



### **APPENDIX 1**

#### ***Multi-Jurisdictional Hazard Risk Assessment***

Carroll County's Multi-Jurisdictional Hazard Risk Assessment, because of its size, is considered an appendix to the Hazard Mitigation Plan. The contents of the risk assessment can be found in Volumes 2 and 3 of the Hazard Mitigation Plan.

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*Including the Villages of Carrollton, Dellroy, Leesville, Malvern, Minerva, and Sherrodsville*

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## DESCRIPTION OF THE PLANNING AREA – CARROLL COUNTY

### *Including the villages within Carroll County*

#### CARROLL COUNTY

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Carroll County is located in the east-central portion of Ohio. The county is bordered to the north by Columbiana and Stark Counties, to the east by Columbiana and Jefferson Counties, to the south by Harrison County, and to the west by Stark and Tuscarawas Counties. The county contains six (6) incorporated municipalities, including the Villages of Carrollton, Dellroy, Leesville, Malvern, Minerva, and Sherrodsville. The nearest major metropolitan areas include Canton, Akron, Cleveland, Columbus, Cincinnati, and Pittsburgh, Pennsylvania. The county was established in January of 1833 and was named for Charles Carroll, a signer of the Declaration of Independence.

Carroll County contains approximately 145 miles of state highway, according to the County Engineer. State Routes 39, 164, 171, and 183 cross the county east and west, and 9, 43, 212, 332, and 542 run north and south. Other components of Carroll County's transportation infrastructure include three (3) commercial airports. Tolson Field, the county airport, is a class II airport with a 4,300-foot runway and can accommodate jet-powered aircraft. There are four (4) functioning railroads serving the county, including the Norfolk and Southern, Penn Central, and Ohio Rail Corporation. The county encompasses approximately 395 square miles of land area.

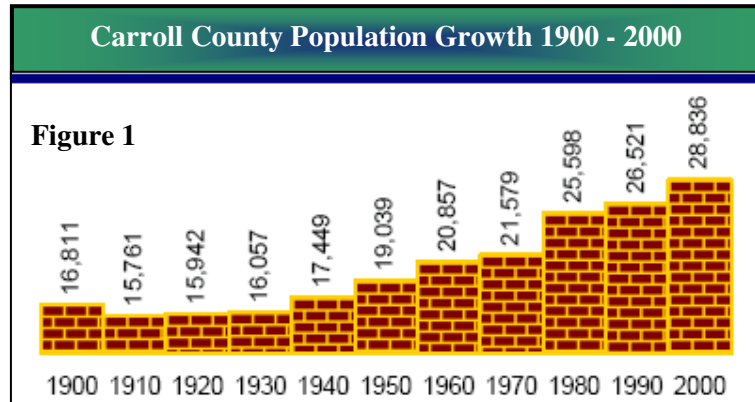
Though Carroll County contains several miles of highway, there are villages and townships with limited access, such as Minerva Village, and August, East, Rose and Union Townships, which could be a concern if these areas would require an emergency evacuation.

There are several small creeks and streams that flow through Carroll County, including Big Sandy Creek which flows through the northern portion of the county near the Village of Malvern, Still Fork which flows near the Village of Minerva, Conotton Creek which flows through the southwestern portion of the county near the villages of Sherrodsville and Leesville and the Upper North Fork of Yellow Creek which flows through Fox Township. Research indicates that these streams have prompted flooding in portions of the county in the past.

There are four (4) large Class I dams located in Carroll County. The Mohawk Lake Dam is located in the northwestern portion of the county. A failure of these dam could result in rapid flooding in portion of Malvern Village. A large portion of the Atwood Lake is located in western Carroll County however the dam is located in Tuscarawas County. Most of the flooding resulting from a failure of the Atwood dam would be in Tuscarawas County. The Leesville Lake Dam is

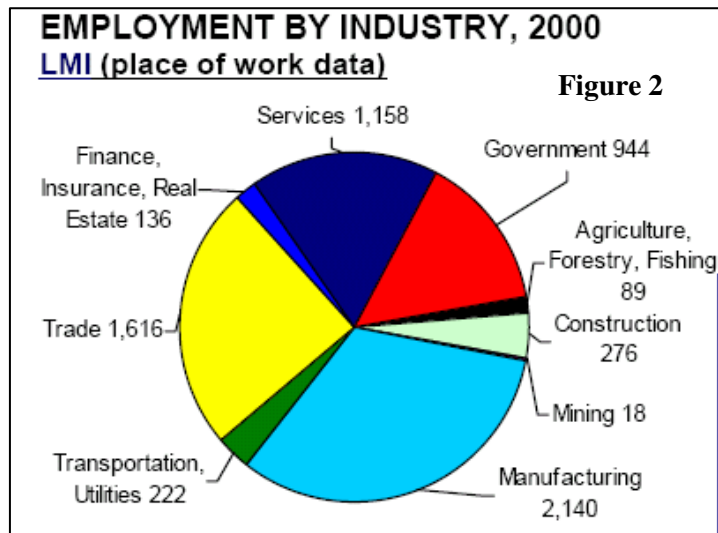
located in southwestern Carroll County; the actual dam structure is located just north of Leesville Village. The failure of this dam could place a large portion of the Village of Sherrodsville in jeopardy of significant flooding.

According to the 2000 Census, Carroll County has a population of 28,836 (see Figure 1), which is a notable increase from 1990. Census figures also indicate that there are 13,016 housing units in Carroll County, with an average of 2.22 persons per household. Further, the county's median household income is listed at \$35,509.



The majority of Carroll County's land cover is wooded or forested; nearly 56% or 141,974 acres, of the total land cover is forested. Approximately 800 individual farms operate in Carroll County, with an average size of 156 acres per farm.

Carroll County has a diverse employment background. According to Census 2000 information, the largest areas of employment are manufacturing, trade and services, as illustrated in Figure 2. Total employment is listed at 13,100 persons. The county's unemployment rate stands at approximately 4.4 percent, ranking forty-fourth among Ohio's 88 counties. Carroll County is the home of several tourist attractions, including Atwood Lake Park and Lodge, Leesville Lake, Algonquin Steam Mill, and the "Elderberry Line," an 11-mile train ride between Carrollton and Minerva.



The education system in Carroll County consists of 11 public schools at which 3,809 students attend and 200 teachers instruct, as well as one (1) private school at which another 16 students attend. The graduation rate stands at 91.6 percent.



There are limited healthcare facilities in Carroll County, as there are no registered hospitals or licensed residential care facilities and only 19 physicians in Carroll County. The only health care facility in county is the Carroll Health Care Center. However, there are at least 14 hospitals in neighboring counties to which the sick or injured can be transported by the eight (8) EMS groups that operate in the county. There are four (4) licensed nursing homes in Carroll County with 252 available beds.

The communications network in Carroll County is also limited as there is no television station, radio station, or daily newspaper in the county, making emergency public notification and warning extremely difficult. The Carroll County Emergency Management Agency (EMA) does have an Emergency Communications Center located in the Emergency Operations Center (EOC), as well as several warning sirens located throughout the county.

### **CARROLLTON VILLAGE**

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The Village of Carrollton is located in the center of Carroll County in Center Township, and is the county seat. The major highways accessing the village include State Route 39 running east west and 9, 43, and 332 running north and south. The Norfolk and Southern railroad traverses the center of the village running north south parallel to State Route 9.

There are six (6) public schools in Carrollton Village including Augusta Elementary, Kilgore Elementary, Carrollton Elementary, Harlem Springs Elementary, Bell-Herron Middle, and Carrollton High. The village also contains the majority of the county's commercial, industrial, and health care facilities, including Myers Mining Company, Carroll Asphalt and Stone, Carrollton Publishing Company, Dominion Transmission, Fusion Ceramics, Heritage Plastics Inc., and Machine Dynamics Engineering. Carrollton Village also contains one (1) of the three (3) water treatment plants of the county.

As indicated by the 2000 Census, the Village of Carrollton has a total population of 3,190 and is the most densely populated village in Carroll County. The village contains 1,531 housing units with an average of 2.08 persons per household. The median household income is listed at \$25,694.

### **DELLROY VILLAGE**

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The Village of Dellroy is positioned in western Carroll County in Monroe Township. The major thoroughfares that can be used to access the village include State Routes 39, and 524.

There is one (1) school that operates in the village, Dellroy Elementary. Conotton Creek flows to the west of the village, and the Atwood Lake Dam, which is a Class I dam, is located just to the west and north of the village.

According to the 2000 Census, the Village of Dellroy has a population of 294. Dellroy contains 130 housing units with an average of 2.26 persons per household. The current median household income is \$27,344.

## **LEESVILLE VILLAGE**

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The Village of Leesville is located in the southwestern most corner of Carroll County in Orange Township. The village can be accessed using State Route 164 running east west or State Route 212 running north south. Conotton Creek flows through the village and the Leesville Lake Dam, which is a Class I dam, is located just to the north of the village. The Atwood Lodge Water Treatment Plant is located just to the north of Leesville Village. The Norfolk and Southern Railroad also traverses the village.

According to the 2000 Census, the Village of Leesville has a population of 184, which is the least populated of the incorporated municipalities. The village contains 77 housing units with an average of 2.39 persons per household and boasts a median household income of \$33,750, which is the highest among the incorporated municipalities in Carroll County.

## **MALVERN VILLAGE**

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The Village of Malvern is located in the northwestern portion of Carroll County in Brown Township. The transportation infrastructure into and out of the village includes State Routes 43 and 183 running east west.

The Big Sandy Creek flows through the middle of the village. The Lake Mohawk Dam, which is a Class I dam, is located just to the south of the village. There are two (2) schools in the Village of Malvern, including Malvern Elementary and Malvern High. The Village of Malvern also contains a portion of the county's commercial and industrial assets, including Three County Asphalt and Paving, Colfor Manufacturing, Cambridge Mill Products, and Kopp Clay Company. The Village of Malvern also contains a water treatment facility.

According to the 2000 Census, the Village of Malvern has a population of 1,218. The village contains 576 housing units with an average of 2.11 persons per household. The current median household income is reported to be \$29,063.

## **MINERVA VILLAGE**

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The Village of Minerva is positioned in the northern most portion of Carroll County in Brown Township and extending into neighboring Stark County. The only major roadway that passes through the Carroll County portion of the village is State Route 183. The Big Sandy Creek branches creating Still Fork at the southern portion of the village.

There are two large industrial and/or commercial facilities located in the Village of Minerva: the General Color and Chemical Company and Summitville Laboratories. The village also contains a water treatment plant.

As indicated by the 2000 Census, the Village of Minerva has a total population of 3,934. Of that total 1,898 persons are located in Carroll County. Minerva contains 1,718 total housing units with an average of 2.29 persons per household. The Village of Minerva currently reports a median household income of \$33,468, which is among the highest in the county.

## **SHERRODSVILLE VILLAGE**

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The Village of Sherrodsville is positioned in southwestern Carroll County between the Villages of Dellroy and Leesville. The village is accessible using State Routes 39 running east west and 212 running north south. The Conotton Creek flows through a portion of the village. The village is positioned between two (2) large class I Dams, the Atwood Lake Dam to the north and the Leesville Lake Dam to the south. The Norfolk and Southern Railroad passes through the center of the village, crossing Conotton Creek.

The 2000 Census indicates that Sherrodsville Village has population of 316. There are 129 housing units in the village with an average of 2.45 persons per household. The median household income is \$28,036.

## HAZARD RISK ASSESSMENT – MULTI-JURISDICTIONAL PLAN REQUIREMENTS

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*According to 44 CFR Part 201.6(c)(2) (iii), the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

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For the purpose of this assessment, risks will be assessed separately for each jurisdiction involved where they differ significantly. If the risk affects one (1) jurisdiction and not another, or if the risk affects one (1) jurisdiction in a significantly different manner, it will be so noted in the hazard identification and hazard profile steps. If the risks are determined to impact each jurisdiction equally or in the same manner, it will be so noted. In such cases, please refer to the hazard profile contained in the larger jurisdiction's hazard profile (i.e. please refer to *Profiling Hazard Events –Carroll County* for risks affecting Carroll County and all of its municipalities in the same manner.)

## IDENTIFYING HAZARDS – CARROLL COUNTY

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*As per requirement 44 CFR Part 201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.*

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Carroll County identified several hazards in its risk assessment that will be addressed in the county's Hazard Mitigation Plan. These hazards were delineated through an extensive research process that utilized input from the following sources:

- Interviews with local officials/experts:
  - Mr. Tom Cottis, Carroll County EMA Director,
- Flood Insurance Rate Map (FIRM) information for Carroll County and the Villages of Carrollton, Dellroy, Leesville, Malvern, Minerva, and Sherrodsville.
- Carroll County Emergency Operations Plan.
- Public input.
- Searches of multiple Internet sites concerning hazard mitigation and planning (The following sites are general listings that were searched at the onset of the project. Sites that were searched regarding specific hazards are listed with those hazards below.):
  - American Red Cross – Local Chapters  
**<http://www.redcross.org/where/where.html>**
  - Disaster Center  
**<http://www.disastercenter.com>**
  - Digital Q3 Flood Data  
**<http://msc.fema.gov/MSD/statemap.htm>**
  - ESRI  
**<http://www.esri.com/hazards>**
  - Federal Emergency Management Agency  
**<http://www.fema.gov>**
  - HAZUS Instruction and Technical Information  
**<http://www.fema.gov/hazus>**
  - Socio-Economic Data Resources  
**[http://www.csc.noaa.gov/products/nchaz/htm/dinfo\\_4.htm](http://www.csc.noaa.gov/products/nchaz/htm/dinfo_4.htm)**

- USDA Natural Resources Conservation Service  
<http://www.nhq.nrcs.usda.gov/RID/RID.html>
- National Oceanic Atmospheric Administration  
<http://www4.ncdc.noaa.gov/cgi-win>

The following hazards were identified for the Carroll County Hazard Risk Assessment.

<i>Hazard</i>	<i>How Identified</i>	<i>Why Identified</i>
<b>Dam Failure</b>	<ul style="list-style-type: none"> <li>• Ohio Department of Natural Resources</li> <li>• National Dam Inventory</li> <li>• Carroll County EOP</li> <li>• Internet research</li> </ul>	<ul style="list-style-type: none"> <li>• There are currently 26 dams in Carroll County, four (4) of which are Class I Dams.</li> <li>• There are several dams located close to populated areas.</li> </ul>
<b>Drought</b>	<ul style="list-style-type: none"> <li>• Review of <i>Palmer Drought Index</i></li> <li>• NOAA Event Records</li> <li>• USGS</li> <li>• Ohio Department of Natural Resources, Division of Water</li> <li>• Ohio Emergency Management Agency</li> <li>• Carroll County EOP</li> <li>• Internet research</li> </ul>	<ul style="list-style-type: none"> <li>• The <i>Palmer Drought Severity Index</i> indicates that Ohio counties spend 0-5% of the summer and autumn months under drought conditions.</li> <li>• Carroll County contains approximately 800 individual farms which could suffer economic loss as a result of drought.</li> </ul>
<b>Earthquake</b>	<ul style="list-style-type: none"> <li>• Review of US Geological Survey National Seismic Hazard Mapping Project</li> <li>• Review of ESRI GIS information on Ohio</li> <li>• Ohio Department of Natural Resources</li> <li>• Carroll County EOP</li> <li>• Ohio Seismic Network</li> </ul>	<ul style="list-style-type: none"> <li>• The US Geological Survey lists Carroll County with a PGA 2.0 to 3.0 (MMI IV).</li> <li>• Carroll County falls within the area predicted to be affected by a disturbance along the New Madrid Fault.</li> </ul>
<b>Epidemic</b>	<ul style="list-style-type: none"> <li>• Internet research</li> <li>• Public input</li> <li>• Ohio Department of Natural Resources</li> <li>• Ohio Department of Health</li> </ul>	<ul style="list-style-type: none"> <li>• Epidemics can strike any area at any time.</li> <li>• Carroll County contains limited health care facilities that could be overwhelmed by even a small epidemic.</li> </ul>
<b>Flooding</b>	<ul style="list-style-type: none"> <li>• Review of FIRM information</li> <li>• Public input</li> <li>• Carroll County EOP</li> <li>• NOAA Event Records</li> <li>• Internet research</li> </ul>	<ul style="list-style-type: none"> <li>• Flood plains indicate that all 14 political subdivisions in Carroll County could be threatened by flooding in a 100-year storm event.</li> <li>• <i>NOAA Event Records</i> report many flood incidents.</li> </ul>

<b>Hailstorm</b>	<ul style="list-style-type: none"> <li>• Climatology reports</li> <li>• National Weather Service</li> <li>• NOAA Event Records</li> </ul>	<ul style="list-style-type: none"> <li>• Severe thunderstorms and windstorms are often accompanied by hail.</li> <li>• <i>NOAA Event Records</i> have recorded 22 hail incidents between 1950 and 2003.</li> </ul>
<b>Infestation</b>	<ul style="list-style-type: none"> <li>• Ohio Department of Health</li> <li>• Ohio Division of Forestry</li> <li>• Ohio Department of Natural Resources</li> </ul>	<ul style="list-style-type: none"> <li>• According to the Ohio Department of Natural Resources, Carroll County is among several Ohio counties to be placed under quarantine in an attempt to prevent the spread of gypsy moth caterpillars.</li> </ul>
<b>Landslide &amp; Erosion</b>	<ul style="list-style-type: none"> <li>• US Geological Survey online</li> <li>• Carroll County EOP</li> </ul>	<ul style="list-style-type: none"> <li>• Carroll County is located in a “moderate risk” area according to the <i>USGS Landslide Overview Map</i>,</li> <li>• According to the Carroll County Emergency Operations Plan, all of Carroll County, with the exception of the northwestern corner, is within an area of frequent landslide activity.</li> </ul>
<b>Mine Subsidence</b>	<ul style="list-style-type: none"> <li>• Ohio Department of Natural Resources, Division of Geological Survey</li> <li>• Internet research</li> <li>• Mine Safety and Health Administration</li> </ul>	<ul style="list-style-type: none"> <li>• There are several villages and townships that could be affected by mine subsidence in the eastern and western portions of the county.</li> </ul>
<b>Severe Thunderstorm</b>	<ul style="list-style-type: none"> <li>• NOAA Event Records</li> <li>• National Weather Service</li> <li>• Carroll County EOP</li> </ul>	<ul style="list-style-type: none"> <li>• There have been 103 thunderstorms recorded in <i>NOAA Event Records</i> between 1950 and 2003, most of which have resulted in property damage.</li> </ul>
<b>Severe Wind and Tornado</b>	<ul style="list-style-type: none"> <li>• NOAA Event Records</li> <li>• Review of ESRI GIS information on Ohio</li> <li>• National Weather Service</li> <li>• <i>State and Local Mitigation Planning How-to Guide: Understanding Your Risks</i></li> <li>• Review of Carroll County EOP</li> </ul>	<ul style="list-style-type: none"> <li>• According to a map prepared by the Ohio Insurance Institute, Ohio endured 18 tornadoes.</li> <li>• According to <i>NOAA Event Records</i>, there have been three (3) tornadoes reported between 1950 and 2003 in Carroll County. One such incident was an F2 tornado that occurred on September 30, 1954.</li> </ul>

<b>Severe Winter Storm and Sleet</b>	<ul style="list-style-type: none"> <li>• NOAA Event Records</li> <li>• Public input</li> <li>• Review of past disaster declarations</li> <li>• Carroll County EOP</li> </ul>	<ul style="list-style-type: none"> <li>• <i>NOAA Event Records</i> list several severe winter storm events which indicate significant snowfall and ice storms.</li> </ul>
<b>Temperature Extreme</b>	<ul style="list-style-type: none"> <li>• Review of past newspaper coverage</li> <li>• National Weather Service</li> <li>• NOAA Event Records</li> <li>• FEMA web site</li> </ul>	<ul style="list-style-type: none"> <li>• According to the Federal Emergency Management Agency (FEMA) in a normal year, approximately 175 Americans die from extreme heat. Young Children, elderly, and those who are sick or overweight are more likely to become victims.</li> <li>• Approximately 25% of Carroll Counties population is between the ages of 45 and 64.</li> </ul>
<b>Wildfire</b>	<ul style="list-style-type: none"> <li>• Ohio Department of Natural Resources</li> <li>• Ohio Division of Forestry</li> <li>• Internet research</li> </ul>	<ul style="list-style-type: none"> <li>• According to the Ohio Department of Natural Resources Carroll County reported 17 fires in 2001.</li> </ul>

Several hazards were not identified in Carroll County. Following are hazards that were not discovered to be significant risks.

- **Avalanche** – Although Carroll County contains elevated and mountainous terrain and receives significant amounts of snowfall per year, the general elevation is not high enough to cause snow to cap mountains year-round. Therefore, avalanches do not appear to be a significant hazard.
- **Coastal Erosion** – Carroll County is located inland from the Atlantic Ocean and does not have any coastal boundaries.
- **Coastal Storm** – Carroll County is located inland from the Atlantic Ocean. (see also *Hurricane*)
- **Expansive Soils** - Research discovered no known natural cases within Carroll County.
- **Hurricane** - While Carroll County sometimes receives precipitation as hurricanes hit the eastern and southern coastal states, the county does not experience intense hurricane conditions. The precipitation that is received can be classified as a severe



thunderstorm or severe winter storm. (see also *Severe Thunderstorm* and *Severe Winter Storm - Sleet*)

- **Tsunami** – Carroll County is located inland from the Atlantic Ocean.
- **Volcano** – Research shows no volcanic activity in Carroll County.

By virtue of their location in Carroll County, the municipalities in the county can be said to be susceptible to the hazards that are identified above. However, these municipalities may be more or less susceptible to the same hazardous events as the rest of the county. The following table illustrates if the municipalities are likely to be affected by the hazard events more, less, or in the same manner as the rest of the county.

