affected Locations

a. Class I Dams

Fairgreens Golf Club. Located in Lick Twp on County Club Rd.

Hammertown Lake. Located in the City of Jackson on Reservoir Rd.

Jackson Lake. Located in Jefferson Twp on SR 279.

Jisco Lake. Located in Liberty Twp on SR 776.

Wellston Reservoir. Located in the City of Wellston on SR 349.

Lake Alma – Vinton County. Located southeast of Hamden near the Jackson-Vinton County line and with a southerly outward flow, catastrophic failure of its dam could impact Jackson County in the Wellston area.

Lake Rupert – Vinton County. Located north of Hamden on the Wellston Wildlife Area, Lake Rupert is the head of the Little Raccoon Creek. Catastrophic failure would have potential impact on Jackson County in the Wellston area.

[31] http://ce-npdp-serv2.stanford.edu/DamDirectory/DamIncidentQuery
[32] https://infrastructurereportcard.org/state-item/ohio/

Sands Hill Slurry Impoundment – Vinton County. Located east of Hamden, the impact of a catastrophic failure of its dam could impact Milton Twp in Jackson County.

b. Class II

Donta Lake. Located in Madison Twp on Emory Centerpoint Rd.

Jackson (Big Rock) Lake. Located in Liberty Twp on Rock Run Rd.

Lake Katharine. Located in Liberty Twp on Rock Run Rd.

Shady Grove. Located in Jefferson Twp on Zane Oak Rd.

6. Analysis

Factor	Ranking
Frequency	Low: 1-2 Declarations
Response	< 1 Week
Onset	> 24 Hours
Magnitude	10% Land Area
Business	No Impact
Human	Minor Injuries
Property	< 10% Damaged

1. Vulnerable Community Assets

Asset	Impact
People	Little or no measurable impact.
Economy	Little or no measurable impact.
Infrastructure	Wellston North Water Treatment Plant Reservoir dam at risk.
Structures	The buildings in the City of Jackson's floodplain would be affected similar to a 100-year flood if the Hammertown Lake dam failed. Damages are estimated at 5% to all structures at risk.

2. Estimated Structural Damages

	Inven-	Average	At Risk		Damaged		Damages	
Structure Type	tory	Value	%	Number	%	Number	%	Total
Residential	15,278	$233,398		207	100	207	5	$2,415,669
Nonresidential	3,248	$1,038,800		58	100	58	5	$3,012,520
Critical	29	$1,038,800		2	100	2	5	$103,880
Totals	**18,555**					**267**		**$5,532,069**

H. Wildfires

1. Description

A wildfire is any uncontrolled fire with extensive size and speed in a combustible vegetative area. The danger of wildfires is that they are unpredictable, especially when weather conditions are warm, dry, and windy and the topography of the area is uneven. Wildfires occur frequently in the fall and early spring.

The vast majority of wildfires in Ohio originally caused. Most are caused by escaped debris or trash burning, filed by incendiary ignitions (arson), and those of unknown or undetermined origin. The large number of urban or suburban transplants to rural areas may contribute to increase wildfire hazard, in part because many of these residents are not familiar with how fire reacts and burns in varying environmental in weather conditions. Burning of debris, yard waste and trash are not uncommon events for many rural residents. The fact that most wildfires are caused by humans allows an opportunity to prevent these occurrences through awareness, education, in prevention campaigns.

2. Extent of Hazard

A reportable wildfire is considered an occurrence.

Major occurrences are those that caused injuries, deaths, total damage $5,000 or greater, or 100 or more acres involved.

3. Historical Occurrence

According to the Ohio Department of Natural Resources Division of Forestry's Wildfire Hazard Assessment, eastern Jackson County ranks overall moderate to high in wildfire risk, while the western portion of the county is rated as low.

Jackson County experiences several wildfires each year. They are generally burn less than 5 acres and may threaten individual homes and outbuildings. While the Planning Team found no records, a number of outbuildings – but no other structures – are known to have been damaged or destroyed. The *2019 State of Ohio Hazard Mitigation Plan (SOHMP)*[33], page 2-125 records reported wildfires for the 11-year period of 2007 – 2017 in Jackson County as follows:

Total Fire Events	Total Acres Burned	Average Acres/ Event	Est. Events per Year	1 to 9.99 Acres		10 to 99.99 Acres		100+ Acres	
				# of Events	% of Total	# of Events	% of Total	# of Events	% of Total
161	949	5.89	15	147	91.3%	11	6.83%	1	1.86

There are no reports of other than minor damage to structures and no adverse impact on people.

4. Probability of Future Occurrences

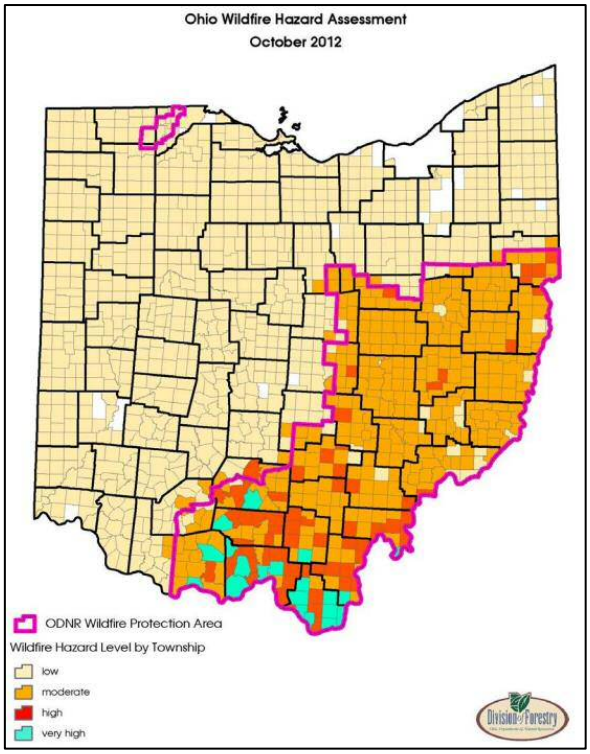
As there are no known developmental or other factors that would indicate that past trends would not extend into the future, the planning team accepts the historical occurrences to be indicative of the future. One such event in an 11-year period equates to a 9% chance in a year.

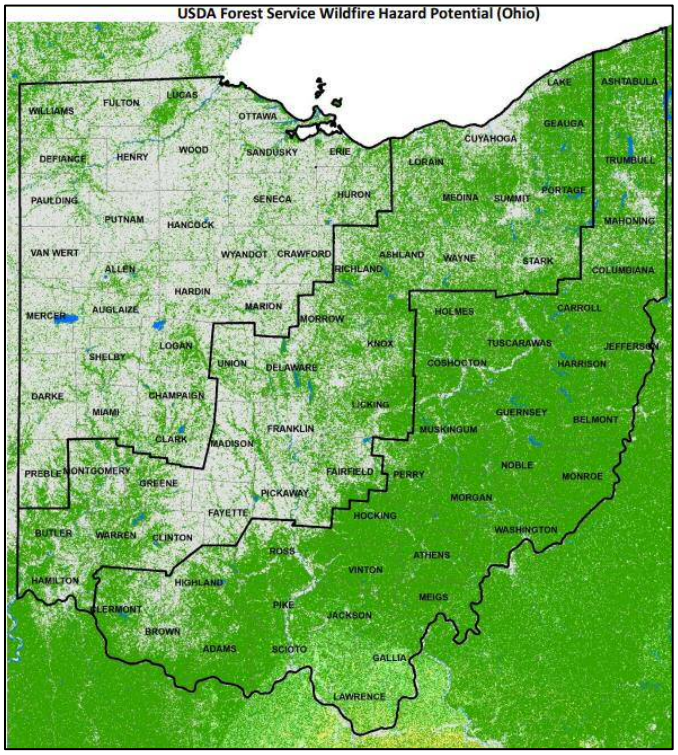
[33] https://ema.ohio.gov/mitigation-recovery/mitigation/mitigation-planning/state-of-ohio-hazard-mitigation-plan/01-state-of-ohio-hazard-mitigation-plan

	Years	Events	Average Injuries	Average Deaths	Average Property Damage	Average Crop Damage	Annual Probability	Mean Time Between Occurrences (Months)
All Events	11	70	0	0	$0	$0	636%	2
Major Events	30	3	0	0	$0	$0	9%	132

5. Affected Locations

Jackson County is located in the high/moderate wildfire risk regions. While wildfires may occur across the county, they do not pose a significant threat to populated or built-up areas. The following maps depict risk areas[34]





6. Analysis

Factor	Ranking
Frequency	Low: 1-2 Declarations
Response	< 1/2 Day
Onset	< 6 Hours
Magnitude	10% Land Area
Business	No Impact
Human	No Impact
Property	< 10% Damaged

[34] https://www.ema.ohio.gov/mip/planning_sohmp.aspx

1. Vulnerable Community Assets

Asset	Impact
People	Little or no measurable impact.
Economy	Little or no measurable impact.
Infrastructure	Little or no measurable impact.
Structures	Little or no measurable impact to residential or commercial structures. Outbuildings in high risk areas may be damaged or lost before a fire is contained.

2. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages	
			%	Number	%	Number	%	Total
Residential	15,278	$233,398		0		0		$0
Nonresidential	3,248	$1,038,800		10		10		$50,000
Critical	29	$1,038,800		0		0		$0
Totals	**18,555**					**10**		**$50,000**

I. Drought

1. Description

Drought is characterized by a period of extreme dry weather usually complicated by warm temperatures. It is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal, recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry. Drought is a temporary aberration from normal climatic conditions, thus it can vary significantly from one region to another. Drought is different than aridity, which is a permanent feature of climate in regions where low precipitation is the norm, as in a desert. Human factors, such as water demand and water management, can exacerbate the impact that drought has on a region. Because of the interplay between a natural drought event and various human factors, drought means different things to different people. In practice, drought is defined in a number of ways that reflect various perspectives and interests. Below are three commonly used definitions:

Meteorological Drought is usually defined based on the degree of dryness (in comparison to some "normal" or average) and the duration of the dry period. Drought onset generally occurs with a meteorological drought.

Agricultural Drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, soil water deficits, reduced ground water or reservoir levels needed for irrigation, and so forth.

Hydrological Drought usually occurs following periods of extended precipitation shortfalls that impact water supply (i.e., streamflow, reservoir and lake levels, ground water), potentially resulting in significant societal impacts. Because regions are interconnected by hydrologic systems, the impact of meteorological drought may extend well beyond the borders of the precipitation-deficient area. Source: NOAA[35]

2. Historical Occurrence

The following occurrences within the past 30 years caused damage to community assets. Primary Source: National Centers for Environmental Information (NCEI)[36].

- **Summer 1999 Drought**
  Drought conditions existed in Adams County for a five-month period during the summer of 1999.
  May 1999. After a dry April, drought conditions resurfaced again during May, after being alleviated during the winter months. Total rains during May were only 1.25 to 2.5 inches. The community of Adams had only 1.3 inches for the entire month, McArthur had 1.5 inches, while South Point measured 1.9 inches.
  June 1999. The drought continued to spread and strengthen in southeast Ohio. A deterioration in stream flow and soil moisture was noted. Some showers at the end of the month temporarily helped the top soil and the crops. Only 1 to 2 inches of rain fell in most areas during the entire month of June.
  July 1999. The drought strengthened during the first half of the month, then eased slightly during the last 2 weeks. The extreme heat depleted much of the moisture from the scattered showers.

[35] http://www.nws.noaa.gov/os/brochures/climate/DroughtPublic2.pdf
[36] http://www.NCEI.noaa.gov/stormevents/

August 1999. The drought eased during the month of August across southeast Ohio. Monthly rains were 3 to 6 inches. Temperatures were not as hot, as those felt during July. However, the drought still lingered at month's end.

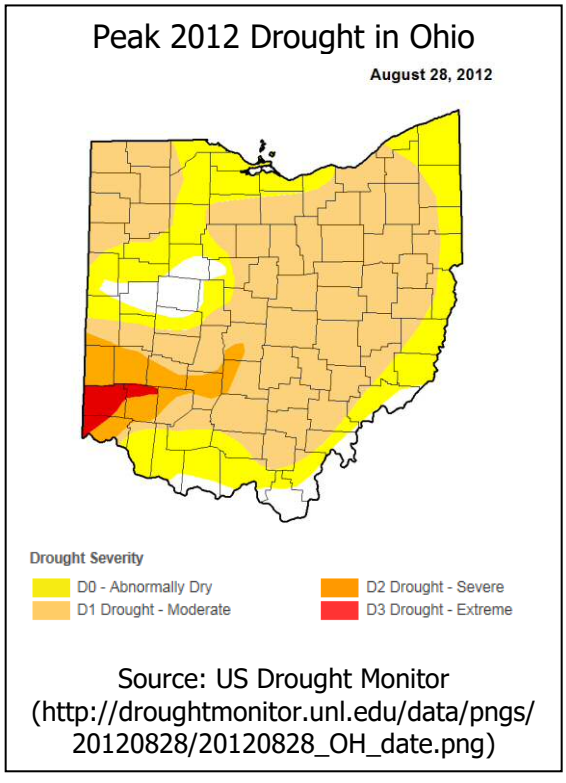
September 1999. Drought severity either increased or remain about constant during the month. The rainfall during September was mostly between 1 to 2 inches

October 1999. The drought severity eased as monthly rainfall was near normal. Amounts of 2.5 to 3.0 inches were common. Ground water shortages were still a concern at the end of the month.

- **Summer 2002 Drought**
  Two months moderate; two months severe. The emerging drought from August peaked during the first 2 weeks of September, as hot and dry conditions lingered. Rains of 1.5 to 2 inches, plus cooler temperatures, dampened the drought by the fourth week of the month.

- **Fall 2007 Drought**
  Three months moderate; one month severe. In September, drought conditions crept north, as the month averaged warmer and drier than normal. The monthly rainfall was mostly between 1 and 2 inches.
  A rare October heat wave, during the 1st and 2nd weeks of the month, helped peak the severity of the drought. With the lowering of the water table, wells were becoming less productive. Deer were dying from the effects of the drought and a dry weather disease.
  Much needed and widespread rain finally arrived on the 23rd and the 24th. Rain amounts of 2 to 3 inches were common. As the growing season ended and the autumn foliage peaked, drought conditions began to abate or ease.
  After peaking in early October, drought conditions continued to ease during the month of November. Monthly rainfall of 3 to 4 inches was common. By the end of November, the drought of 2007 was also coming to an end across southeast Ohio.

- **2012 North American Drought**
  The 2012-2013 North American Drought was an expansion of the 2010-2012 United States drought which began in the spring of 2012, when the lack of snow in the United States caused very little melt water to absorb into the soil. The drought includes most of the United States and included Ohio. Among many counties, Adams County was designated with moderate drought conditions by mid-June. It has been equaled to similar effects as droughts in the 1930s and 1950s but it has not been in place as long. However, the drought has inflected, and is expected to continue to inflict, catastrophic economic ramifications. In most measures, the drought has exceeded the 1988-1989



Source: US Drought Monitor (http://droughtmonitor.unl.edu/data/pngs/20120828/20120828_OH_date.png)

North American Drought, which is the most recent comparable drought.

On July 30, 2012, the Governor of Ohio sent a memorandum to the United States Department of Agriculture's (USDA) Ohio State Executive Director requesting primary county natural disaster designations for eligible counties due to agricultural losses caused by drought and additional disasters during the 2012 crop year. The USDA reviewed and Loss Assessment Reports and determined that there were sufficient production losses in 85 counties to warrant a Secretarial disaster designation. On September 5, 2012, Adams County was one of those designated counties. Source: Ohio EMA.

The 2012 North American Drought is the largest drought since the 1950's as reported by NOAA's National Climatic Data Center National Drought Report of 15 August 2012[37].

3. Historical Occurrence

The following major occurrences were recorded affecting Jackson County.

Event/Time Frame	Injured	Deaths	Property Damage	Crop Damage
Summer 1999 Drought	0	0	$0	$0
Summer 2002 Drought	0	0	$0	$0
Fall 2007 Drought	0	0	$0	$0
2012 North American Drought	0	0	$0	$0

4. Probability of Future Occurrences

With four major occurrences in the past 24 years, the probability of an occurrence in a given year is 17%. None resulted in recorded damages; the probability of a building damaging occurrence in a given year is close to 0%.

5. Affected Locations

Drought affects the entire county. However, it is estimated that less than 10% of the county's population uses private wells for water and this number is constantly growing smaller with the expansion of public water lines. Public water supplies are generally considered to be adequate to withstand periods of drought. The greatest impact would be on water supplies for livestock and crops.

6. Analysis

Factor	Ranking
Frequency	None: No Declarations
Response	> 1 Month
Onset	> 24 Hours
Magnitude	No Impact
Business	< 24 Hours
Human	No Impact
Property	< 10% Damaged

7. Vulnerable Community Assets

Asset	Impact
People	People relying on private wells may need to find alternate sources of potable water. 95% are on public water.

[37] http://www.NCEI.noaa.gov/sotc/drought/201207#det-reg

Asset	Impact
Economy	Agricutural impact - crops and livestock. Water-dependent businesses such as car washes.
Infrastructure	No impact.
Structures	No impact.

The following table quantifies corn and soybean production at risk:

	Planted (Acres)	Harvested (Acres)	Production (1,000 Bushels)	Price Per Unit (2021 Estimates)	Production Value
Corn (2021)	4,400	4,070	670	$5.92	$3,966,400
Soybeans (2020)	5,000	4,970	250	$13.60	$3,400,000

8. Estimated Structural Damages

	Inven-	Average	At Risk		Damaged		Damages	
Structure Type	tory	Value	%	Number	%	Number	%	Total
Residential	15,278	$233,398		0				$0
Nonresidential	3,248	$1,038,800		0				$0
Critical	29	$1,038,800		0				$0
Totals	**18,555**							**$0**

J. Land Subsidence

1. Description

A mine void found beneath the eastbound lanes of Ohio Route 32 in Jackson County. Photo courtesy of the Ohio Department of Transportation.

Subsidence is the motion of the Earth's surface as it shifts downward relative to a benchmark (often sea-level) of the surrounding terrain. There are a number of causes for this effect. In Ohio, the two primary causes are abandoned underground mines (AUMs) and karst.

Underground mining of coal began in the early 1800's and continues to current day. In the 1900s, underground salt, limestone, and gypsum mining began. All mining activities create voids under the Earth's surface. Several key factors determining the potential for these voids to collapse include depth, mining technique used, types of rock and/or soils, and development on the ground surface. Abandoned underground coal mines in Ohio have the added environmental impact of discharging acidic water. If acidic mine water is discharged into creeks or streams, it can alter the chemical composition of the water habitat and cause considerable harm to sensitive aquatic life.

Per the ODNR, Division of Geological Survey, karst is a little-known, but unique and important landform that can be found throughout the state of Ohio. Regions that contain sinkholes and other solutional features, such as caves, springs, disappearing streams, and enlarged fractures, are known as karst terrains. Sinkholes form as bedrock dissolves and surface materials erode or collapse into the resulting voids. Sinkholes are the main hazard associated with karst landforms in Ohio, and there are thousands of them in the state.

The last form of land subsidence in Ohio is associated with soils, which dramatically expand when wet and contract when dry. Structures built on these soils can experience significant shifting as the ground saturates and dries.

The current landscape in the karst region of Ohio was created by glaciers as they advanced from the north reaching to the Ohio River roughly 14,000 years ago. When the last glacier receded, it left behind a layer of unconsolidated material in a wide range of depths. The shallower the loose material layer, the greater the chance of water penetrating to the underlying bedrock, resulting in a void or ground deformation occurring. This is represented by the probable karst areas on the map which group into two significant clusters. In the south, the greatest impacted counties include Brown, Adams, and Highland. In the north, the greatest impacted counties include Seneca, Huron, Erie, Sandusky, and Ottawa.38

38 https://ohiomitigationplan.ohio.gov/wps/portal/gov/ema-mp/section-2

Ohio Department of Transportation (ODOT) assesses the risk (probability of additional movement x probability of significant impact to an ODOT asset or adjacent property or features) of abandoned underground mine sites as follows[39]:

Table 500 - 01: Risk Assessment Site Groups

Tier	Group Designation:	Group Description:
4	Surface Deformation Group	Sites with evidence of surface deformation, such as areas of surface settlement and subsidence or irregular drainage conditions which may be mine-related, and may exist or may have historically been observed in the R/W or within view of the R/W.
3	Vertical Shaft Group	Sites with evidence that Vertical Shaft mine opening(s) exist or have historically been observed or recorded as being in the R/W or within view of the R/W.
2	Mine Opening Group	Sites with evidence that Slope or Drift mine opening(s) exist or have historically been observed or recorded as being in the R/W or within view of the R/W.
1(A)	High Rating Group	The ten sites per District having the highest Initial Site Evaluation rating score not already in one of the higher priority site groups.
1	Low Rating Group	All other rated sites.
0	Eliminated Sites Group	Sites eliminated (screened) from further evaluation through the verification that an AUM does not exist in the area in question.

2. Extent of Hazard

An event that causes injury, death, or damage to structures is considered an occurrence. Major occurrences are those that caused injuries, deaths or total damage $5,000 or greater.

3. Historical Occurrence

There are 375 known abandoned underground mines in the county. Approximately 60 percent of the City of Wellston is undermined and it is in and around the Wellston area that most mine subsidence damage has occurred. In the late 1960's, Pennsylvania Avenue in Wellston settled a foot or more causing damages to homes and businesses along the street. The street was closed until it could be rebuilt. Portions of South Pennsylvania Avenue began to collapse again in 1983 under the weight of large trucks parked around a restaurant near the football field. Numerous reports of homes, garages, and outbuildings being damaged by subsidence have been reported throughout the years.

Duplex on S Pennsylvania Ave, Wellston - 1990's. Home was damaged beyond repair and later demolished.

From 2007 to 2014, Jackson County averaged 7 new claims with an average estimated loss of just over $5,000 each. Source: Ohio Mine Subsidence Insurance Underwriting Association

[39] https://www.transportation.ohio.gov/wps/wcm/connect/gov/4dc4d4cf-25b4-45d9-86e2-475f05ea4536/AUMIRA_Manual.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_M1HGGIK0N0JO00QO9DDDDM3000-4dc4d4cf-25b4-45d9-86e2-475f05ea4536-nUMQw0A

4. Probability of Future Occurrences

As there are no known factors that would indicate that past trends would not extend into the future, the planning team accepts the historical occurrences to be indicative of the future; it estimates an 88% (7 occurrences in 8 years) annual probability.

5. Affected Locations

The primary affected areas are the City of Wellston, the Village of Coalton and areas in between. Note that Jackson County homeowners are eligible for subsidence coverage through the Mine Subsidence Insurance Fund. Source: Ohio Mine Subsidence Insurance Underwriting Association

ODOT reports the following statistics for Jackson County[40]:

Tier 1	Tier 2	Tier 3	Tier 4	New	Inspection Due	Remediated
23	6	23	0	0	0	0

6. Analysis

Factor	Ranking
Frequency	None: No Declarations
Response	< 1/2 Day
Onset	> 24 Hours
Magnitude	10% Land Area
Business	< 24 Hours
Human	No Impact
Property	10-25% Damaged

1. Vulnerable Community Assets

Asset	Impact
People	People inside subsiding structures may receive minor injuries.
Economy	Subsiding/subsided business locations would be adversely affected.
Infrastructure	Subsiding/subsided roads and other infrastructures would be adversely affected. Undergrond mines contain potentially contaminated water that may be released into the aquafer.
Structures	Subsidence is the greatest natural hazard vulnerability in the City of Wellston. Approximately 60 percent of the city is undermined. There are also significant undermined areas near Wellston in Coal and Milton Townships. Vaules were provided by the Ohio EMA.

2. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages
			%	Number	%	Number	%	Total

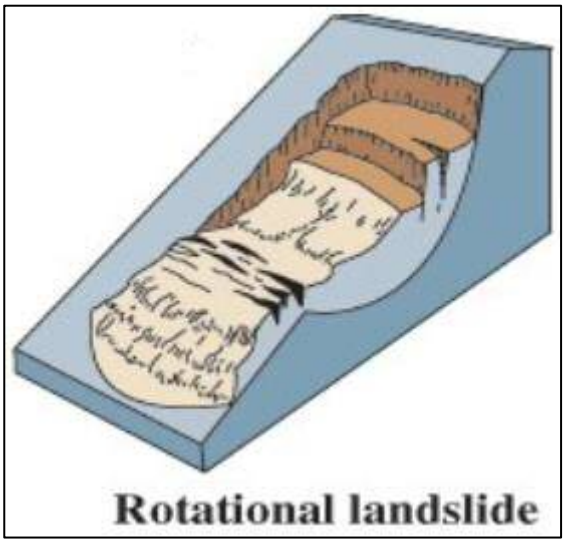
[40] https://app.powerbigov.us/view?r=eyJrIjoiNGE2YWM5YjgtMDE3Zi00OGUxLWExNDAtYjU5ZmY3OTIzNmNmIiwidCI6IjUwZjhmY2M0LTk0ZDgtNGYwNy04NGViLTM2ZWQ1N2M3YzhhMiJ9&pageName=ReportSectionb3fbde310610830ed6c6

Residential	15,278	$233,398		1,517	100	1,517		$16,939,720
Nonresidential	3,248	$1,038,800		66	100	66		$5,858,600
Critical	29	$1,038,800		10	100	10		$8,794,080
Totals	**18,555**					**1,593**		**$31,592,400**

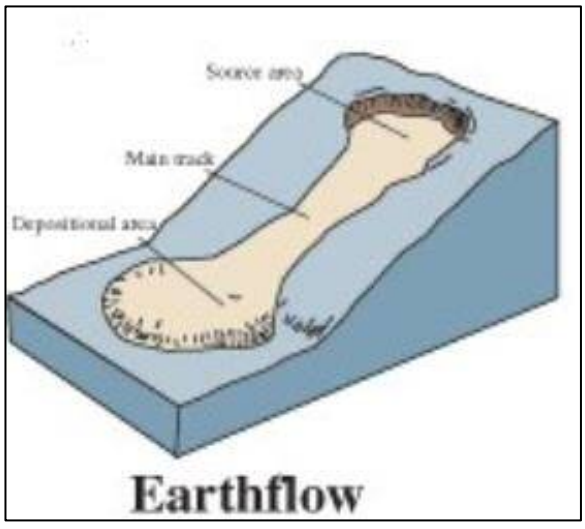
K. Landslides

1. Description

Per the Ohio Department of Natural Resources – Division of Geological Survey GeoFacts publication, a landslide is the downward and outward movement of soil and rock material on slopes. There are three main types of landslides that occur in Ohio[41]:



Rotational Slump: the movement of a mass of weak rock or sediment as a block unit along a curved slip plane. In Ohio, these types of slides commonly involve hundreds of thousands of cubic yards of material and extend for hundreds of feet. The crown or head, located in the upper section of the ground surface, consists of one or more rupture zones (scarps) that form a stair-step pattern of displaced blocks. The surfaces of these blocks are commonly rotated backward (reverse slope) and form depressions where water may accumulate, creating small ponds or swampy areas. Trees on these blocks may be inclined upslope, toward the top of the hill. The lower, downslope end (toe) of a rotational slump is a fan shaped, bulging mass of material characterized by radial ridges and cracks. Trees on this portion of the landslide may be inclined at strange angles, giving rise to the descriptive terms "drunken" or "staggering" forest. Rotational slumps may develop comparatively slowly and commonly require several months or even years to reach stability; however, on occasion, they may move rapidly, achieving stability in only a few hours.

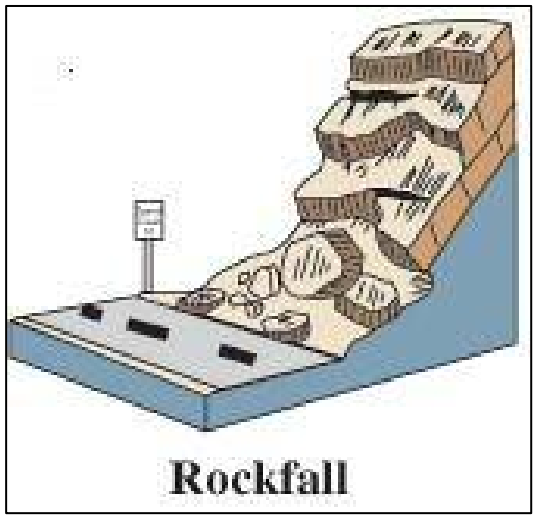


Earthflow: involves rock, sediment, or weathered surface materials moving downslope in a mass. The most common form of earth movement in Ohio, earthflow involves a smaller area than a rotational slump and forms a hummocky topography of ridges and swales. Trees may be inclined at odd angles throughout the length of an earthflow. Earthflows are most common in weathered surface materials, do not necessarily indicate weak rock, and are also common in unconsolidated glacial sediments. The rate of movement of an earthflow is generally quite slow.

Rockfall: an extremely rapid, potentially dangerous downslope movement of earth materials. Large blocks of massive bedrock suddenly become detached from a cliff or steep hillside and free fall in a rolling, bounding, or sliding manner downslope. Most rockfalls in Ohio involve massive beds of sandstone or limestone. Surface water seeps

[41] http://geosurvey.ohiodnr.gov/portals/geosurvey/PDFs/GeoFacts/geof08.pdf

into joints or cracks in the rock, increasing its weight and causing expansion of joints in freezing temperatures, thus prying blocks of rock away from the main cliff. Weak and easily eroded clay or shale beneath the massive bed is an important contributing factor to rockfall. All illustrations were provided by the USGS.



One or more of the following conditions contribute to the occurrence of landslide events:

- Steep slope: All landslides move downslope under the influence of gravity. Therefore, steep slopes, cliffs, or bluffs are a required element leading to a landslide, especially in conjunction with one or more of the conditions listed below.
- Jointed rocks: Fractures in rocks allow surface moisture to penetrate and weaken it. When the moisture freezes, it pries the rock masses apart at the joint.
- Fine-grained, permeable rock or sediment: Fine rock particles are particularly conducive to landslide development because large amounts of moisture can enter them easily, increasing the material's weight, reducing the bonding strength of individual grains, and dissolving grain cementing materials.
- Clay or shale units subject to lubrication: Groundwater penetration of clay or shale can lead to a loss of binding strength between individual mineral grains and subsequent failure.
- Large amounts of water: Periods of heavy rainfall, excess snowmelt, or other events where water is accumulated saturate the zone above the normal water table and cause a landslide.

In addition to the conditions noted above, a landslide requires a triggering mechanism to initiate downslope movement. Several events or circumstances, many of them human-caused, can trigger landslides, including:

- Vibrations such as those from human-causes like blasting, the passing of a heavy truck, or from natural events like earthquakes, although no such occurrence has been documented in Ohio.
- Over steepened slopes caused by undercutting by stream or wave erosion, by human construction activities, or by the addition of fill material to the upper portion of a slope, disturb the equilibrium of a stable slope and cause the angle of stability to be exceeded.
- Increased weight on a slope caused by the addition of large amounts of fill, the construction of a building or other structure, or an unusual increase in precipitation, either from heavy rains or from artificial alteration of drainage patterns.
- Removal of vegetation and trees because of the loss of roots, which tend to hold the rock or sediment in place and soak up excess moisture.

According to the Ohio Department of Natural Resources[42], the causes of landslides are steep slopes; jointed rocks; fine-grained, permeable rock or sediment; and clay or shale units subject to lubrication (ground water).

[42] http://geosurvey. ohiodnr.gov/portals/geosurvey/PDFs/GeoFacts/geof08.pdf

Ohio Department of Transportation (ODOT) assesses the risk (probability of additional movement x probability of significant impact to an ODOT asset or adjacent property or features) of landslide sites as follows[43]:

Table 300-06. Probability Table

Probability of Additional Movement (A)	Probability of Significant Impact to an ODOT asset or adjacent property or features (B)			
	Very High (4)	High (3)	Moderate (2)	Low (1)
Very High (4)	Very High 16	Very High 12	High 8	Moderate 4
High (3)	Very High 12	High 9	High 6	Moderate 3
Moderate (2)	High 8	High 6	Moderate 4	Low 2
Low (1)	Moderate 4	Moderate 3	Low 2	Low 1

The Preliminary Score is calculated by multiplying Column A (Probability of Additional Movement) by Column B (Probability of Significant Impact to the Roadway, Structures, Adjacent Property or Feature.

Table 300-07. Tier Based on Tier Determination Score

Tier Determination Score	Tier Action
1 or 2	**Tier 1 Site** No Detailed Rating Needed
3 or 4	**Tier 2 Site** Detailed Rating Needed
6, 8, or 9	**Tier 3 Site** Detailed Rating Needed
12 or 16	**Tier 4 Site** Detailed Rating Needed

ODOT assesses the risk (probability of additional movement x probability of significant impact to an ODOT asset or adjacent property or features) of landslide sites as follows[44]:

[43] https://www.transportation.ohio.gov/wps/wcm/connect/gov/3ab29238-940c-4133-a0ca-63117386246f/Manual_of_Landslide_Inventory.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_K9I401S01H7F40QBNJU3SO1F56-3ab29238-940c-4133-a0ca-63117386246f-nUMRoKz

[44] https://www.transportation.ohio.gov/wps/wcm/connect/gov/6bf9a042-f48c-4eac-ad0f-2c8e612ee259/Rock_Slope_Inventory_Manual.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE.Z18_K9I401S01H7F40QBNJU3SO1F56-6bf9a042-f48c-4eac-ad0f-2c8e612ee259-nUMS5-r

Table 300-07. Probability Table

Potential of Rockfall Occurrence (A)	Potential of Rockfall to Impact Roadway (B)			
	Very High (10)	High (8)	Moderate (4)	Low (1)
Very High (10)	Very High 20	Very High 18	High 14	Moderate 11
High (8)	Very High 18	High 16	High 12	Moderate 9
Moderate (4)	High 12	High 12	Moderate 8	Low 5
Low (1)	Moderate 11	Moderate 9	Low 5	Low 2

The Preliminary Score is calculated by multiplying Column A (Probability of Additional Movement) by Column B (Probability of Significant Impact to the Roadway, Structures, Adjacent Property or Feature.

Table 300-08. Tier Type Based on Tier Determination Score

Tier Determination Score	Tier Type Action
2 to 5	**Tier 1 Site** No Detailed Rating Needed
8 to 11	**Tier 2 Site** Detailed Rating Needed
12 to 16	**Tier 3 Site** Detailed Rating Needed
18 to 20	**Tier 4 Site** Detailed Rating Needed

2. Extent of Hazard

Landslides are measured by a count of occurrences that cause damage to structures or infrastructure or restrict travel.

Any landslide that impacts people, structures or infrastructure (such as roads) is considered an occurrence.

3. Historical Occurrence

Landslides generally occur during or after heavy rain and sometimes result in blocked roadways.

4. Probability of Future Occurrences

Landslides do occur in Jackson County but their impact on community assets is minimal. Therefore, the estimated risk of the future occurrence of an impacting landslide is once in twenty years or 5% in a given year.

5. Affected Locations

Locations along steep hillsides are most at risk.

Landslides. ODOT reports the following statistics for Jackson County[45]:

Tier 1	Tier 2	Tier 3	Tier 4	New	Inspection	Remediated	Progressing

[45] https://app.powerbigov.us/view?r=eyJrIjoiNGE2YWM5YjgtMDE3Zi00OGUxLWExNDAtYjU5ZmY3OTIzNmNmIiwidCI6IjUwZjhmY2M0LTk0ZDgtNGYwNy04NGViLTM2ZWQ1N2M3YzhhMiJ9&pageName=ReportSectionb3fbde310610830ed6c6

					Due		
302	23	4	0	0	327	0	0

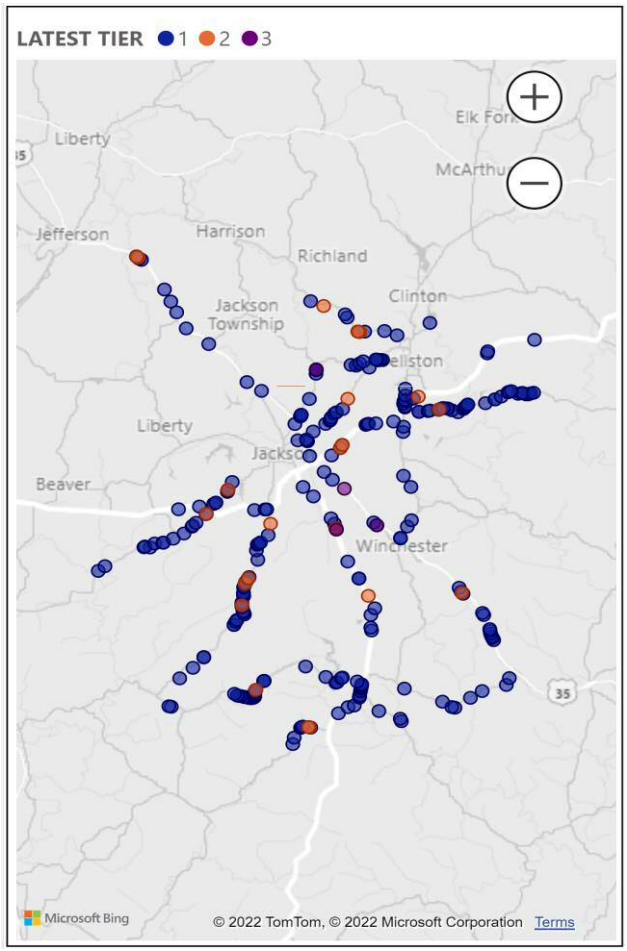
Refer to the Landslide Locations map for plot of locations.

Rockslides. ODOT reports the following statistics for Jackson County[46]:

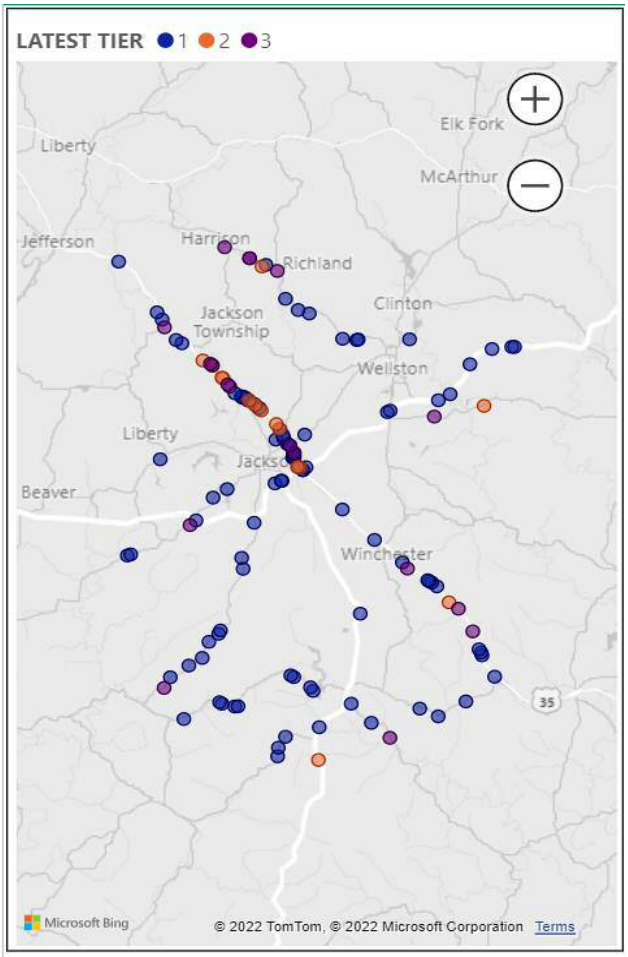
Tier 1	Tier 2	Tier 3	Tier 4	New	Inspection Due	Remediated	Progressing
104	15	18	0	0	127	0	0

Refer to the Rockslide Locations map for plot of locations.

Landslide Locations



Rockslide Locations



6. Analysis

Factor	Ranking
Frequency	None: No Declarations
Response	< 1/2 Day
Onset	> 24 Hours

[46] https://app.powerbigov.us/view?r=eyJrIjoiNGE2YWM5YjgtMDE3Zi00OGUxLWExNDAtYjU5ZmY3OTIzNmNmIiwidCI6IjUwZjhmY2M0LTk0ZDgtNGYwNy04NGViLTM2ZWQ1N2M3YzhhMiJ9&pageName=ReportSectionb3fbde310610830ed6c6

Factor	Ranking
Magnitude	10% Land Area
Business	No Impact
Human	Minor Injuries
Property	< 10% Damaged

7. Vulnerable Community Assets

Asset	Impact
People	No impact.
Economy	Little or no measurable impact.
Infrastructure	Roads and bridges
Structures	Minimal impact. Unpermitted mobile homes have been found to be in risk areas. Only residential structures are at risk. The Planning Team estimates that less than 2% of county residential structures are at risk; due to the isolation of incidents, only abut 1% would be damaged in a typical event. Damages would probably be 10% of the structures' values.

8. Estimated Structural Damages

Structure Type	Inven-tory	Average Value	At Risk		Damaged		Damages	
			%	Number	%	Number	%	Total
Residential	15,278	$233,398	2	306	1	3	10	$58,251
Nonresidential	3,248	$1,038,800	0	0	1	0	10	$0
Critical	29	$1,038,800	0	0	0	0	10	$0
Totals	**18,555**					**3**		**$58,251**

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Section VI – Mitigation Goals and Actions

A. Overview

The Jackson County Mitigation Planning Team identified hazards of credible threat and analyzed their impact using qualitative and quantitative methods. The team used the *FEMA Local Mitigation Planning Handbook, March 2013,* as a guide for conducting analysis.

B. Identification and Analysis Methodology

The Planning Team profiled each hazard. It collected and reviewed hazard information, assessed the impacts and the vulnerabilities of the community's assets. The team assigned risk factor values based on the criteria and adjusting factors established by the Ohio EMA.

The team then estimated structures at risk and associated damages.

C. Goals

The Planning Team selected the following mitigation goals:

- Reduce or eliminate impact to property and loss of life caused by flooding
- Enhance emergency response capability
- Provide timely warning
- Protect future economic development and critical infrastructure from natural hazards
- Increase public awareness

D. Actions

The Planning Team then reviewed actions from the previous mitigation plan and added several actions.

- Reduce or eliminate impact to property and loss of life caused by flooding
  - Mitigate flood-prone structures through acquisition, relocation, and/or retrofitting.
  - Mitigate infrastructure problems
  - Update dam Emergency Action Plans, update inundation data for dams without EAPs or current data.
  - Develop and update flood hazard data
  - Mitigate Risks to Publicly Owned Utilities
  - Procure Backup Generators at Critical Facilities
  - Remove Debris and Sediment from Creeks
  - Design and create retention basins
- Enhance emergency response capability
  - Upgrade the public safety countywide radio communications system.
  - Survey county roads and bridges updating addresses.
- Provide timely warning
  - Upgrade public warning systems
- Protect future economic development and critical infrastructure from natural hazards
  - Review and update subdivision, zoning, storm water management, flood damage prevention and related regulations.
  - Locate/relocate critical facilities in/to areas not subject to hazards.
  - Promote the construction and use of residential safe rooms.
  - Build community safe rooms.
  - Extend public sewer lines to rural areas.

- Extend county water to rural areas
- Increase public awareness
  - Develop and implement an all-hazards public education program.

E. Cost-Benefit Review

Cost-Benefit Review is used to determine the relative feasibility of mitigation actions, thus establishing a prioritized list. The Planning Team used *Using Benefit-Cost Review in Mitigation Planning – State and Local Mitigation Planning How-To Guide Number Five – FEMA 386-5, May 2007*, to conduct this review. Using qualitative methods (Method A), this Cost-Benefit Review methodology was emphasized in the prioritization process.

1. Review Benefits and Costs

This step is documented with each selected mitigation action. Refer to *Mitigation Action Analysis* section.

2. Prioritize Actions

The following summarizes the benefits and costs of each mitigation action and reflects the priority assigned by the Planning Team. Guiding criteria was:

- Impact on public safety (isolation and injuries)
- Impact on property damage
- Impact on other mitigation actions
- Acceptability of implementation by elected officials and voters
- Monetary costs

Priority	Action	Benefits	Costs
1	Mitigate flood-prone structures through acquisition, relocation, and/or retrofitting	Increased public safety Decreased response and recovery costs Community-owned green space	Buy-in and funding by elected officials and property owners
2	Design and create retention basins	Decreased flooding in residential areas Decreased damage to infrastructure Increased public safety	Planning and project costs
3	Mitigate risks to publicly owned utilities	Decreased utility outages Increased public safety	Funding by utility owners - Electric Generation: $4.5m - Wellston Waste Water: $2m - Jackson Waste Water: $5m - Wellston South Water Treatment: Unknown - Rail System: Unknown
4	Procure backup generators at critical facilities	Decreased utility outages Increased public safety	By-in and funding by elected officials and facility owners - Stationary Generator - Wellston SWTP: $250k - Stationary Generator - Wellston Lift Stations (3): $25k - Stationary Generators - Otheres: $15k - $25k each - Portable Generators,

Priority	Action	Benefits	Costs
			Switching & Batteries: Not yet quantified
5	Upgrade the public safety countywide radio communications system	Reliable communications Increased public safety	Equipment/installation costs
6	Mitigate infrastructure problems	Decreased damage to infrastructure Decreased isolation	Funding; estimated $1.5m per road site; $1m per bridge site
7	Locate/relocate critical facilities in/to areas not subject to hazards	Increased public safety Decreased response and recovery costs	Involved planning Potential increased initial costs
8	Update dam Emergency Action Plans, update inundation data for dams without EAPs or current data	Decreased potential damage	Funding for research; By-in and funding by elected officials, affected property owners and dam owners
9	Upgrade public warning systems	Increased public awareness	Funding
10	Develop and update flood hazard data	Increased public awareness Decreased potential damage	Funding for research
11	Survey county roads and bridges updating addresses	Reduced response time to affected residents Increased public safety	Project costs
12	Remove debris and sediment from creeks	Increased public safety Decreased damage to infrastructure Decreased response and recovery costs	Possible collateral adverse environmental impact Debris removal costs Property owner buy-in
13	Develop and implement an all-hazards public education program	Increased public safety Increased self-sufficiency Decreased response and recovery costs	EMA availability to include volunteers - 250-300 labor hours/year
14	Review and update subdivision, zoning, storm water management, flood damage prevention and related regulations	Increased public safety Decreased response and recovery costs Increased attractiveness to new businesses, visitors and residents	Elected official buy-in Voter buy-in Increased economic development costs
15	Extend county water to rural areas	Clean potable water to all residents Decreased health concerns	Project costs
16	Extend public sewer lines to rural areas	Propely handled waste water Decreased health concerns	Project costs

Priority	Action	Benefits	Costs
17	Build/retrofit existing structures to serve as community safe rooms	Increased public safety Decreased response and recovery costs	Community buy-in Construction Costs
18	Promote the construction and use of residential safe rooms	Increased public safety Decreased response and recovery costs	Community education

Note: The Village of Coalton did not participate in the planning process and are not eligible for federal mitigation funding unless the plan is amended to incorporate necessary requirements.

Section VII – Mitigation Action Analysis

A. Goal: Reduce or eliminate impact to property and loss of life caused by flooding.

1. Action: Mitigate flood-prone structures through acquisition, relocation, and/or retrofitting

Mitigate chronically-flooded/damaged dwellings of willing residents to break the damage-repair-damage-repair cycle.