	Dam Failure	Drought	Earthquake	Epidemic	Flooding	Hailstorm	Infestation	Landslide	Mine Subsidence	Thunderstorm	Tornado	Winter Storm	Heat Wave	Wildfire
Carrollton Village	<	=	=	>	=	=	=	=	<	=	=	=	>	<
Dellroy Village	=	=	=	<	=	=	>	=	>	=	=	=	=	=
Leesville Village	>	<	=	<	>	=	>	=	>	=	=	=	=	=
Malvern Village	>	<	=	>	>	=	=	=	>	=	=	=	>	<
Minerva Village	<	>	=	>	>	=	=	=	=	=	=	=	=	<
Sherrodsville Village	>	=	=	=	>	=	>	=	>	=	=	=	=	=

#### Key

- = : Municipality affected by hazard same as county  
 > : Municipality affected by hazard more than county  
 < : Municipality affected by hazard less than county

## PROFILING HAZARD EVENTS – CARROLL COUNTY

*Including the villages within Carroll County*

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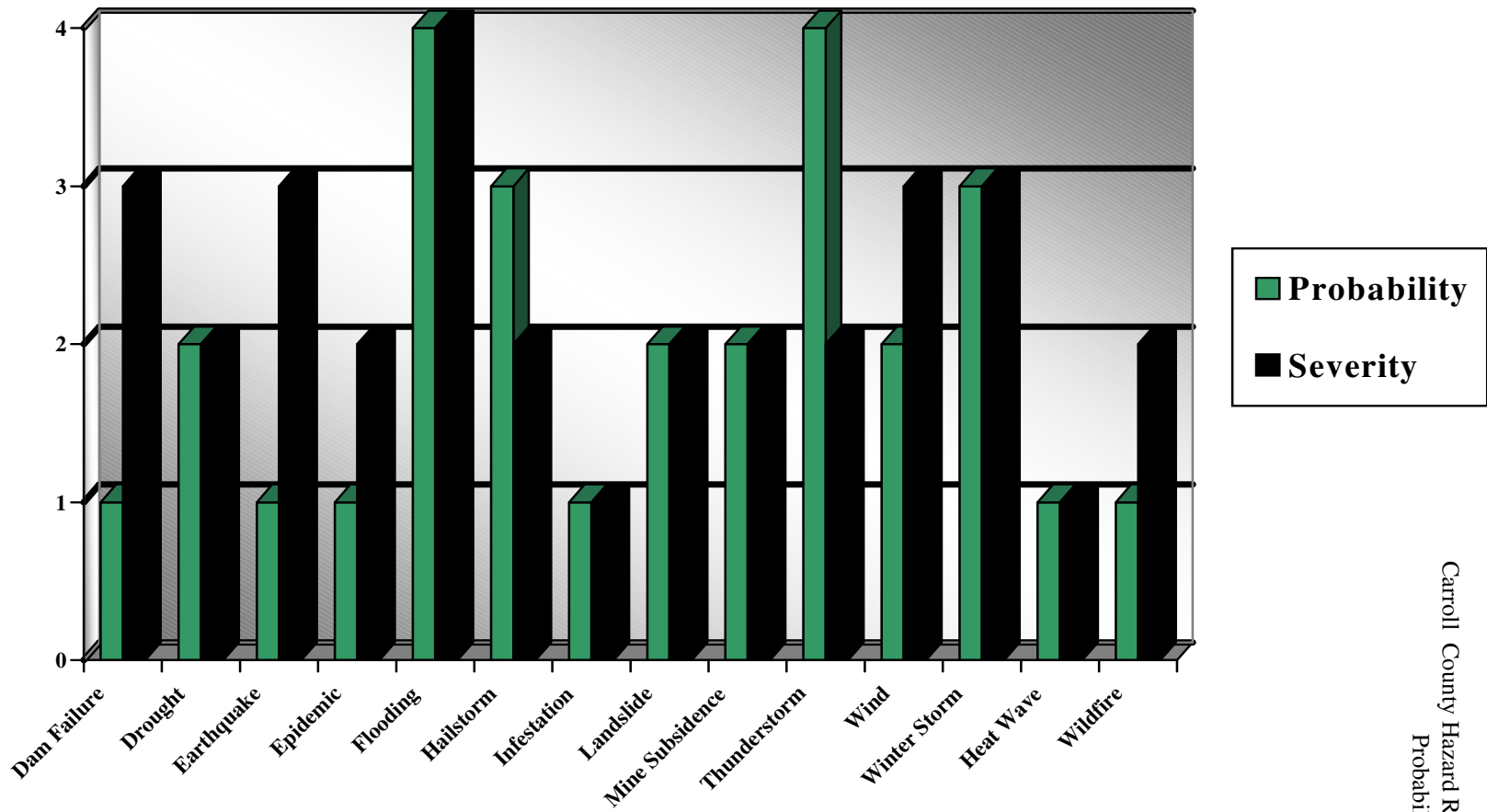
*As per requirement 44 CFR Part 201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future events.*

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Carroll County is subject to many hazard events. As discussed above, past newspaper research, review of the Carroll County Emergency Operations Plan (EOP), searches of multiple Internet sites, reviews of current FIRM information, reviews of various mapping compiled for the county, and discussions with local emergency management personnel assisted in the identification of these hazards. Each hazard is defined, discussed, and profiled below in detail. Also, a GIS-based map has been developed for each one of these hazards, which illustrates the areas that are most susceptible to the different hazards.

The hazard profiles for each hazard are included in this report under a section labeled by the hazard, which includes Worksheets #3a. and #4 from FEMA's *State and Local Mitigation Planning How-to Guide*, and the appropriate GIS-based mapping.

# Probability vs. Severity



0 = No Occurrence, 1 = Low, 2 = Moderate, 3 = High, 4 = Extreme High

## PROBABILITY VS. SEVERITY EXPLANATION

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In the case of many hazards, it is not possible to eliminate risks; they can only be reduced. When many risks exist at once, or when resources are limited, mitigation and preparedness require the setting of priorities. The classification of probability and severity for hazard risks in Carroll County is covered in the following Risk Assessment Decision Matrix.

This decision matrix was then translated into the Probability vs. Severity Chart for reader usability. It was determined that a bar graph format was much easier to understand than the matrix below. For probability, frequent equals four (4), probable equals three (3), occasional equals two (2), remote equals one (1), and improbable equals zero (0). For severity, catastrophic equals four (4), critical equals three (3), marginal equals two (2), and negligible equals one (1).

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## METHODOLOGY

### Probability

The first task that was undertaken was to determine the frequency of hazard occurrences. For instance, how many floods occur in a year? How many winter storms has Carroll County experienced in the past ten (10) years? To answer these questions, *NOAA Event Records* were analyzed. NOAA keeps records of significant storm events back to 1950. The number of hazard events (i.e. floods, hailstorms, thunderstorms, tornadoes, winter storms, etc.) was counted. Based on records for Carroll County only, probability was determined. From this analysis, it became evident that severe thunderstorms and flooding occur frequently.

If the information contained in NOAA's records was insufficient, other historical data such as media archives were examined. Again, if repeated coverage was given to a particular hazard event, that event was considered highly probable to occur. If neither source yielded sufficient data, information gathered from interviews with local representatives was used.

### Severity

The second and final task was to determine the severity of identified hazard events. Again, *NOAA Event Records* were used. Each of these documents records the atmospheric conditions of the event and other details such as wind speeds, the amount of loss incurred (in dollars), and the number of lives lost. If it appears that thunderstorms occur frequently but do not result in significant monetary losses or deaths, then thunderstorms were said to have a high probability and low severity. If winter storms, for example, appeared to occur frequently and also

cause significant damage or deaths, then winter storms were said to have a high probability and high severity.

Again, if *NOAA Event Records* were insufficient, local media archives were used as newspapers often report known damages and deaths following hazard events. If neither source yielded sufficient data, information gathered from interviews with local representatives was used.

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### HAZARD PROBABILITY CLASSIFICATION

Description	Frequency
Frequent	Continuously experienced
Probable	Experienced several times
Occasional	Experienced
Remote	Unlikely that it has been experienced
Improbable	Not experienced

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### HAZARD SEVERITY CLASSIFICATION

Description	Mishap Definition
Catastrophic	Death or major structural loss
Critical	Severe injury, severe illness, or marginal structural damage
Marginal	Minor injury, minor illness, or structural damage
Negligible	Less than minor injury, illness, or structural damage

## RISK ASSESSMENT MATRIX

HAZARD SEVERITY	PROBABILITY				
	Frequent	Probable	Occasional	Remote	Improbable
Catastrophic	5				
Critical		13	12	1, 3	
Marginal	11	6	2, 9, 10	4, 15	
Negligible				7, 14	

- |                 |                                    |
|-----------------|------------------------------------|
| 1 – Dam Failure | 9 – Landslide & Erosion            |
| 2 – Drought     | 10 – Mine Subsidence               |
| 3 – Earthquake  | 11 – Severe Thunderstorm           |
| 4 – Epidemic    | 12 – Severe Wind and Tornado       |
| 5 – Flooding    | 13 – Severe Winter Storm and Sleet |
| 6 – Hailstorm   | 14 – Temperature Extremes          |
| 7 – Infestation | 15 – Wildfires                     |

## ASSET INVENTORY – CARROLL COUNTY

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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### METHODOLOGY

Several resources were used to inventory the assets in Carroll County, both for the county as a whole and within designated hazard risk areas. For example, HAZUS, and Census data were used, in addition to extensive correspondence with local representatives.

The first task that was undertaken was to identify the number of residential, commercial, industrial, agricultural, religious/non-profit, government, education, and utility facilities throughout the county and municipalities. Each type of structure was further broken down into three (3) sub-categories: # in Community or State, # in Hazard Area, and % in Hazard Area. (The hazard area was identified in the mapping generated during the hazard profiling step.) The number of structures, value of structures, and number of people for each type of structure was listed, along with the three (3) sub-categories mentioned above.

HAZUS, Census 2000 information, and the GIS-based mapping that was generated during the hazard-profiling step determined the number and value of structures. Finally, the number of people was determined by Census 2000 information. This was done by highlighting all of the affected census block groups in the previously identified hazard areas on the GIS-based maps. The census block group information had been loaded into an ArcView 8.3 base map at the start of this project. All of this information was marked on Worksheet #3a. from FEMA's *State and Local Mitigation Planning How-to Guide: Understanding Your Risks*. This information was listed and reanalyzed for each of the hazards that were profiled.

Next, a specific asset inventory was developed based on HAZUS, Census 2000 data, and information provided by local representatives in Carroll County. Each of these specific assets was classified in categories such as critical facility, vulnerable population, economic asset, special consideration, or historic/other consideration. The size of each of the structures, as well as the replacement value, contents value, function use or value, displacement cost (should the asset be non-operational for a day or longer), occupancy or capacity, and other hazard specific information was compiled.

Following are the methods used to determine the above-categories for each of the county's assets.

- Size of buildings = square footage (for assets such as railroads and highways, length was used): This was usually determined by calling an official representative of the asset (e.g. the company president, utility manager, etc.).
- Replacement value of the structure: This was usually determined by calling an official representative of the asset (e.g. the company president, utility manager, etc.).
- Contents value, if not obtained by calling an official representative of the asset, was determined by HAZUS, which gave a table breaking each type (i.e. commercial or residential) of facility into a percentage by which to multiply the replacement value. (e.g. Contents Value of Schools/Libraries = Replacement Value X 100%)
- Function use or value was determined by total annual operating budget.
- Displacement cost (\$ per day) was determined by the function use or value divided by 365.
- Occupancy was determined by calling an official representative of the asset. (e.g. Occupancy of Schools = Total Students + Paid Staff)

A composite list of all of the county's assets was compiled. Worksheet #3b. from the *State and Local Mitigation Planning How-to Guide: Understanding Your Risks* was used to show this list.

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## ASSETS

Carroll County's Risk Assessment identifies specific assets located throughout the county and the hazards to which these facilities are susceptible. An asset is defined as a facility which is either in the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in Carroll County, or fulfills important public safety, emergency response, and/or disaster recovery functions. Assets can be a critical facility, vulnerable population, economic asset, special consideration, or historic/other consideration.

The assets identified in the county are emergency services facilities (i.e. fire departments, EMS stations, police stations, etc.), hospitals, utility systems (i.e. water, sewer, gas, and electric), airports, government facilities, schools, historic sites, bridges and transportation systems, and large industrial or commercial facilities. (See "Carroll County Asset Inventory" map.)

In addition to critical facilities, an analysis of Census 2000 data indicates that the county contains at-risk populations that should be factored into this risk assessment. Carroll County and



all of its municipalities contain elderly and youth populations with limited mobility; in fact, approximately 14% or 4,079 persons of the total population are over the age of 65. Limited health care facilities are located throughout the county but primarily within municipal areas. This population is adversely affected during hazard events because of a lack of accessibility to these emergency and other services. The county also contains youth populations that may be affected by certain hazard events. Hazards such as floods, winter storms, hail, etc. pose health and safety threats during hazard events.

A further analysis of Census 2000 data, coupled with historical census data indicates that Carroll County and all municipalities therein have experienced a significant increase in population over the past ten (10) years. Similar residential development trends are likely to continue as the development in the larger villages of Carrollton and Minerva increases. Local leaders are working to increase residential development throughout Carroll County. These leaders should be encouraged to consider mitigation, e.g. strengthened building materials, landscaping, etc., as this development occurs.

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The following are major assets located in Carroll County. Please see the attached chart that lists the replacement value, contents value, function use or value, displacement cost, occupancy or capacity, and other hazard specific information for each of these assets.

- **GOVERNMENTAL FACILITIES**

- Augusta Township – Critical Facility (Government Facility)
- Brown Township – Critical Facility (Government Facility)
- Carroll County Court House – Critical Facility (Government Facility)
- Carrollton Village – Critical Facility (Government Facility)
- Center Township – Critical Facility (Government Facility)
- Dellroy Village – Critical Facility (Government Facility)
- East Township – Critical Facility (Government Facility)
- Fox Township – Critical Facility (Government Facility)
- Harrison Township – Critical Facility (Government Facility)
- Lee Township – Critical Facility (Government Facility)
- Loudon Township – Critical Facility (Government Facility)
- Magnolia Village – Critical Facility (Government Facility)
- Malvern Village – Critical Facility (Government Facility)
- Minerva Village – Critical Facility (Government Facility)

- Monroe Township – Critical Facility (Government Facility)
- Orange Township – Critical Facility (Government Facility)
- Perry Township – Critical Facility (Government Facility)
- Rose Township – Critical Facility (Government Facility)
- Sherrodsville Village – Critical Facility (Government Facility)
- Union Township – Critical Facility (Government Facility)
- Washington Township – Critical Facility (Government Facility)
  
- **TRANSPORTATION INFRASTRUCTURE**
  - Atwood Lodge Runway – Critical Facility (Transportation Infrastructure)
  - Bridges – Critical Facility (Transportation Infrastructure)
  - Carroll County-Tolson Runway – Critical Facility (Transportation Infrastructure)
  - Hibbetts Runway – Critical Facility (Transportation Infrastructure)
  - Parsons Runway – Critical Facility (Transportation Infrastructure)
  - McClain Field Runway – Critical Facility (Transportation Infrastructure)
  - Railroads – Critical Facility (Transportation Infrastructure)
  - Roads – Critical Facility (Transportation Infrastructure)
  - Schneider-Mohawk Runway – Critical Facility (Transportation Infrastructure)
  
- **PUBLIC UTILITIES & SERVICE DEPARTMENTS**
  - Carrollton Water and Sewer – Critical Facility (Utilities)
  - Deshea Water Treatment System – Critical Facility (Utilities)
  - Malvern Water – Critical Facility (Utilities)
  - Minerva Waste Water Treatment Plant – Critical Facility (Utilities)
  - Minerva Water Plant – Critical Facility (Utilities)
  - Waynesburg Village Water Treatment Plant – Critical Facility (Utilities)
  
- **FIRE & POLICE DEPARTMENTS**
  - Augusta Township Volunteer Fire Department – Critical Facility (Emergency Services)
  - Brown Township Fire Department – Critical Facility (Emergency Services)
  - Carroll County Sheriff – Critical Facility (Emergency Services)
  - Carrollton Police – Critical Facility (Emergency Services)
  - Carrollton Village Fire Department – Critical Facility (Emergency Services)

- Dellroy Community Volunteer Fire Department – Critical Facility (Emergency Services)
- Dellroy Police – Critical Facility (Emergency Services)
- Fox Township Volunteer Fire Department – Critical Facility (Emergency Services)
- Leesville Fire Department – Critical Facility (Emergency Services)
- Loudon Township Fire Department – Critical Facility (Emergency Services)
- Magnolia Police – Critical Facility (Emergency Services)
- Malvern Fire Department – Critical Facility (Emergency Services)
- Malvern Police – Critical Facility (Emergency Services)
- Minerva Fire Department – Critical Facility (Emergency Services)
- Minerva Police – Critical Facility (Emergency Services)
- Perry Township Volunteer Fire Department – Critical Facility (Emergency Services)
- Sherrodsville Volunteer Fire Department – Critical Facility (Emergency Services)
- **HOSPITALS, NURING HOMES, & AMBULANCE SERVICES**
  - Carroll Golden Age Retreat – Vulnerable Population (Elderly)
  - Carroll Healthcare Center Inc. – Vulnerable Population (Elderly)
  - Minerva Eldercare Center – Vulnerable Population (Elderly)
- **SCHOOLS & EDUCATIONAL FACILITIES**
  - Augusta Elementary School – Critical Facility (Education)
  - Bell-Horn Middle School – Critical Facility (Education)
  - Carrollton Elementary School – Critical Facility (Education)
  - Carrollton High School – Critical Facility (Education)
  - Dellroy Elementary School – Critical Facility (Education)
  - Harlem Springs Elementary School – Critical Facility (Education)
  - Kilgore Elementary School – Critical Facility (Education)
  - Brown Local School District – Critical Facility (Education)
  - Malvern Elementary School – Critical Facility (Education)
  - Malvern High School – Critical Facility (Education)
  - Willis Elementary School – Critical Facility (Education)
- **POST OFFICES**
  - Carrollton Post Office – Special Consideration (Federal Facility)

- Dellroy Post Office – Special Consideration (Federal Facility)
- Malvern Post Office – Special Consideration (Federal Facility)
- **OTHER CRITICAL FACILITIES**
  - Residential – Special Consideration (Residential Housing)

## ASSET INVENTORY – VILLAGE OF CARROLLTON

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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## METHODOLOGY

The methodology for the asset inventory of the Village of Carrollton is exactly the same as for Carroll County. In fact, the assets that are located within the corporate limits are listed on the composite asset and hazard lists that encompass the county assets. For the purpose of clarity, the following assets are located within the corporate limits of the Village of Carrollton.

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## ASSETS

- Augusta Elementary School – Critical Facility (Education)
- Bell-Horn Middle School – Critical Facility (Education)
- Bridges – Critical Facility (Transportation Infrastructure)
- Carroll County Court House – Critical Facility (Government Facility)
- Carroll County Sheriff – Critical Facility (Emergency Services)
- Carroll Golden Age Retreat – Vulnerable Population (Elderly)
- Carroll Healthcare Center Inc. – Vulnerable Population (Elderly)
- Carrollton Elementary School – Critical Facility (Education)
- Carrollton High School – Critical Facility (Education)
- Carrollton Police – Critical Facility (Emergency Services)
- Carrollton Post Office – Special Consideration (Federal Facility)
- Carrollton Village – Critical Facility (Government Facility)
- Carrollton Village Fire Department – Critical Facility (Emergency Services)
- Carrollton Water and Sewer – Critical Facility (Utilities)
- Harlem Springs Elementary School – Critical Facility (Education)
- Kilgore Elementary School – Critical Facility (Education)
- Railroads – Critical Facility (Transportation Infrastructure)
- Roads – Critical Facility (Transportation Infrastructure)

## ASSET INVENTORY – VILLAGE OF DELLROY

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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## METHODOLOGY

The methodology for the asset inventory of the Village of Dellroy is exactly the same as for Carroll County. In fact, the assets that are located within the corporate limits are listed on the composite asset and hazard lists that encompass the county assets. For the purpose of clarity, the following assets are located within the corporate limits of the Village of Dellroy.

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## ASSETS

- Bridges – Critical Facility (Transportation Infrastructure)
- Dellroy Community Volunteer Fire Department – Critical Facility (Emergency Services)
- Dellroy Elementary School – Critical Facility (Education)
- Dellroy Police – Critical Facility (Emergency Services)
- Dellroy Post Office – Special Consideration (Federal Facility)
- Dellroy Village – Critical Facility (Government Facility)
- Railroads – Critical Facility (Transportation Infrastructure)
- Roads – Critical Facility (Transportation Infrastructure)

## ASSET INVENTORY – VILLAGE OF LEESVILLE

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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## METHODOLOGY

The methodology for the asset inventory of the Village of Leesville is exactly the same as for Carroll County. In fact, the assets that are located within the corporate limits are listed on the composite asset and hazard lists that encompass the county assets. For the purpose of clarity, the following assets are located within the corporate limits of the Village of Leesville.

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## ASSETS

- Bridges – Critical Facility (Transportation Infrastructure)
- Leesville Fire Department – Critical Facility (Emergency Services)
- Railroads – Critical Facility (Transportation Infrastructure)
- Roads – Critical Facility (Transportation Infrastructure)

## ASSET INVENTORY – VILLAGE OF MALVERN

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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## METHODOLOGY

The methodology for the asset inventory of the Village of Malvern is exactly the same as for Carroll County. In fact, the assets that are located within the corporate limits are listed on the composite asset and hazard lists that encompass the county assets. For the purpose of clarity, the following assets are located within the corporate limits of the Village of Malvern.

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## ASSETS

- Augusta Township Volunteer Fire Department – Critical Facility (Emergency Services)
- Bridges – Critical Facility (Transportation Infrastructure)
- Brown Local School District – Critical Facility (Education)
- Malvern Elementary School – Critical Facility (Education)
- Malvern Fire Department – Critical Facility (Emergency Services)
- Malvern High School – Critical Facility (Education)
- Malvern Police – Critical Facility (Emergency Services)
- Malvern Post Office – Special Consideration (Federal Facility)
- Malvern Village – Critical Facility (Government Infrastructure)
- Malvern Water – Critical Facility (Government Infrastructure)
- Railroads – Critical Facility (Transportation Infrastructure)
- Roads – Critical Facility (Transportation Infrastructure)



## ASSET INVENTORY – VILLAGE OF MINERVA

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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## METHODOLOGY

The methodology for the asset inventory of the Village of Minerva is exactly the same as for Carroll County. In fact, the assets that are located within the corporate limits are listed on the composite asset and hazard lists that encompass the county assets. For the purpose of clarity, the following assets are located within the corporate limits of the Village of Minerva.

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## ASSETS

- Bridges – Critical Facility (Transportation Infrastructure)
- Minerva Eldercare Center – Vulnerable Population (Elderly)
- Minerva Fire Department – Critical Facility (Emergency Services)
- Minerva Police – Critical Facility (Emergency Services)
- Minerva Village – Critical Facility (Government Facility)
- Minerva Waste Water Treatment Plant – Critical Facility (Utilities)
- Minerva Water Plant – Critical Facility (Utilities)
- Railroads – Critical Facility (Transportation Infrastructure)
- Roads – Critical Facility (Transportation Infrastructure)

## ASSET INVENTORY – VILLAGE OF SHERRODSVILLE

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*As per requirement 44 CFR Part 201.6 (c)(2)(ii)(A): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.*

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## METHODOLOGY

The methodology for the asset inventory of the Village of Sherrodsville is exactly the same as for Carroll County. In fact, the assets that are located within the corporate limits are listed on the composite asset and hazard lists that encompass the county assets. For the purpose of clarity, the following assets are located within the corporate limits of the Village of Sherrodsville.

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## ASSETS

- Bridges – Critical Facility (Transportation Infrastructure)
- Railroads – Critical Facility (Transportation Infrastructure)
- Roads – Critical Facility (Transportation Infrastructure)
- Sherrodsville Village – Critical Facility (Government Facility)
- Sherrodsville Volunteer Fire Department – Critical Facility (Emergency Services)

## ESTIMATE LOSSES – CARROLL COUNTY

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*As per 44 CFR Part 201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.*

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Carroll County used GIS-based mapping, HAZUS, and interviews with local representatives, as well as Worksheet #4 from the Federal Emergency Management Agency's (FEMA) *State and Local Mitigation Planning How-to Guide: Understanding Your Risks* to estimate the potential dollar losses if the county was to experience the hazard events that are profiled above.

The information that was gathered in the asset inventory stage of the risk assessment was used to determine the estimated losses. For example, Worksheet #4 makes use of the replacement value, contents value, functional use or value, displacement cost, and occupancy or capacity information from Worksheet #3b. Displacement time was estimated based on historical data of past hazard events. For example, historical data was reviewed to determine how long the average flooding event closes county schools.

Following are the estimated losses to each asset if the hazard event were to occur. Please note that these are *estimates* for *potential* hazard events. The percentage of damage was determined on a "per hazard" basis depending also on the physical location of the asset. For example, assets in high hazard areas for winter storms received a higher damage percentage than assets in low hazard areas. The justification for such a determination is because winter storms are predicted to not only strike high hazard areas more frequently, but also be more severe (based on historical data). These dollar values do not represent actual losses from past hazard events.

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### Dam Failure

There are twenty-six total dams in Carroll County, four (4) of which are Class I Dams. According to the Ohio Department of Natural Resources, the failure of a Class I Dam could potentially result in the loss of life and structural damage to high valued properties such as homes, industries, and major public utilities.