Priority	Start Date	End Date	Estimated Cost	Current Status
1	8/1/2010	1/20/2028	$268m	Unchanged

Hazards Addressed: Flooding, Severe Summer Storm/Thunderstorm/Windstorm/Hail

Jurisdiction(s) Affected: Scioto Township, Coal Township, Madison Township, Bloomfield Township, Milton Township, Franklin Township, Jefferson Township, Hamilton Township, Wellston City, Lick Township, Jackson City, Jackson County, Oak Hill Village, Coalton Village, Jackson Township, Liberty Township, Washington Township

Project Lead(s): Jurisdictional Chief Elected Officials and Property Owners

Funding Resource(s): Flood Mitigation Assistance Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, Repetitive Flood Claims Program, Severe Repetitive Loss Grant, State Funds, Neighborhood Stabilization Grant, Moving Ohio Forward

Mitigation Action Type(s): Acquisition, Elevation, Planning, Relocation, Retrofit, Stormwater

Vulnerability	Before Implementation	After Implementation	Difference
People - casualities	20% of Structures x 2.5 = 319	0	-319
Structures - damaged/destroyed	537	0	-537

Benefits	Costs
Increased public safety Decreased response and recovery costs Community-owned green space	Buy-in and funding by elected officials and property owners

2. Action: Mitigate infrastructure problems

Elevate rodas and bridges; reinforce supporting structures.

Priority	Start Date	End Date	Estimated Cost	Current Status
6	8/1/2010	1/20/2028	$2,325m	Unchanged

Hazards Addressed: Earthquake, Land Subsidence, Flooding, Mud/Landslide, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Severe Winter Storm, Tornado

Jurisdiction(s) Affected: Lick Township, Scioto Township, Madison Township, Jackson County, Milton Township, Franklin Township, Jefferson Township, Coal Township,

Washington Township, Liberty Township, Jackson Township, Coalton Village, Oak Hill Village, Bloomfield Township, Jackson City, Hamilton Township, Wellston City

Project Lead(s): Jurisdictional Chief Elected Officials and Property Owners

Funding Resource(s): Community Development Block Grant, Clean Ohio Grant, Flood Mitigation Assistance Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, State Funds

Mitigation Action Type(s): Acquisition, Elevation, Minor Localized Flood Reduction, Planning, Storm Shelter, Soil Stabilization, Stormwater

Vulnerability	Before Implementation	After Implementation	Difference
Roads - potential damage	75	0	-75
Bridges - potential damage	300 x 40% = 120	0	-120

Benefits	Costs
Decreased damage to infrastructure Decreased isolation	Funding; estimated $1.5m per road site; $1m per bridge site

3. Action: Update dam Emergency Action Plans, update inundation data for dams without EAPs or current data

Identify and mitigate threats to people and property from Class I dam failures and incidents. This includes developing inundation maps and potential dam reinforcement.

Priority	Start Date	End Date	Estimated Cost	Current Status
8	8/1/2010	1/20/2028	Unknown	Unchanged

Hazards Addressed: Dam/Levee Failure

Jurisdiction(s) Affected: Scioto Township, Liberty Township, Washington Township, Hamilton Township, Lick Township, Milton Township, Wellston City, Jefferson Township, Madison Township, Oak Hill Village, Jackson Township, Coalton Village, Jackson County, Bloomfield Township, Coal Township, Franklin Township, Jackson City

Project Lead(s): Jackson County Emergency Management Agency

Funding Resource(s): Community Development Block Grant, Flood Mitigation Assistance Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, State Funds

Mitigation Action Type(s): Minor Localized Flood Reduction, Planning, Stormwater

Vulnerability	Before Implementation	After Implementation	Difference
People - isolated	Unknown	Decrease	Not quantifiable
Structures - damaged/destroyed	Unknown	Lower Cost	Not quantifiable

Benefits	Costs
Decreased potential damage	Funding for research; By-in and funding by elected officials, affected property owners and dam owners

4. Action: Develop and update flood hazard data

Identify and satisfy flood-mapping needs.

Priority	Start Date	End Date	Estimated Cost	Current Status
10	8/1/2010	1/20/2028	Unknown	Unchanged

Hazards Addressed: Flooding

Jurisdiction(s) Affected: Madison Township, Coal Township, Milton Township, Wellston City, Bloomfield Township, Franklin Township, Jefferson Township, Hamilton Township, Scioto Township, Lick Township, Washington Township, Liberty Township, Jackson Township, Oak Hill Village, Jackson City, Jackson County, Coalton Village

Project Lead(s): Jackson County Emergency Management Agency

Funding Resource(s):

Mitigation Action Type(s): Planning

Vulnerability	Before Implementation	After Implementation	Difference
People - Casualities	Unknown	More accurate information	Not quantifiable
People - Isolation	Unknown	More accurate information	Not quantifiable
Road & Bridge Damage	Unknown	More accurate information	Not quantifiable
Economy	Unknown	More accurate information	Not quantifiable

Benefits	Costs
Increased public awareness Decreased potential damage	Funding for research

5. Action: Mitigate risks to publicly owned utilities

Water Treatment, Waste Water Treatment, Electric Plant, Distribution

Elevate controls above flood levels.

Priority	Start Date	End Date	Estimated Cost	Current Status
3	12/1/2016	1/20/2028	$115m	Unchanged

Hazards Addressed: Dam/Levee Failure, Land Subsidence, Flooding, Mud/Landslide, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Severe Winter Storm

Jurisdiction(s) Affected: Oak Hill Village, Jackson County, Jackson City, Wellston City, Coalton Village

Project Lead(s): Jurisdictional Chief Elected Officials

Funding Resource(s): Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, Utilities' funds

Mitigation Action Type(s): Planning, Retrofit, Reconstruction

Vulnerability	Before Implementation	After Implementation	Difference
Electic Generation & Distribution System	Jackson: 1	0	-1
Water Treatment Plants & Distribution Systems	Wellston South: 1	0	-1
Waste Water Treatment Plants & Collection Systems	Wellston: 1; Jackson: 1	0	-2
Rail System	Unknown	Unknown	Unknown

Benefits	Costs
Decreased utility outages Increased public safety	Funding by utility owners - Electric Generation: $4.5m - Wellston Waste Water: $2m - Jackson Waste Water: $5m - Wellston South Water Treatment: Unknown - Rail System: Unknown

6. Action: Procure backup generators at critical facilities

Provide backup power for facilities such as water treatment plants & lift stations, fire departments, police departments, Health Deaprtment.

Priority	Start Date	End Date	Estimated Cost	Current Status
4	12/1/2016	1/20/2028	$375k	Unchanged

Hazards Addressed: Earthquake, Flooding, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Severe Winter Storm, Tornado

Jurisdiction(s) Affected: Scioto Township, Jackson County, Jackson City, Wellston City, Oak Hill Village, Coalton Village, Jackson Township, Liberty Township, Bloomfield

Township, Lick Township, Coal Township, Hamilton Township, Jefferson Township, Franklin Township, Milton Township, Madison Township, Washington Township

Project Lead(s): Jackson County Emergency Management Agency

Funding Resource(s): Community Development Block Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, State Funds

Mitigation Action Type(s): Minor Localized Flood Reduction, Soil Stabilization, Stormwater, Wildfire

Vulnerability	Before Implementation	After Implementation	Difference
Law enforcement facilities	Oak Hill PD: 1	0	-1
Fire & rescue facilities	Scioto Twp FD: 1; EMS: 3	0	-4
Waste water facilites & lift stations	Wellston: 7; Jackson: 16; Coalton: 1	0	-28

Benefits	Costs
Decreased utility outages Increased public safety	By-in and funding by elected officials and facility owners - Stationary Generator - Wellston SWTP: $250k - Stationary Generator - Wellston Lift Stations (3): $25k - Stationary Generators - Otheres: $15k - $25k each - Portable Generators, Switching & Batteries: Not yet quantified

7. Action: Remove debris and sediment from creeks

Remove debris and dredge sediment from creeks that causes creeks to overflow their banks and back up water.

Priority	Start Date	End Date	Estimated Cost	Current Status
12	8/1/2010	1/20/2028	Unknown	Unchanged

Hazards Addressed: Flooding

Jurisdiction(s) Affected: Jackson Township, Madison Township, Coal Township, Coalton Village, Jackson County, Jackson City, Oak Hill Village, Liberty Township, Lick

Township, Scioto Township, Washington Township, Jefferson Township, Franklin Township, Milton Township, Bloomfield Township, Hamilton Township, Wellston City

Project Lead(s): Jackson County Health Department

Funding Resource(s): Community Development Block Grant, Flood Mitigation Assistance Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, State Funds

Mitigation Action Type(s): Minor Localized Flood Reduction, Stormwater, Debris Removal

Vulnerability	Before Implementation	After Implementation	Difference
People - Isolated	Unknown	Decrease	Not quantifiable
Infrustructure Repair	Unknown	Lower Cost	Not quantifiable

Benefits	Costs
Increased public safety Decreased damage to infrastructure Decreased response and recovery costs	Possible collateral adverse environmental impact Debris removal costs Property owner buy-in

8. Action: Design and create retention basins

Priority	Start Date	End Date	Estimated Cost	Current Status
2	1/20/2023	1/20/2028	$22m	New

Hazards Addressed: Flooding

Jurisdiction(s) Affected: Jackson City

Project Lead(s): Jackson County Engineer, City/Village Mayors, Township Trustees

Funding Resource(s): Community Development Block Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Planning, Minor Localized Flood Reduction, Reconstruction, Soil Stabilization, Stormwater

Vulnerability	Before Implementation	After Implementation	Difference
Roads & bridges: damage/destruction	~40	0	~ -40
People in flooding areas: isolation, injury, death	~250	0	~ -250

Benefits	Costs
Decreased flooding in residential areas Decreased damage to infrastructure Increased public safety	Planning and project costs

B. Goal: Enhance emergency response capability

1. Action: Upgrade the public safety countywide radio communications system

Priority	Start Date	End Date	Estimated Cost	Current Status
5	1/20/2023	1/20/2028	Unknown	New

Hazards Addressed: Dam/Levee Failure, Drought, Earthquake, Land Subsidence, Mud/Landslide, Severe Winter Storm, Wildfire, Tornado, Infectious Disease

Jurisdiction(s) Affected: Jackson County

Project Lead(s): Jackson County EMA

Funding Resource(s): Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Public Safety

Vulnerability	Before Implementation	After Implementation	Difference
Responders: unreliable/ nonredundant comm	Not Quantifiable	Reliable Comm	Not Quantifiable

Benefits	Costs
Reliable communications Increased public safety	Equipment/installation costs

2. Action: Survey county roads and bridges updating addresses

Priority	Start Date	End Date	Estimated Cost	Current Status
11	1/20/2023	1/20/2028	Unknown	New

Hazards Addressed: Dam/Levee Failure, Drought, Earthquake, Flooding, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Severe Winter Storm, Tornado

Jurisdiction(s) Affected: Franklin Township, Washington Township, Coal Township, Jackson County, Hamilton Township, Jackson Township, Jefferson Township, Liberty Township, Lick Township, Madison Township, Milton Township, Scioto Township, Bloomfield Township

Project Lead(s): Jackson County Engineer

Funding Resource(s): Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Planning

Vulnerability	Before Implementation	After Implementation	Difference
Residents are non-sequential addresses	Unknown	0	Unknown

Benefits	Costs
Reduced response time to affected residents Increased public safety	Project costs

C. Goal: Provide timely warning.

1. Action: Upgrade public warning systems

Priority	Start Date	End Date	Estimated Cost	Current Status
9	8/1/2010	1/20/2028	$10m	Unchanged

Hazards Addressed: Dam/Levee Failure, Drought, Earthquake, Land Subsidence, Flooding, Mud/Landslide, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Severe Winter Storm, Wildfire, Tornado, Infectious Disease

Jurisdiction(s) Affected: Jackson County

Project Lead(s): Jackson County Emergency Management Agency

Funding Resource(s): Community Development Block Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Planning, Public Safety

Vulnerability	Before Implementation	After Implementation	Difference
People - stranded/isolated	10% of Population	5% of Population	-50%
People - casualities	1% of Population	0	-100%

Benefits	Costs
Increased public awareness	Funding

D. Goal: Protect future economic development and critical infrastructure from natural hazards.

1. Action: Review and update subdivision, zoning, storm water management, flood damage prevention and related regulations

Priority	Start Date	End Date	Estimated Cost	Current Status
14	8/1/2010	1/20/2028	Unknown	Unchanged

Hazards Addressed: Dam/Levee Failure, Earthquake, Land Subsidence, Flooding, Mud/Landslide, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Wildfire, Tornado

Jurisdiction(s) Affected: Jefferson Township, Oak Hill Village, Coalton Village, Jackson Township, Jackson City, Jackson County, Washington Township, Lick Township, Liberty Township, Hamilton Township, Franklin Township, Milton Township, Bloomfield Township, Wellston City, Madison Township, Coal Township, Scioto Township

Project Lead(s): Jurisdictional Chief Elected Officials; Jackson County Engineer

Funding Resource(s): In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Acquisition, Dry Floodproofing, Elevation, Minor Localized Flood Reduction, Planning, Reconstruction, Relocation, Retrofit, Storm Shelter, Soil Stabilization, Stormwater, Wildfire

Vulnerability	Before Implementation	After Implementation	Difference
All assets	Unclear regulatory guidance	Clear/meaningful regulatory guidance	Not quantifiable

Benefits	Costs
Increased public safety Decreased response and recovery costs Increased attractiveness to new businesses, visitors and residents	Elected official buy-in Voter buy-in Increased economic development costs

2. Action: Locate/relocate critical facilities in/to areas not subject to hazards
To include facilties such as the Dog Pound.

Priority	Start Date	End Date	Estimated Cost	Current Status
7	8/1/2010	1/20/2028	Unknown	Unchanged

Hazards Addressed: Dam/Levee Failure, Earthquake, Land Subsidence, Flooding, Mud/Landslide

Jurisdiction(s) Affected: Jackson County

Project Lead(s): Jurisdictional Chief Elected Officials

Funding Resource(s): Community Development Block Grant, Flood Mitigation Assistance Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant, State Funds

Mitigation Action Type(s): Reconstruction, Elevation, Relocation, Retrofit

Vulnerability	Before Implementation	After Implementation	Difference
New critical facilities - preventable damage	Potential hazard impact	Avoided hazard impact	Not quantifiable

Benefits	Costs
Increased public safety Decreased response and recovery costs	Involved planning Potential increased initial costs

3. Action: Promote the construction and use of residential safe rooms
A safe room is an extreme-wind shelter or space that provides protection to people during a tornado. It can be constructed/installed in one of several laces in the home. in the basement, beneath a concrete slab-on-grade foundation or garage floor, or in an interior room on the first floor. A safe room may also be buried in the yard or be a stand-alone structure near your home.

Priority	Start Date	End Date	Estimated Cost	Current Status
18	12/1/2016	1/20/2028	$75k	Unchanged

Hazards Addressed: Severe Summer Storm/Thunderstorm/Windstorm/Hail, Tornado

Jurisdiction(s) Affected: Jefferson Township, Liberty Township, Lick Township, Madison Township, Milton Township, Washington Township, Oak Hill Village, Wellston City, Scioto Township, Bloomfield Township, Hamilton Township, Franklin Township, Jackson City, Coal Township, Jackson Township, Coalton Village, Jackson County

Project Lead(s): Ohio Emergency Management Agency

Funding Resource(s): Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Storm Shelter

Vulnerability	Before Implementation	After Implementation	Difference
People in vulnerable structures	Unknown	Unknown	Unknown

Benefits	Costs
Increased public safety Decreased response and recovery costs	Community education

4. Action: Build/retrofit existing structures to serve as community safe rooms

A safe room is an extreme-wind shelter or space that provides protection to people during a tornado or other severe weather.

Priority	Start Date	End Date	Estimated Cost	Current Status
17	1/20/2023	1/20/2028	$15m	New

Hazards Addressed: Severe Summer Storm/Thunderstorm/Windstorm/Hail, Tornado

Jurisdiction(s) Affected: Jefferson Township, Oak Hill Village, Liberty Township, Milton Township, Washington Township, Lick Township, Jackson Township, Scioto Township, Jackson County, Hamilton Township, Wellston City, Franklin Township, Jackson City, Coal Township, Bloomfield Township, Madison Township, Coalton Village

Project Lead(s): Jurisdictional Chief Elected Officials

Funding Resource(s): Community Development Block Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Retrofit, Storm Shelter, Planning, Reconstruction

Vulnerability	Before Implementation	After Implementation	Difference
People in vulnerable structures	Unknown	Unknown	Unknown

Benefits	Costs
Increased public safety Decreased response and recovery costs	Community buy-in Construction Costs

5. Action: Extend public sewer lines to rural areas

Priority	Start Date	End Date	Estimated Cost	Current Status
16	1/20/2023	1/20/2028	Unknown	New

Hazards Addressed: Infectious Disease

Jurisdiction(s) Affected: Jefferson Township, Coal Township, Washington Township, Hamilton Township, Jackson Township, Lick Township, Liberty Township, Madison Township, Jackson County, Milton Township, Bloomfield Township, Scioto Township, Franklin Township

Project Lead(s): Jackson County Health Department

Funding Resource(s): Community Development Block Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Public Safety

Vulnerability	Before Implementation	After Implementation	Difference
Residents with septic systems	Unknown	0	Unknown

Benefits	Costs
Propely handled waste water Decreased health concerns	Project costs

6. Action: Extend county water to rural areas

Priority	Start Date	End Date	Estimated Cost	Current Status
15	1/20/2023	1/20/2028	Unknown	New

Hazards Addressed: Drought, Infectious Disease

Jurisdiction(s) Affected: Liberty Township, Washington Township, Scioto Township, Milton Township, Madison Township, Lick Township, Jefferson Township, Jackson Township, Hamilton Township, Franklin Township, Coal Township, Bloomfield Township, Jackson County

Project Lead(s): Jackson County Commissioners

Funding Resource(s): Community Development Block Grant, Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Public Safety

Vulnerability	Before Implementation	After Implementation	Difference
Residents relying on private wells	Unknown	0	Unknown

Benefits	Costs
Clean potable water to all residents Decreased health concerns	Project costs

E. Goal: Increase public awareness

1. Action: Develop and implement an all-hazards public education program

Increase public awareness of natural hazards by taking various opportunities to educate the public on mitigation, preparedness, response and recovery actions and programs.

Priority	Start Date	End Date	Estimated Cost	Current Status
13	8/1/2010	1/20/2028	$5k	Unchanged

Hazards Addressed: Dam/Levee Failure, Drought, Earthquake, Land Subsidence, Flooding, Mud/Landslide, Severe Summer Storm/Thunderstorm/Windstorm/Hail, Severe Winter Storm, Wildfire, Tornado, Infectious Disease

Jurisdiction(s) Affected: Jackson County

Project Lead(s): Jackson County Emergency Management Agency

Funding Resource(s): Hazard Mitigation Grant Program, In-Kind (Work or Labor), Local Funds, Pre-Disaster Mitigation Grant

Mitigation Action Type(s): Planning, Public Education

Vulnerability	Before Implementation	After Implementation	Difference
People - unprepared	80%	50%	-30%

Benefits	Costs
Increased public safety Increased self-sufficiency Decreased response and recovery costs	EMA availability to include volunteers - 250-300 labor hours/year

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Section VIII – Supplemental Information

A. Meetings Held

The Planning Team held public meetings to officially brief chief elected officials and gather data for inclusion in the updated plan. The following are minutes and rosters of Planning Team meetings:

MITIGATION PLAN UPDATE MEETING

March, 16, 2022

The meeting was called to order by Robert Czechlewski, Jackson County EMA Director for the purpose of updating the Jackson County Hazard Mitigation Plan. Other people present at this organizational meeting are as follows: Samantha Brooks, Jackson County EMA Deputy Director; David Pollinger, RDI Solutions/Planner; William Faught, Vinton County EMA Director; Larry Mullins, Pike County EMA Director,Mark Jenkins with Jackson County Engineer's Office, Brody Davis, Ohio EMA, Brett Hinsch, City of Jackson Police Dept, David Ramby & Terry Barr Jackson County Health Dept.

Dave Pollinger presented the group with a handout. "Mitigation Planning Kick- Off Meeting" There were 11 different hazards identified with a couple others possible ones to list. See attached handouts for details. Dave took current hazards and historical data to update the information for the new mitigation plan.

Robert said he would like to have another meeting in April.

Meeting was adjourned at 12:00 pm.

1st Mitigation Mtg 3/16/2022

Name	County/Agency	E-mail	Signature
Robert Czechlewski	Jackson Co. EMA	jacksoncoema@Hotmail.com	Robert Czechlewski
Larry Mullins	Scioto Co. EMA	scioto ema@frontier.com	Larry Mullins
Tim Dickerson	Pike Co. EMA	emapikecounty.oh.gov	
William Faught	Vinton Co EMA	ema@VintonCountyOHIO.gov	
Mark Jenkins	Jackson Co Eng.	Mark@JCENGR.NET	
Samantha Brooks	jacksonco ema	jacksoncoema@yahoo.com	
Brody Davis	Ohio EMA	bjdavis@dps.ohio.gov	
Brett Hinsch	City of Jackson Police Dept	bhinsch@jacksonohio.us	
Dan Ramby	JCHD	dramby@jchd.us	
Terri Barr	JCHD	tbarr@jchd.us	
David Pollinger	RDI Solutions		

2nd Mitigation Mtg 4/13/2022

Name	County/Agency	E-mail	Signature
Robert Czechlewski	JCEMA	jacksoneema@Hotmail.com	Robert Czechlewski
Larry Mullins	Scioto EMA	sciotoema@frontier.com	Larry Mullins
Brett Hinsch	City of Jackson/ Police Dept	bhinsch@jacksonohio.us	Brett Hinsch
Samantha Brooks	JCEMA	jacksoncoema@yahoo.com	SBrooks
Terry Barr	JCHD	tbarr@jchd.us	
David Ramby	JCHD	dramby@jchd.us	
Ryan Pelletier	City of Wellston/Iwa	rpelletier@cityofwellston.org	
David Pollinger	RDI Solutions	main@rdisolutions.org	
Brody Davis	OEMA	bjdavis@dps.ohio.gov	
Donnie Willis	Jackson Co	jccommissioner.willis@gmail	
	Engineer's	Mark@JCENGR.NET	

MITIGATION PLAN UPDATE MEETING 2nd

April-13-2022

The meeting was called to order by Robert Czechlewski, Jackson County EMA Director for the purpose of updating the Jackson County Hazard Mitigation Plan. Robert introduced himself and Dave Pollinger, Hazard Mitigation Planner from RDI Solutions

Other people present at this organizational meeting are as follows: Commissioner Donnie Willis, Terry Barr, Jackson County Health Department and Jackson County EMA; Samantha Brooks, Jackson County EMA Deputy Director; Robert Czechlewski, Jackson County EMA Director; Brody Davis, Ohio EMA; Mark Jenkins with Jackson County Engineer office, Larry Mullins Scioto EMA Director, Brett Hinsch City of Jackson Chief of Police, David Ramby with Jackson County Health Dept., Ryan Pelletier City of Wellston Fire Chief.

Robert passed out a handout to each person: "Mitigation Plan Update-Hazard Identification and Ranking". Dave explained that this handout is to help the Local Mitigation Committee to meet the requirements and also helps the States and FEMA Mitigation Planners to provide feedback.

He explained why we need to prepare a Hazard Mitigation Plan, an overview of the plan update process, and the new requirements. He also explained the difference between the Hazard Mitigation Plan and the Emergency Operations Plan. Needing to identify hazards and rank the importance of each one. Actions need to cover a good amount of info about each hazard but not get too specific.

Dave proceeded to talk us through the process of updating the plan. He explained we need to review the current plan, attend all meetings, OEMA would review the updated plan draft, any final revisions and lastly OEMA would submit the final plan to FEMA for approval. Dave stressed there needs to be an emphasis on community participation. Also he made suggestions as to who should be represented in the planning group.

There was some discussion of current and new projects that may need to be added. Next mitigation meeting planned for May 18, 2022 at 10:00 am

Meeting was adjourned at 12:00pm

MITIGATION PLAN UPDATE MEETING #3

June 10, 2022

The meeting was called to order by Robert Czechlewski, Jackson County EMA Director for the purpose of updating the Jackson County Hazard Mitigation Plan. Other people present at this organizational meeting are as follows: David Ramby, Jackson County Health Department, Samantha Brooks, Jackson County EMA Deputy Director; Brody Davis Ohio EMA; David Pollinger, RDI Solutions/Planner, Melissa Miller, Jackson County Engineer, George Andres, OSCR Railroad

Dave Pollinger explained that we would be prioritizing the goals at this meeting. We discussed each goal/action and the before and after vulnerabilities and benefits. Robert stressed that the hazards/projects must be listed in the plan to be eligible for Federal and State funding and any other agencies that would offer funding.

A retention basin was discussed for the areas of Harding Ave and Broadway around Eddy Jones Park. Debris catcher around Veterans Drive. Also talk of removing sediment for storm water management to help with the issues of flooding in other areas. Talks of preparedness, generators, health department refrigeration, modifying health department and other critical infrastructure. Another project for water and sewer lines in rural areas. Communications upgrades for MARCS radios and communication systems in general. Planning on mid-August for another meeting.

MITIGATION PLAN UPDATE MEETING

August 31, 2022

Dave Pollinger explained that we would be prioritizing the goals at this meeting. We discussed each goal/action and the before and after vulnerabilities and benefits. Robert stressed that the hazards/projects must be listed in the plan to be eligible for Federal and State funding and any other agencies that would offer funding.

Newer projects being addressed; Marcs radio issues, retention bases, updating county addresses, expanding water and sewer lines, big push for safe rooms, dams and tornado sirens.

- Any structures at risk in the county for flooding or prone to
- Dams- Requirements for dams and FEMA flood maps
- Water Treatments Plants- Evaluate flood control
- Back up generators for critical infrastructures
- Keep debris clear at bridges and creeks. Clear all sediment from beds
- Overgrowth
- Color coded hydrants for county wide.
- Replace older ones- DRY hydrants

Meeting Sign in Sheet Date: 8 / 31 /2022

NAME	ORGANIZATION	e-mail address
Robert Czechlewski	JC EMA	jacksonco ema @ Hotmail. com
John Robinson	Wellston PD	jrobinson@cityofwellston.org
Ryan Pelletier	Wellston Fire	rpelletier@cityofwellston.com
Brett Hinsch	Jackson P.D. / City of Jackson	bhinsch@jacksonohio.us
Charlie Hudson	Wellston	chudson@CityofWellston.org
Anthony Brenner	Wellston	service director@cityofwellston.org
GEORGE ANDRES	OSC Railroad	g.andres@ierr.net
Samantha Brado	JCEMA	jacksoncoema@yahoo.com
Larry Mullins	Scioto Co. EMA	sciotoema@frontier.com
David Ramby	JCHD	dramby@jchd.us
TERRY BARR	JCHD - DEP DIR	TBarr@jchd.us
David P Ward	OHPD	dward@OakHillPD.org
David Swackhammer	City of Jackson	dswackhammer@jacksonohio.us

B. Available Major Event Narratives

1. Flooding

Narrative
Flash Flood - 1/17/1998 Rains of 1.5 to over 3 inches fell along a frontal boundary in 12 to 18 hours. The heaviest rains in southeast Ohio were over Perry, Vinton, and Jackson Counties. McArthur reported 3.25 inches of rain. The Middle Fork of Salt Creek flooded around Ratcl
Flash Flood - 6/29/1998 The second night of thunderstorms hit during Saturday night the 27th, into Sunday morning, the 28th. Portions of Athens, Washington, and Meigs Counties were hit hard by flooding from this round. The third night of thunderstorms was on Sunday the 28th into
Flash Flood - 2/13/2000 Rains of 1.5 ot 2.5 inches fell from 1300E on the 13th to 0500E on the 14th. Jackson measured 2.07 inches, Salem Center had 2.16 inches, McArthur 2.18 inches, Beverly 2.3 inches, and Marietta 2.43 inches. Only minor damage to roads occurred, but this event left the ground saturated
Flash Flood - 2/18/2000 Rains of 2 to 4 inches fell in about an 18 hour period. A strong frontal zone was in the vicinity, as low pressure moved up the Ohio Valley. Southerly winds pulled low level moisture north from Tennessee and Kentucky . Surface dew points were in the 55 to 60 degree range south of the frontal boundary. Carpenter of western Meigs County had 4.1 inches, Gallipolis meausred 3.7 inches, Jackson 3.45 inches, Patriot, Salem Center, and Willow wood all had around 3.3 inches, while McArthur had 3.2 inches. A spotter network in Meigs County revealed 3.9 inches at Racine and 3.6 inches at Syracuse.Preliminary damage accessment figures from emergency management officials had 3 homes in Meigs County and 2 homes inLawrence County sustaining major damage. Minor damage to homes was reported in Athens, Gallia, Meigs, and Washington Counties. In Gallia County, about a dozen homes sustained minor damage. Racoon Creek flooded and closed roads.Minor river flooding occurred after the flash flooding on the small streams. The Hocking River in Athens County crested just over its 20 foot flood stage at 20.49 feet around 0600E on the 20th. The Ohio River caused the usual backwater flooding from below Belleville Lock and Dam to the Ironton vicinity. The crest at Pomeroy was a half of a foot over the 46 foot flood stage around 0500E on the 21st. This was not high enough to affect the businesses in town. In Meigs County, a 51 year old man drowned in the flooded backwaters of the Ohio River near the mouth of Leading Creek. The area is known as Shady Cove near Hudson. A father and his son were in a small boat, ferrying across a flooded area. The boat hit a submerged object around 1430E on the 20th. The father fell out of the boat. He was not wearing a life jacket. His body was recovered that evening by the fire department.
Flood - 4/21/2002 Warm frontal rains of 1.5 to 2.5 inches were common in about an 18 hour period on the 21st. McArthur measured 2.27 inches, Gallipolis had 2 inches. Isolated amounts over 3 inches were likely. Roads were closed in the usual low spots by overflowing small streams. Jackson County Sheriff's department reported a mobile home flooded along Route 279. A 44 year old Lawrence County man drowned in Johns Creek along County Road 4 in Aid Township around 2200E on the 21st. He was driving to a job in Gallipolis. County officials believed he drove into some water on the road, stopped, put his vehicle in reverse to turn around, and then drove into the swollen stream. His body was discovered on Monday morning the 22nd, by a local resident, who was checking the level of the stream. A few reports of large hail also occurred with this episode.
Flood - 4/28/2002 Warm frontal rains fell during the predawn hours on the 28th, as a low pressure lifted northeast, toward Michigan. Rains of 1.5 to 2.75 inches fell over saturated ground. Gallipolis, McArthur, and Waterloo all reported

Narrative
around 2 inches of rain in their Sunday morning cooperative reports. Several roads were blocked by overflowing small streams. A few evacuations took place in Gallia County near Gallipolis, as rising water surrounded some apartments. Water covered fields and hampered spring planting. Later in the day, thunderstorms formed along the cold front. Large hail was common. The largest hail was across northwest Athens County near Nelsonville and Trimble. Several vehicles were dented. Some roof and window damage also occurred to residential homes.
Flood - 5/10/2003 On the 10th, several rounds of showers and thunderstorms crossed southeast Ohio. Flooding, gusty winds, hail, and even some funnel clouds occurred. The heaviest rains were across southern Jackson County on east, into Gallia County. Gallipolis had a 24 hour rain amount of 2.67 inches, ending at dawn on the 11th. Jackson County emergency officials reported a tributary to Huntingcamp Creek overflowed into 3 homes and 4 businesses around Oak Hill. Over recent years, the stream has seen more culverts installed. In Hamilton Township of Jackson County, several homes had flooded basements. The fire department rescued a person in a flooded car along Route 139.
Flood - 11/12/2003 Rains of 1.5 to 2.1 inches fell in a 8 to 10 hour period, causing numerous small streams to flood. Several roads were closed early on the 12th. The heavier rains shifted south during the day of the 12th, keeping this event minor for southeast Ohio.
Flood - 1/14/2004 A strong frontal boundary pushed across southeast Ohio late on the 3rd. By dawn on the 4th, the frontal zone stalled just to the south. Late on the 4th and into the 5th, a low pressure wave lifted northeast, along this boundary, and through the Ohio River Valley.Rains of 1.5 to 3.3 inches fell on saturated ground, during about a 36 hour time span. One rain maximum extended northeast from the Scioto River Valley, across the northern half of Perry County, then continued northeast into the Muskingum River Valley. Another maximum of rain extended out of central Vinton County, across central Athens County, and into central and northern Washington County. McArthur measured 3.3 inches of rain for the event. Other rain measurements from cooperative observers included 2.6 inches at Athens, 2.3 inches at McConnelsville, 2.2 inches from Nelsonville, 2 inches at Marietta, 1.9 inches at Beverly, 1.6 inches from both New Lexington and Jackson. Widespread small stream flooding occurred on Sunday the 4th and Monday the 5th. In Jackson County, the stream flooding was limited to townships near the Vinton County border. Water was 2 to 3 feet deep in the streets of Glenford of northern Perry County. Water and debris forced numerous road closures. As the water receded, cleanup was complicated by some ice formation. River flooding followed on the Muskingum, the Hocking, and on the Ohio. The swollen rivers also caused feeder streams to have backwater flooding. During the morning of the 5th, the Muskingum River crested at McConnelsville of Morgan County around 12.7 feet. Flood stage is 11 feet. This was the highest water level at McConnelsville since the 12.8 feet back in August, 1980. About 27 homes and 1 business along the river in Morgan County sustained at least major damage. All total, about 77 homes in Morgan County, were affected to some degree. At Athens, the Hocking River crested around 21.3 feet about midday on the 6th. Flood stage is 20 feet. The floods of 1997 and 1998 were higher at Athens. The county engineer reported about a dozen road slippages and a dozen road washouts on roads in Athens County. Near dawn on the 6th, York Township firemen rescued a woman whose vehicle was washed into the Hocking River from County Route 4. She called 911 on her cell phone, while the water was rushing into her vehicle. She got outside and on to the roof, but was swept off the vehicle by the rushing water. She was in the water for nearly 45 minutes, with air temperatures in the 20s. When rescued by boat, her head was poking out of the water and one arm was hanging on to a brush pile. The fire chief commented, about how lucky she was. He said the spot where she drove into the water is usually a dead zone for cell phone service, but somehow she got a signal. The Ohio River crested at Marietta at 36.8 feet during the afternoon of the 6th. Flood stage is 34 feet. The flood of January 1996 crested at 39.3 feet. Further down the Ohio River, the crest at Racine was 44.7 feet, plus near 47.3

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feet at Pomeroy, both on the 7th.In Washington County, the heaviest flood damage was along the Muskingum River, plus the usual low lying sections in the city of Marietta. Three occupied dwellings were destroyed in Washington County. Over 200 dwellings were affected to some degree. Local fire departments in Washington County performed several rescues, most of which were along County Route 32, known as the Muskingum River Road. Athens, Morgan, Perry, and Washington Counties were included in a major federal disaster declaration. See FEMA disaster 1507 for the specifics.
Flood - 9/18/2004 The low pressure remains of Hurricane Frances caused about a 30 hour rain event, from the afternoon of the 7th, into the evening hours of the 8th. A stalled frontal boundary helped trigger heavier convection on the northern, or leading edge, of the rain shield during the late afternoon and evening of the 7th. This initial convection caused the heavier storm totals to be over Morgan and Perry Counties, compared to points further south. Storm totals of 4 to 7 inches were common, with isolated amounts both above and below those totals. Some specific preliminary totals include New Lexington with 7.5 inches, McConnelsville 6.6 inches, McArthur 6.3 inches, Salem Center 5.7 inches, Athens 5.5 inches, Gallipolis 5.1 inches, Carpenter 5.0 inches, South Point 4.7 inches, Newport and Nelsonville 4.6 inches, and finally Marietta 3.8 inches. The Scalia Lab on the Ohio University campus in Athens reported a storm total of 5.3 inches. Other rain totals from spotters included 5.9 inches at Pageville of Meigs County, 5.7 inches from Darwin of Meigs County and Guysville of Athens County. Tuppers Plain of Meigs County measured 5.4 inches. A few automated gauges totaled 5.1 inches at Coolville, 4.9 inches at Kitts Hill, and 4.8 inches at Amesville. Since the ground was dry prior to this event, most flooding was to roads and low lying areas. In Athens County, Sunday Creek surrounded buildings in Trimble and blocked streets. Some residents evacuated their homes as a precaution. Flooding remained minor. The gauge at Glouster crested at 16.4 feet on the 9th, well below the 19 foot crest observed back in May, 2004.However, flooding was more severe in Perry, Morgan, and Washington Counties, affecting some homes. In Perry County, around 50 homes had major damage, with 3 homes destroyed. Duck Creek flooded in Washington County, including around Elba and Lower Salem. In Washington County, one house was destroyed, while 7 homes had major damage. In Morgan County, 8 homes had major damage. The Muskingum River crested at 11.7 feet early on the 9th at McConnelsville in Morgan County. Flood stage is 11 feet. The Shade river near Chester of Meigs County rose from 4.7 feet around 0500E on the 8th, to 21.5 feet around 1830E on the 9th. Bankfull is around 17 feet.This event set the stage for a more widespread flood across southeast Ohio, to follow later in the month.
Flood - 3/19/2008 Rain spread into southeast Ohio near dawn on Tuesday, the 18th. A strong east to west warm front had set up across northern Kentucky. By late afternoon, rain amounts of 0.5 to 1.35 had already fallen, with the heaviest being over northern Jackson, Vinton, and Athens Counties. A lull occurred Tuesday evening, as the warm front and its rain shifted north. However, as the low pressure lifted northeast through the Ohio Valley, another 1 to 2 inches of rain fell on the 19th. Some preliminary rain totals over about a 36 hour period included, 3.5 inches at McArthur, 3.0 inches at New Lexington, 2.7 inches at Jackson, 2.6 inches at Salem Center, 2.3 inches at McConnelsville, 2.2 inches at Beverly, 2.1 inches at Athens, and 1.7 inches at Nelsonville. Storm totals were even higher further southwest, down the Ohio River Valley, where the moisture inflow was greater. ||Luckily, southeast Ohio avoided a major flood event. Small stream flooding was widespread across Perry, Athens, Morgan, Vinton, Jackson, and Meigs Counties. A few streams, such as Duck Creek, also flooded in Washington County. Numerous roads were closed by high water, but no dwellings were damaged by flood waters. Several school districts closed schools on the 19th. County maintenance departments were kept busy clearing debris off of culverts and roads.||Later, the larger streams and rivers also saw minor flooding on the 19th into the 20th. The Muskingum River creasted just over 12 feet at McConnelsville during the predawn hours of the 20th. Flood stage there is 11 feet. The Hocking River at Athens crested at 21.4 feet during the late evening of the 20th.

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Flood stage at Athens is 20 feet. The Shade River near Chester crested at 20 feet during the evening of the 20th. Bankfull is 17 feet near Chester.
Flood - 6/14/2008 Increasing moisture quickly moved up the Ohio River Valley on the morning of the 3rd into a developing east to west frontal zone. The first of several thunderstorm complexes moved from west to east into extreme southern Ohio during the early afternoon on Tuesday, the 3rd. The west to east band of training thunderstorms shifted slightly north overnight, to include Jackson, Vinton, Athens, Meigs, Morgan, and Washington Counties. A tornado warning, during the evening of the 3rd, prompted Ohio University at Athens to enact emergency precautions for their dormitories. However, no tornado occurred. ||The ground was already wetter than normal in the Hocking Valley on north, from above normal rainfall in May. By dawn on the 4th, the highest rain totals were over 2 inches around Jackson on northeast toward Athens. ||These rain amounts over the wet terrain, caused some flash flooding on small streams late on the 3rd and early on the 4th. ||The west to east band of convection sank slightly back to the south during the daylight hours on Wednesday, the 4th. Portions of Jackson, Meigs, Gallia, and Lawrence Counties saw the heaviest rains then. Small stream flooding was widespread with numerous road closures. Lawrence County was hit the hardest with small stream flooding. ||Hail and some wind damage occurred with the convection.||The last of the significant showers exited after 2100E on the 4th.||Rain totals over a 30 to 36 hour time frame were 2.5 to 4.5 inches. A few specific preliminary totals from cooperative observers included Waterloo with 4.5 inches, Jackson 4.3 inches, Gallipolis 3.8 inches, Salem Center 3.4 inches, South Point 3.1 inches, and Athens, McArthur, plus McConnelsville 2.9 inches.
Flood - 5/12/2010 A strong southerly flow, ahead of a cold front, transported very moist air through Tennessee, Kentucky and into southeast Ohio. Surface dew points were in the mid and upper 60s. Wave after wave in the mid and upper levels helped trigger widespread showers, with embedded thunderstorms. These training rains first affected Jackson and Vinton Counties between 0500E and 0600E on Sunday May 2nd. The heaviest rains arched into Athens County and eventually sank slowly south, to affect Lawrence, Gallia, and Meigs Counties later in the day.||The rains continued into the evening hours on the 2nd, then diminished during the late evening. However, some light rain lingered until after midnight on the 3rd.||The rain amounts over about an 18 to 20 hour period were mostly 3.5 to 4.5 inches across Lawrence, Jackson, Viinton, Gallia, Meigs, and Athens Counties. Waterloo in northern Lawrence County reported 4.8 inches for the maximum. McArthur in Vinton County and Jackson in Jackson County both measured around 4.3 inches. The town of Athens had 4.1 inches, while Gallipolis had 3.9 inches, and South Point measured 3.8 inches. An automatic gauge in Gallia County, between Gallipolis and Rio Grande measured 3.7 inches.||Small stream flooding was common. Roads were flooded. Some small bridges and culverts were washed out. Two men drowned near the Athens County line in Morgan County.
Flash Flood - 6/13/2010 A line of thunderstorms formed over eastern Indiana during the mid afternoon. With afternoon heating, the thunderstorms intensified as they moved east across Ohio. The leading edge of the storms moved into southeast Ohio near sunset. Severe wind gusts were noted in a few localities. ||In the wake of the afternoon and evening cluster of thunderstorms, new thunderstorms formed along a leftover boundary. They were oriented in a narrow west to east line. Training of cells occurred over southern Vinton County and northern Jackson County later that night. ||The maximum total rain from the initial storms plus the smaller training cells was estimated at 3 to 4 inches. This occured in a narrow west to east band along the border of Jackson and Vinton Counties. Just north of this band, the cooperative observer in McArthur measured 2.3 inches.
Flash Flood - 8/11/2010 With plenty of sunshine, a convective complex developed during the heat of the afternoon over central Ohio in

Narrative
a weak wind flow. The storms intensified as they drifted southeast into southern Ohio. The rain did bring some temporary relief from the heat. However, some minor wind damage occurred along with minor flash flooding. Rain rates of up to 2 inches in an hour were likely.
Flood - 4/12/2011 Rain began Monday evening the 11th, around the north side of a strong mid level disturbance. The rain increased during the predawn hours on the 12th. Rain amounts of 1 to 1.5 inches were measured by dawn on the 12th. Another half inch of rain fell during the morning to midday time frame, before tapering off. Most maximum rain totals were in the 1.5 to 2 inch range. ||Minor stream flooding occurred, blocking and closing roads, but not flooding homes.
Flood - 4/23/2011 Several more rounds of showers and thunderstorms moved through southeast Ohio from Friday the 22nd into Sunday the 24th. This time the heaviest rains were a bit further south. The counties of Gallia and Lawrence were hit the hardest. For example, the cooperative observer at Waterloo measured 1.9 inches at dawn on the 23rd and another 1.67 inches at dawn on the 24th. Meanwhile, Gallipolis had 1.57 inches and 1.40 inches respectively. ||Small stream flooding was again common from the late on the 22nd into the 25th. The larger creeks, such as Symmes Creek, did not crest until early on the 25th. At Aid in Lawrence County, the crest on Symmes Creek was 21.5 feet. This was the highest stage in over 11 years, since February 2000. The bankfull stage there is 19 feet. According to county emergency officials, only roads were flooded and closed. No dwellings were flooded.||The thunderstorms also caused wind damage early on 23rd and again later that afternoon across Lawrence County.
Flash Flood - 5/10/2011 Repetitive showers and thunderstorms, moved southeast through western Vinton County, Jackson County, and western and central portions of Lawrence County between 1500E and 1830E on Tuesday, the 10th. This convection was just northeast of the surface warm front. A sharp dew point gradient existed along the front. Surface dew points were around 70 degrees just southwest of the boundary. Luckily, later that same evening, repetitive convection occurred in the Scioto River Valley, missing this area just to the west. ||Initially, the main impact was large hail. As back building caused repetitive showers and thunderstorms, flooding became the primary issue. Maximum rain amounts of 3 to 4 inches were observed. Jackson measured 3.35 inches. Waterloo observed 3.76 inches. South Point had 3.25 inches of rain.||Luckily, no injuries or fatalities occurred. ||State assistance money was committed to aid uninsured homeowners and renters.
Flash Flood - 5/14/2012 Convection dropped from northwestern Ohio during the late afternoon and reached into southeast Ohio during the evening hours of the 4th. This was south of an east to west cold front in northern Ohio. That front was sinking slowly south. Surface dew points were in the mid 60s. ||The convection consolidated into large cold clusters, first in eastern Ohio. As these weakened, the clusters of showers and thunderstorms to their southwest got stronger. These moved through southeast Ohio. Rain amounts of 1.5 to 2 inches fell in less than 2 hours. A few very localized amounts around 2.25 inches were likely. The Jackson cooperative observer measured 2.03 inches.||One fatality occurred in Athens County. Most of the flooding was confined to roads. Damage occurred to vehicles that stalled when motorists drove through flooded roads. Several motorists were rescued in Jackson and Gallia Counties.
Flood - 4/30/2014 Rounds of convection began on Monday the 28th. A nearly stationary front was located across the Tri State area near extreme southeast Ohio on Tuesday the 29th with more unstable air upstream over Kentucky. Additional rounds of convection fell on Tuesday. More discrete thunderstorm cells formed during the late afternoon and early evening of the 29th. This produced some large hail and damage to vehicles. One of those downpours caused a flash flood in western Lawrence County. ||Additional showers fell on the 30th, but