Total loss to structures as a result of a dam failure is estimated to be \$1,457,800; total contents loss is estimated at \$94,600; total loss to structure use and function is anticipated to be \$34,420. The total estimated loss as a result of a dam failure is \$1,586,820.

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### Drought

It is very unlikely that drought would cause any damage to the county's structural assets. Drought would, however, have a direct impact of the agricultural assets and the local water supply. Effects on the water supply can potentially disrupt service, especially in many residential areas that rely on private wells.

Total loss to structures as a result of a drought is estimated to be \$0.00; total contents loss is estimated at \$0.00; total loss to structure use and function is anticipated to be as much as \$0.00. The total estimated loss as a result of a drought is \$0.00.

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### Earthquake

(Carroll County is listed as an MMI IV area with a Peak Ground Acceleration (PGA) of 2.0-3.0 with respect to earthquakes.) According to FEMA's *State and Local Mitigation Planning How-to Guide: Understanding Your Risks*, MMI IV areas will experience little to no damage as a result of earthquakes. As such, damage from earthquakes is anticipated to be low in Carroll County. However Carroll County falls within the area predicted to be affected by disturbances along the New Madrid Fault in Missouri, the predicted intensity of an event along this fault would be VII according to the Modified Mercalli Intensity Scale.

Total loss to structures as a result of an earthquake is estimated to be \$1,095,300; total contents loss is estimated at \$73,900; total loss to structure use and function is anticipated to be as much as \$103,230. The total estimated loss as a result of an earthquake is \$1,272,430.

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### Epidemic

Losses to structural assets are relatively low when considering epidemic. This hazard primarily affects the human population. However, a large-scale epidemic could affect enough of the population to close an asset.

Total loss to structures as a result of an epidemic is estimated to be \$0.00; total contents loss is estimated at \$0.00; total loss to structure use and function is anticipated to be as much as \$140. The total estimated loss as a result of an epidemic is \$140.

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### Flooding

Flood damage is reported often throughout Carroll County, as a result of both flash flooding and riverine flooding. Further, floods affect both structures and the contents in those

structures as water often enters them. Flood plain maps illustrate that all of the 14 political subdivisions in the county are subject to possible flooding. Consequently, loss estimates for flooding events are high.

Potential structural losses due to flooding are estimated to be \$3,854,800; potential contents losses total \$58,600; and structure use and function loss estimates total \$51,620. The total potential loss due to a flooding event in Carroll County is \$3,965,020.

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### Hailstorm

Hailstorms are a significant hazard throughout all of Carroll County. These events can cause structural damage to the county's assets, such as possible broken window or damaged heating/cooling equipment. As with many of these identified hazards, it is perhaps more pertinent to review the accompanying charts for an asset-by-asset listing of potential loss.

Total, countywide structural losses are estimated to be \$415,600. This damage would be broken windows, damaged HVAC equipment, etc. Contents losses due to hail would be relatively low. Potential contents losses total \$15,000. Total potential losses due to a hailstorm are \$430,600.

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### Infestation

Losses to structural assets are relatively low when considering infestation. This hazard primarily affects agricultural assets. Therefore, anticipated potential losses to structural assets due to an infestation are low to nonexistent.

Total, countywide structural losses are estimated to be \$0.00. Contents losses due to infestations would also be relatively low. Potential contents losses total \$0.00. Total potential losses in this category are estimated at \$0.00. Total potential losses due to infestations are \$0.00.

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### Land subsidence and Erosion

Landslides are natural hazards that have the potential to cause significant structural damage. As such, potential loss figures are high, both countywide and structural asset-by-structural asset. However, while the severity of the potential hazard event is high, the actual probability of that event occurring in Carroll County is low. Consequently, it is especially stressed in this section that these figures are *estimates* of losses during *potential* hazard events.

There are several abandoned mines in Carroll County most of which are located beneath heavily populated municipalities. Sinkholes are common occurrences around abandoned mines

and can result in significant property damage to a large area over a short period of time, and places a large portion of the county's population at risk.

Potential structural losses due to land subsidence total \$670,700. Potential contents losses total \$37,400. Potential structure use and function loss estimates total \$51,620. The total potential losses for Carroll County due to land subsidence are estimated at \$759,720.

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#### Severe Thunderstorm

Many of the structural damages associated with severe thunderstorms include downed power lines, fallen trees and other debris that causes structural damage, etc. Further, damage to contents is also potentially high, as in power surges due to lightning, etc.

Potential structural losses in Carroll County total \$1,095,300; content losses total \$73,900; and structure use and function loss estimates total \$51,620. The total potential loss in Carroll County due to a severe thunderstorm is \$1,220,820.

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#### Severe Wind and Tornado

Strong windstorms, especially tornadoes, can cause significant damage to structural assets. Carroll County's topography is that of gently sloping, which offers somewhat of a natural barrier to breakup severe wind or tornadoes that form. The following estimates were developed based on historic hazard events as well as statewide wind zone designations. Again, these figures are representative of the potential losses of a hazard event if it were to occur.

These figures in no way insinuate that the particular hazard event will occur. Potential structural losses total \$1,086,400; potential contents losses total \$69,500; and structure use or function loss totals \$51,620. Total potential losses in Carroll County due to severe wind and a possible tornado total \$1,207,520.

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#### Severe Winter Storm and Sleet

Damage as a result of winter storms often is associated with snow weight, hazardous driving conditions, etc. Loss estimates from winter storms were calculated both by the probability and severity of a potential hazard event. For instance, damage to assets in a "Low Hazard Risk" areas, are estimated lower than damage in "High Hazard Risk" areas, in part because not only are winter storm events more common in high hazard areas, but they are also more severe (because of the higher elevations associated with the "High Hazard Risk" areas).

Potential structural losses due to winter storms are estimated to be \$6,290,700; potential contents losses total \$72,900; and structure use and function loss estimates total \$51,620. The total potential loss due to a winter storm event in Carroll County is \$6,415,220.

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#### Temperature Extreme – Heat Wave

It is anticipated that extreme heat will not cause any damage to structural assets in Carroll County. A heat wave can affect employers at the county's assets. However the possibility of enough people getting sick as a result of heat wave to close the asset is relatively low.

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#### Wildfire

A large portion of Carroll County is covered with vast wooded areas. Many of the structural assets in the county are within close proximity of those wooded areas. If a wildfire were to occur a large portion of structural assets could possibly be damaged or completely destroyed.

Potential structural losses due to wildfires total \$730,700. Potential contents losses total \$71,800. Potential structure use and function loss estimates total \$51,620. The total potential losses for Carroll County due to wildfires are estimated at \$854,120.

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## ANALYZING DEVELOPMENT TRENDS – CARROLL COUNTY

### *Including the villages within Carroll County*

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*As per 44 CFR Part 201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

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Carroll County is located in northeastern Ohio, and is bordered by Columbiana and Stark Counties to the north, Columbiana and Jefferson Counties to the east, Harrison County to the south, and Stark and Tuscarawas Counties to the west. Carrollton, the county seat, is currently the most populated of the municipalities in Carroll County and contains a large portion of the commercial and industrial assets of the county.

In the past, Carroll County has been the home of several small businesses. During the recent history of the county, these businesses have changed. For example, companies are bought and sold; old companies close, leaving empty facilities behind that are filled by new companies, etc. In 2002, 44 new businesses opened while 21 businesses closed, creating a net formation of 23 new businesses within the county, bringing the number of active businesses in the county to 430.

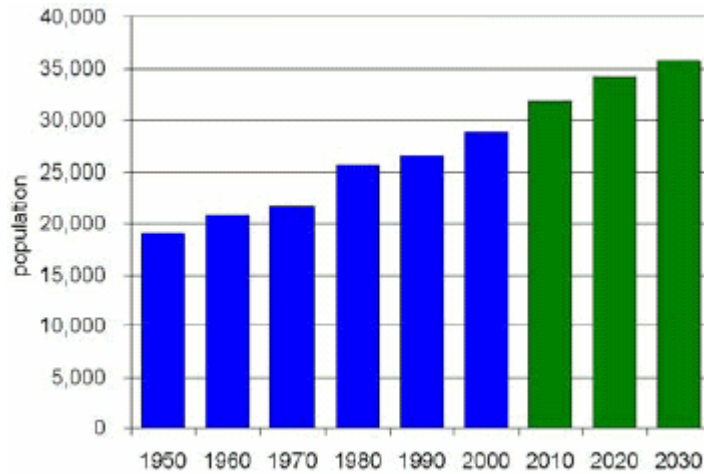
Other land uses in the county consist of the following:

- ***Industrial and commercial areas*** – The majority of the commercial areas can be found in and near the incorporated areas of the county, primarily in the larger villages of Carrollton, Minerva, and Malvern.
- ***Residential areas*** – Located primarily in the western portion of the county and elsewhere along the major roadways. The Village of Carrollton is the “residential anchor” of Carroll County.
- ***Farmland*** – Agricultural land covers 122,000 acres, with a total of 780 individual farms. These agricultural areas are spread throughout the county; however, the majority is located in the western portion.
- ***Specialized land use designations*** – Carroll County contains several unique attractions, including the McCook House, which is a memorial to the famous “Fighting McCooks.” Other attractions in Carroll County include Atwood Lake Park and Lodge, Leesville Lake, Algonquin Steam Mill, and the “Elderberry Line,” an 11-mile train ride between Carrollton and Minerva.



The residential areas in the county have experienced a population increase. As indicated by Census data, all but two (2) of the largest areas by population increased from 1990 to 2000.

The total population in 1990 was 26,521, which increased to 28,836 in 2000, an average increase of 232 people per year over the 10-year period. According to the Ohio Department of Development, this is a trend that is expected to continue; the projected population for the year 2010 is 31,820, which is illustrated in the figure to the



right. The majority of the employment sector in 2000 was comprised of manufacturing, trade, and service. Organizations such as the Carroll County Economic Development Center and the Community and Economic Development Program of Carroll County are working to attract business to and retain business in Carroll County.

Projected	
2010	31,820
2020	34,170
2030	35,716

There are two (2) industrial parks located in the county: the Carroll County Industrial Park and the Minerva Industrial Park (with space available for development). Local officials should review floodplain and other maps to determine if these areas are prone to flooding, landslides, or mine subsidence prior to any future construction.

The major employers in the county include American Axle and Manufacturing/Colfor, Carroll Health Care Center Inc., Carrollton Exempt Village Board of Education, GBS Corporation, Genuine Parts Company/NAPA, Graphic Planet, and Metaldyne.

There are several active and abandoned mines located in Carroll County. Coal Companies that still operate include Buckeye Industrial Mining Company, Craval Coal Company, James Brothers Coal Company, and Myers Mining Company. The majority of these mines are located in the eastern and western portions of the county. In addition to abandoned mines causing subsidence problems the departure of the mining industry has significantly affected the economy of the county. Local officials should determine if abandoned mines could be re-used as recreation or other areas. Prior to any plans for re-use, these areas should be examined for the potential for the aforementioned subsidence.

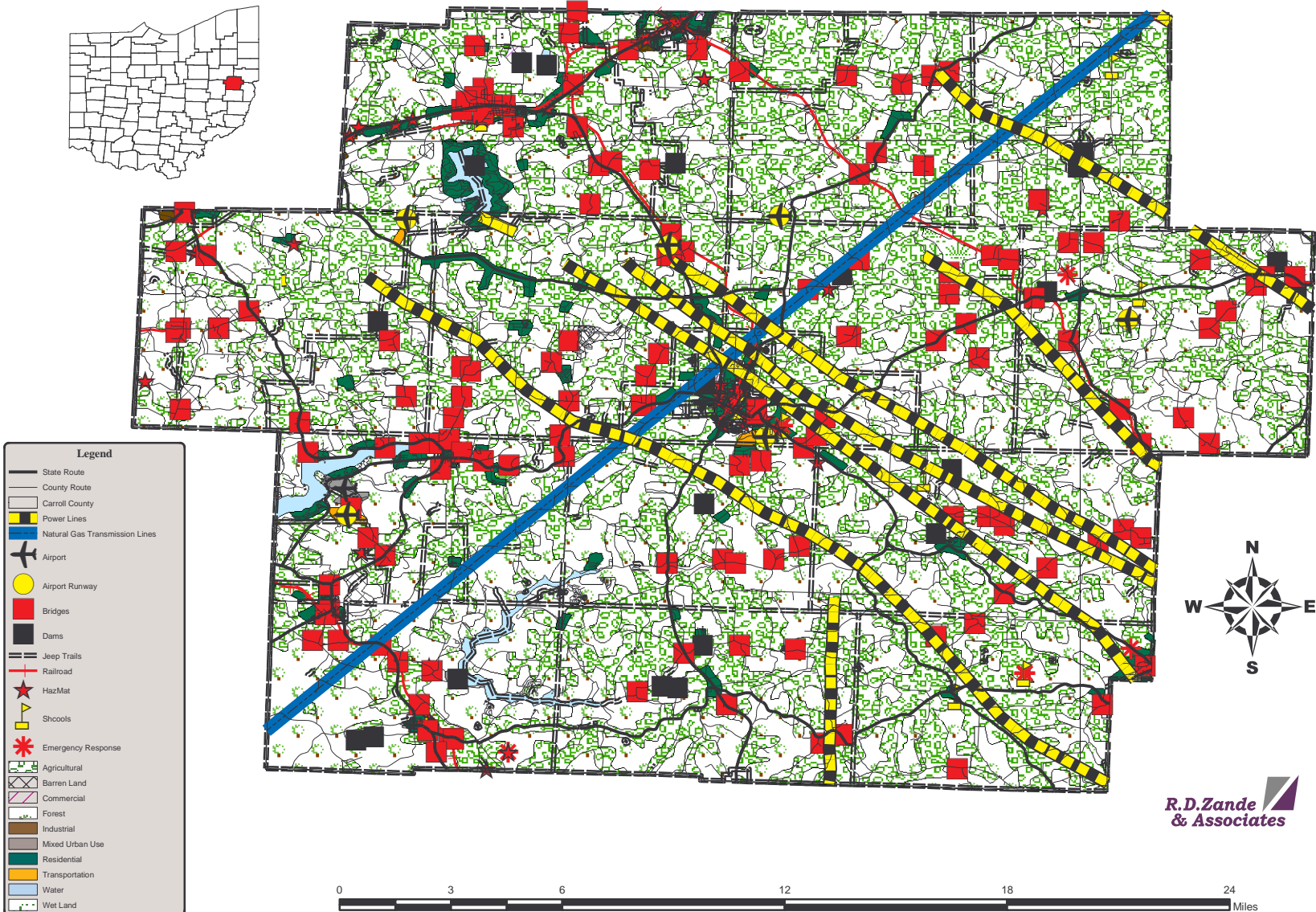
## **VULNERABILITY TO FUTURE BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES**

Development is occurring primarily in Carroll County's three (3) most densely populated municipalities, as well as along routes between them. Portions of the Canton Road northwest of Carrollton are particularly dense with commercial establishments. Further, the county's two (2) industrial parks offer space for development. As such, future commercial and industrial development is likely to be impacted by the hazards affecting these areas. These same areas, particularly within Carrollton, Malvern and Minerva, are likely to see continued residential development due to their proximity to the economic sector of the county. Infrastructure upgrades may be necessary in these areas, which will increase the number of entries on the county's critical facilities list. Also, economic development may be significant enough to be considered a "critical facility".

The above areas are highly susceptible to flooding (in certain areas, particularly near Malvern), land subsidence and winter storms. They are moderately susceptible to drought and infestation conditions (although these will most likely not affect structural assets), earthquakes, epidemics, hazmat incidents (particularly along roadways), thunderstorms, wildfires, and severe wind. Finally, these areas are unlikely to be affected by events surrounding a dam failure, hailstorms, or temperature extremes.

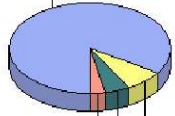
Additionally, as evidenced by county maps from the Carroll County Engineer's office, residential subdivisions are being constructed in the southwestern portion of the county near Atwood Lake and Leesville Lake. These areas are particularly susceptible to events surrounding a dam failure, land subsidence and wildfires (many of the residential areas interface wooded areas).

# Carroll County Asset Mapping



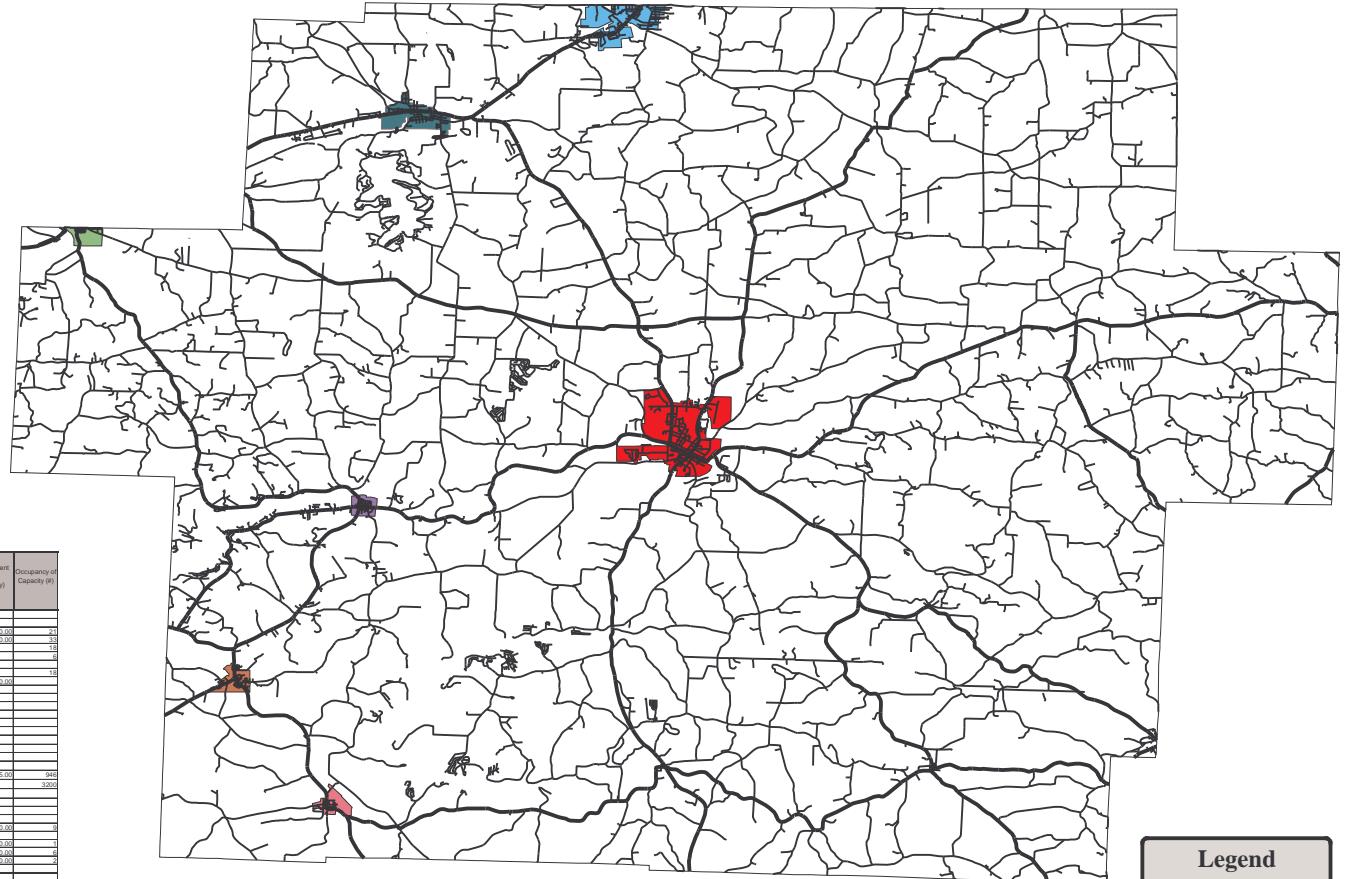
# Carroll County Municipal Areas

Residential  
970507

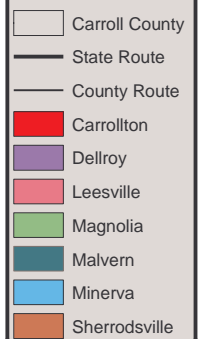


Commercial  
85815  
Industrial  
58648  
Others  
33951

Figure 1: Building Exposure by Occupancy Type  
(Thousands of dollars)

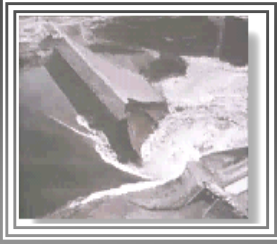


## Legend



Inventory Assets														
Task C. Compile a detailed inventory of what can be damaged by a hazard event.														
Name or Description of Asset	Source of Information	Type of Asset	Latitude	Longitude	County	City	State	Size of Building (sq ft or Length ft)	Replacement Value (\$)	Contents Value (\$)	Function Use or Value (\$)	Displacement Cost (\$ per day)	Occupancy or Capacity (#)	
Residential									\$245,680,940.00					
Augusta TWP VFD	330-895-3351	X												
Bloom TWP VFD	330-893-450-50-51	X						12,430	\$750,000.00	\$2,500,000.00	\$30,000.00	\$9,200.00	27	
Carrollton Village VFD	330-827-2850-3050	X						10,000	\$500,000.00	\$1,000,000.00	\$100,000.00	\$30,000.00	33	
Delroy Community VFD	330-735-2050	X						2,000	\$100,000.00	\$200,000.00	\$20,000.00	\$6,000.00	10	
Fox TWP VFD	330-738-2411-2444	X						3,000	\$200,000.00	\$400,000.00	\$40,000.00	\$12,000.00	9	
Harlow TWP	330-893-5411-5413	X												
Leesville TWP VFD	330-738-4611	X						3,200	\$410,000.00	\$750,000.00			18	
Minerva TWP	330-893-5411-5413	X						3,400	\$180,000.00	\$300,000.00	\$30,000.00	\$9,000.00	12	
Minerva VFD	330-893-4717	X						11,832	\$1,640,000.00	\$3,000,000.00	\$30,000.00			
Perry TWP VFD	330-827-2118	X												
Sherrodsville VFD	740-260-8000-8001	X							\$300,000.00	\$600,000.00				
Sherradsville VFD	330-827-4444	X												
Ball Harlow MS	330-827-3788	X												
Carrollton ES	330-827-3788	X												
Delroy ES	330-827-2850	X												
Harlow School ES	330-738-2411	X												
Minerva ES	330-893-450-50-51	X						13,072	\$1,130,000.00				940	
Sherradsville ES	330-827-4444	X							\$11,000,000.00	\$20,000,000.00	\$2,000,000.00	\$1,000,000.00	3200	
Carrollton Elementary Schools								286,000	\$30,000,000.00	\$60,000,000.00	\$10,000,000.00	\$5,000,000.00		
Minerva ES	330-893-450-50-51	X												
Malvern ES	330-893-450-50-51	X												
Malvern ES	330-893-450-50-51	X												
Augusta TWP	330-895-3145	X						3,600	\$117,000.00				8	
Bloom TWP	330-893-450-50-51	X							\$200,000.00	\$400,000.00	\$40,000.00	\$12,000.00	9	
Center TWP	330-827-450-50-51	X						1,250	\$107,000.00				3	
East TWP	330-827-450-50-51	X						1,000	\$100,000.00	\$200,000.00	\$20,000.00	\$6,000.00	6	
Fox TWP	330-738-2444	X						4,000	\$200,000.00	\$400,000.00	\$40,000.00	\$12,000.00	9	
Harlow TWP	330-893-5411-5413	X							\$100,000.00	\$200,000.00	\$20,000.00	\$6,000.00	6	
Leesville TWP	330-827-2118	X												
Malvern TWP	330-893-450-50-51	X						7,000	\$600,000.00	\$1,100,000.00	\$110,000.00	\$33,000.00	12	
Orange TWP	330-827-2118	X						1,100	\$111,000.00	\$220,000.00	\$22,000.00	\$6,600.00	10	
Perry TWP	330-827-2118	X							\$200,000.00	\$400,000.00	\$40,000.00	\$12,000.00	9	
Ross TWP	330-738-2113-2133	X												
Sherradsville TWP	330-827-4444	X						10,000	\$50,000.00	\$100,000.00	\$10,000.00	\$3,000.00	25	
Carrollton Village	330-827-2850-3050	X							\$1,750,000.00	\$3,500,000.00	\$350,000.00	\$105,000.00	25	
Dellroy Village	330-738-2444	X							\$700,000.00	\$1,400,000.00	\$140,000.00	\$42,000.00	51	
Leesville Village	330-893-450-50-51	X						1,800	\$2,450,000.00	\$4,900,000.00	\$490,000.00	\$147,000.00	71	
Minerva Village	330-893-450-50-51	X							\$300,000.00	\$600,000.00	\$60,000.00	\$18,000.00	71	
Sherradsville Village	740-260-8000	X							\$200,000.00	\$400,000.00	\$40,000.00	\$12,000.00	9	
Roads								2,000	\$2,391,840.000.00					
Busstop								270,840	\$48,330,000.00					
Busstop								2,000	\$300,000.00					
Parsons Runway								2,000	\$15,180,000.00					
Parsons Runway								2,000	\$15,180,000.00					
Carroll County Police Bureau								2,000	\$30,000,000.00					
Carroll County Sheriff								2,000	\$30,000,000.00					
Malvern Police Bureau								2,000	\$30,000,000.00					
Minerva Police Bureau								2,000	\$30,000,000.00					
Sherradsville Police Bureau								2,000	\$30,000,000.00					
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Malvern Police Bureau								2,000	\$30,000,000.00					
Minerva Police Bureau								2,000	\$30,000,000.00					
Sherradsville Police Bureau								2,000	\$30,000,000.00					
Malvern Police Bureau														

## **Dam Failure**



A dam is a barrier built across a waterway to control the flow or raise the level of water. A dam failure occurs when the barrier constructed across the waterway fails or otherwise does not obstruct or restrain the flow of water, which can rapidly result in a large area of completely inundated land.