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amounts were not as heavy. The storm totals for the rain reached into the 3 to 3.6 inch range. This was over a 3 day period. Spotters in Albany and Athens both measured around 3.6 inches of rain. A spotter in Guysville measured around 3.3 inches. An automatic gauge near Pomeroy had around 3.2 inches of rain. Dean State Forest in Lawrence County and Rio Grande in Gallia County both had around 3 inches. The cooperative observer in Jackson measured just over 3 inches. ||Many streams eventually overflowed, causing minor flooding on the 30th. A strong rise occurred on the Hocking River, but eventually the crest remained below flood stage.
Flash Flood - 6/26/2015 During the afternoon of the 26th, a low pressure system was organizing over the lower Ohio River. Meanwhile, ahead of that system, a frontal boundary stretched east through southern Ohio and central West Virginia. ||Thunderstorms formed along the frontal boundary in southern Ohio, with more widespread rain north of the front. One of the leading storms was severe as it moved east. Repetitive thunderstorms and showers affected Jackson, northern Gallia, and southern Meigs Counties for a few hours. Downpours occurred. An automatic gauge in Jackson measured 1.5 inches in less than an hour. Its total by 2200E was 2.96 inches. Flash flooding closed several roads, but damage to houses was minimal.||Other storms formed further south during the evening, affecting Lawrence County.
Flash Flood - 7/12/2015 Showers and thunderstorms formed during the evening hours on the 12th. A weak low pressure was over southern Ohio. Minor flash flooding occurred in Jackson County.||After a lull in the rain during the morning into the early afternoon on the 13th, a mesoscale convective complex moved southeast through southern Ohio during the mid and late afternoon.||After another lull during the evening, more thunderstorms formed by late evening on the 13th in southeast Ohio. These moved southeast and caused repetitive showers. The heaviest rains were from Jackson County through Gallia County. The 24 hour rain maximum was from an automatic gauge near Rio Grande with 3.98 inches. Another gauge in Gallia County at Northup measured 3.23 inches. Two gauges around Jackson measured 2.68 and 2.03 inches of rain. The cooperative observer in Gallipolis measured 2.25 inches. Significant flash flooding occurred.||Finally, more thunderstorms formed in northern Ohio ahead of a cold front and mid level disturbance during the midday and early afternoon on the 14th. These storms formed into a squall line and moved southeast, through southern Ohio during the late afternoon. Rain amounts of a half inch to an inch in an hour were enough to cause minor flash flooding, since streams were running well above normal and soils were saturated. In less than 8 days, the rain total at both Waterloo and Gallipolis was around 6.1 inches. ||The last event from this multiple day episode was from the slow responding Symmes Creek in Lawrence County.
Flash Flood - 7/13/2015 Showers and thunderstorms formed during the evening hours on the 12th. A weak low pressure was over southern Ohio. Minor flash flooding occurred in Jackson County.||After a lull in the rain during the morning into the early afternoon on the 13th, a mesoscale convective complex moved southeast through southern Ohio during the mid and late afternoon.||After another lull during the evening, more thunderstorms formed by late evening on the 13th in southeast Ohio. These moved southeast and caused repetitive showers. The heaviest rains were from Jackson County through Gallia County. The 24 hour rain maximum was from an automatic gauge near Rio Grande with 3.98 inches. Another gauge in Gallia County at Northup measured 3.23 inches. Two gauges around Jackson measured 2.68 and 2.03 inches of rain. The cooperative observer in Gallipolis measured 2.25 inches. Significant flash flooding occurred.||Finally, more thunderstorms formed in northern Ohio ahead of a cold front and mid level disturbance during the midday and early afternoon on the 14th. These storms formed into a squall line and moved southeast, through southern Ohio during the late afternoon. Rain amounts of a half inch to an inch in an hour were enough to cause minor flash flooding, since streams were running well above normal and soils were saturated. In less than 8 days, the rain total at both Waterloo and Gallipolis was

Narrative
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Flash Flood - 7/29/2016 A weak complex of thunderstorms moved south and east from central Ohio into southeastern Ohio. Large precipitatable water values were in place leading to extremely heavy rainfall rates in some of the thunderstorms. Light steering winds lead to slow storm motion. A few instances of minor flash flooding occurred in Jackson County as a result during the evening hours of the 29th and into the early morning hours of the 30th.
Flash Flood - 5/31/2019 Following several days of showers and thunderstorms, a final upper level disturbance crossed on the 31st bringing another round of showers and storms. A couple of the storms produced hail. The ground was wet enough that the additional 0.5 to 1.0 inch of rain that fell on the 31st caused flash flooding in the late morning and early afternoon. This led to areal flooding during the late afternoon and evening.
Flood - 12/16/2019 A strong storm system brought a prolonged period of moderate to heavy rainfall to the middle Ohio River Valley on the 15th and 16th. Over a roughly 36 hour period, 1.5 to 3 inches of rain fell. This led to flooding along creeks, streams, and eventually smaller rivers as the water worked through the system.

2. Severe Summer Storm/Thunderstorm/Windstorm/Hail

Narrative
Thunderstorm Wind - 4/23/1996 A barn along John Hoops Road in Scioto Township washeavily damaged.
Thunderstorm Wind - 4/23/1996 Large trees were uprooted.
Thunderstorm Wind - 5/14/1996 A school roof and a barn were damaged.
Thunderstorm Wind - 6/17/1996 Large tree branches were snapped off and a few trees wereuprooted.

Narrative
Thunderstorm Wind - 5/19/1997 Trees and power lines were blown down.
Thunderstorm Wind - 7/12/1997 Minor damage occurred as trees or large branches were blown down. Power lines came down in Lawrence County.
Hail - 5/31/1998 Large hail and damaging winds hit around the city of Jackson. Trees and power lines were downed, some onto homes. One tree fell on an occupied car that was stopped at a traffic light. Luckily no one was hurt. The largest hail was reported just west of
Thunderstorm Wind - 5/31/1998 Large hail and damaging winds hit around the city of Jackson. Trees and power lines were downed, some onto homes. One tree fell on an occupied car that was stopped at a traffic light. Luckily no one was hurt. The largest hail was reported just west of
Thunderstorm Wind - 6/29/1998 The second night of thunderstorms hit during Saturday night the 27th, into Sunday morning, the 28th. Portions of Athens, Washington, and Meigs Counties were hit hard by flooding from this round. The third night of thunderstorms was on Sunday the 28th into
High Wind - 3/19/2002 A strong cold front blew through southeast Ohio. A narrow and brief line of showers was associated with the front. Winds gusted into the 45 to 70 mph range. Numerous trees and power lines were blown down. In Somerset of Perry County, 40 foot trees were snapped in half. Law enforcement in Meigs County reported damage to barns, also a few windows were blown out of buildings.
High Wind - 1/19/2008 Showers, ahead of a strong cold front, produced brief wind gusts of 50 to 65 mph during the late night hours. An unofficial wind sensor in Thornville of northern Perry County measured a wind gust to 58 mph.
Thunderstorm Wind - 2/11/2009 A strong low pressure center tracked from Missouri to Michigan. Meanwhile, its associated upper level trough pushed a cold front through southeast Ohio just before sunset. A fast moving band of rain, along and immediately ahead of the front, featured a narrow line of embedded showers. These convective showers helped mix down the winds that were located at 4 to 6 thousand feet above the ground. Surface wind gusts of 55 to 65 mph were common.||Later that night, wind gusts near 60 mph occurred, as the colder air poured in.||Power outages were common throughout southeast Ohio, as tree branches fell onto power lines. One major utility company reported the electricity remained out until late on the 13th or early on the 14th for some of its customers in southeast Ohio.
Thunderstorm Wind - 6/12/2010 A line of thunderstorms formed over eastern Indiana during the mid afternoon. With afternoon heating, the thunderstorms intensified as they moved east across Ohio. The leading edge of the storms moved into southeast Ohio near sunset. Severe wind gusts were noted in a few localities. ||In the wake of the afternoon and evening cluster of thunderstorms, new thunderstorms formed along a leftover boundary. They were oriented in a narrow west to east line. Training of cells occurred over southern Vinton County and northern Jackson County later that night. ||The maximum total rain from the initial storms plus the smaller training cells was estimated at 3 to 4 inches. This occured in a narrow west to east band along the border of Jackson and Vinton Counties. Just north of this band, the cooperative observer in McArthur measured 2.3 inches.
Thunderstorm Wind - 10/26/2010 A squall line developed ahead of a strong autumn cold front. The front was associated with the record setting

Narrative
low pressure system lifting northeast through Minnesota into Canada. The front passed through southeast Ohio during the mid afternoon. Strong to severe wind gusts occurred near the squall line and in its wake. Temperatures dropped rapidly from around 80 degrees to near 60 degrees, then eventually into the lower 50s by sunset.
Thunderstorm Wind - 2/28/2011 Out ahead of a strong late winter cold front, dew points rose into the 50s. A marginally unstable air mass allowed a squall line to sweep through during the early morning hours.
Thunderstorm Wind - 3/23/2011 This was a synoptic scale event. A strong north to south temperature gradient existed along the Interstate 70 corridor in Ohio. Low pressure moved out of Illinois in the morning, reaching western Pennsylvania by evening.||Individual thunderstorm cells developed in western Ohio and southern Indiana around midday. Hail was initially the main impact, but higher wind gusts developed as the thunderstorm complex matured.||A separate batch of showers and thunderstorms developed closer to the cold front and reached into southeast Ohio during the late evening.
Hail - 5/10/2011 Repetitive showers and thunderstorms, moved southeast through western Vinton County, Jackson County, and western and central portions of Lawrence County between 1500E and 1830E on Tuesday, the 10th. This convection was just northeast of the surface warm front. A sharp dew point gradient existed along the front. Surface dew points were around 70 degrees just southwest of the boundary. Luckily, later that same evening, repetitive convection occurred in the Scioto River Valley, missing this area just to the west. ||Initially, the main impact was large hail. As back building caused repetitive showers and thunderstorms, flooding became the primary issue. Maximum rain amounts of 3 to 4 inches were observed. Jackson measured 3.35 inches. Waterloo observed 3.76 inches. South Point had 3.25 inches of rain.||Luckily, no injuries or fatalities occurred. ||State assistance money was committed to aid uninsured homeowners and renters.
Thunderstorm Wind - 6/17/2011 Morning showers and thunderstorms in northern Ohio dropped south into southeast Ohio during the afternoon. Strong heating helped increase buoyancy during the afternoon.
Thunderstorm Wind - 6/21/2011 Thunderstorms developed over southern West Virginia and eastern Kentucky during the heat and humidity of this June afternoon. The storms moved northeast into southeast Ohio by the early evening. Despite the high freezing level, some large hail still occurred. The rapid temperature drop from near 90 to 70 degrees also helped produced some damaging wind gusts.
Thunderstorm Wind - 5/11/2012 An east to west front was lifting slowly back north through central Ohio into western Pennsylvania by evening. Several mid level disturbances moved east to help form afternoon and evening convection. ||As the evening continued, the convection became oriented more west to east, or parallel to their movement. The lingering showers caused minor flash flooding as localized rain totals reached near 2 inches.
Thunderstorm Wind - 5/14/2012 Convection dropped from northwestern Ohio during the late afternoon and reached into southeast Ohio during the evening hours of the 4th. This was south of an east to west cold front in northern Ohio. That front was sinking slowly south. Surface dew points were in the mid 60s. ||The convection consolidated into large cold clusters, first in eastern Ohio. As these weakened, the clusters of showers and thunderstorms to their southwest got stronger. These moved through southeast Ohio. Rain amounts of 1.5 to 2 inches fell in less than 2 hours. A few very localized amounts around 2.25 inches were likely. The Jackson cooperative observer measured 2.03 inches.||One fatality occurred in Athens County. Most of the flooding was confined to roads.

Narrative
Damage occurred to vehicles that stalled when motorists drove through flooded roads. Several motorists were rescued in Jackson and Gallia Counties.
Thunderstorm Wind - 6/29/2012 On the second day of a developing heat wave, under a sunny sky, afternoon temperatures reached the upper 90s to above 100 degrees across most of southeast Ohio. For example, Waterloo in Lawrence County reached 104 degrees that Friday afternoon. Marietta had 100 degrees. Meanwhile, an area of multi-cellular convection had moved out of northern Illinois that morning. It continued to organize and strengthen, as it propagated east and southeast across northern Indiana into western Ohio during the afternoon. As it moved toward southeast Ohio, it had already formed into a large arch of storms, or bow, with a developing cool pool in its wake. The temperature contrast between the air ahead of the developing derecho, compared to that in its wake was reaching 30 to 35 degrees. The resultant wind shift in the cool pool resulted in strong moisture convergence on the leading edge of the complex. This in turn, helped drive the storms further southeast, away from the mid and upper level wind support. However, the complex was diving right into that hot air that had obtained large convective available potential energy (CAPE), on the order of 4000 to 5000 j/kg. ||The derecho reached southeast Ohio near the hottest time of the day, after 1600E. It was racing southeast around 65 mph. The outflow or gust front began to outrace the rain as it moved into southeast Ohio. As the system matured, the strong gusts were longer in duration, in some cases around 10 minutes. That gust front then crossed the Ohio River into northeast Kentucky and western West Virginia on either side of 1730E. The storms and showers only provided about a quarter to a half inch of rain. ||Widespread wind gusts of 60 to 85 mph were likely with the leading gust front across southeast Ohio. A department of highways garage in Perry County measured 62 mph at 1650E. Ohio University at Athens measured 64 mph at 1712E. The airport near Albany of Athens County had a gust to 59 mph at 1715E. The department of highways garage in Gallia County near Kerr had 62 mph at 1731E.||The wind caused trees and large branches to fall in scattered locations throughout the 9 counties in southeast Ohio. There was some structural damage. Corrugated metal and siding were ripped off a few buildings. Trees fell onto houses and vehicles. Out of the 9 counties only 4 counties reported individual damage to the state. Those counties were Athens, Jackson, Lawrence and Meigs. The fallen trees and power lines also caused roads to be temporarily blocked. However, the largest impact was on the electric power grid. Prolonged power outages occurred. Some areas were without electricity for 4 to 7 days. ||Luckily there were no direct deaths or injuries. One indirect death can be attributed to the storm. ||The lack of electricity in the midst of the heat wave, disrupted the daily routines of most citizens for several days. Water and ice were in high demand. An emergency declaration by President Obama allowed federal supplies to be quickly delivered. Family and retail refrigerated food lost was substantial. Rural citizens with private wells may have been hit harder than those living in towns on public water systems. Citizens that relied on well water had no power to pump the water from their wells. Water had to be hauled just to flush the toilet. Some people slept outside on porches where it was cooler. With limited gas stations available to pump gas, long lines developed for a few days in the wake of the storm. Workers trying to restore the electricity had to take frequent breaks due to the heat and the safety equipment they had to wear.||Due to the public damage, a federal major disaster was eventually declared for this episode. A few others episodes during the first few days of July were also included. See FEMA disaster number 4077 for more details.
Thunderstorm Wind - 7/11/2012 A nearly stationary front lingered in the Ohio Valley. There was still a west to northwest flow aloft. Disturbances in the wind flow aloft continued to ride southeast, triggering showers and thunderstorms in the late afternoon and evening heat. The flow had weakened, compared to the large scale event from the 29th of June. As a result, cell movement was less. ||This episode was still included with the June 29th outbreak in the federal disaster declaration.

Narrative
Thunderstorm Wind - 7/26/2012 Well in advance of an approaching cold front, thunderstorms formed during the afternoon. The first cells reached into southeast Ohio after 1400E, with the main cluster of storms after 1600E. Out ahead of the storms, temperatures were in the 90s. A steep low level lapse rate and strong unidirectional flow aloft helped produce some damaging wind gusts.
Hail - 9/26/2012 The area was in the warm sector, ahead of an approaching cold front. Abundant afternoon sunshine and ample moisture combined with a disturbance aloft to produce thunderstorms in the late afternoon and evening hours. Large hail fell from the strongest storms.
Strong Wind - 11/24/2014 As a strengthening low pressure system lifted north through the Great Lakes into Ontario, strong winds aloft mixed down to the ground during the late morning and early afternoon. Surface temperatures were still in the 60s with partial sunshine. The cold air advection aloft aided in the downward momentum transfer.||Wind gusts of 40 to 50 mph were common. Electricity was temporarily out, mostly due to weak tree limbs falling on overhead lines. The most power outages were in Perry County where 5,900 customers were affected. In Athens County, over 4,000 customers were affected.
Hail - 4/19/2015 Thunderstorms existed at dawn on the 8th in Indiana. With support for the mid and upper level winds, this mesoscale convective complex maintained its intensity through the morning. It raced southeast at 50 mph reaching southeast Ohio during the midday time frame. Most areas saw brief wind gusts of 40 to 45 mph and rains of a quarter to a half inch. A few areas saw stronger wind gusts.||After a lull, additional rounds of convection moved into southeast Ohio after sunset on the 8th. Minor flooding occurred in Washington County as a result of the overnight convection. Rain amounts of 1.5 to 2.5 inches occurred in 24 hours.||Distinct thunderstorm cells formed during the day on the 9th. On the southern edge of a larger complex, one storm that moved from Athens County through southern Washington County had significant mid level rotation. Yet, no evidence of a tornado was found. ||Widespread showers accompanied the cold frontal passage early on the 10th. Rain totals of 1 to 1.5 inches were reported that included both the afternoon convection on the 9th and the predawn showers on the 10th.||In the wake of the cold front, drier air finally moved into southeast Ohio during the daylight hours of the 10th.
Thunderstorm Wind - 4/19/2015 Thunderstorms existed at dawn on the 8th in Indiana. With support for the mid and upper level winds, this mesoscale convective complex maintained its intensity through the morning. It raced southeast at 50 mph reaching southeast Ohio during the midday time frame. Most areas saw brief wind gusts of 40 to 45 mph and rains of a quarter to a half inch. A few areas saw stronger wind gusts.||After a lull, additional rounds of convection moved into southeast Ohio after sunset on the 8th. Minor flooding occurred in Washington County as a result of the overnight convection. Rain amounts of 1.5 to 2.5 inches occurred in 24 hours.||Distinct thunderstorm cells formed during the day on the 9th. On the southern edge of a larger complex, one storm that moved from Athens County through southern Washington County had significant mid level rotation. Yet, no evidence of a tornado was found. ||Widespread showers accompanied the cold frontal passage early on the 10th. Rain totals of 1 to 1.5 inches were reported that included both the afternoon convection on the 9th and the predawn showers on the 10th.||In the wake of the cold front, drier air finally moved into southeast Ohio during the daylight hours of the 10th.
Thunderstorm Wind - 5/11/2015 Well in advance of a surface cold front, afternoon heating had temperatures in the mid and upper 80s. Dew points were in the mid 60s. Clusters of thunderstorms formed and moved through southeast Ohio during the afternoon and early evening.

Narrative
Thunderstorm Wind - 6/26/2015 During the afternoon of the 26th, a low pressure system was organizing over the lower Ohio River. Meanwhile, ahead of that system, a frontal boundary stretched east through southern Ohio and central West Virginia. ||Thunderstorms formed along the frontal boundary in southern Ohio, with more widespread rain north of the front. One of the leading storms was severe as it moved east. Repetitive thunderstorms and showers affected Jackson, northern Gallia, and southern Meigs Counties for a few hours. Downpours occurred. An automatic gauge in Jackson measured 1.5 inches in less than an hour. Its total by 2200E was 2.96 inches. Flash flooding closed several roads, but damage to houses was minimal.||Other storms formed further south during the evening, affecting Lawrence County.
Thunderstorm Wind - 7/13/2015 Showers and thunderstorms formed during the evening hours on the 12th. A weak low pressure was over southern Ohio. Minor flash flooding occurred in Jackson County.||After a lull in the rain during the morning into the early afternoon on the 13th, a mesoscale convective complex moved southeast through southern Ohio during the mid and late afternoon.||After another lull during the evening, more thunderstorms formed by late evening on the 13th in southeast Ohio. These moved southeast and caused repetitive showers. The heaviest rains were from Jackson County through Gallia County. The 24 hour rain maximum was from an automatic gauge near Rio Grande with 3.98 inches. Another gauge in Gallia County at Northup measured 3.23 inches. Two gauges around Jackson measured 2.68 and 2.03 inches of rain. The cooperative observer in Gallipolis measured 2.25 inches. Significant flash flooding occurred.||Finally, more thunderstorms formed in northern Ohio ahead of a cold front and mid level disturbance during the midday and early afternoon on the 14th. These storms formed into a squall line and moved southeast, through southern Ohio during the late afternoon. Rain amounts of a half inch to an inch in an hour were enough to cause minor flash flooding, since streams were running well above normal and soils were saturated. In less than 8 days, the rain total at both Waterloo and Gallipolis was around 6.1 inches. ||The last event from this multiple day episode was from the slow responding Symmes Creek in Lawrence County.
Thunderstorm Wind - 8/10/2015 Thunderstorms intensified during the late afternoon, as a weak low pressure was moving across northern Ohio. A humid air mass existed across southeast Ohio.
Strong Wind - 3/11/2016 A strengthening low pressure system tracked east into northern Ohio and the Lake Erie vicinity by the early evening. Temperatures had peaked in the mid and upper 60s during the early and mid afternoon. The powerful cold front, associated with the storm system, streaked through between 1800E and 2100E. Wind gusts of 40 to 50 mph occurred with the showers associated with the front. The airport near Athens measured a gust to 43 mph. As colder air moved in, winds continued overnight, but gusts were not as strong.||A few trees fell causing power outages. Roughly 1,000 customers were without electricity.
Strong Wind - 4/12/2016 A cold front whipped through during the evening with just light showers and some graupel. The front was associated with a strong flow aloft and falling temperatures. ||Wind gusts of 45 to 55 mph were common during the late afternoon into the evening.||There were no injuries. Minor damage and power outages occurred. Fallen trees, tree limbs, and blown debris partially blocked roads. A tall pine tree fell and smashed a car in Gallipolis. The most power outages were in Washington County where over 1800 customers were affected. Jackson County had nearly 900 customers affected, with around 600 without power in Athens and Meigs Counties.
Thunderstorm Wind - 4/28/2017 A slow moving warm front combined with an upper level disturbance kicked off showers and thunderstorms

Narrative
late on the 28th. These storms were fueled by strong southerly flow from a low level jet, and produced isolated wind damage and hail across the middle Ohio River Valley overnight into the 29th.
Strong Wind - 2/24/2019 A warm front lifted northward into Ohio on the evening of the 23rd, promoting widespread showers and a few isolated thunderstorms due to the close proximity of an approaching cold front. Local reports of 1 to 1.5 inches of rain had fallen between the evening of the 23rd and the morning of the 24th.||Behind the cold front, very gusty winds developed with most areas seeing gusts of 40 to 50 knots. Combined with the soggy ground, these winds led to power outages due to downed trees and power lines. Thousands of power customers lost power, and it took a couple days for all service to be restored.
Thunderstorm Wind - 4/14/2019 A very strong low pressure system moved from the lower Ohio River Valley to the Great Lakes on the 14th, pushing a cold front through late that evening. Ahead of the cold front, strong to severe thunderstorms developed, producing mainly scattered wind damage.
Thunderstorm Wind - 5/29/2019 Abundant low level moisture was located over the middle Ohio River Valley on the 29th. As a mid and upper level disturbance passed, showers and storms developed, with some of the storms producing damaging winds.
Thunderstorm Wind - 8/20/2019 Severe thunderstorms entered into southeast Ohio on the evening of the 20th as an upper level disturbance crossed through the region. Strong wind gusts associated with these storms inflicted numerous tree and power line damage around the area.
Strong Wind - 11/27/2019 A strong low pressure system moved through the Great Lakes on the 26th and 27th. This pushed a cold front through the middle Ohio River Valley on the afternoon of the 27th. Very strong synoptic winds behind the front led to a couple thousand utility company customers losing power as multiple trees fell onto power lines across southeast Ohio. Hardest hit by the power outages were Gallia, Jackson and Meigs Counties. In Lawrence County, a tree fell through the roof of a home in Coal Grove. The automated weather system at Ohio University Airport near Albany measured a max wind gust of 45 mph just before 1 PM EST.
Thunderstorm Wind - 4/18/2020 A strong low pressure system crossing through the state inflicted multiple rounds of severe weather across southeast Ohio. Starting on the 7th, a warm front draped across the Ohio Valley was the primary focus for convection to develop that evening. These storms produced large hail across portions of Ohio. A brief lull in storms during the day of the 8th primed the atmosphere once more for severe thunderstorms to arise ahead of a cold front which passed through late that night. During which time, another round of thunderstorm wind damage and hail occurred in the state late that evening and into the early morning hours of the 9th. An EF1 tornado briefly touched down in Wilkesville shortly after midnight on the 9th, inflicting damage to several mobile homes.
Thunderstorm Wind - 6/10/2020 On a warm afternoon on June 10th, a line of strong thunderstorms entered southeast Ohio ahead of an approaching cold front. These storms brought strong winds and a few instances of small hail across the region. The Automated Weather Observing System in Athens County recorded a wind gust of 53 MPH at the time strong storms were pressing eastward into the Ohio River Valley. Widespread wind damage was observed through downed trees and power lines, as well as a roof being partially blown off in Lawrence County.
Thunderstorm Wind - 6/21/2021 Thunderstorms flourished across southeast Ohio on the afternoon and evening of June 21st as a cold front glided through the region. Most of the storms became stronger after passing over the Ohio River, but there

Narrative
were a few instances of damaging wind gusts that resulted in downed trees in the area. The combination of previous rainfall and multiple rounds of showers that day resulted in several flash flooding events. Multiple gauges in the area reported three to four inches of rain had fallen, which led to several roads closing for a brief period of time due to high water issues.

3. Severe Winter Storm

Narrative
Ice Storm - 2/16/2003 A severe ice storm occurred, when 1 to 2 inches of ice from freezing rain accumulated on trees and power lines. The precipitation initially started as snow then changed to rain then freezing rain. The freezing rain was mixed with sleet at times. The storm finally ended as a period of snow on Monday, the 17th. Roads remained blocked by fallen branches and trees for several days. A Meigs County deputy sheriff said on the 17th, "We've got trees coming down about every 5 minutes". The city of Pomeroy was without electricity for 5 days, No electricity lead to water shortages. Refrigerated frozen foods spoiled. Governor Taft declared a state of emergency in Lawrence, Gallia, and Meigs Counties for the severe icing. Jackson and Vinton Counties in southeast Ohio were later added for a request of federal assistance. President Bush declared a major disaster that included Jackson, Lawrence, Vinton, Meigs, and Gallia Counties. See FEMA disaster number 1453.
Extreme Cold/Wind Chill - 1/16/2014 An arctic cold front sweep through southeast Ohio just after midnight on Monday the 6th. Rain showers and temperatures in the 40s quickly became snow showers with temperatures falling through the 20s by the predawn hours.||During these predawn hours, an Athens County woman with mental health issues went outside in Knollwood Trailer Park. This mobile home park was located just southwest of the city of Athens. She apparently slipped and fell a few times on driveways. Detectives concluded she staggered and collapsed in a yard. She was not found until after daybreak and likely died of exposure.||Snow accumulations across southeast Ohio were less than 2 inches. Temperatures continued to fall during the day on the 6th, with blustery winds. Readings reached down to either side of zero by sunset. ||Temperatures at dawn on the 7th were mostly 5 below zero to 10 below zero. Wind chill readings bottomed out around minus 25 degrees overnight and into the morning hours.||Despite sunshine, temperatures were slow to rise during the day on the 7th. However, the wind did subside during the mid and late afternoon.||A scattering of frozen pipes, power outages, home furnace difficulties, and vehicular engine problems occurred during the cold wave. Repair companies were kept busy. School systems were closed.
Extreme Cold/Wind Chill - 1/27/2014 Arctic air poured into southeast Ohio on the 27th. A clear night with diminishing winds resulted in temperatures mostly in the minus 5 to minus 20 degree range across southeast Ohio.||At dawn on Tuesday the 28th, preliminary data indicated the coldest temperature from the official cooperative observers network was 21 degrees below zero from New Lexington. ||Some of the other minimum temperature readings around dawn on the 28th from cooperative observers included minus 9 at Jackson, minus 8 at Newport, minus 7 at Marietta, and minus 6 at Gallipolis. ||Some unofficial readings included a minus 20 from Corning in Perry County and a minus 16 from McConnelsville in Morgan County. A minus 14 was reported from both Zaleski in Vinton County and Watertown in Washington County. Readings of minus 13 to minus 17 were reported around the town of Athens. ||The night of Jan 28th into Jan 29th was another bitter cold night with readings in interior southeast Ohio very similar to the previous night. New Lexington reached minus 22 degrees, Beverly minus 16, Waterloo minus 13, Jackson minus 10.||With the Ohio River filled with broken ice, communities along the river were colder at dawn on the 29th. Marietta observed 11 below zero. Newport reached down to 10 below zero, while Gallipolis fell to minus 8, and South Point reached minus 2.||Some unofficial readings from the 29th included

Narrative
minus 21 at Corning, minus 19 along Interstate 77 in northern Washington County, minus 18 at Ohio University in Athens, plus Zaleski in Vinton County and McConnelsville in Morgan County. A minus 17 was reported in Wellston in Jackson County. ||The 3rd clear night was not quite as bitter, but still resulted in temperatures dipping below zero in many areas for dawn on Thursday the 30th. New Lexington had 10 below zero. Some unofficial readings also included minus 10 at Ohio University and Zaleski.||The 3 day cold wave finally broke that afternoon, as temperatures rose to either side of freezing with sunshine.
Heavy Snow - 3/14/2015 A warm front lifted north through southeast Ohio on the 3rd with a quarter to a half inch of rain. Late afternoon and evening temperatures rose into the 40s and 50s. Winds and dew points also increased. This combination helped accelerate the melting of the leftover snow pack.||Rains increased again overnight, with 1 to 1.7 inches of rain falling by dawn on the 4th in mainly north of the Hocking River Valley. An automatic gauge near Lower Salem in Washington County measured 1.69 inches. Beverly had 1.48 inches of rain through dawn. This caused small stream flooding to begin.||Small stream flooding became more common along the Ohio River counties as a steady rain fell. Rain rates were mostly 1 to 2 tenths of an inch per hour. Total rainfall of 1.5 to 2 inches became common by that evening.||As the small stream flooding continued, the rain changed to sleet and wet snow during the late afternoon and early evening of the 4th. Heavy wet snow quickly accumulated along the Ohio River counties during the late evening on the 4th and into the morning hours of Thursday the 5th. As the heavy snow was falling, several high water signs and barricades were stolen across Lawrence County. Further north, the snow was lighter over Morgan and Perry Counties.||The snow diminished by early afternoon of the 5th. A total snow accumulation of 10 to 13 inches was common from Jackson and Lawrence Counties on up the Ohio River to Washington County. For example, Waterloo of northern Lawrence County measured a 13 inch accumulation. The snow depth at Gallipolis also went from zero to 13 inches during the storm. Marietta reported a snow accumulation of a foot. Further north snow accumulations were mostly 4 to 8 inches across Morgan, and 3 to 5 inches in Perry County. An unofficial report of 17 inches was received north of Waterloo near the border with Gallia County. A spotter in Thurman of Gallia County measured 14 inches of snow.||After transitioning from rain to snow, the wet snow accumulated on trees, especially evergreen trees. Prolonged power outages were common in the counties adjacent to the Ohio River. ||After the storm, clearing resulted in a cold dawn on the 6th for so late in the season. The coldest minimum temperatures was 8 below zero at New Lexington of Perry County. Waterloo of Lawrence County had 6 below zero, while Jackson had minus 3. Near the Ohio River readings were closer to zero degrees. Newport in Washington County was 2 below zero. ||Eventually, the Ohio River had minor flooding from Gallia County on down the river through Ironton on the 6th into the 7th. Overall, both the stream and river flooding mainly blocked roads with little damage to structures.
Winter Weather - 1/19/2019 A strong storm system moved through the Ohio River Valley and central Appalachians on the 19th and 20th. Temperatures ahead of this system were warm, so precipitation started as rain. Around one inch of rain fell on the 19th. A cold front moved through late that evening, with temperatures dropping very quickly behind the front. This changed the precipitation over to a wintry mix of snow, sleet, and freezing rain before becoming all snow early on the 20th. ||The rain ahead of the system turned mostly into runoff due to already saturated soils. This caused minor flooding on some creeks and streams.||Heavy snow fell early on the 20th, with 6-7 inches near New Lexington in Perry County. In Morgan County, McConnelsville received 4 inches of snow. Amounts tapered off to the south and west with only 1-2 inches along the Ohio River. In Jackson County, a 34-year-old woman was killed in a single vehicle accident on Vega Road. The vehicle she was driving slid off the side of an ice covered road, dropped over an embankment and ended up on its top in a creek.

4. Tornado

Narrative
Tornado - 6/27/2018 Following on and off rain through the day on the 27th, a cold front pushed through during the evening with heavy rainfall leading to flooding. One low topped cell produced a concentrated damage path in Jackson County. This was determined to be a tornado through the combination of eyewitness videos and a NWS storm survey. There was no lightning in the cell.

Drought

- **Summer 1999 Drought**

  Drought conditions existed in Lawrence County for a five-month period during the summer of 1999.

  May 1999. After a dry April, drought conditions resurfaced again during May, after being alleviated during the winter months. Total rains during May were only 1.25 to 2.5 inches. The community of Lawrence had only 1.3 inches for the entire month, McArthur had 1.5 inches, while South Point measured 1.9 inches.

  June 1999. The drought continued to spread and strengthen in southeast Ohio. A deterioration in stream flow and soil moisture was noted. Some showers at the end of the month temporarily helped the top soil and the crops. Only 1 to 2 inches of rain fell in most areas during the entire month of June. Nelsonville observed the minimum, with just a half inch of rain. Temperatures peaked in the mid and upper 90s during the second week of the month. Beverly registered 98 degrees, while South Point had 97 degrees on the 10th.

  July 1999. The drought strengthened during the first half of the month, then eased slightly during the last 2 weeks. The worst drought conditions remained in Athens, Lawrence, Gallia, Meigs, and Lawrence Counties. In Lawrence County, an emergency drought declaration was issued. Delivery of water to residents with dry or contaminated wells continued in Lawrence County. The town of Rio Grande in Gallia County had to connect to another water system when their source was depleted. In Lawrence County, filling stations were set-up for families that had problems with their wells.

  The extreme heat depleted much of the moisture from the scattered showers. Preliminary data indicated Beverly of Washington County and South Point of Lawrence County both reached 102 degrees on the 30th.

  August 1999. The drought eased during the month of August across southeast Ohio. Monthly rains were 3 to 6 inches. Temperatures were not as hot, as those felt during July. However, the drought still lingered at month's end.

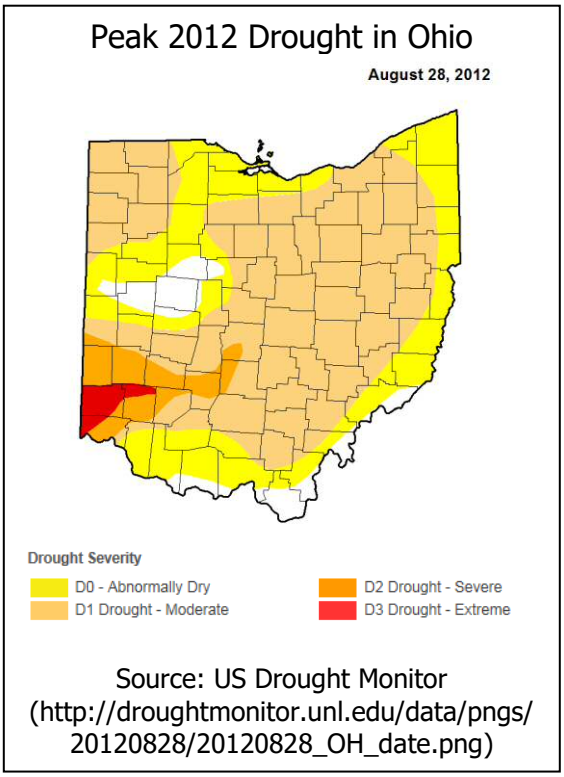
  September 1999. Drought severity either increased or remain about constant during the month. The rainfall during September was mostly between 1 to 2 inches. Yet, South Point of Lawrence County had even less rain, with just three quarters of an inch.

  October 1999. The drought severity eased as monthly rainfall was near normal. Amounts of 2.5 to 3.0 inches were common. Ground water shortages were still a concern at the end of the month.

- **Summer 2002 Drought**

Two months moderate; two months severe. The emerging drought from August peaked during the first 2 weeks of September, as hot and dry conditions lingered. Rains of 1.5 to 2 inches, plus cooler temperatures, dampened the drought by the fourth week of the month.

- **Fall 2007 Drought**
  Three months moderate; one month severe. In September, drought conditions crept north, as the month averaged warmer and drier than normal. The monthly rainfall was mostly between 1 and 2 inches.
  A rare October heat wave, during the 1st and 2nd weeks of the month, helped peak the severity of the drought. On the 11th, Gallia County declared an emergency due to a water shortage. With the lowering of the water table, wells were becoming less productive. Morgan County officials reported that their wildlife was being stressed from the lack of available water. Deer were dying from the effects of the drought and a dry weather disease.
  Much needed and widespread rain finally arrived on the 23rd and the 24th. Rain amounts of 2 to 3 inches were common. As the growing season ended and the autumn foliage peaked, drought conditions began to abate or ease.
  After peaking in early October, drought conditions continued to ease during the month of November. Monthly rainfall of 3 to 4 inches was common. By the end of November, the drought of 2007 was also coming to an end across southeast Ohio.



Source: US Drought Monitor (http://droughtmonitor.unl.edu/data/pngs/20120828/20120828_OH_date.png)

- **2012 North American Drought**

  The 2012-2013 North American Drought was an expansion of the 2010-2012 United States drought which began in the spring of 2012, when the lack of snow in the United States caused very little melt water to absorb into the soil. The drought includes most of the United States and included Ohio. Among many counties, Lawrence County was designated with moderate drought conditions by mid-June. It has been equaled to similar effects as droughts in the 1930s and 1950s but it has not been in place as long. However, the drought has inflected, and is expected to continue to inflict, catastrophic economic ramifications. In most measures, the drought has exceeded the 1988-1989 North American Drought, which is the most recent comparable drought.

  On July 30, 2012, the Governor of Ohio sent a memorandum to the United States Department of Agriculture's (USDA) Ohio State Executive Director requesting primary county natural disaster designations for eligible counties due to agricultural losses caused by drought and additional disasters during the 2012 crop year. The USDA

reviewed and Loss Assessment Reports and determined that there were sufficient production losses in 85 counties to warrant a Secretarial disaster designation. On September 5, 2012, Lawrence County was one of those designated counties. Source: Ohio EMA.

The 2012 North American Drought is the largest drought since the 1950's as reported by NOAA's National Climatic Data Center National Drought Report of 15 August 201247. At its peak in Ohio, Lawrence County experienced "Moderate Drought Severity" for four months. The University of Illinois at Urbana-Champaign reported a slightly elevated crop insurance loss ratio of 1.02 for 2012, indicating little insurance-reported crop loss during this period48. Lawrence County had no reported crop losses. Source: NCEI49

47 http://www.NCEI.noaa.gov/sotc/drought/201207#det-reg
48 http://farmdocdaily.illinois.edu/2013/03/drought-crop-insurance-loss-2012. html
49 http://www.NCEI.noaa.gov/stormevents/

C. Acronyms, Terms and Definitions

Term	Acronym	Description
Community Development Block Grant Program	CDBC	The Community Development Block Grant program is a flexible program that provides communities with resources to address a wide range of unique community development needs.
Community Asset		The people, structures, facilities, and systems that have value to the community
Dam - Class I		Dams having a total storage volume greater than five thousand acre-feet or a height of greater than sixty feet shall be placed in class I. A dam shall be placed in class I when sudden failure of the dam would result in one of the following conditions: (a) Probable loss of human life. (b) Structural collapse of at least one residence or one commercial or industrial business. Reference: OAC 1501:21-13-01(A)(1)
Dam - Class II		Dams having a total storage volume greater than five hundred acre-feet or a height of greater than forty feet shall be placed in class II. A dam shall be placed in class II when sudden failure of the dam would result in at least one of the following conditions, but loss of human life is not probable. (a) Disruption of a public water supply or wastewater treatment facility, release of health hazardous industrial or commercial waste, or other health hazards. (b) Flooding of residential, commercial, industrial, or publicly owned structures. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property. (c) Flooding of high-value property. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property. (d) Damage or disruption to major roads including but not limited to interstate and state highways, and the only access to residential or other critical areas such as hospitals, nursing homes, or correctional facilities as determined by the chief. (e) Damage or disruption to railroads or public utilities. (f) Damage to downstream class I, II or III dams or levees, or other dams or levees of high value. Damage to dams or levees can include, but is not limited to, overtopping of the structure. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property. Reference: OAC 1501:21-13-01(A)(2)
Dam - Class III		Dams having a total storage volume greater than fifty acre-feet or a height of greater than twenty-five feet shall be placed in

Term	Acronym	Description
		class III. A dam shall be placed in class III when sudden failure of the dam would result in at least one of the following conditions, but loss of human life is not probable. (a) Property losses including but not limited to rural buildings not otherwise described in paragraph (A) of this rule, and class IV dams and levees not otherwise listed as high-value property in paragraph (A) of this rule. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property. (b) Damage or disruption to local roads including but not limited to roads not otherwise listed as major roads in paragraph (A) of this rule. Reference: OAC 1501:21-13-01(A)(3)
Dam - Class IV		Dams which are twenty-five feet or less in height and have a total storage volume of fifty acre-feet or less may be placed in class IV. When sudden failure of the dam would result in property losses restricted mainly to the dam and rural lands, and loss of human life is not probable, the dam may be placed in class IV. Class IV dams are exempt from the permit requirements of section 1521.06 of the Revised Code pursuant to paragraph (C) of rule 1501:21-19-01 of the Administrative Code. Reference: OAC 1501:21-13-01(A)(4)
Emergency Management Agency	EMA	
Federal Emergency Management Agency	FEMA	FEMA's mission is to support our citizens and first responders to ensure that as a nation we work together to build, sustain and improve our capability to prepare for, protect against, respond to, recover from and mitigate all hazards.
Hazards U.S. Multi-Hazard	HAZUS-MH	The Hazards U.S. Multi-Hazard is a nationally applicable standardized method that estimates potential losses from earthquakes, hurricane winds, and floods. HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and estimates of damage and economic loss to buildings and infrastructure.
Impact		The consequences or effects of a hazard on the community and its assets
Mitigation		Activities providing a critical foundation in the effort to reduce the loss of life and property from natural and/or manmade disasters by avoiding or lessening the impact of a disaster and providing value to the public by creating safer communities. Mitigation seeks to fix the cycle of disaster damage, reconstruction, and repeated damage. These activities or actions, in most cases, will have a long-term sustained effect.

Term	Acronym	Description
		Mitigation measures may be implemented prior to, during, or after an incident. Mitigation measures are often informed by lessons learned from prior incidents. Mitigation involves ongoing actions to reduce exposure to, probability of, or potential loss from hazards. Measures may include zoning and building codes, floodplain buyouts, and analysis of hazard related data to determine where it is safe to build or locate temporary facilities. Mitigation can include efforts to educate governments, businesses, and the public on measures they can take to reduce loss and injury.
Modified Mercalli Intensity Scale		The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place. The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage.
Natural Hazard		Source of harm or difficulty created by a meteorological, environmental, or geological event
National Flood Insurance Program	NFIP	The National Flood Insurance Program is aimed at reducing the impact of flooding on private and public structures. This is achieved by providing affordable insurance for property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. Overall, the program reduces the socio-economic impact of disasters by promoting the purchase and retention of Risk Insurance in general, and National Flood Insurance in particular.
National Oceanic and Atmospheric Administration	NOAA	Science, Service, and Stewardship. Mission: To understand and predict changes in climate, weather, oceans, and coasts, To share that knowledge and information with others, and To conserve and manage coastal and marine ecosystems and resources.
National Weather Service	NWS	The National Weather Service provides weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

Term	Acronym	Description
Ohio Department of Natural Resources	ODNR	
Per Capita		Per unit of population.
Risk		The potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets.
Risk Assessment		Product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.
Threat or Human-Caused Incident		Intentional actions of an adversary, such as a threatened or actual chemical or biological attack or cyber event
United States Geological Survey	USGS	The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.
United States Department of Housing and Urban Development	USHUD	HUD's mission is to create strong, sustainable, inclusive communities and quality affordable homes for all. HUD is working to strengthen the housing market to bolster the economy and protect consumers; meet the need for quality affordable rental homes; utilize housing as a platform for improving quality of life; build inclusive and sustainable communities free from discrimination, and transform the way HUD does business.
Vulnerability		Characteristics of community assets that make them susceptible to damage from a given hazard

D. HAZUS-MH Modeling Reports

The following documents are the HAZUS reports referenced in this document

Hazus: Flood Global Risk Report

Region Name: JacksonCo

Flood Scenario: 100 Year Flood

Print Date: Thursday, January 5, 2023

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

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

Table of Contents

General Description of the Region

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

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Ohio

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

The geographical size of the region is approximately 16 square miles and contains 1,524 census blocks. The region contains over 13 thousand households and has a total population of 32,646 people. The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 18,555 buildings in the region with a total building replacement value (excluding contents) of 6,970 million dollars. Approximately 82.34% of the buildings (and 51.16% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 18,555 buildings in the region which have an aggregate total replacement value of 6,970 million dollars. Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	3,565,626	51.2%
Commercial	1,325,381	19.0%
Industrial	751,517	10.8%
Agricultural	795,028	11.4%
Religion	198,567	2.8%
Government	112,954	1.6%
Education	220,526	3.2%
Total	**6,969,599**	**100%**

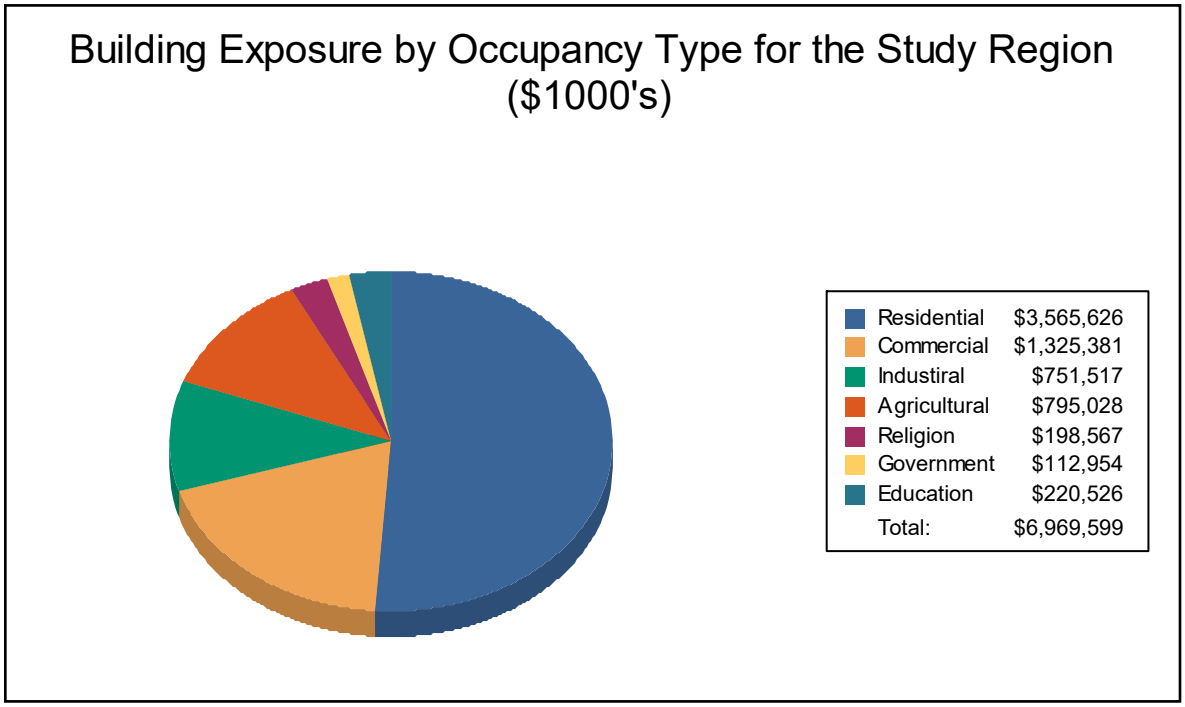
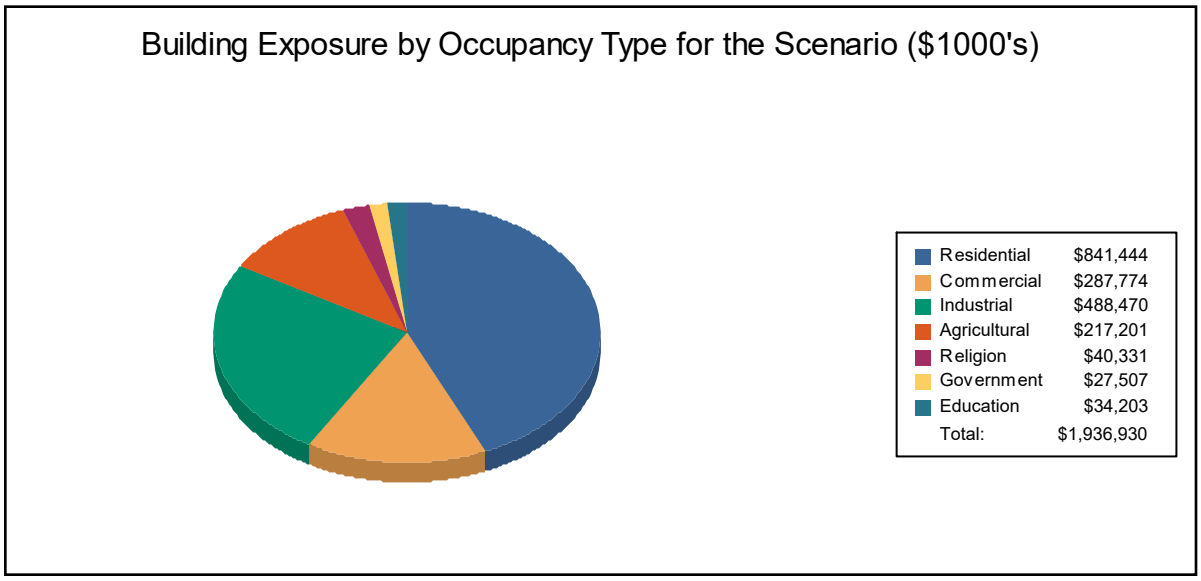


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	841,444	43.4%
Commercial	287,774	14.9%
Industrial	488,470	25.2%
Agricultural	217,201	11.2%
Religion	40,331	2.1%
Government	27,507	1.4%
Education	34,203	1.8%
Total	**1,936,930**	**100%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 24 beds.
There are 13 schools, 8 fire stations, 6 police stations and 1 emergency operation center.