There are about 80,000 dams in the United States, the majority of which are privately owned. State and local authorities, public utilities, and federal agencies own others. The benefits of dams are numerous: they provide water for drinking, navigation, and agricultural irrigation, and save lives by preventing or reducing floods. Several methods of research identified dam failure as a hazard in Carroll County. General information on dam failures was obtained from the following sources.

- Ohio Department of Natural Resources Division of Water
- HAZUS Instruction and Technical Information  
<http://www.fema.gov/hazus/>
- National Inventory of Dams
- Carroll County Emergency Operations Plan, 1994

Dams are designed to obstruct or restrain waters that may cause flooding downstream. These structures are generally made with concrete or earthen materials. The failure of dams, although a man-made structure, results in the natural event of flooding. There are 26 dams in Carroll County according to the Ohio Department of Natural Resources, and the Carroll County Emergency Operations Plan. Of those dams, four (4) are Class I, ten (10) are Class II, and 12 are Class III. Dams are

Height of Dam	
Class I	Greater than 60 feet
Class II	Greater than 40 feet
Class III	Greater than 25 feet
Class IV	Less than or equal to 25 feet
Storage Volume	
Class I	Greater than 5000 acre-feet
Class II	Greater than 500 acre-feet
Class III	Greater than 50 acre-feet
Class IV	Less than/equal to 50 acre-feet



classified under two (2) conditions: height and storage volume (as illustrated in the charts above). The height of a dam is defined as the vertical dimension measured from the natural streambed at the downstream toe of a dam to the low point along the top of the dam. The storage volume is defined as the total volume impounded when the pool level is at the top of the dam immediately before it is overtopped. According to the Ohio Department of Natural Resources, the damage predicted by a dam failure coincides with the class of the dam. The potential downstream hazards are defined as the resultant downstream damage should the dam fail, including probable future development. The potential downstream hazards are broken into four (4) classes.

<b>POTENTIAL DOWNSTREAM HAZARDS</b>	
<b>Class I</b>	<b>Probable loss of life, structural damage to high value property (i.e. homes, industries, major public utilities).</b>
<b>Class II</b>	<b>Damage to structures (no loss of life envisioned), state and interstate highways, and railroads.</b>
<b>Class III</b>	<b>Damage to low value non-residential structures, blocked roads, damage to crops, and injuries to livestock.</b>
<b>Class IV</b>	<b>Losses restricted mainly to the dam.</b>

The potential for damage due to dam failure is increasing as residential and commercial development continues downstream of dams. In many cases, existing dams will need to be modified to keep downstream areas safe from catastrophic flooding.

There are four (4) large class I dams in Carroll County, including Lake Mohawk located near the Village of Malvern, Atwood Lake located near Dellroy, and Leesville Lake located near Leesville Village, all of which are in the western portion of the county. The actual dam for Atwood Lake is located in Tuscarawas County. There have been no recorded failures of these dams.

There are three (3) types of earthen dam failures: overtopping, seepage, and structural failure. Overtopping failures result from the erosive action of water on the embankment. Erosion is caused by uncontrolled flow of water over, around, and adjacent to the dam. Earthen embankments are not designed to be overtopped and therefore are particularly susceptible to erosion. Once erosion has begun during overtopping, it is almost impossible to stop.

All earthen dams experience seepage as water percolates slowly through the dam and its foundation. However, seepage must be controlled in both velocity and quantity. If uncontrolled, it can progressively erode soil from the embankment or its foundation, resulting in rapid failure of the dam. Erosion of the soil begins at the downstream side of the embankment either in the dam proper or the foundation, progressively works toward the reservoir, and eventually develops a

“pipe” or direct conduit into the reservoir. Seepage can cause slope failure by either creating high pressures in the soil pores or saturating the slope.

Structural failures can occur in either the embankment or the appurtenances. Structural failure of a spillway, lake drain, or other appurtenance may lead to failure of the embankment. Cracking, settlement, and slides are the more common signs of structural failure of embankments. Large cracks in either an appurtenance or the embankment, major settlement, and major slides will require emergency measures to ensure safety, especially if the problems occur suddenly. Minor defects such as cracks in the embankment may be the first visual sign of a major problem which could lead to failure of the structure. Someone experienced in dam design and construction should evaluate the seriousness of all deficiencies as soon as they are detected.

The three (3) types of failures are often interrelated in a complex manner. For example, uncontrolled seepage may weaken the soil and lead to a structural failure. A structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may result in structural failure, and the cycle continues.

The following table lists the dams in Carroll County along with the classification, approximate location, and owner.

<b>Name</b>	<b>Class</b>	<b>Location</b>	<b>Owner</b>
Atwood Lake Dam	<b>I</b>	Village of Dellroy	*****
Leesville Lake Dam	<b>I</b>	Village of Leesville	COE, Huntington District
Lake Mohawk Dam	<b>I</b>	Village of Malvern	Assn, Inc.
Stony Lake Dam	<b>I</b>	Perry Township	Stony Lake Club, Inc.
Chicks Lake Dam	<b>II</b>	Village of Carrollton	Paul D. & Diane Talkington, Jr.
Boy Scout Dam	<b>II</b>	*****	Buckeye Council No. 436
Gravis Lake Dam	<b>II</b>	Village of Carrollton	Donald E. Gravis
Stanley Lower Lake Dam	<b>II</b>	*****	Lawrence Stanley
Stanley Upper Lake Dam	<b>II</b>	*****	Lawrence Stanley
Seminter Pond No. 1	<b>II</b>	Salineville	Jan C. & Vicki L. Needham
Hornberger-Long Lake	<b>II</b>	Village of Carrollton	Rickard C. Hornberger & Ed Long
Trail Run Lower Lake	<b>II</b>	Village of Carrollton	Willard E. Spencer, Jr.
Olivito Lake Dam	<b>II</b>	Village of Carrollton	Dominick E. & Cynthia Olivito, Jr.
Puskarick Lake Dam	<b>II</b>	*****	Conotton Land Company

Vo-Ash Lake Dam	III	Northfield	Assn., Inc.
Burke Pond Dam	III	*****	Raymond V. Burke
Ledger Lake Dam	III	*****	Estate of Harry J. Ledger
Spring Haven Lake Dam	III	*****	Wayne German
Hall Lake Dam	III	Kensington	J. Howard & Marie M. Hall
Dunn Lake Dam	III	Kensington	Daniel R. & Elizabeth F. Dunn
Lake Mohelo Dam	III	Village of Malvern	Mattheuw Oberholtzer
Tennessee Gas Lake Dam	III	Village of Carrollton	Tennessee Gas Company
Great Trail Lake Dam	III	*****	Great Trail Girl Scout Council
Pride Valley Beach Club Lake Dam	III	Village of Malvern	Evelyn Foltz
Hecxanan Lake Dam	III	*****	Dr. James H. Heckaman
Dews Pond Dam	III	Village of Malvern	William & Maryland Dews

## VULNERABILITY OF EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

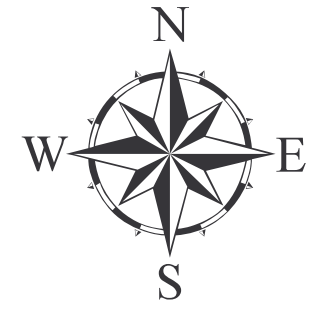
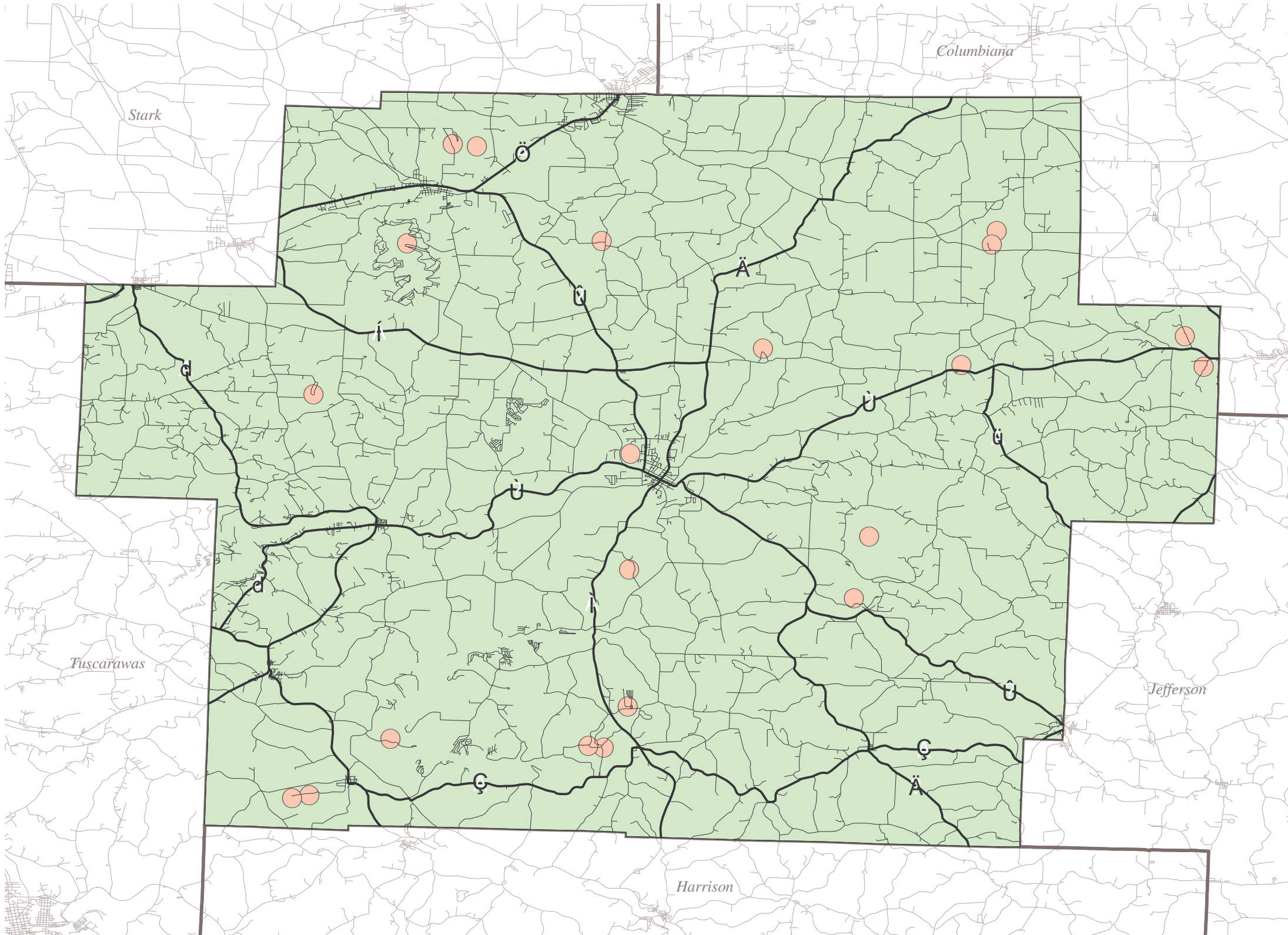
Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	1995	15	\$246,689,940.00	\$37,097,000.00	9	22,024	3,325
COMMERCIAL	337	51	0	\$25,980,630.00	\$3,923,000.00	1	3,408	515
INDUSTRIAL	45	7	0	\$11,227,650.00	\$1,695,000.00	0	2,158	326
AGRICULTURAL	3	0	0	\$92,489,610.00	\$13,965,000.00	3	89	13
GOVERNMENT	19	3	0	\$14,712,300.00	\$2,221,000.00	1	944	143
EDUCATION	12	2	0	\$43,940,400.00	\$6,635,000.00	2	213	32
Total	13,432	2,028	15	\$434,040,430.0	\$65,536,000.00	15	28,836	4,354

## MAPPING

See the Carroll County Dam Failure Map for a graphical representation of the hazard areas with regard to dam failure. The green areas represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the orange areas represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”



# Dam Failure



R.D.Zande  
& Associates



## LEGEND

### Roads

- County Route
- State Route
- Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Drought**



A drought is a period of abnormally dry weather, which persists long enough to produce a serious hydrological imbalance.

Several methods of research identified drought as a hazard in Carroll County, including discussions with local representatives. Drought information was obtained from the following Internet sites.

- United States Department of Agriculture  
<http://enso.unl.edu/monitor/monitor.html>
- United States Geological Survey  
<http://www.usgs.gov>
- National Oceanic Atmospheric Administration (NOAA)  
<http://www.ncdc.noaa.gov>
- Carroll County Emergency Operations Plan (EOP), 1994

Drought is a relative term and is used in relation to who or what is being affected by the lack of moisture. Droughts can be categorized into three (3) types – each one affecting the other.

***Agricultural Drought*** – Moisture deficiency seriously injurious to crops, livestock, or other agricultural commodities. Parched crops may wither and die. Pastures may become insufficient to support livestock. Effects of agricultural droughts are difficult to measure because there are many other variables that may impact production during the same growing season.

***Hydrological Drought*** – Reduction in stream flow, lake and reservoir levels, depletion of soil moisture, and a lowering of the ground water table. Consequently, there is a decrease in groundwater discharge to streams and lakes. A prolonged hydrological drought will affect the water supply.

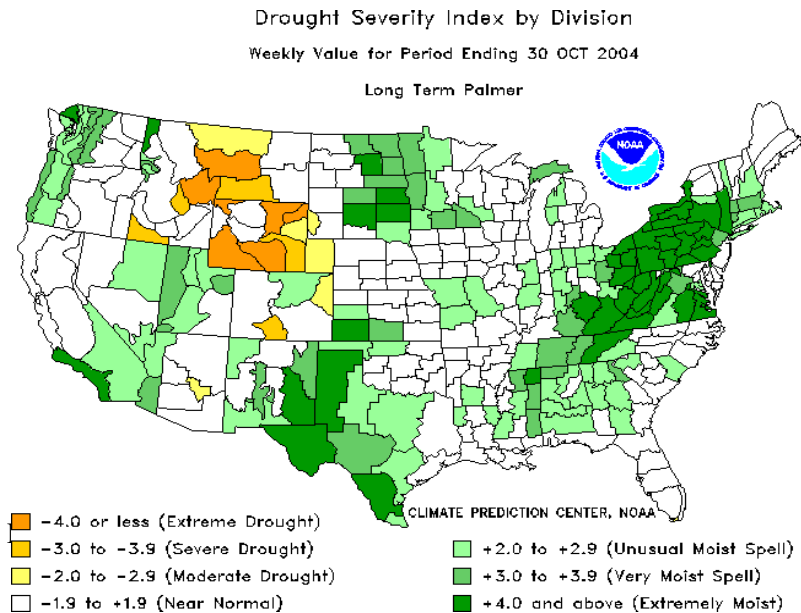
***Mathematical Drought*** – Computation in which rainfall deficiencies are expressed.

Extended, widespread droughts are fairly infrequent; however, brief local droughts are common and can be severe. Carroll County is susceptible to drought conditions during the

summer and autumn months due to a significant lack of rainfall and/or other precipitation. These drought conditions often affect local farmers (both commercial farmers and personal farmers) and the local water supply (wells often run dry and rivers run low forcing public water supplies to decrease).

Carroll County's agricultural sector, which makes up approximately 41% of the total land cover, is extremely susceptible to drought, and could suffer significant economic losses.

According to the *Palmer Drought Severity Index* for a period between 1985 and 1995, Ohio counties spend 0-5% of the summer and autumn months under drought conditions. As of October 30, 2004, Carroll County's precipitation levels were extremely moist according to the map on the right. Although significant droughts are fairly



infrequent, they have been recorded in Carroll County. According to an August 1, 1999 *NOAA Event Record*, dry conditions that actually began in July 1998 continued through the month of August. On August 10, the U.S. Department of Agriculture declared all of eastern Ohio an agricultural disaster area. Precipitation deficits for the period of May through August showed the area to be anywhere between two (2) and eight (8) inches below normal.

## VULNERABILITY OF EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

Carroll County Hazard Risk Assessment  
Hazard Profile

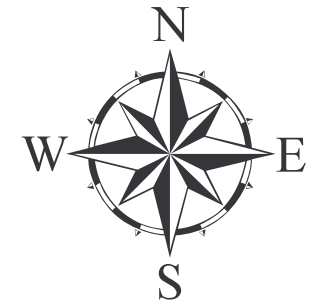
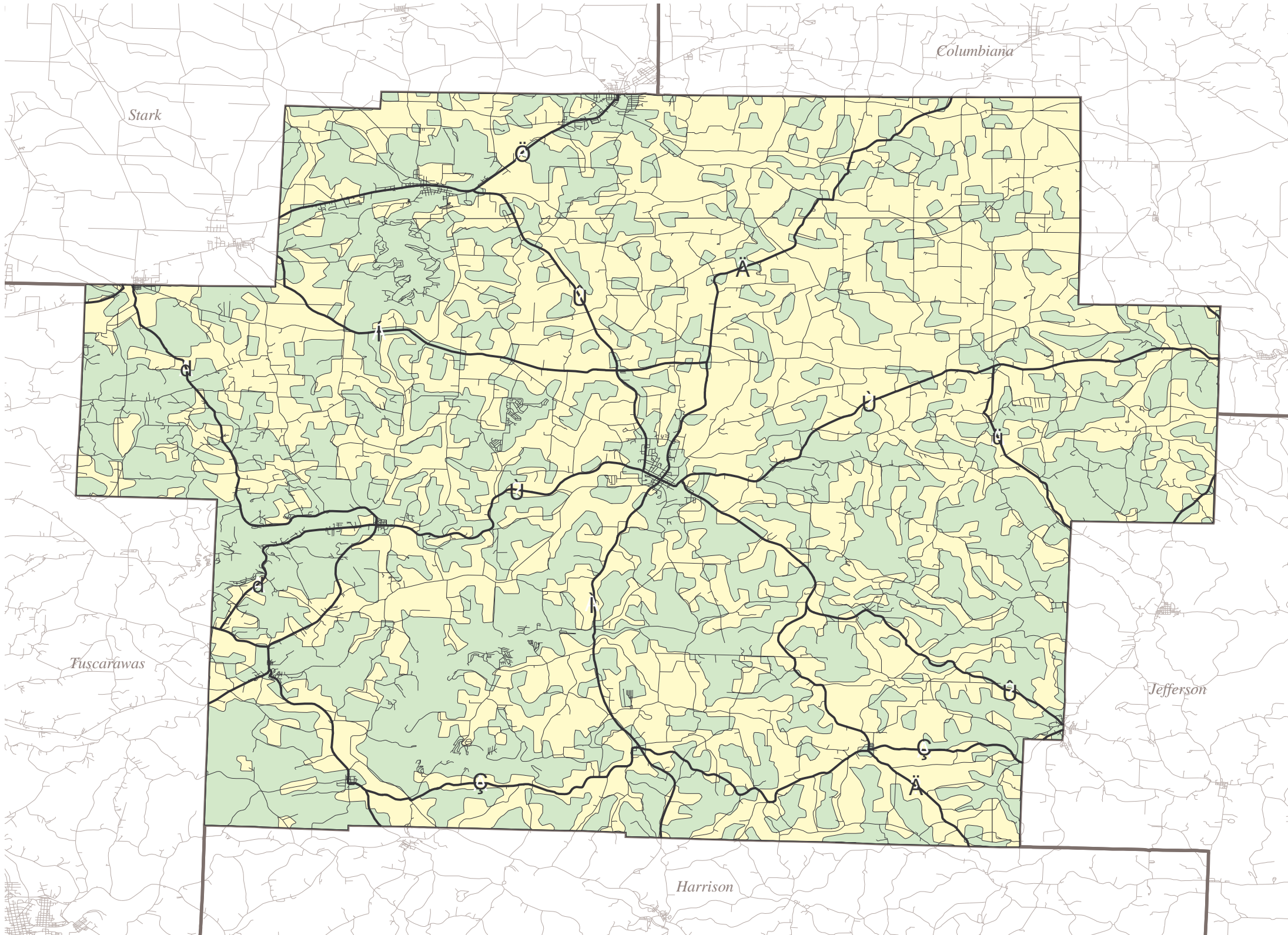
Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	0	0	\$245,689,940.00	\$0.00	0	22,024	4,542
COMMERCIAL	337	0	0	\$25,980,530.00	\$0.00	0	3,408	703
INDUSTRIAL	45	0	0	\$11,227,850.00	\$0.00	0	2,158	446
AGRICULTURAL	3	0	0	\$92,489,610.00	\$0.00	0	89	18
GOVERNMENT	19	0	0	\$14,712,300.00	\$0.00	0	944	195
EDUCATION	12	0	0	\$43,940,400.00	\$0.00	0	213	44
<b>Total</b>	<b>13,432</b>	<b>0</b>	<b>0</b>	<b>\$434,040,430.00</b>	<b>\$0.00</b>	<b>0</b>	<b>28,836</b>	<b>5,947</b>

## MAPPING

See the Carroll County Drought Map for a graphical representation of hazard areas with regard to drought conditions. The green areas represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the orange areas represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”



# Drought



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## LEGEND

### Roads

- County Route
- State Route
- Highway

- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Earthquake**



An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the Earth's tectonic plates. The severity of these effects is dependent on the amount of energy released from the fault or epicenter. The effects of an earthquake can be felt far beyond the site of its occurrence. They usually occur without warning and after just a few seconds can cause massive damage and extensive casualties. Common effects of earthquakes are ground motion and shaking, surface ruptures, and ground failure.