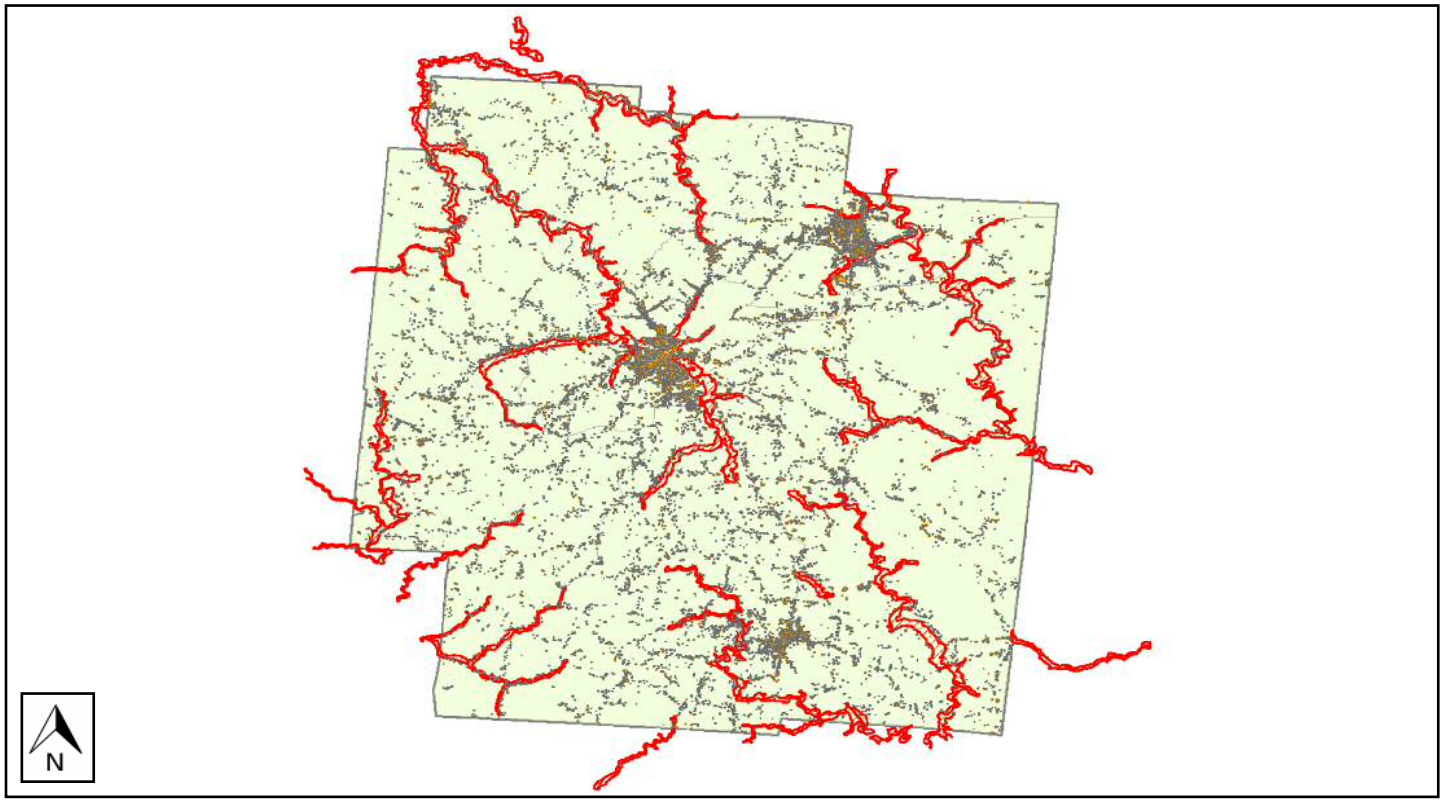
Flood Scenario Parameters

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

Study Region Name:	JacksonCo
Scenario Name:	100 Year Flood
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 83 buildings will be at least moderately damaged. This is over 83% of the total number of buildings in the scenario. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

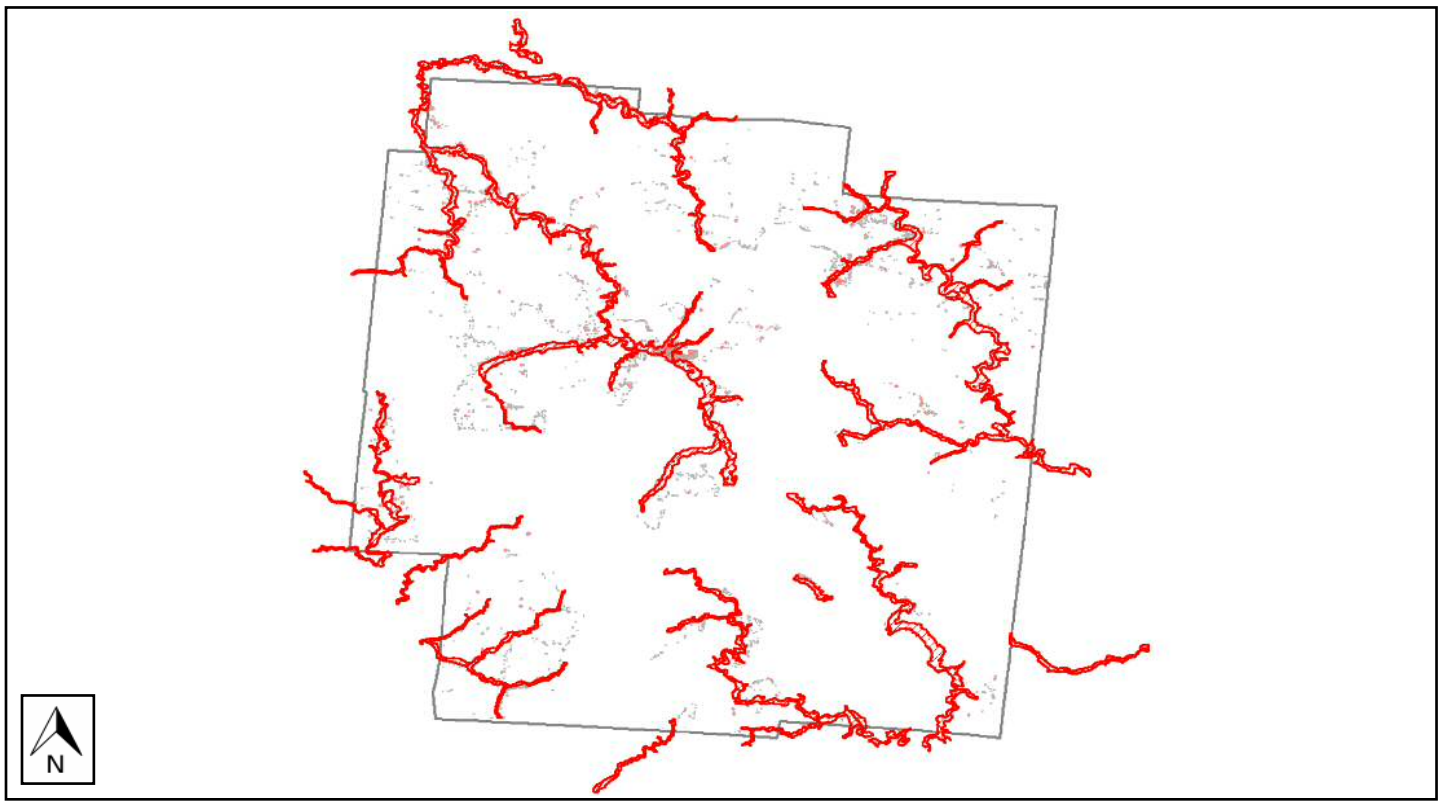


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		>50	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	1	13	2	25	1	13	3	38	0	0	1	13
Commercial	2	22	6	67	0	0	1	11	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	2	100	0	0	0	0	0	0	0	0
Religion	0	0	2	100	0	0	0	0	0	0	0	0
Residential	19	23	42	50	14	17	4	5	1	1	4	5
Total	**22**		**54**		**15**		**8**		**1**		**5**	

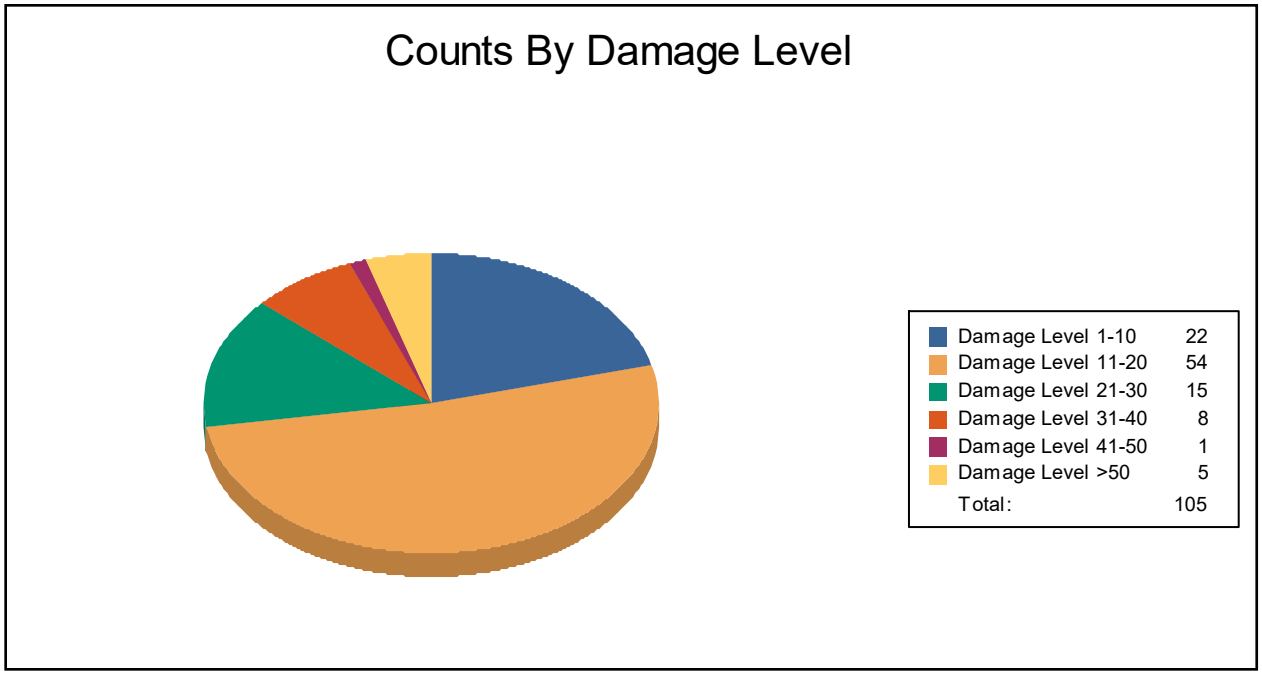


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		>50	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	1	100	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	4	100
Masonry	2	15	8	62	1	8	2	15	0	0	0	0
Steel	0	0	2	67	0	0	1	33	0	0	0	0
Wood	17	23	40	54	13	18	3	4	1	1	0	0

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 24 hospital beds available for use. On the day of the scenario flood event, the model estimates that 24 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Emergency Operation Centers	1	0	0	0
Fire Stations	8	0	0	0
Hospitals	1	0	0	0
Police Stations	6	0	0	0
Schools	13	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

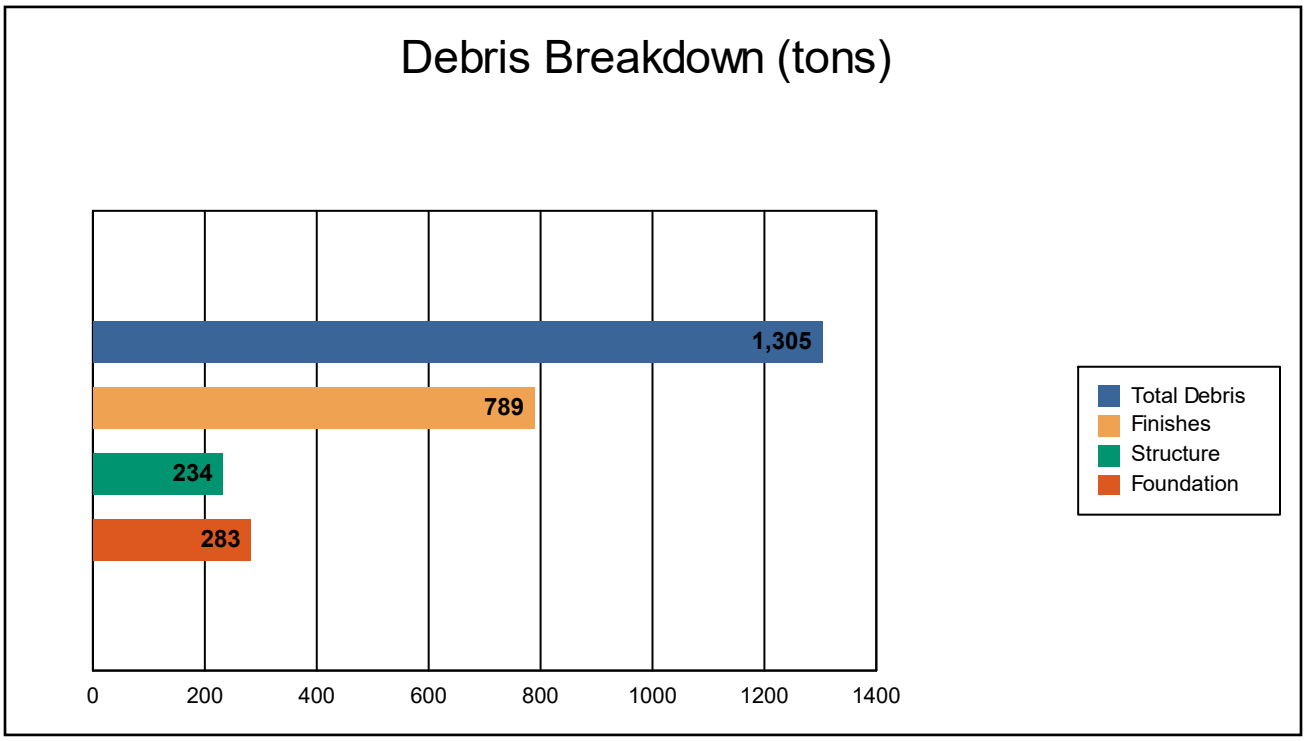
(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

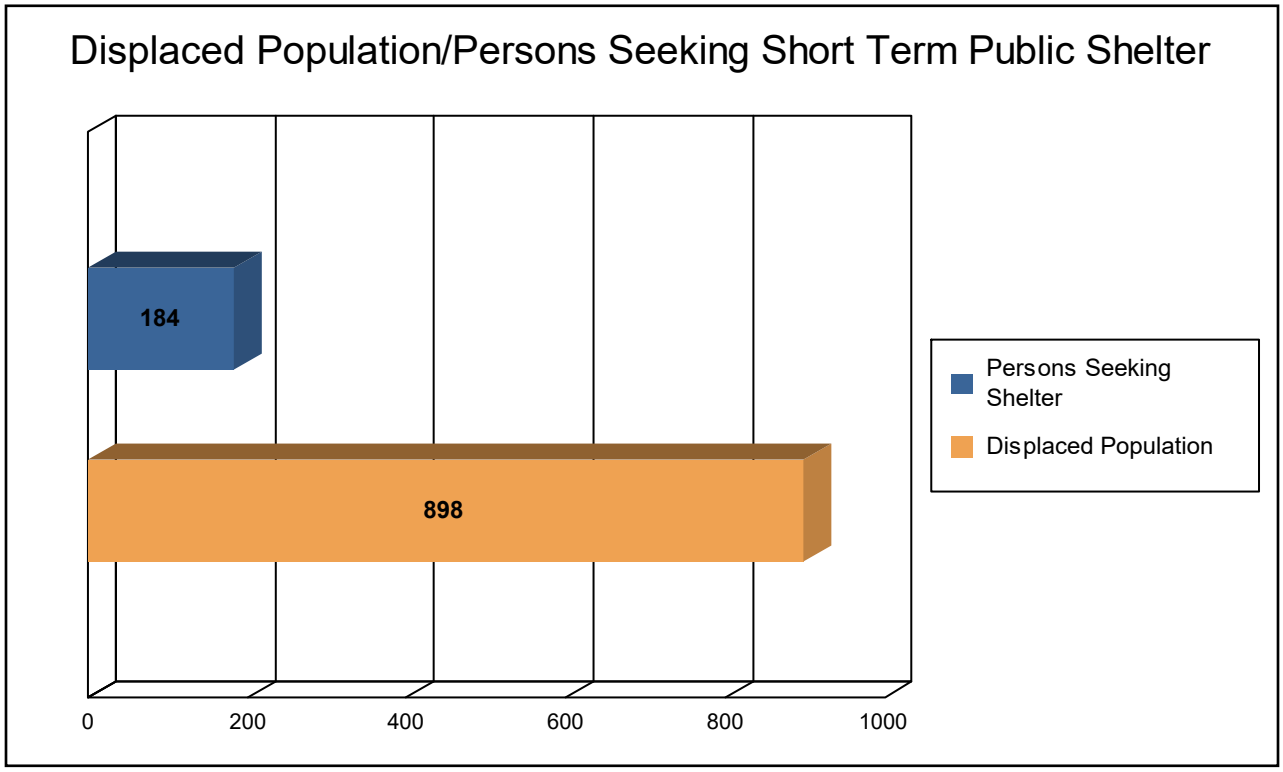


The model estimates that a total of 1,305 tons of debris will be generated. Of the total amount, Finishes comprises 60% of the total, Structure comprises 18% of the total, and Foundation comprises 22%. If the debris tonnage is converted into an estimated number of truckloads, it will require 53 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 299 households (or 898 of people) will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 184 people (out of a total population of 32,646) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 294.81 million dollars, which represents 15.22 % of the total replacement value of the scenario buildings.

Building-Related Losses

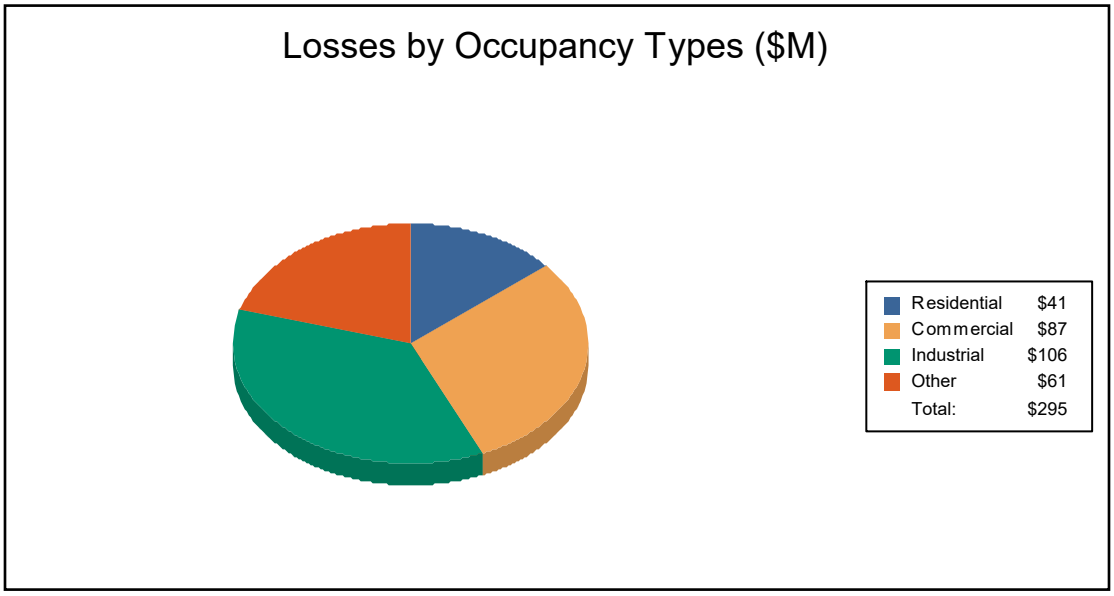
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability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

The total building-related losses were 199.35 million dollars. 32% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 13.99% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	21.34	7.98	20.78	5.58	55.69
	Content	9.67	22.52	61.09	18.20	111.47
	Inventory	0.00	6.23	13.55	12.40	32.18
	Subtotal	**31.01**	**36.73**	**95.42**	**36.18**	**199.35**
Business Interruption						
	Income	0.31	17.92	3.01	4.92	26.16
	Relocation	6.37	6.82	2.98	2.41	18.57
	Rental Income	2.82	4.35	0.76	0.23	8.16
	Wage	0.74	20.97	3.86	17.01	42.58
	Subtotal	**10.24**	**50.05**	**10.61**	**24.57**	**95.47**
ALL	**Total**	**41.25**	**86.78**	**106.03**	**60.75**	**294.81**



Appendix A: County Listing for the Region

Ohio

- Jackson

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Ohio				
Jackson	32,646	3,565,626	3,403,973	6,969,599
Total	**32,646**	**3,565,626**	**3,403,973**	**6,969,599**
Total Study Region	**32,646**	**3,565,626**	**3,403,973**	**6,969,599**

Hazus: Earthquake Global Risk Report

Region Name: JacksonCo

Earthquake Scenario: CityofJackson 5mag, 5km Depth

Print Date: January 04, 2023

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

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

Table of Contents

General Description of the Region

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

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

Ohio

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

The geographical size of the region is 421.29 square miles and contains 7 census tracts. There are over 12 thousand households in the region which has a total population of 32,653 peopleF. The distribution of population by Total Region and County is provided in Appendix B.