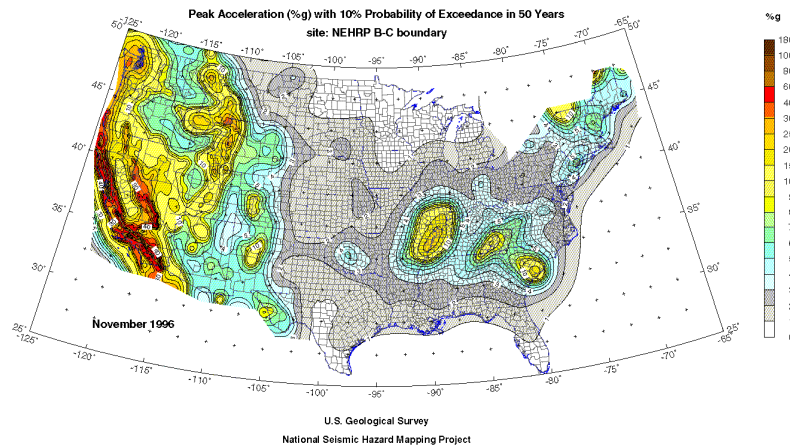
Earthquakes are one of nature's most damaging hazards, and are more widespread than is often realized. The area of greatest seismic activity in the United States is along the Pacific Coast in the states of California and Alaska; however, as many as 40 states can be characterized as having moderate earthquake risk.

Although most people do not think of Ohio as an earthquake-prone state, at least 170 earthquakes with epicenters in Ohio have been felt since 1776. Several methods of research identified earthquakes as a hazard in Carroll County, including reviews of the FEMA-issued *State and Local Mitigation Planning How-to Guide: Understanding Your Risks* and the Carroll County Emergency Operations Plan (EOP), and reviews of several Internet sites, which are listed below.

- Building Seismic Safety Council  
<http://www.bssconline.org>
- Earthquake Hazard History by State  
<http://www.neic.cr.usgs.gov/neis/states.states.html>
- Earthquake Map and Information  
<http://www.abag.ca.gov/bayarea/eqmaps/eqmaps.html>
- FEMA HAZUS Homepage  
<http://www.fema.gov/hazus/>
- GIS Data Available on Earthquakes  
<http://geohazards.cr.usgs.gov/eq/html/genmap.html>

- USGS Earthquake Homepage  
<http://quake.wr.usgs.gov/>
- USGS National and Regional Custom Earthquake Risk Maps  
<http://eqint.cr.usgs.gov/eq/html/custom.shtml>
- Ohio Department of Natural Resources, Division of Geological Survey  
<http://www.ohiodnr.com/OhioSeis/>

The USGS lists Carroll County as an MMI IV in regard to earthquakes. Carroll County's Peak Ground Acceleration (PGA) is 2.0 to 3.0 according to the USGS National Seismic Hazard Mapping Project. Because the area ranks as an MMI IV, earthquake hazards must be taken into consideration.



According to the FEMA *State and Local Mitigation Planning How-to Guide: Understanding Your Risks*, areas rated as an MMI IV (a PGA of 2.0-3.0 classifies an area as MMI IV) will not experience damage as a result of earthquakes. In these areas, perceived shaking is also light.

Earthquakes could affect the entire county, although with differing levels of damage. Carroll County does fall within the area predicted to be affected by disturbances along the New Madrid Fault. Ohio is on the periphery of the New Madrid Seismic Zone, an area in Missouri and adjacent states that was the site of the largest earthquake sequence to occur in historical times in

Modified Mercalli Scale		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, vibrations like passing truck	2.5
IV	Felt indoors by many, outdoors by few, at night some awaken; dishes, windows, doors disturbed; standing 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; walls, monuments, chimneys fall; 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 into air	7
		7.5
		8

the continental United States.

According to an *Earthquake Epicenters In Ohio* (Map) prepared by the Ohio Department of Natural Resources there have been no reported earthquakes in Carroll County since the early 1800's. However, there have been three (3) earthquakes in Portage County, which is just to the north of Carroll County, with the most recent occurring in 2000.

The table above is the Modified Mercalli Scale, which is the general relationship between epicentral Modified Mercalli intensities and magnitude. Intensities can be highly variable depending on local geologic conditions. The Mercalli Scale is a semi-quantitative linear scale, whereas the more-familiar Richter Scale is a quantitative logarithmic scale. The Richter Magnitude Scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. It is illustrated in the table above. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded between the various seismographs. Adjustments are made for the variation in the distance between the various seismographs and the epicenter of the earthquake. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 4.7 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude.

Severity	Richter Scale	
	Magnitude	Mercalli
Mild	0-2.9	I-III
Moderate	2.9-4.1	IV-V
Intermediate	4.1-5.4	VI-VII
Severe	5.4-7.3	VIII-X
Catastrophic	7.3 +	XI-XIII

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.



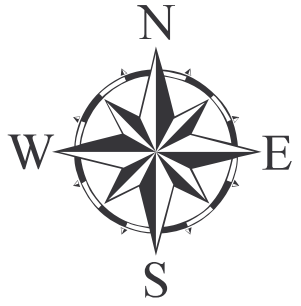
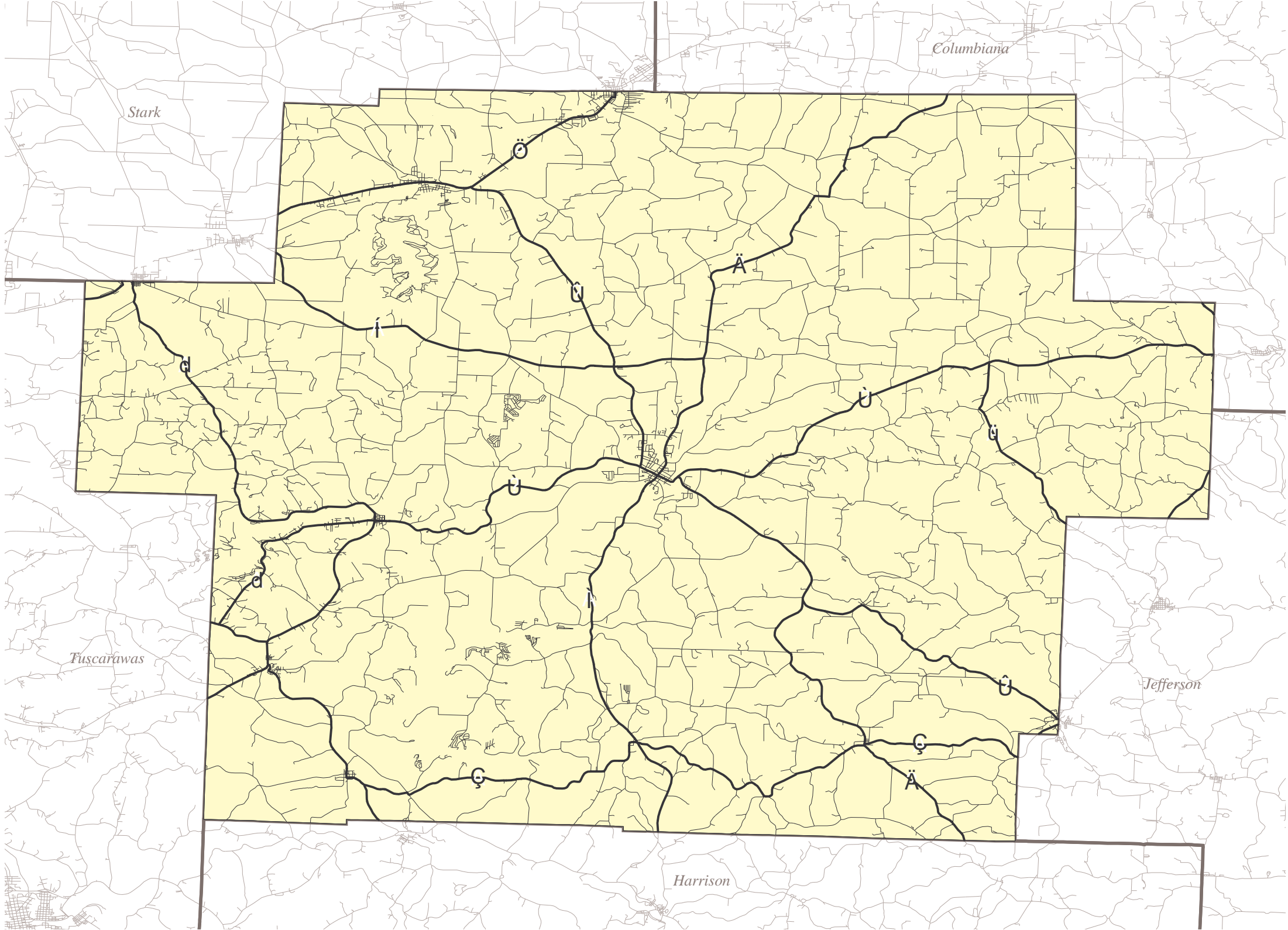
Carroll County Hazard Risk Assessment  
Hazard Profile

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	5,206	39	\$245,689,940.00	\$96,273,000.00	23	22,024	8,809
COMMERCIAL	337	135	1	\$25,980,530.00	\$10,392,000.00	2	3,408	1,363
INDUSTRIAL	45	18	0	\$11,227,650.00	\$4,491,000.00	1	2,158	863
AGRICULTURAL	3	1	0	\$92,489,610.00	\$36,995,000.00	9	89	36
GOVERNMENT	19	8	0	\$14,712,300.00	\$5,885,000.00	1	944	378
EDUCATION	12	5	0	\$43,940,400.00	\$17,576,000.00	4	213	85
<b>Total</b>	<b>13,432</b>	<b>5,373</b>	<b>40</b>	<b>\$434,040,430.0</b>	<b>\$173,612,000.00</b>	<b>40</b>	<b>28,836</b>	<b>11,534</b>

## MAPPING

See the Carroll County Earthquake Map for a graphical representation of hazard areas with regard to earthquakes. The green areas represent “low hazard areas,” yellow represents “moderate hazard areas,” orange represents “high hazard areas,” and red represents “extreme high hazard areas.”

# Earthquake



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## LEGEND

### Roads

- County Route
- State Route
- Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Epidemic**



An epidemic is a disease, usually contagious, that recurs in a community and attacks a large number of people at the same time. The potential impacts of an epidemic are illness or fatalities, disruption or closing of schools, or the forced closure of businesses and industrial operations.

Epidemic is a natural hazard risk in Carroll County. The probability of an epidemic striking Carroll County is relatively low. However, the risk associated with this hazard is very high.

An epidemic has the potential to affect the entire county, but is more probable to occur in densely populated areas, such as the municipalities, especially at facilities containing large numbers of occupants. Many commercial and industrial sites contain many facilities at which a large work force is employed.

Epidemics can develop with little or no warning and quickly erode the capacity of local medical care providers. This fact is especially true in Carroll County, due to the fact there is no full hospital in the county and patients must be transported to neighboring hospitals. A fast developing epidemic can last several days and extend into several weeks. In some extreme cases, they can last for several months.

An epidemic can occur at any time of the year, but the warm summer months, when bacteria and microorganism growth are at their highest, present the greatest risk. The West Nile Virus has created growing concern in Ohio and the northeast where widespread spraying to kill mosquitoes has not stopped the spread of the virus. The location of Carroll County with respect to the Ohio River increases the probability of infected mosquitoes in the area.

### **VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES**

The following information is taken from Worksheet #3a.

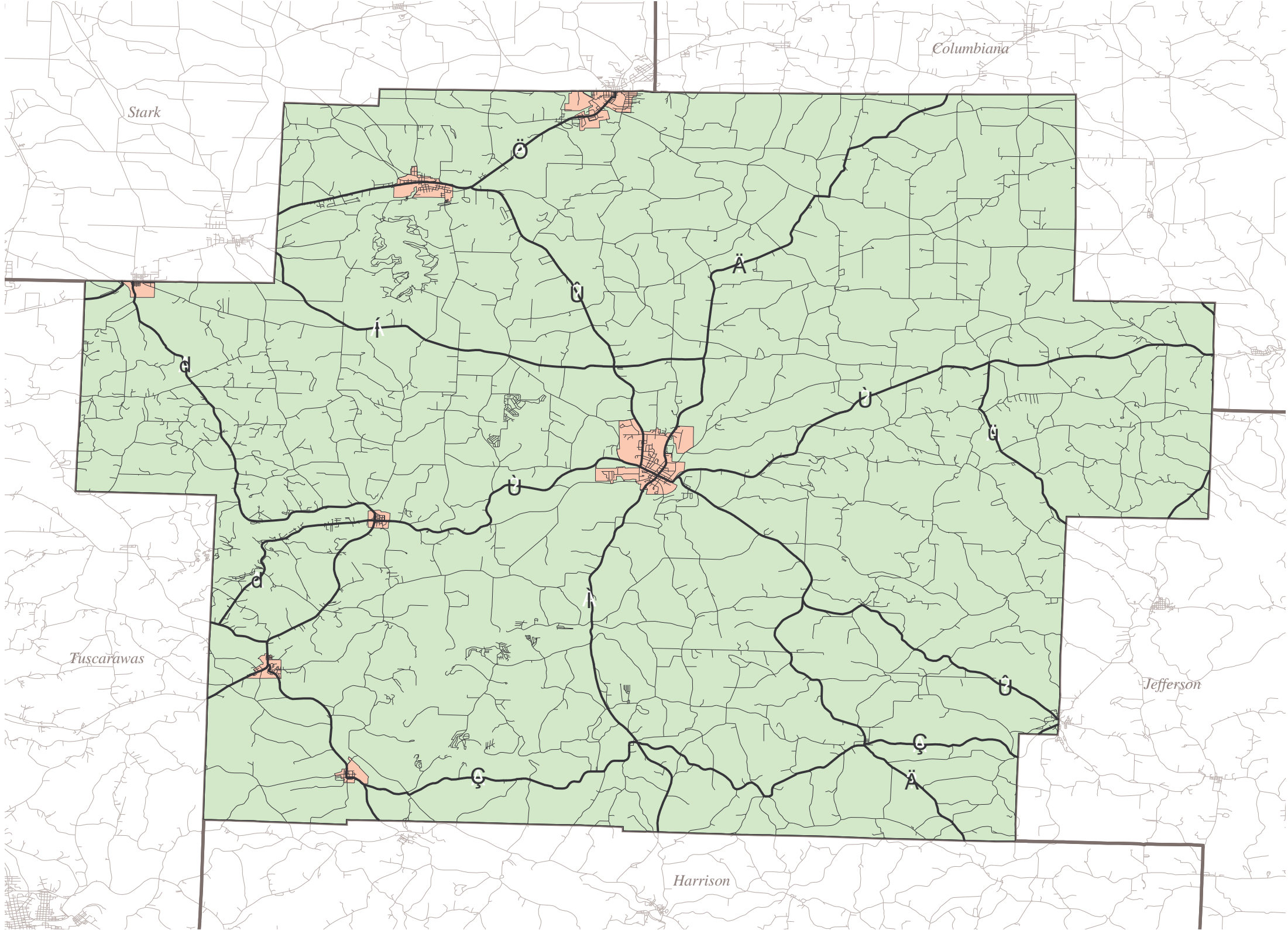
Carroll County Hazard Risk Assessment  
Hazard Profile

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,018	3,644	27	\$245,689,940.00	\$0.00	0	22,024	6,166
COMMERCIAL	337	94	1	\$25,980,530.00	\$0.00	0	3,408	954
INDUSTRIAL	45	13	0	\$11,227,650.00	\$0.00	0	2,158	604
AGRICULTURAL	3	1	0	\$92,489,610.00	\$0.00	0	89	25
GOVERNMENT	19	5	0	\$14,712,300.00	\$0.00	0	944	264
EDUCATION	12	3	0	\$43,940,400.00	\$0.00	0	213	60
<b>Total</b>	<b>13,432</b>	<b>3,760</b>	<b>28</b>	<b>\$434,040,430.0</b>	<b>\$0.00</b>	<b>0</b>	<b>28,836</b>	<b>8,073</b>

## MAPPING

See the Carroll County Epidemic Map for a graphical representation of high-risk areas with regard to an epidemic. The green areas represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the orange areas represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”

# Epidemic



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## LEGEND

### Roads

- County Route
- State Route
- Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard





## **Flooding**



A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation of runoff or surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Floods are the most prominent hazard in the United States. Each year, floods cause more property damage than any other type of natural disaster, killing an average of 150 people a year. The history of flooding within Carroll County indicates that flooding can occur at any time of the year.

Several methods of research identified flooding as a hazard in Carroll County, including reviews of FIRM maps, reviews of newspaper coverage, reviews of past disaster declarations, review of the Carroll County Emergency Operations Plan, discussions with local officials, and public input. The following Internet sites were also used to gain information on flooding.

- Association of Dam Safety Officials  
<http://crunch.tec.army.mil/nid/webpages/nid.cfm>
- Federal Emergency Management Agency  
<http://www.fema.gov/maps/>
- Flash-Flood Safety Rules  
<http://www.nws.noaa.gov/om/nh-flfd.htm>
- Flood Risk and Map Information  
<http://www.fema.gov/nfip/fmapinfo.htm>
- Flood Safety Rules  
<http://www.new.noaa.gov/om/nh-flood.html>
- Floodplain Management Association  
<http://www.floodplain.org>

- General Flood Information  
[http://www.nfpa.org/Education/Consumers\\_and\\_Families/Fire\\_Safety\\_Information/Talking\\_About\\_Disaster/Flood\\_and\\_Flash\\_Flood/flood\\_and\\_flash\\_flood.html](http://www.nfpa.org/Education/Consumers_and_Families/Fire_Safety_Information/Talking_About_Disaster/Flood_and_Flash_Flood/flood_and_flash_flood.html)
- Guide to Flood Maps on the Web  
<http://www.fema.gov/nfip/readmap>
- Latest Hydrological Information (Flooding, Droughts, Snow Conditions, and Water Supply)  
<http://www.new.noaa.gov/oh/hic/current/>
- Real-Time Hydrologic Data Page  
<http://water.usgs.gov/realtime.html>
- Regional River Forecast Centers  
[http://www.srh.noaa.gov/abrfc.rfc\\_wfo.html](http://www.srh.noaa.gov/abrfc.rfc_wfo.html)
- State Floodplain Managers  
<http://www.floods.org/stcoor.htm>
- United States Army Corps of Engineers (USACOE)  
<http://www.wsace.army.mil/inet/functions/cw>
- USGS Streamflow Data Historical  
<http://water.usgs.gov/usa/nwis/sw>

## RIVERINE FLOODING

There have been 29 flood events recorded in Carroll County between 1950 and 2004. Flooding continues to be a relatively frequent and damaging natural disaster as a result of several large creeks that flow through the county, including Conotton Creek, which flows through the southwestern portion of the county near the villages of Sherrodsville and Leesville, Big Sandy Creek and the Still Fork of Big Sandy Creek which flow near the villages of Minerva and Malvern and Scott Run Creek that flows just south of Perryville. According to *NOAA Event Records* from June 1997 through August 2000, there have been four (4) flood events along Scott Run Creek in the Perryville area.

According to a *NOAA Event Record* dated February 6, 2004, a combination of rain, snow melt and ice jams resulted in the flooding of streams, roads, and basements throughout the county. *NOAA Event Records* also indicate that later on September 8, 2004 a flood caused \$1,000,000 in damages. The event continued through the morning of September 9, 2004 as Conotton Creek rose in the Village of Sherrodsville and Sandy Creek flooded Minerva.

Congruently, several roads were closed due to floodwaters near the Village of Carrollton. In total, 251 homes were damaged or destroyed by the flood, including 30 mobile homes in the Village of Minerva; 12 roads were closed; and damage was sustained to the Minerva Sewage Treatment Plant.

Riverine flooding is very likely to continue striking these same areas. Some areas near the paths of Conotton Creek, Big Sandy Creek, and Scott Run Creek are particularly low-lying areas. Local officials should consider strengthening and/or developing building and/or development regulations in these areas.

According to FEMA Region V, there are three (3) “repetitive loss” properties in Carroll County; a table indicating the type of structures and the number of losses is listed below. This information is legally privileged and confidential. Its use is protected under the privacy act of 1974, 5 U.S.C. Section 552(a). Use of the information provided should be restricted to applicable routine use.

CARROLL COUNTY REPETITIVE LOSS DETAILS		
TYPE OF STRUCTURE	NUMBER OF LOSSES	LOCATION
2-4 Family	2	Minerva
Single Family	2	Malvern
Single Family	2	Malvern

## FLASH FLOODING

Because the majority of Carroll County is of gently rolling and mountainous topography, flash flooding is usually a widespread event in the valleys, as small creeks and streams over fill their banks from runoff and flood large areas of agricultural fields and several rural roads. Flooding that occurs in or near the urban areas is often attributed to failing storm sewers and poor drainage systems. According to *NOAA Event Records*, there have been 13 total flash flood events in Carroll County between 1950 and 2003.

Flash flooding is difficult to mitigate against, as many structures in slightly higher-elevated areas are not subject to floodplain ordinances. Also, areas that may fall victim to flooding from overflowing storm drains may not be in floodplains and thus exempt from regulations. Residents and business owners in these areas should be warned of the potential for flash flooding.



According to a *NOAA Event Record* dated June 14, 1996, very heavy rain moved through Carroll County prompting a small stream in Rose Township that normally runs four (4) feet wide to reach 100 feet in width. Two (2) roads in the western portion of the county were blocked by mudslides as a result of the heavy rainfall. *NOAA Event Records* also report several instances of flash flooding in Carroll County during the month of June 2004. On June 14, 2004 several roads were closed due to flooding in the Village of Carrollton. On June 15, 2004 Sandy Creek overwhelmed its banks causing flash floodwaters, which closed the intersection of State Route 43 and 183. Also on June 17, 2004 State Routes 39 and 212 were closed as a result of a flash flooding event.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	2,994	22	\$245,689,940.00	\$66,515,000.00	13	22,034	5,068
COMMERCIAL	337	78	1	\$25,980,530.00	\$5,976,000.00	1	3,408	784
INDUSTRIAL	46	10	0	\$11,227,650.00	\$2,583,000.00	1	2,188	466
AGRICULTURAL	3	1	0	\$92,489,610.00	\$21,275,000.00	5	89	20
GOVERNMENT	19	4	0	\$14,712,300.00	\$3,384,000.00	1	944	217
EDUCATION	12	3	0	\$43,940,400.00	\$10,107,000.00	2	203	47
<b>Total</b>	<b>13,432</b>	<b>3,090</b>	<b>23</b>	<b>\$434,040,430.0</b>	<b>\$99,840,000.00</b>	<b>23</b>	<b>28,836</b>	<b>6,633</b>

## MAPPING

See the Carroll County Flooding Map for a graphical representation of high-risk areas with regard to flooding. The green areas represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the orange areas represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”

# Flooding



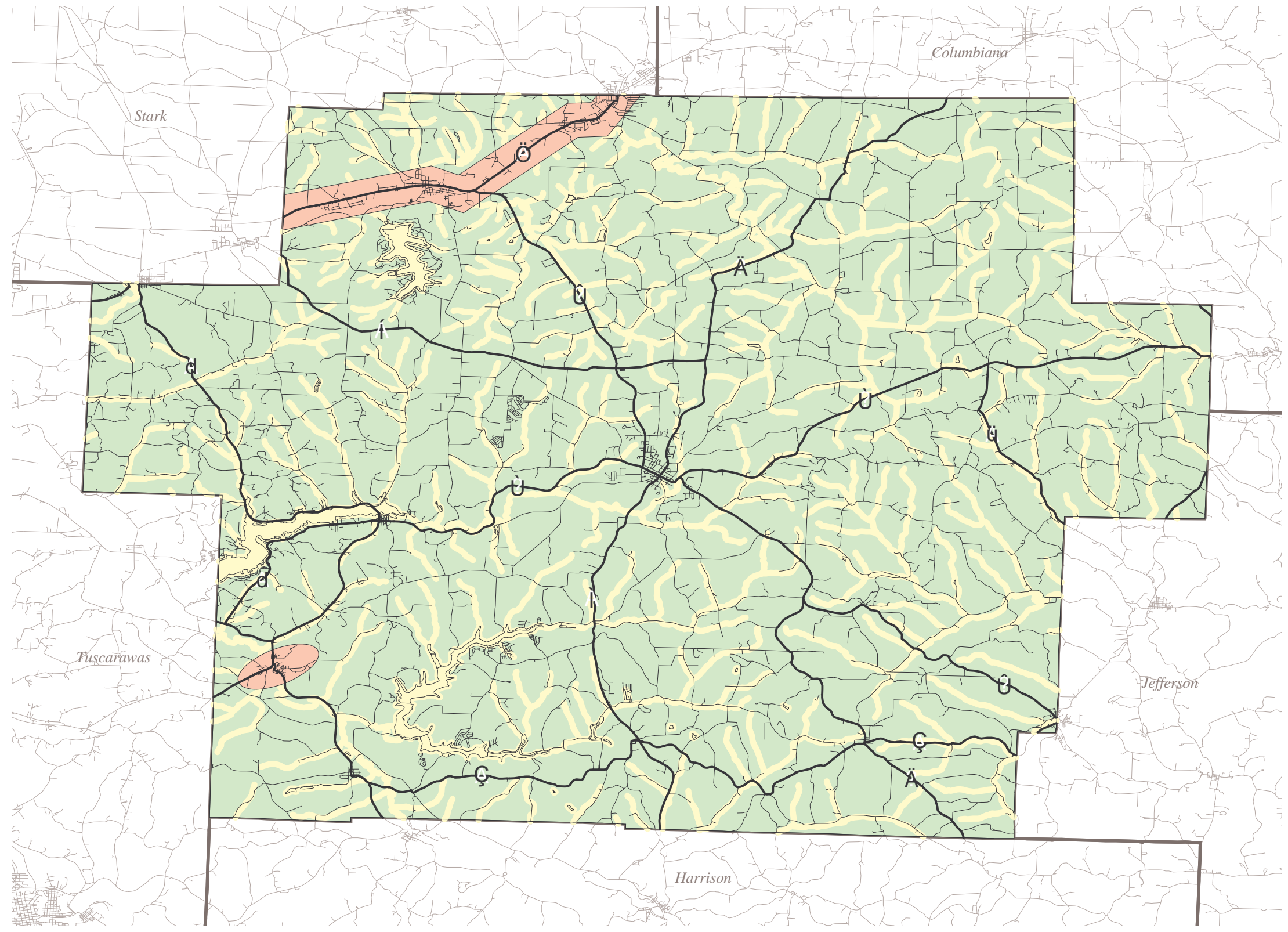
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## LEGEND

### Roads

- County Route
- State Route
- Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Hailstorm**



A hailstorm is defined as an atmospheric disturbance manifested in strong winds and accompanied by precipitation. The precipitation is made of hailstones, or hard pellets of snow and ice.

Numerous methods of research identified hailstorms as a natural hazard in Carroll County, including discussions with local representatives and Internet searches at ESRI, National Weather Service, and National Oceanic Atmospheric Administration (NOAA) sites.

A hot summer afternoon thunderstorm is capable of transforming the landscape from verdant green to icy white with the onset of a hailstorm. The first sign that hail may be arriving is a growing whitening among the shafts of rain. Soon a rattling sound is heard as hailstones strike roofs and pavements, and the ground whitens, becoming slippery as hailstones cover grass and roadways. A hailstorm can be the most damaging part of a thunderstorm, inflicting injury to both man and beast and destroying crops, gardens, and property.

Hailstone damage is often confined to automobiles and crops; however, structural damage is a possibility in the form of broken windows and damaged gutters or HVAC systems (depending on the size of the structure). Historical records indicate that hailstorms are a countywide hazard and can occur at any time and location. Hail is often associated with severe thunderstorms and/or severe winter storms, both of which have been identified as naturally occurring hazards in Carroll County.

As indicated by a *NOAA Event Record* dated August 27, 1994, hail approximately one (1) inch in diameter, damaged crops, and did minimal structural damage in the Magnolia area. There have been 22 measurable hail events reported in Carroll County between 1950 and 2003, according to the National Oceanic Atmospheric Administration.

### **VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES**

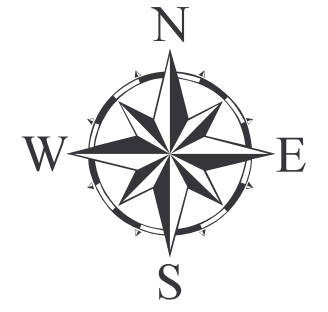
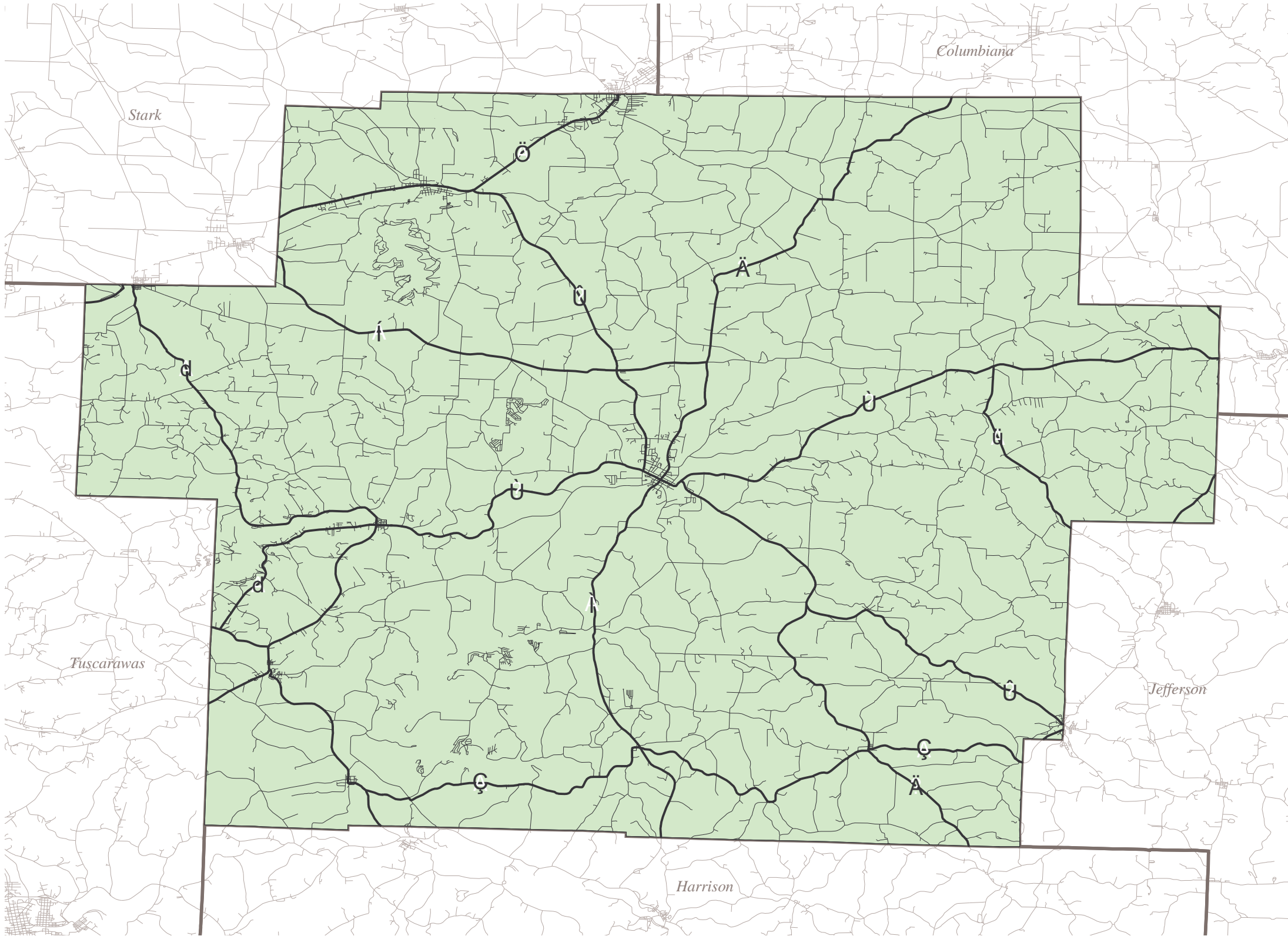
The following information was taken from Worksheet #3a.

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	1,302	10	\$245,689,940.00	\$24,572,000.00	6	22,024	2,203
COMMERCIAL	337	34	0	\$25,980,530.00	\$2,598,000.00	1	3,408	341
INDUSTRIAL	46	5	0	\$11,227,650.00	\$1,123,000.00	0	2,168	216
AGRICULTURAL	3	0	0	\$92,489,610.00	\$9,250,000.00	2	89	9
GOVERNMENT	19	2	0	\$14,712,300.00	\$1,471,000.00	0	944	94
EDUCATION	12	1	0	\$43,940,400.00	\$4,395,000.00	1	213	21
<b>Total</b>	<b>13,432</b>	<b>1,343</b>	<b>10</b>	<b>\$434,040,430.00</b>	<b>\$43,409,000.00</b>	<b>10</b>	<b>28,836</b>	<b>2,884</b>

## **MAPPING**

See the Carroll County Hailstorm Map for a graphical representation of hazard areas with regard to hailstorms. The areas in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”





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### LEGEND

#### Roads

- County Route
- State Route
- Highway

- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



# Hailstorm

## **Infestation**

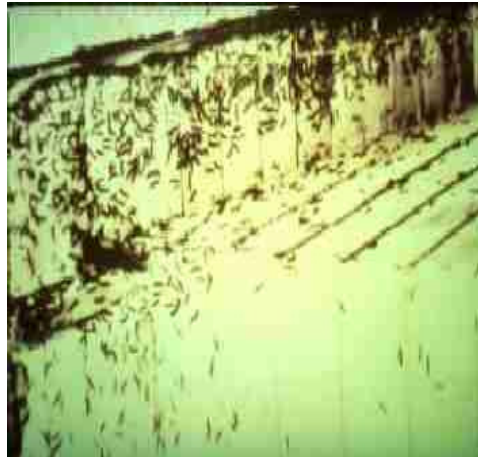


**An infestation is to spread or swarm in or over in a troublesome manner, also, to live in or on as a parasite.**

According to searches and reviews of online information provided by the Ohio Division of Forestry, Carroll County is subject to an infestation primarily of a European strain of gypsy moth (pictured at right), which is one of the most destructive defoliating insect pests to attack the trees and forests of the northeastern United States. The impact of gypsy moths includes economic losses through timber mortality, loss of recreational opportunities in severely defoliated areas, and nuisances from gypsy moth caterpillars. The image at bottom right illustrates the severity of a gypsy moth caterpillar infestation.



A state gypsy moth quarantine was established in 1987. The quarantine is an effort to minimize the movement of egg masses into non-infested areas of Ohio. Carroll County is among several counties in northeastern Ohio that have been quarantined due to gypsy moth infestation. Other infestations that could possibly occur in Carroll County include Asian long



horned beetles, mosquito's known to be infected with the West Nile Virus, and spider mites.

The probability of an infestation hazard event actually occurring in Carroll County is relatively low, with only moderate associated risk. Infestation is most likely to occur in the 141,974 acres of forest or the 122,000 acres of farmland and will likely cause no damage to structural assets. Infestation is considered as a hazard in Carroll County due to the high percentage of agricultural and forest land in the county.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

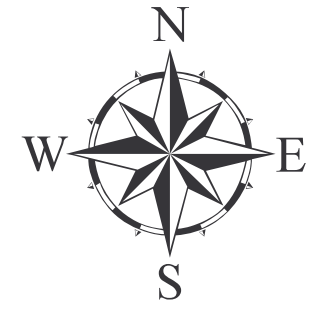
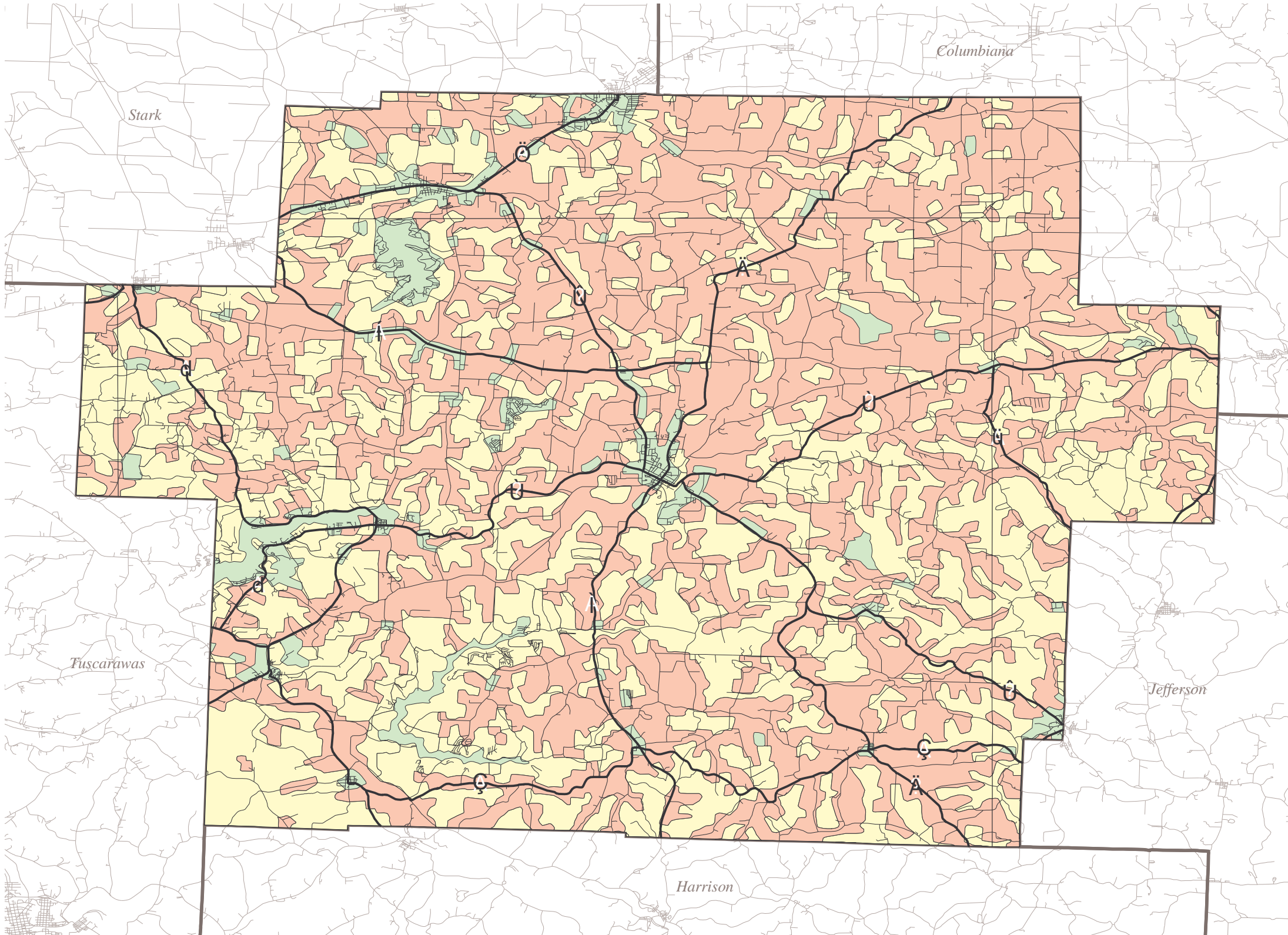
Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	0	0	\$245,689,940.00	\$0.00	0	22,024	9,857
COMMERCIAL	337	0	0	\$25,980,530.00	\$0.00	0	3,408	1,525
INDUSTRIAL	45	0	0	\$11,227,650.00	\$0.00	0	2,158	966
AGRICULTURAL	3	1	0	\$92,489,610.00	\$41,395,000.00	10	89	40
GOVERNMENT	19	0	0	\$14,712,300.00	\$0.00	0	944	423
EDUCATION	12	0	0	\$43,940,400.00	\$0.00	0	213	95
Total	13,432	1	0	\$434,040,430.0	\$41,395,000.00	10	28,836	12,906

## MAPPING

See the Carroll County Infestation Map for a graphical representation of high-risk areas with regard to infestation. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”



# Infestation



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## LEGEND

### Roads

- County Route
- State Route
- Highway

- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard





## **Landslide & Erosion**



Landslides are described as the downward movement of a slope and materials under the force of gravity. The term includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Landslides are influenced by human activity (mining and construction of buildings, railroads, and highways) and natural factors (geology, precipitation, and topography).




Several methods of research identified landslides and erosion as natural hazards in Carroll County, including a review of the Carroll County Emergency Operations Plan (EOP) and searches of the following Internet sites.

- Ohio Department of Natural Resources (ODNR)
- Ohio Environmental Protection Agency (OEPA)
- United State Geological Survey (USGS)




Landslides have been known to occur in Ohio and adjoining states since 1850, but the damage caused by landslides has become increasingly expensive as urban development encroaches more and more on the area's hillsides, and other known landslide-prone areas.

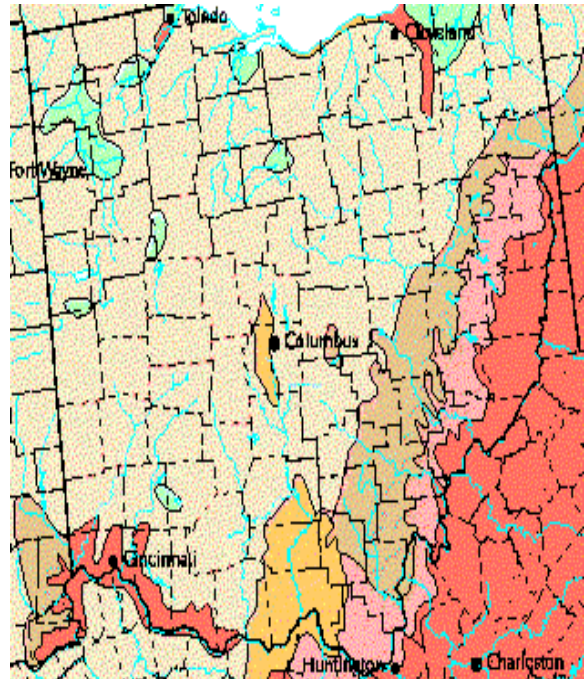
### **EXPLANATION OF GRAPHIC**

#### **LANDSLIDE SUSCEPTIBILITY/INCIDENCE**

-  Moderate susceptibility/low incidence
-  High susceptibility/low incidence
-  High susceptibility/moderate incidence

#### **LANDSLIDE INCIDENCE**

-  Low (less than 1.5% of area involved)
-  Moderate (1.5%-15% of area involved)
-  High (greater than 15% of area involved)



According to the United States Geological Survey (USGS), Ohio is listed as having low, moderate, and high percentages of landslide incidents. Specifically, Carroll County is listed as having a low percentage of landslide incidences, as illustrated in the figure above. This ranking means that Carroll County has a moderate susceptibility/low incidence to landslides. Susceptibility to landslides is defined as the probable degree of response of the areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. This information is taken from the *Landslide Overview Map of the Conterminous United States*.

According to the Carroll County EOP, topography, sub-surface mining, and surface mining, place a large portion of Carroll County in jeopardy of experiencing landslides. Erosion of slopes may also lead to landslide occurrences, especially along roadways. Many of the roadways in Carroll County cut in the hillside, which may leave areas exposed to slips and erosion.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	4,664	35	\$245,689,940.00	\$88,040,000.00	20	22,024	7,892
COMMERCIAL	337	121	1	\$25,980,530.00	\$9,310,000.00	2	3,408	1,221
INDUSTRIAL	46	16	0	\$11,227,650.00	\$4,023,000.00	1	2,168	773
AGRICULTURAL	3	1	0	\$92,489,610.00	\$33,142,000.00	8	89	32
GOVERNMENT	19	7	0	\$14,712,300.00	\$5,272,000.00	1	944	338
EDUCATION	12	4	0	\$43,940,400.00	\$15,745,000.00	4	213	76
Total	13,432	4,813	36	\$434,040,430.00	\$155,532,000.00	36	28,836	10,333

## MAPPING

See the Carroll County Landslide Map for a graphical representation of hazard areas with regard to landslide and erosion. The green areas represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the orange areas represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”

## **Mine Subsidence**



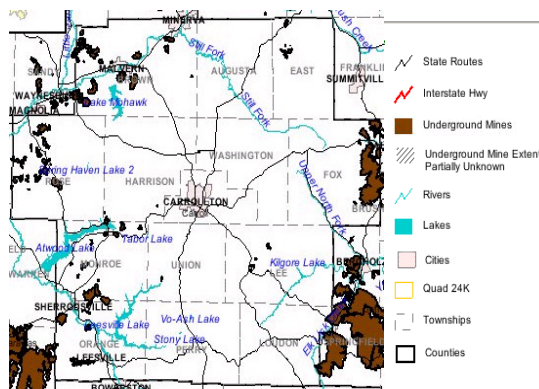
**Subsidence, in the context of underground mining, is the lowering of the Earth's surface due to collapse of bedrock and unconsolidated materials (sand, gravel, silt, and clay) into underground mined areas.**

Several methods of research identified mine subsidence as a hazard in Carroll County. Mine subsidence information was obtained from the Carroll County Emergency Operations Plan and the following Internet sites.

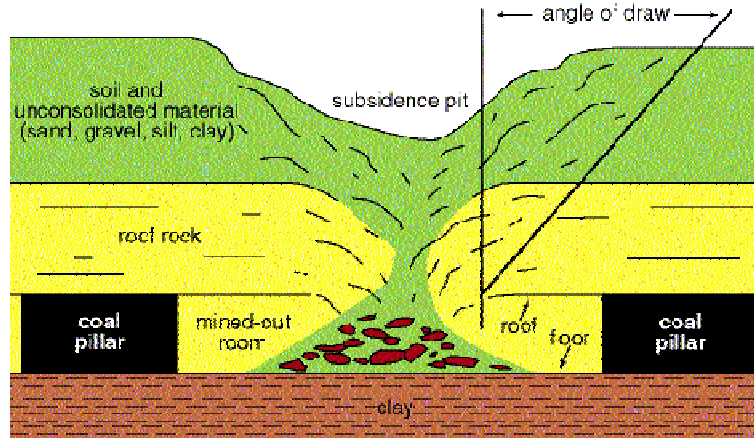
- Ohio Department of Natural Resources Division of Geological Survey

**[http://www.dnr.state.oh.us/geosurvey/geo\\_fact/geo\\_f12.htm](http://www.dnr.state.oh.us/geosurvey/geo_fact/geo_f12.htm)**

According to the Ohio Department of Natural Resources, Division of Geological Survey (Mineral Resources Management), there are abandoned underground mines located in southeastern and western Carroll County near the villages of Dellroy, Leesville, Malvern, and Sherrodsville, as well as East, Fox, Lee, and Loudon Townships, as can be seen in the map at right. Safety problems for travelers caused by sinkholes and slides (see photo below) initiated by abandoned underground mines are a growing concern. Mine subsidence, like an earthquake, is a geologic hazard that can strike with little or no warning and can result in catastrophic and costly damages. There are at least six (6) highways that could become damaged as a result of mine subsidence in Carroll County, including State Routes 39, 43, 164, 171, 212, and 542. Unlike an earthquake, mine subsidence normally only affects few people. However, if a mine collapses under a busy highway, several lives and industries are subject to potential damage.