There are an estimated 18 thousand buildings in the region with a total building replacement value (excluding contents) of 6,971 (millions of dollars). Approximately 82.00 % of the buildings (and 51.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 1,271 and 1,357 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 18 thousand buildings in the region which have an aggregate total replacement value of 6,971 (millions of dollars) . Appendix B provides a general distribution of the building value by Total Region and County.

In terms of building construction types found in the region, wood frame construction makes up 52% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

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

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 24 beds. There are 13 schools, 8 fire stations, 6 police stations and 1 emergency operation facilities. With respect to high potential loss facilities (HPL), there are no dams identified within the inventory. The inventory also includes no hazardous material sites, no military installations and no nuclear power plants.

Transportation and Utility Lifeline Inventory

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

The total value of the lifeline inventory is over 2,628.00 (millions of dollars). This inventory includes over 85.75 miles of highways, 261 bridges, 1,848.58 miles of pipes.

Table 1: Transportation System Lifeline Inventory

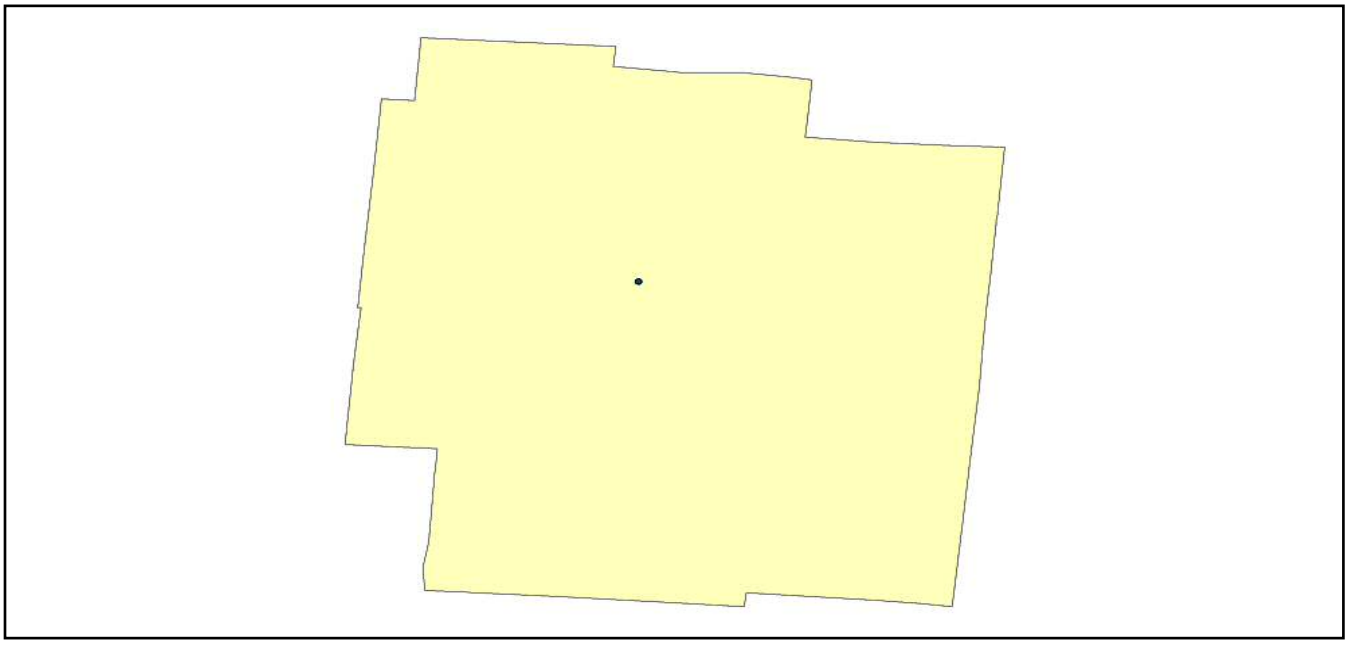
System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	261	234.3734
	Segments	37	796.9323
	Tunnels	0	0.0000
		Subtotal	**1031.3057**
Railways	Bridges	31	140.7400
	Facilities	0	0.0000
	Segments	16	87.5593
	Tunnels	0	0.0000
		Subtotal	**228.2993**
Light Rail	Bridges	0	0.0000
	Facilities	0	0.0000
	Segments	0	0.0000
	Tunnels	0	0.0000
		Subtotal	**0.0000**
Bus	Facilities	1	1.7743
		Subtotal	**1.7743**
Ferry	Facilities	0	0.0000
		Subtotal	**0.0000**
Port	Facilities	0	0.0000
		Subtotal	**0.0000**
Airport	Facilities	1	5.3000
	Runways	1	4.8486
		Subtotal	**10.1486**
		Total	**1,271.50**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	35.5256
	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**35.5256**
Waste Water	Distribution Lines	NA	21.3154
	Facilities	5	685.9940
	Pipelines	0	0.0000
		Subtotal	**707.3094**
Natural Gas	Distribution Lines	NA	14.2102
	Facilities	0	0.0000
	Pipelines	8	599.8123
		Subtotal	**614.0225**
Oil Systems	Facilities	0	0.0000
	Pipelines	0	0.0000
		Subtotal	**0.0000**
Electrical Power	Facilities	0	0.0000
		Subtotal	**0.0000**
Communication	Facilities	4	0.4200
		Subtotal	**0.4200**
		Total	**1,357.30**

Earthquake Scenario

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



Scenario Name	CityofJackson 5mag, 5km Depth
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-82.64
Latitude of Epicenter	39.05
Earthquake Magnitude	5.00
Depth (km)	5.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Direct Earthquake Damage

Building Damage

Hazus estimates that about 5,554 buildings will be at least moderately damaged. This is over 30.00 % of the buildings in the region. There are an estimated 387 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Damage Categories by General Occupancy Type

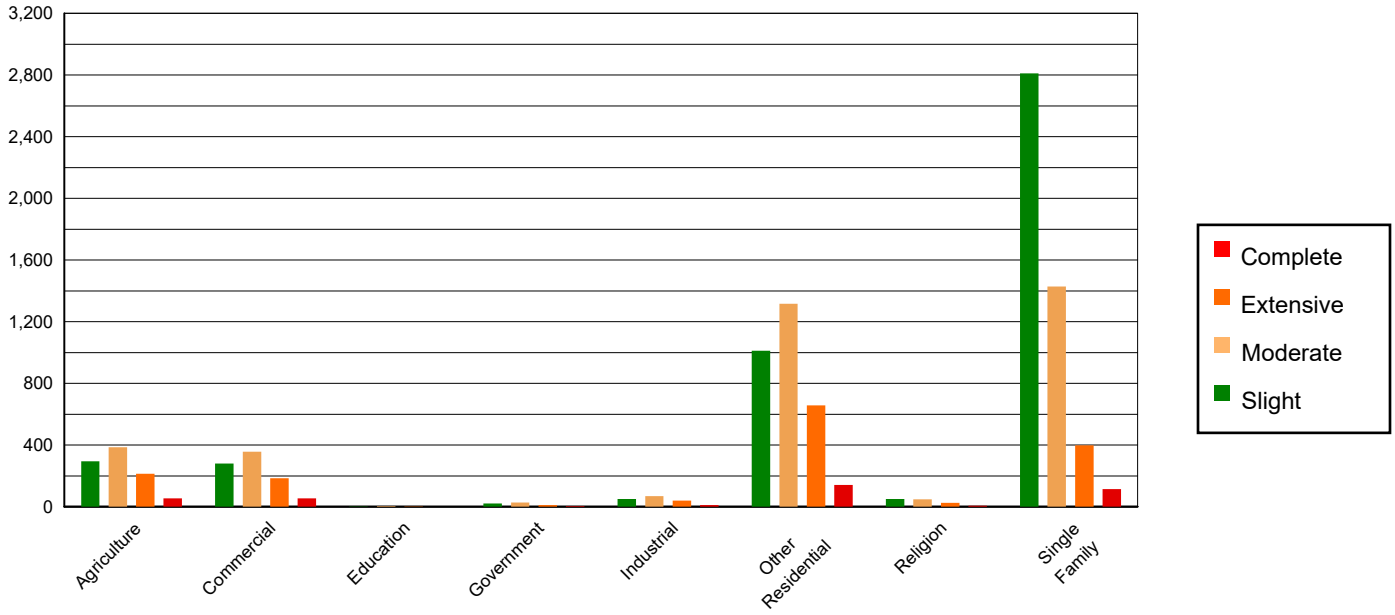


Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	502.77	5.93	293.74	6.50	386.38	10.63	213.18	13.92	53.93	13.91
Commercial	374.06	4.41	279.59	6.19	356.42	9.80	185.73	12.13	55.20	14.24
Education	5.13	0.06	3.32	0.07	4.12	0.11	1.86	0.12	0.57	0.15
Government	29.85	0.35	20.19	0.45	26.74	0.74	11.58	0.76	3.64	0.94
Industrial	75.60	0.89	49.88	1.10	69.23	1.90	39.47	2.58	10.82	2.79
Other Residential	1467.04	17.30	1011.26	22.38	1315.37	36.18	656.67	42.89	140.66	36.29
Religion	91.30	1.08	50.41	1.12	48.73	1.34	25.10	1.64	7.46	1.92
Single Family	5935.88	69.99	2810.45	62.19	1428.74	39.30	397.63	25.97	115.30	29.75
Total	**8,482**		**4,519**		**3,636**		**1,531**		**388**	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	5839.50	68.85	2645.44	58.54	1038.39	28.56	131.91	8.61	10.18	2.63
Steel	239.16	2.82	152.60	3.38	303.38	8.34	207.34	13.54	59.12	15.25
Concrete	122.35	1.44	70.57	1.56	96.79	2.66	50.11	3.27	10.31	2.66
Precast	125.83	1.48	57.77	1.28	103.41	2.84	75.57	4.94	14.23	3.67
RM	39.12	0.46	14.07	0.31	25.13	0.69	16.97	1.11	2.09	0.54
URM	1359.08	16.02	899.34	19.90	925.24	25.45	442.43	28.89	164.56	42.46
MH	756.58	8.92	679.07	15.03	1143.38	31.45	606.89	39.63	127.08	32.79
Total	**8,482**		**4,519**		**3,636**		**1,531**		**388**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 24 hospital beds available for use. On the day of the earthquake, the model estimates that only 5 hospital beds (24.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 46.00% of the beds will be back in service. By 30 days, 75.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	1	0	0
Schools	13	6	0	5
EOCs	1	0	0	1
PoliceStations	6	0	0	5
FireStations	8	1	0	5

Transportation Lifeline Damage

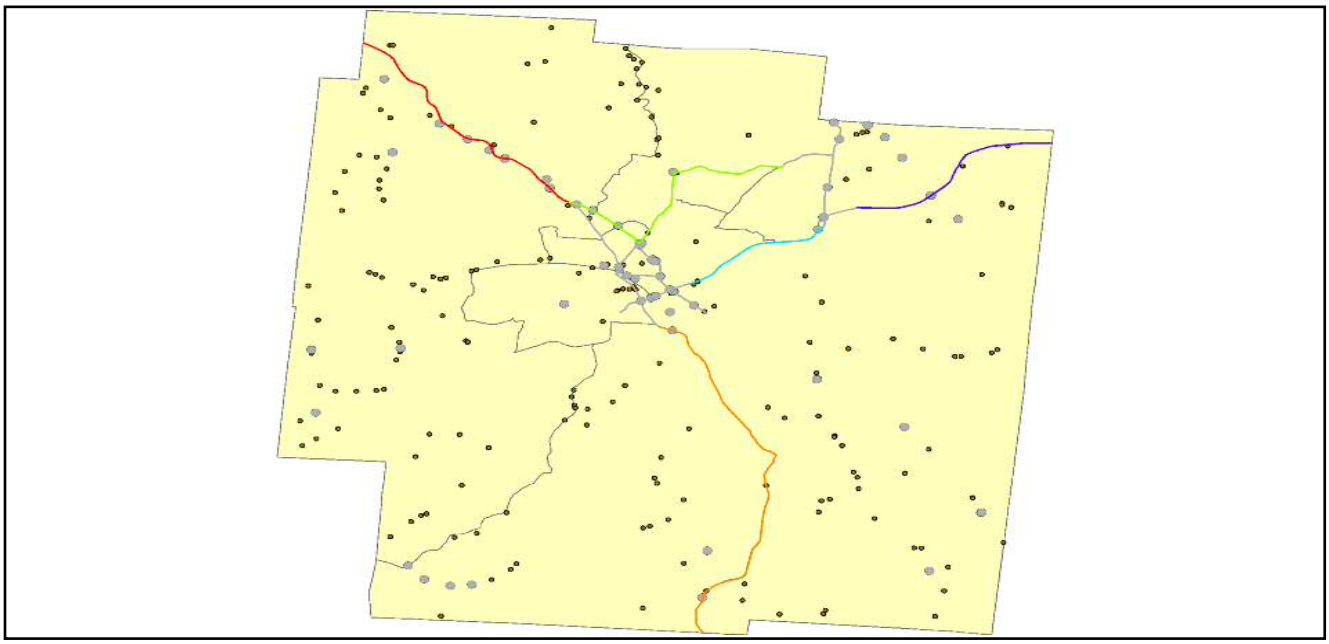


Table 6: Expected Damage to the Transportation Systems

System	Component		Number of Locations			
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	37	0	0	37	37
	Bridges	261	3	0	258	261
	Tunnels	0	0	0	0	0
Railways	Segments	16	0	0	16	16
	Bridges	31	0	0	31	31
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	1	1	0	1	1
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	1	1	0	1	1
	Runways	1	0	0	1	1

Table 6 provides damage estimates for the transportation system.

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

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

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	5	3	0	1	5
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	4	4	0	2	4

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

System	Total Pipelines Length (miles)	Number of Leaks	Number of Breaks
Potable Water	1,104	205	51
Waste Water	662	103	26
Natural Gas	83	2	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	12,936	160	0	0	0	0
Electric Power		10,590	8,079	4,488	536	13

Induced Earthquake Damage

Fire Following Earthquake

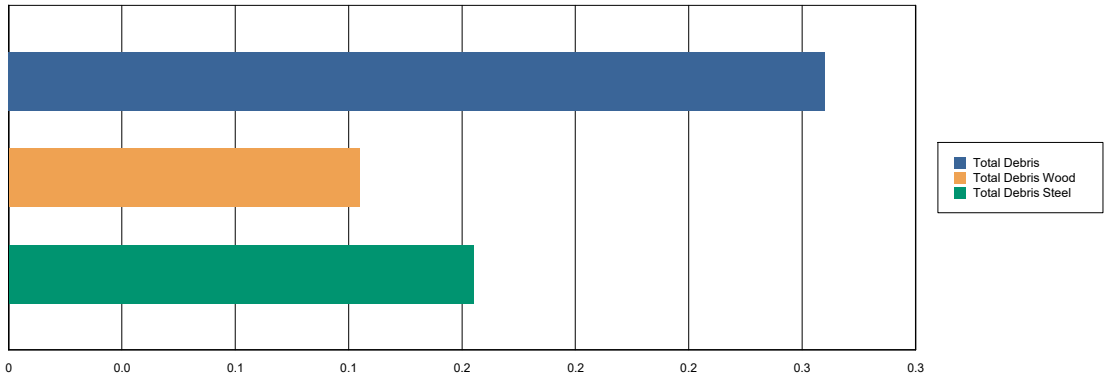
Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there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

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 288,000 tons of debris will be generated. Of the total amount, Brick/Wood comprises 43.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 11,520 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Earthquake Debris (millions of tons)



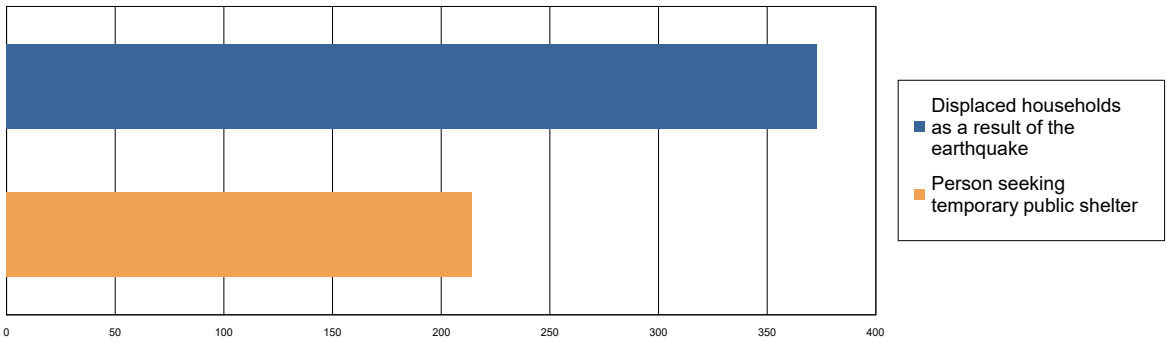
Brick/ Wood	Reinforced Concrete/Steel	Total Debris	Truck Load
0.12	0.16	0.29	11,520 (@25 tons/truck)

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 373 households to be displaced due to the earthquake. Of these, 214 people (out of a total population of 32,653) will seek temporary shelter in public shelters.

Displaced Households/ Persons Seeking Short Term Public Shelter



Displaced households as a result of the earthquake	Persons seeking temporary public shelter
373	214

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	2.19	0.52	0.07	0.13
	Commuting	0.00	0.00	0.00	0.00
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.21	0.05	0.01	0.01
	Industrial	2.51	0.62	0.08	0.16
	Other-Residential	47.95	9.09	0.72	1.30
	Single Family	60.86	13.73	1.85	3.63
	Total	**114**	**24**	**3**	**5**
2 PM	Commercial	161.30	37.98	5.06	9.77
	Commuting	0.01	0.02	0.03	0.01
	Educational	27.90	6.88	0.99	1.93
	Hotels	0.04	0.01	0.00	0.00
	Industrial	18.53	4.58	0.63	1.22
	Other-Residential	15.94	3.09	0.26	0.47
	Single Family	22.56	5.26	0.74	1.39
	Total	**246**	**58**	**8**	**15**
5 PM	Commercial	112.41	26.53	3.56	6.81
	Commuting	0.27	0.41	0.63	0.13
	Educational	0.00	0.00	0.00	0.00
	Hotels	0.06	0.02	0.00	0.00
	Industrial	11.58	2.86	0.39	0.76
	Other-Residential	17.69	3.42	0.29	0.52
	Single Family	24.43	5.69	0.80	1.50
	Total	**166**	**39**	**6**	**10**

Economic Loss

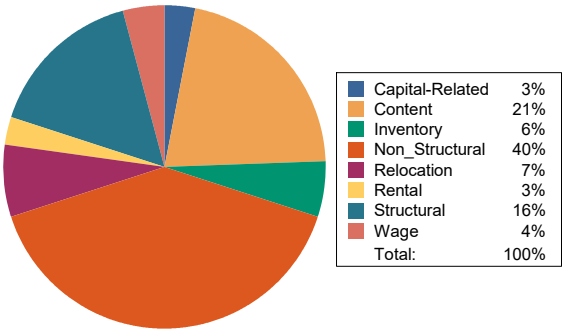
The total economic loss estimated for the earthquake is 1,228.11 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

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

The total building-related losses were 1,083.77 (millions of dollars); 17 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 30 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Earthquake Losses by Loss Type ($ millions)



Earthquake Losses by Occupancy Type ($ millions)

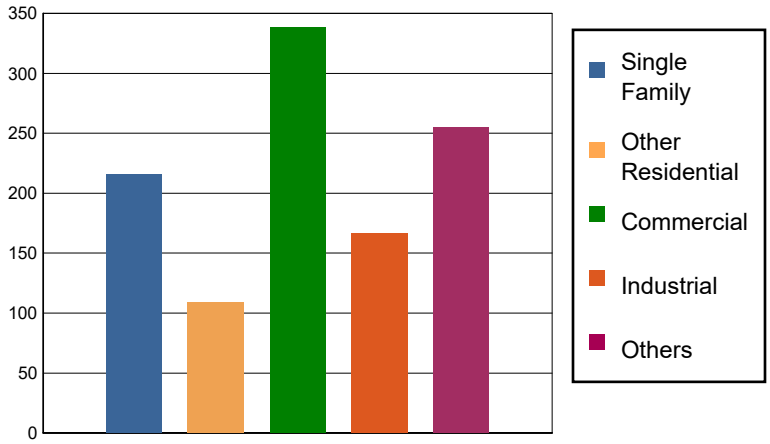


Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.0000	3.3356	35.8267	2.5388	4.4755	46.1766
	Capital-Related	0.0000	1.4183	29.4772	1.6822	1.7169	34.2946
	Rental	4.7789	5.6442	15.7852	1.1144	1.8438	29.1665
	Relocation	17.1540	8.8918	26.7816	5.7022	18.5878	77.1174
	Subtotal	**21.9329**	**19.2899**	**107.8707**	**11.0376**	**26.6240**	**186.7551**
Capital Stock Losses							
	Structural	29.2324	13.7954	42.2386	21.8092	64.7302	171.8058
	Non_Structural	116.5643	59.3241	110.6586	69.6742	77.3326	433.5538
	Content	47.9969	16.0440	63.1040	51.8927	52.3841	231.4217
	Inventory	0.0000	0.0000	14.6294	11.7646	33.8401	60.2341
	Subtotal	**193.7936**	**89.1635**	**230.6306**	**155.1407**	**228.2870**	**897.0154**
	Total	**215.73**	**108.45**	**338.50**	**166.18**	**254.91**	**1083.77**

Transportation and Utility Lifeline Losses

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

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	796.9323	0.0000	0.00
	Bridges	234.3734	6.3556	2.71
	Tunnels	0.0000	0.0000	0.00
	Subtotal	**1031.3057**	**6.3556**	
Railways	Segments	87.5593	0.0000	0.00
	Bridges	140.7400	0.6204	0.44
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**228.2993**	**0.6204**	
Light Rail	Segments	0.0000	0.0000	0.00
	Bridges	0.0000	0.0000	0.00
	Tunnels	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Bus	Facilities	1.7743	0.7839	44.18
	Subtotal	**1.7743**	**0.7839**	
Ferry	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Port	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Airport	Facilities	5.3000	1.9271	36.36
	Runways	4.8486	0.0000	0.00
	Subtotal	**10.1486**	**1.9271**	
	Total	**1,271.53**	**9.69**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	35.5256	0.9227	2.60
	Subtotal	**35.5256**	**0.9227**	
Waste Water	Pipelines	0.0000	0.0000	0.00
	Facilities	685.9940	132.9388	19.38
	Distribution Lines	21.3154	0.4635	2.17
	Subtotal	**707.3094**	**133.4023**	
Natural Gas	Pipelines	599.8123	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Distribution Lines	14.2102	0.1588	1.12
	Subtotal	**614.0225**	**0.1588**	
Oil Systems	Pipelines	0.0000	0.0000	0.00
	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Electrical Power	Facilities	0.0000	0.0000	0.00
	Subtotal	**0.0000**	**0.0000**	
Communication	Facilities	0.4200	0.1696	40.38
	Subtotal	**0.4200**	**0.1696**	
	Total	**1,357.28**	**134.65**	

Appendix A: County Listing for the Region

Jackson,OH

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Ohio					
	Jackson	32,653	3,566	3,404	6,971
Total Region		**32,653**	**3,566**	**3,404**	**6,971**