Mine subsidence can also cause foundation damage to buildings, disrupt underground utilities, and be a potential risk to human life. There are approximately 1,000 housing units that could be affected by mine subsidence. There are two (2) types of subsidence: (1) pit, also called sinkhole or pothole, and (2) sag or through. (The term “sinkhole” more properly refers to solution collapse features in limestone). Pit subsidence is characterized by an abrupt sinking of the surface resulting in



a circular, steep-sided, craterlike feature that has an inward drainage pattern, which is illustrated above. It is often associated with the roof collapse of mines that have total overburden (overlying unconsolidated material and rock) of less than 165 feet, a weak roof rock of shale or mudstone, and a ratio of unconsolidated-material thickness to rock thickness of less than 1.2. Sag subsidence is a gentle, gradual settling of the surface. It is associated with pillar crushing or pillar punching in deeper mines (overburden of more than 75 feet). Sag subsidence features may fill with water if the surface of the subsidence intersects the water table.

Mine subsidence can be controlled by several factors, including the height of mined-out areas, the width of unsupported mine roofs, the thickness of overburden, competency (strength) of bedrock, pillar dimensions, hydrology, fractures/joints, and time.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

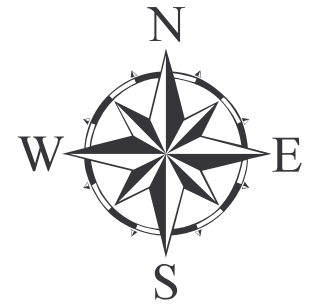
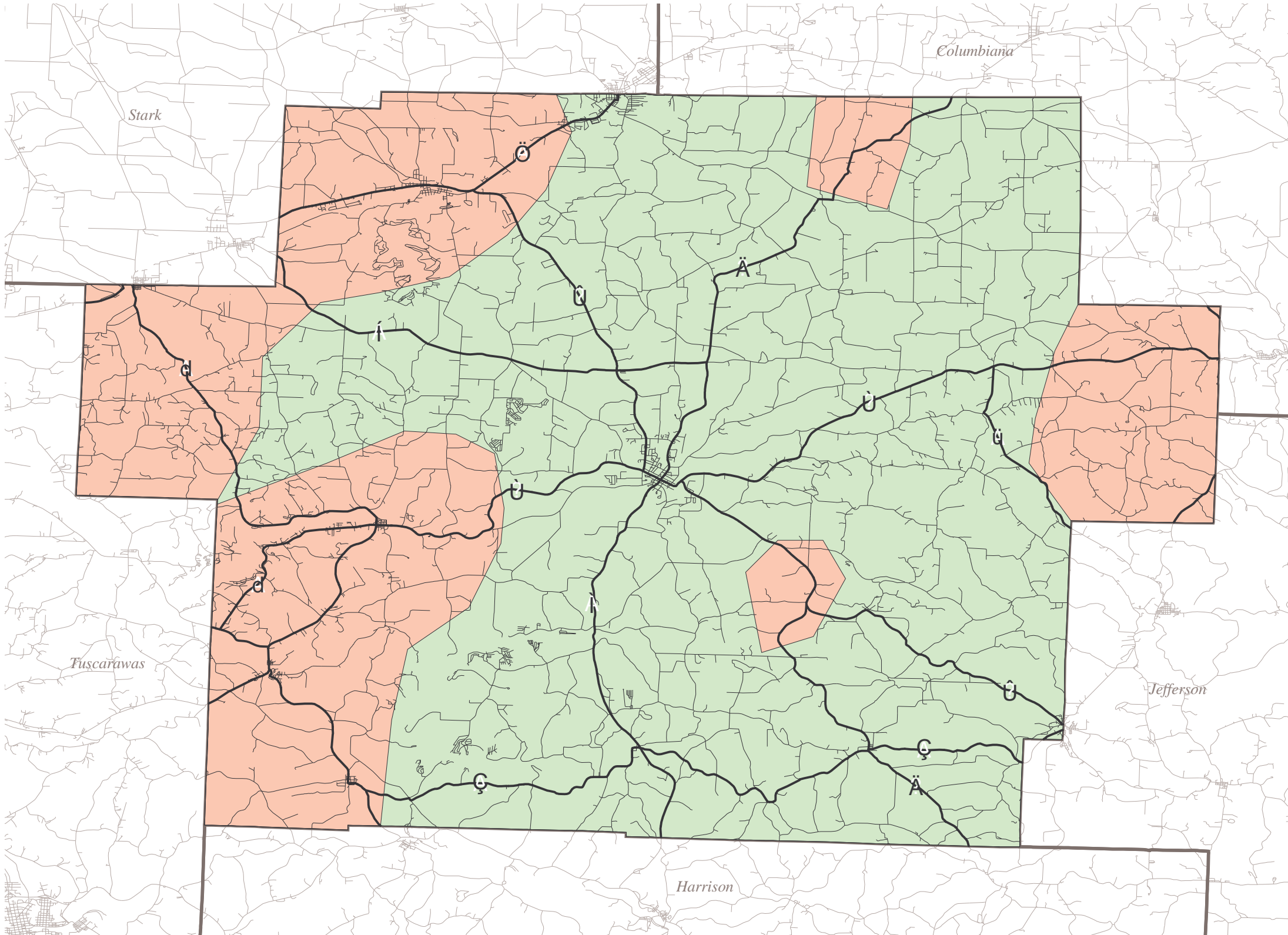
Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	4,664	35	\$245,689,940.00	\$88,040,000.00	20	22,024	7,892
COMMERCIAL	337	121	1	\$25,980,530.00	\$9,310,000.00	2	3,408	1,221
INDUSTRIAL	46	16	0	\$11,227,660.00	\$4,023,000.00	1	2,168	773
AGRICULTURAL	3	1	0	\$92,489,610.00	\$33,142,000.00	8	89	32
GOVERNMENT	19	7	0	\$14,712,300.00	\$5,272,000.00	1	944	338
EDUCATION	12	4	0	\$43,940,400.00	\$15,746,000.00	4	213	76
<b>Total</b>	<b>13,432</b>	<b>4,813</b>	<b>36</b>	<b>\$434,040,430.0</b>	<b>\$155,532,000.00</b>	<b>36</b>	<b>28,836</b>	<b>10,333</b>

## **MAPPING**

See the Carroll County Mine Subsidence Map for a graphical representation of high-risk areas with regard to mine subsidence. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”



# Mine Subsidence



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## LEGEND

### Roads

- County Route
- State Route
- Highway

- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Severe Thunderstorm and Lightning**

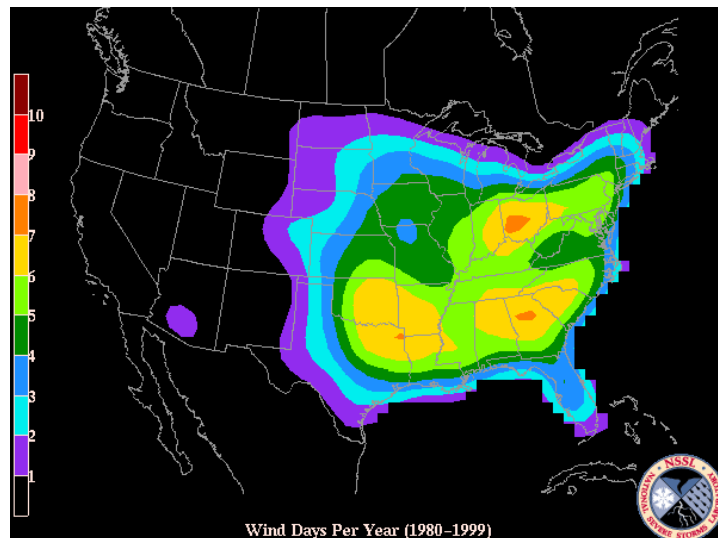


A severe thunderstorm is the result of a violent form of convection wherein cold, upper air falls and warm, moist air rises. As the warm air rises, cumulonimbus clouds can develop and turn into severe thunderstorms with strong winds, lightning, heavy rain, and hail.

Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a bolt. This flash of light usually occurs within the clouds or between the clouds and the ground.

Several methods of research identified severe thunderstorms and lightning as natural hazards in Carroll County, including discussions with local representatives and officials, as well as review of the Carroll County Emergency Operations Plan (EOP). General severe thunderstorm information was gathered at [http://www.nfpa.org/Education/Consumers\\_and\\_Families/Fire\\_Safety\\_Information/Talking\\_About\\_Disaster/Severe\\_Thunderstorm/severe\\_thunderstorm.html](http://www.nfpa.org/Education/Consumers_and_Families/Fire_Safety_Information/Talking_About_Disaster/Severe_Thunderstorm/severe_thunderstorm.html).

The National Weather Service (NWS) defines a thunderstorm as “severe” when wind speeds reach 58 mph or stronger, and/or hail is produced that is ¾ inch in diameter or larger, and/or a tornado is produced. High wind events are one of the most common types of hazards in Carroll County and Ohio. The map at right shows the number of high wind days that occur per year. To be classified as a “high wind event”, winds must be in excess of 52 mph. As can be seen, Ohio is one of the most prominent areas for high wind events. Winds at these speeds are capable of doing great damage.



Thunderstorms are a seasonal hazard and can be expected to occur every year. According to the NWS, the most active thunderstorm season in Ohio is late spring and early summer. The key ingredient defining a thunderstorm is lightning. Because lightning creates thunder, a storm with lightning is termed a thunderstorm. A bolt of lightning reaches a temperature of 50,000 degrees Fahrenheit in a split second. The rapid heating and cooling of air near the lightning causes thunder.

According to the *NOAA Event Record* database, there have been 103 severe thunderstorm events in Carroll County between 1950 and 2003. A *NOAA Event Record* dated March 9, 2002 indicated that a deepening area of low pressure moved eastward across the northern great lakes sweeping a strong cold front across east central Ohio producing large areas of low-level winds, both ahead of and behind the front. Winds between 70 and 80 mph were present just a few thousand feet off the surface. Later, enough instability was present to produce a line of severe thunderstorms along the main cold front as it entered east central Ohio. The combination of strong gradient winds and severe thunderstorm winds produced widespread damage across the area. An estimated 15,000 people were left without electricity in east central Ohio.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

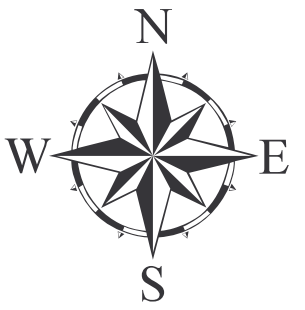
Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	5,206	39	\$245,689,940.00	\$98,273,000.00	23	22,024	8,809
COMMERCIAL	337	135	1	\$25,980,530.00	\$10,392,000.00	2	3,408	1,363
INDUSTRIAL	45	18	0	\$11,227,650.00	\$4,491,000.00	1	2,168	863
AGRICULTURAL	3	1	0	\$92,489,610.00	\$36,995,000.00	9	89	36
GOVERNMENT	19	8	0	\$14,712,300.00	\$5,885,000.00	1	944	378
EDUCATION	12	5	0	\$43,940,400.00	\$17,576,000.00	4	213	85
<b>Total</b>	<b>13,432</b>	<b>5,373</b>	<b>40</b>	<b>\$434,040,430.0</b>	<b>\$173,612,000.00</b>	<b>40</b>	<b>28,836</b>	<b>11,534</b>

## MAPPING

See the Carroll County Severe Thunderstorm and Lightning Map for a graphical representation of hazard areas with regard to severe thunderstorms and lightning. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”



# Thunderstorm



R.D.Zande  
& Associates



## LEGEND

### Roads

County Route

State Route

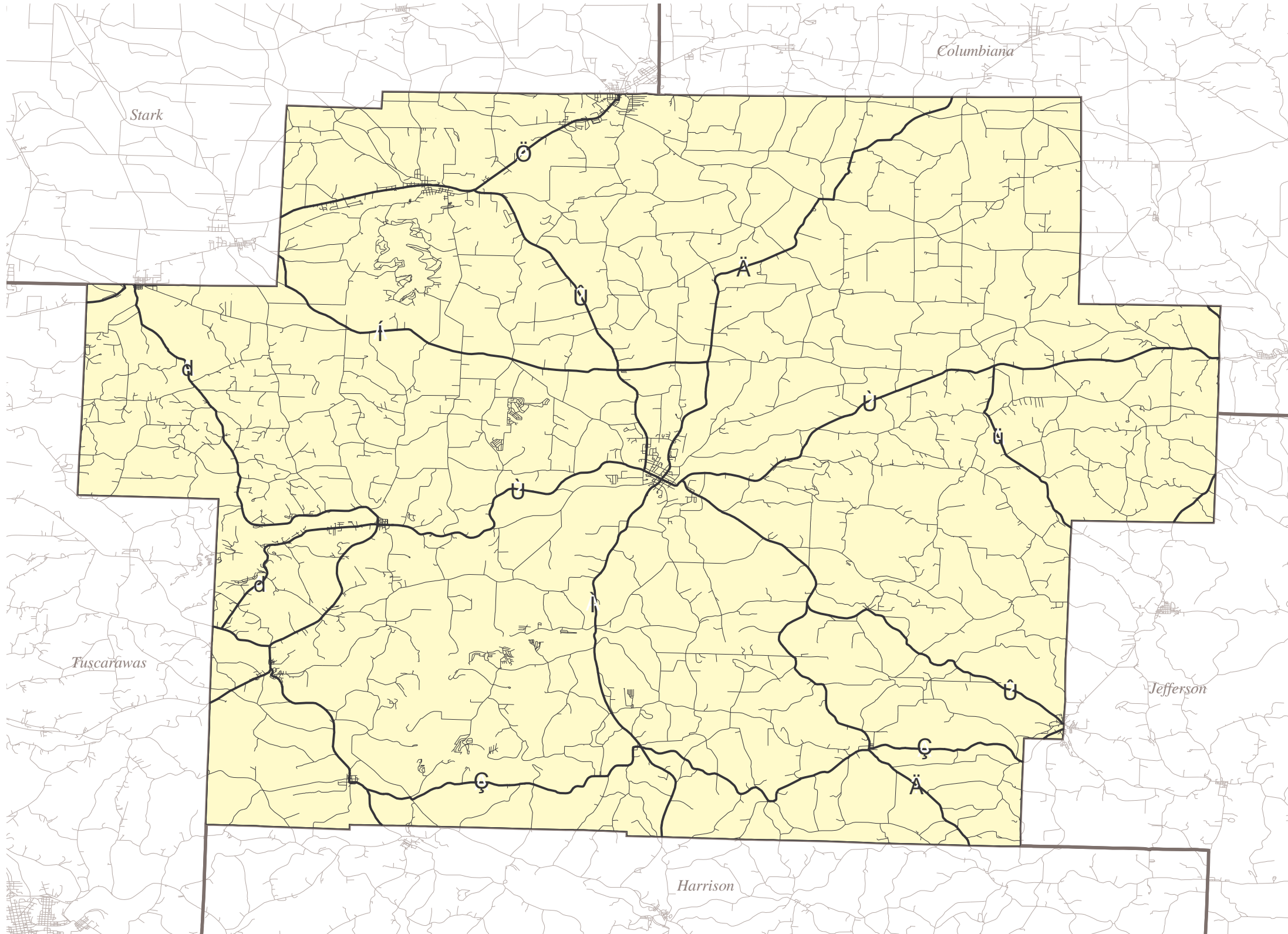
Highway

Carroll County

Low Hazard

Moderate Hazard

High Hazard



## Severe Wind and Tornado



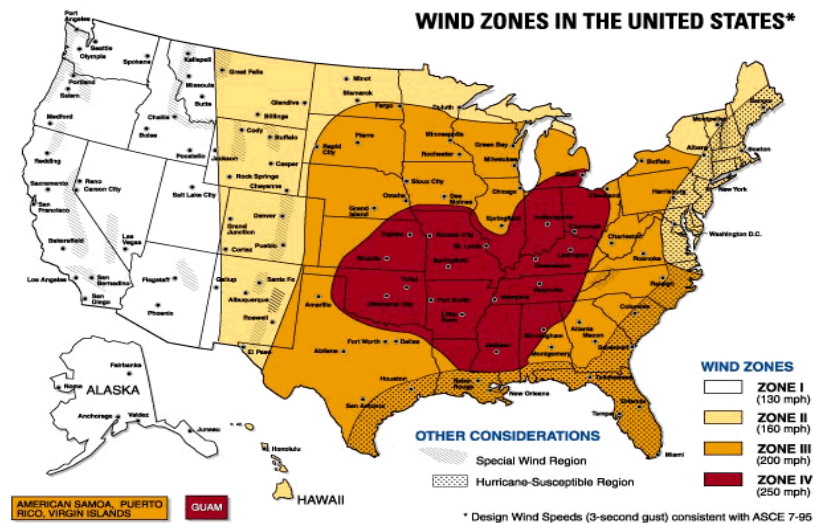
A windstorm is a storm with high winds or violent gusts, sometimes called wind shears or microbursts, but with little or no rain.

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one (1) mile wide and 50 miles long.

Several methods of research identified severe wind and tornadoes as natural hazards in Carroll County, including reviews of the Carroll County Emergency Operations Plan (EOP). General severe wind and tornado information was obtained from the following sources:

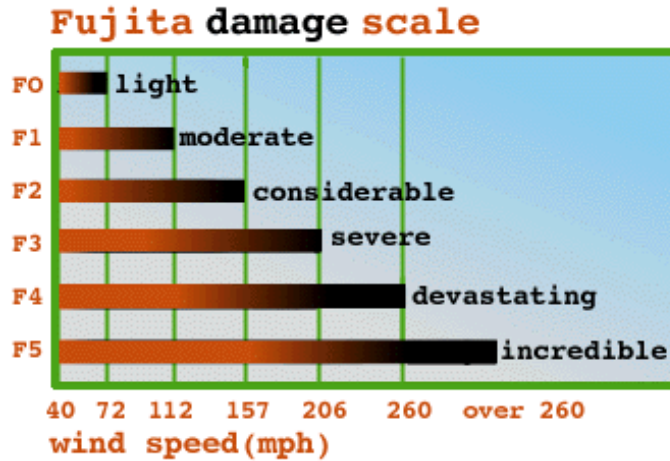
- *State and Local Mitigation Planning How-to Guide Understanding Your Risks*, FEMA
- National Oceanic & Atmospheric Administration (NOAA)  
<http://www4.ncdc.noaa.gov/cgi-win/wwwcgi.d11?wwdevent~ShowEvent>

Ohio falls into the “high” category for tornado risk and the highest category for wind zones in the United States, which is illustrated at right. Most sources have only been recording tornado activity since 1950. Carroll County has reported three (3) tornadoes between 1950 and 2001. The entire county is in a Zone III wind zone according to the *Design Wind Speed*



for Community Shelters Map. This wind zone places Carroll County in a category that could experience severe tornadoes with 158 to 206 mph winds. Such winds could cause significant damage to structures, such as roofs torn off frame houses, mobile homes demolished, and boxcars pushed over.

The Fujita Damage scale is illustrated at right. The Fujita scale is a scale or measure developed by Theodore Fujita of the University of Chicago to relate the speed of winds associated with tornadoes to the damage they cause. As can be seen, Carroll County could incur moderate or severely damaging tornadoes.



While tornadoes are relatively short lived in duration, they are intensely focused, making them one of the most destructive of the natural hazards. Ohio is positioned geographically on the eastern-most edge of what has come to be known as “tornado alley” and is no stranger to tornado sightings.

According to a *NOAA Event Record* dated September 30, 1954 an F2 tornado ripped through Carroll County resulting in significant property damage and one (1) fatality. According to a November 12, 2003 *NOAA Event Record* a microburst with estimated winds of 60 mph, struck near Atwood Lake, producing a swath of damage along Menlo Drive off Route 542. The microburst was 200 yards long and 50 yards wide. Numerous tall pine trees were snapped, some of which fell onto houses and sheds.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information was taken from Worksheet #3a.

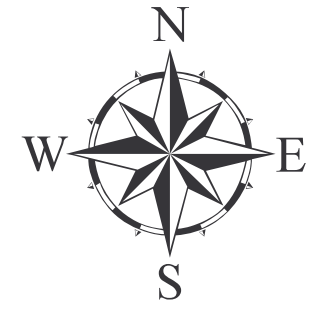
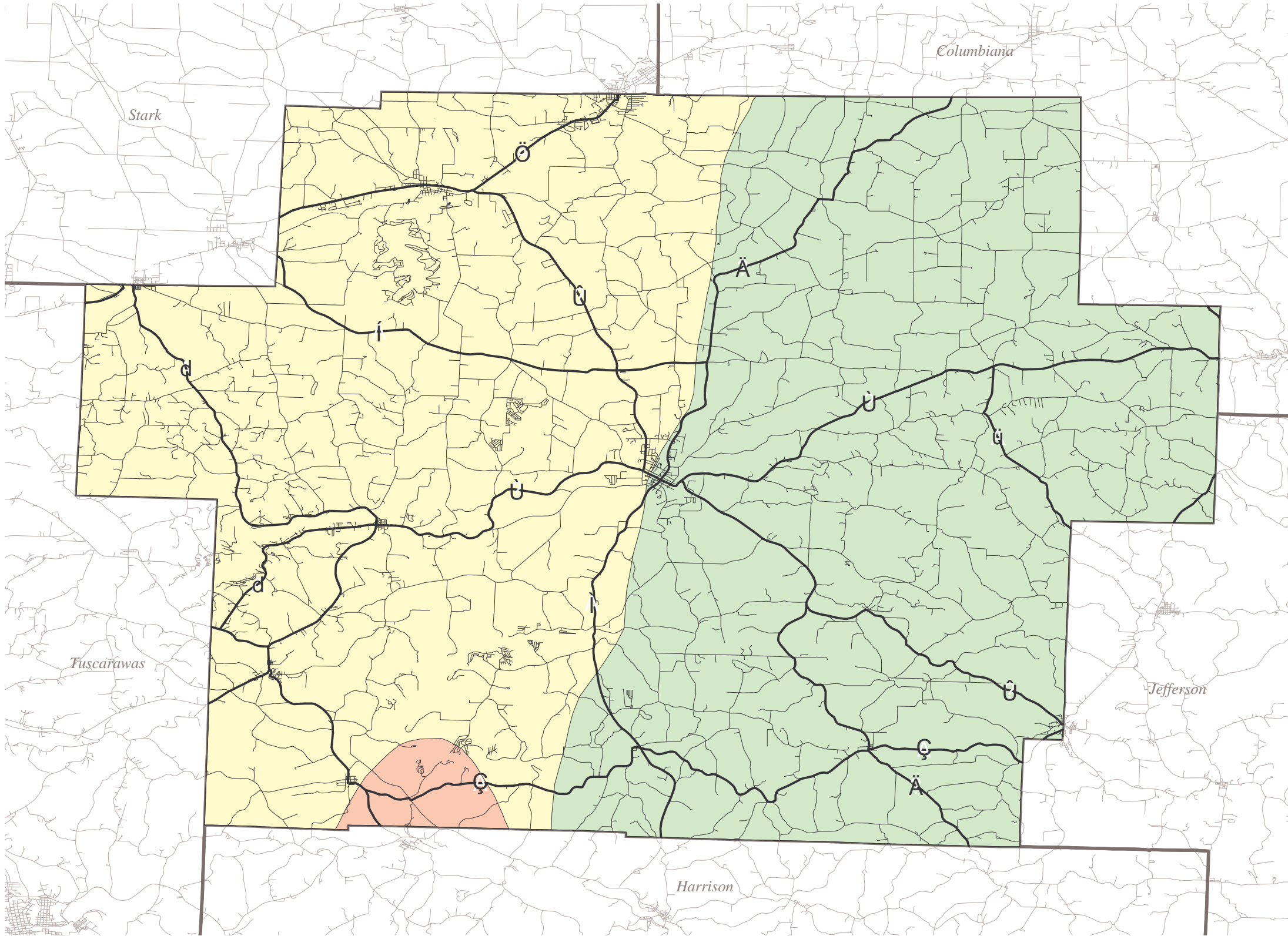
Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	3,947	29	\$246,689,940.00	\$74,510,000.00	17	22,024	6,879
COMMERCIAL	337	102	1	\$25,980,530.00	\$7,879,000.00	2	3,408	1,034
INDUSTRIAL	46	14	0	\$11,227,650.00	\$3,405,000.00	1	2,158	654
AGRICULTURAL	3	1	0	\$92,489,610.00	\$28,049,000.00	6	89	27
GOVERNMENT	19	6	0	\$14,712,300.00	\$4,462,000.00	1	944	286
EDUCATION	12	4	0	\$43,940,400.00	\$13,326,000.00	3	213	66
Total	13,432	4,073	30	\$434,040,430.00	\$131,631,000.00	30	28,836	8,746

## **MAPPING**

See the Carroll County Severe Wind and Tornado Map for a graphical representation of hazard risk areas with regard to tornadoes and windstorms. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas”.



# Severe Wind/ Tornado



R.D.Zande  
& Associates



## LEGEND

### Roads

- County Route
- State Route
- Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Severe Winter Storm and Sleet**



**One or more of the following characterizes a winter storm: heavy snow, ice storms, strong winds, extreme cold, and, in certain areas, coastal flooding and beach erosion.**

Several methods of research identified winter storms as a hazard in Carroll County, including a review of the Carroll County Emergency Operations Plan (EOP), reviews of past disaster declarations, and interviews with local officials. General winter storm information was also gathered at [http://www.nfpa.org/Education/Consumers\\_and\\_Families/Fire\\_Safety\\_Information/Talking/About\\_Disaster/Winter\\_Storm/winter\\_storm.html](http://www.nfpa.org/Education/Consumers_and_Families/Fire_Safety_Information/Talking/About_Disaster/Winter_Storm/winter_storm.html), as well as the NOAA web site, [www.noaa.gov](http://www.noaa.gov).

Carroll County is highly vulnerable to the wide-ranging effects of snowstorms, blizzards, ice storms, and severe cold snaps. A severe winter storm could affect the entire county at the same time virtually bringing all county operations to a stand still. This type of hazard creates a difficult emergency response effort due to adverse road conditions that impede or prohibit vehicle movement.

Research indicates that all of Carroll County is equally susceptible to winter storms. Driving is treacherous during winter storms as roadways freeze and become covered with snow and slush. During severe winter storms, heavy snow may cause property damage and power outages. Also, the aforementioned adverse driving conditions may lead to additional property damage. According to a *FEMA Winter Storm Fact Sheet*, the leading cause of death during winter storms is from automobile or other transportation accidents. Roads are sometimes blocked, stranding some rural residents from the incorporated areas where medical and other emergency services are centered. Heavy snowfall and blizzards can trap motorists in their cars. Attempting to walk for help in a blizzard can be a deadly decision. Disorientation and confusion come very quickly in blowing snow.

Health hazards generated from severe winter storms include frostbite and hypothermia. Frostbite is a severe reaction to cold exposure that can permanently damage its victims. A loss of feeling and a white or pale appearance in fingers, toes, or the nose and ear lobes are symptoms of frostbite.

Hypothermia is a condition brought on when the body temperature drops to less than 55 degrees Fahrenheit. Symptoms of hypothermia include uncontrollable shivering, slow speech, memory lapses, frequent stumbling, drowsiness, and exhaustion.

According to a Hazard Analysis Snowfall Map prepared by the Ohio Agricultural Research and Development Center, the southeastern portion of Carroll County, mainly Fox, Lee and Loudon Townships, receives 30 to 40 inches of snowfall per year; the remainder of the county receives 20 to 30 inches per year.

There have been 11 recorded severe winter storms in Carroll County between 1950 and 2003 according to the *NOAA Event Record* database. According to a *NOAA Event Record* dated February 16, 2003, a massive slow moving snowstorm crept through Carroll County shortly after midnight, dumping nearly two (2) feet of snow. Several roof collapses were reported. Also reported in an event record dated February 5, 2004 an ice storm began in the after noon and glazed the county with ice one (1) quarter of an inch thick.

## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information was taken from Worksheet #3a.

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	5,844	44	\$245,689,940.00	\$110,303,000.00	25	22,024	9,888
COMMERCIAL	337	151	1	\$25,980,530.00	\$11,664,000.00	3	3,408	1,530
INDUSTRIAL	46	20	0	\$11,227,650.00	\$5,041,000.00	1	2,158	969
AGRICULTURAL	3	1	0	\$92,489,610.00	\$41,523,000.00	10	89	40
GOVERNMENT	19	9	0	\$14,712,300.00	\$6,605,000.00	2	944	424
EDUCATION	12	5	0	\$43,940,400.00	\$19,727,000.00	5	213	96
Total	13,432	6,030	45	\$434,040,430.0	\$194,863,000.00	45	28,836	12,946

## MAPPING

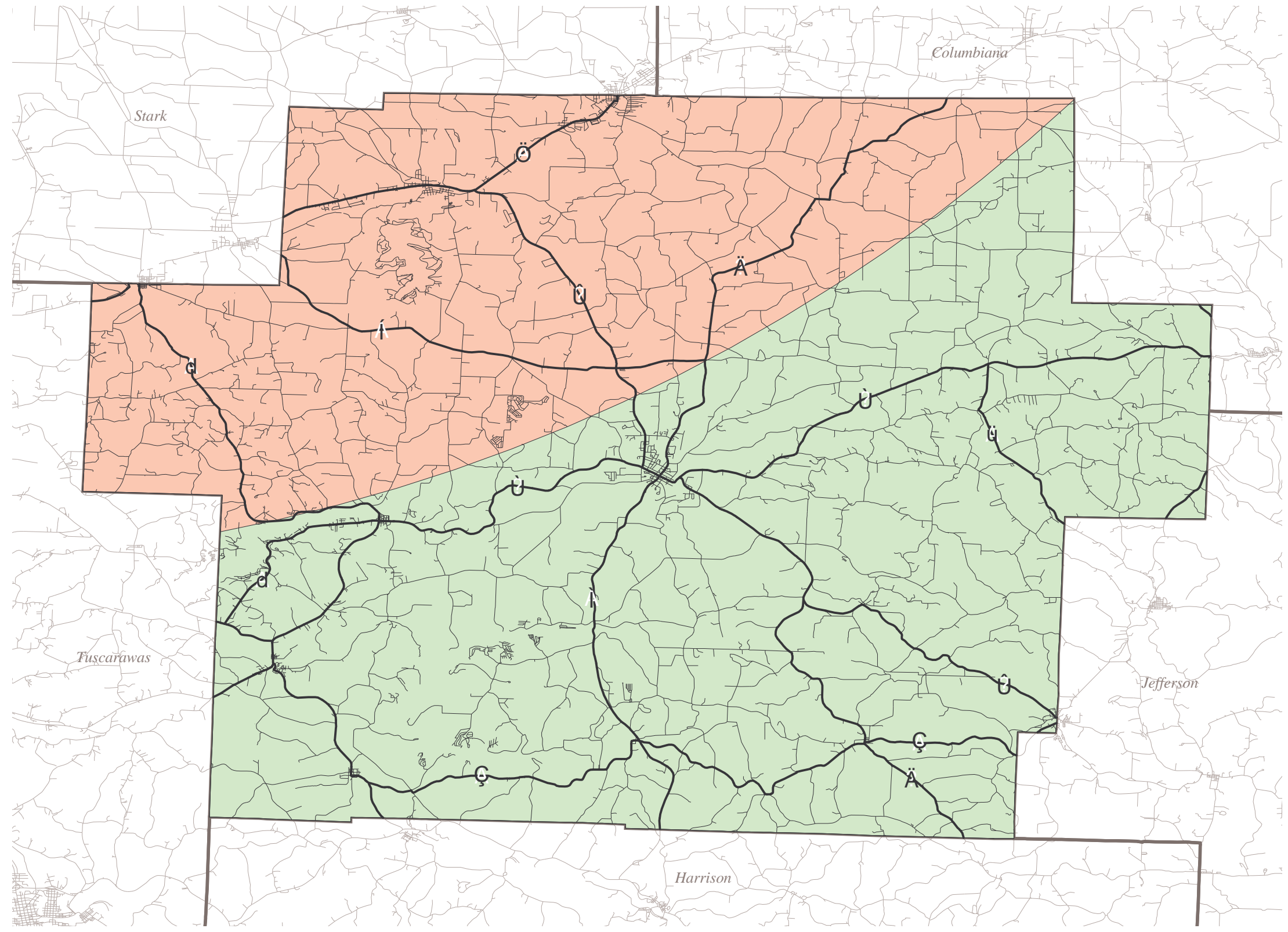
See the Carroll County Severe Winter Storm and Sleet Map for a graphical representation of the hazard risk areas associated with winter storms. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the areas in red represent “extreme high hazard areas.”

# Severe Winter Storm



## LEGEND

- Roads**
- County Route
  - State Route
  - Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard





## **Temperature Extreme and Heat Wave**



Extreme heat is defined as three (3) or more consecutive days with daytime temperatures of 90 degrees F or higher and nighttime temperatures no lower than 85 degrees F, accompanied by high humidity and causing a significant amount of medically treated, heat-related illnesses or deaths.

Several methods of research identified extreme heat as a minor hazard in Carroll County, including searches of Internet sites such as:

- Extreme Heat Fact Sheet  
<http://www.feam.gov/library/heat.html>
- General Heat Wave Information  
[http://www.nfpa.org/Education/Consumers\\_and\\_Families/Fire\\_Safety\\_Information/Talking\\_About\\_Disaster/Heat\\_Heat\\_Wave/heat\\_heat\\_wave.html](http://www.nfpa.org/Education/Consumers_and_Families/Fire_Safety_Information/Talking_About_Disaster/Heat_Heat_Wave/heat_heat_wave.html)
- National Oceanic & Atmospheric Administration  
<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.d11?wwevent~storms>

Extreme heat is a hazard usually found in more desert regions than Carroll County, Ohio. However, extreme heat can and has been a hazard in Ohio, causing heat strokes to occur to residents and proving detrimental to crops. The highest reported temperature in Ohio through the year 2000 was 113 degrees Fahrenheit, and was reported in the eastern portion of Ohio.

Health hazards related to extreme heat include sunburns, heat cramps, heat exhaustion, and heat stroke. In a normal year, approximately 175 Americans die from extreme heat. Young children, the elderly, and those who are sick or overweight are more likely to become victims. According to the 2000 Census, approximately 25% (7,399 people) of the total population in Carroll County is between the ages of 45 and 64. The remainder of the population could be considered susceptible to extreme heat. Because men perspire more than women, men are more susceptible to heat related illnesses because they become more quickly dehydrated.

### **VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES**

The following information is taken from Worksheet #3a.

Carroll County Hazard Risk Assessment  
Hazard Profile

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	0	0	\$245,689,940.00	\$0.00	0	22,024	6,166
COMMERCIAL	337	0	0	\$25,980,530.00	\$0.00	0	3,408	954
INDUSTRIAL	46	0	0	\$11,227,650.00	\$0.00	0	2,158	604
AGRICULTURAL	3	0	0	\$92,489,610.00	\$0.00	0	89	25
GOVERNMENT	19	0	0	\$14,712,300.00	\$0.00	0	944	264
EDUCATION	12	0	0	\$43,940,400.00	\$0.00	0	213	60
<b>Total</b>	<b>13,432</b>	<b>0</b>	<b>0</b>	<b>\$434,040,430.00</b>	<b>\$0.00</b>	<b>0</b>	<b>28,836</b>	<b>8,073</b>

## MAPPING

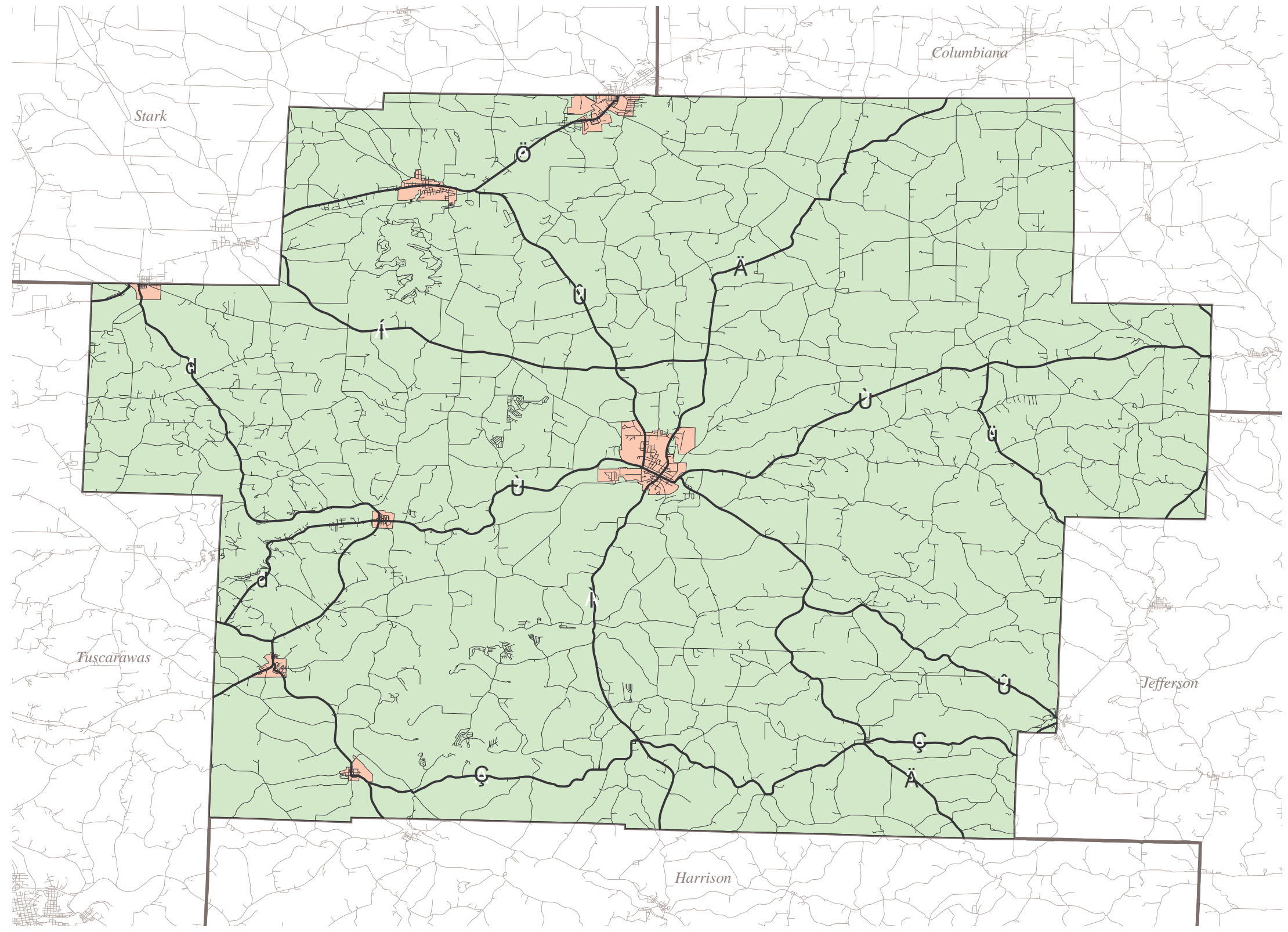
See the Carroll County Heat Wave Map for a graphical representation of hazard areas with regard to extreme heat. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”

# Heat Wave



## LEGEND

- Roads**
- County Route
  - State Route
  - Highway
- Carroll County
- Low Hazard
- Moderate Hazard
- High Hazard



## **Wildfire**



A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that fills the area for miles around. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires.

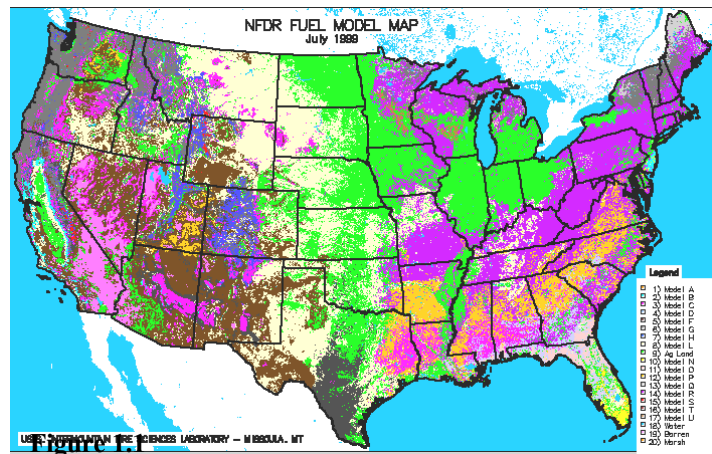
Several methods of research identified wildfires (on a very small scale) as a hazard in Carroll County, including discussions with local representatives. The following Internet sites were also searched with regard to wildfires.

- Firewise  
<http://www.firewise.org>
- General Wildfire Information  
[http://www.nfpa.org/Education/Consumers\\_and\\_Families/Fire\\_Safety\\_Information/Talking\\_About\\_Disaster/Wildfire/wildfire.html](http://www.nfpa.org/Education/Consumers_and_Families/Fire_Safety_Information/Talking_About_Disaster/Wildfire/wildfire.html)
- Local Wildfire Observations and Trend Forecasts for Fire Weather Forecast Zones  
[http://www.fs.fed.us/land/wfas/fd\\_class.gif](http://www.fs.fed.us/land/wfas/fd_class.gif)
- NOAA Fire Event Satellite Photos  
<http://www.osci.noaa.gov/Events/Fires/>
- Resolution Fire Danger Rating Fuel Model Map  
[http://www.fs.fed.us/land/wfas/nfer\\_map.htm](http://www.fs.fed.us/land/wfas/nfer_map.htm)
- US Forest Service (USDA)  
<http://www.fs.fed.us/land/wfas/welcome.html>
- USGS Topographic Maps  
<http://mcmcweb.cr.usgs.gov/topomaps/>
- Wildland Fire Assessment System  
<http://www.fs.fed.us/land/wfas/>
- Wildland Fire Updates  
<http://www.nifc.gov/fireinfo/nfn.html>

According to the Ohio Division of Forestry, there are several factors that can contribute to the starting of wildfires in Carroll County, including arson, equipment fires, campfires, and lightning. Approximately 10,000 forest fires are started each year by lightning. Carroll County contains a great deal of forestland, with recreational campsites and other attractions in designated areas such as Atwood Lake Park. Campfires, coupled with large numbers of visitors and a large proportion of trees make wildfires a potential hazard for Carroll County.

As shown below, Carroll County is currently marked as having a “low” fire class rating. However, this can change with climatic conditions. A large period of drought and high heat may dry up many areas of the county and add them to the amount of fuel for a potentially destructive wildfire.

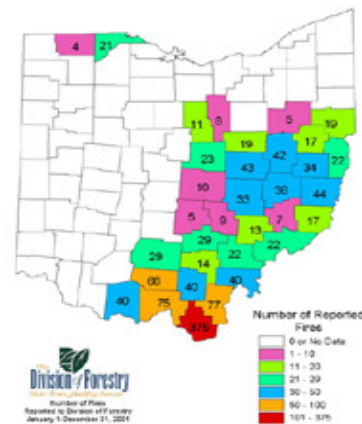
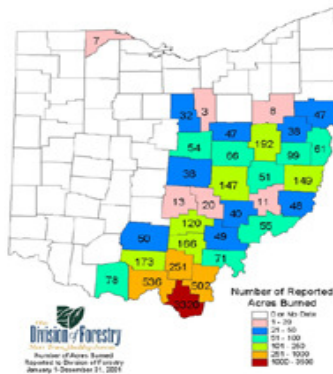
Carroll County falls into the classes of R Land or herbaceous plants and round wood less than ¾ inch in diameter, with regard to fuel types. Both of these classes are considered to be low hazards in terms of wildfires. With climatic changes over prolonged periods, the fuel that is not normally considered to be dangerous could become dry and increase the potential for a large-scale wildfire event. The dollar amount of damage will fluctuate according to where the fire occurs. If, for some reason, the area affected by a wildfire



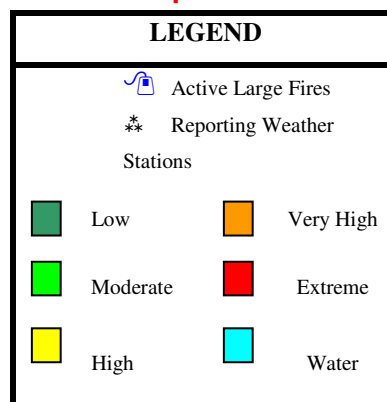
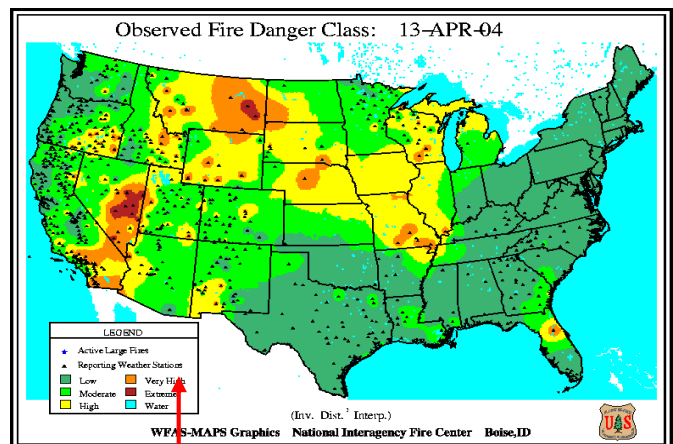
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interfaced a municipality, the amount of damage could be greatly increased. However, most historical events have not consumed much land or property.

According to the Ohio Department of Natural Resources, there were 17 reported fires in Carroll County from January 1 through December 31, 2001, consuming 38 acres of land. This fact is illustrated in the figures below.



The Observed Fire Danger Class Map developed by the US Forestry Service (at right) illustrates the fire danger conditions as of March 13, 2004 and is based on current and past weather, fuel types, and fuel moisture. As can be seen, the entire state of Ohio (with the exception of the northwestern-most corner) is currently in a low fire danger class, including Carroll County.





## VULNERABILITY TO EXISTING BUILDINGS, INFRASTRUCTURE AND CRITICAL FACILITIES

The following information is taken from Worksheet #3a.

Type of Structure (Occupancy Class)	Number of Structures			Value of Structures			Number of People	
	# In County	# In Hazard Area	% In Hazard Area	\$ In County	\$ In Hazard Area	% In Hazard Area	# In County	# In Hazard Area
RESIDENTIAL	13,016	4,390	33	\$245,689,940.00	\$82,859,000.00	19	22,024	7,428
COMMERCIAL	337	114	1	\$25,980,530.00	\$8,762,000.00	2	3,408	1,149
INDUSTRIAL	45	15	0	\$11,227,650.00	\$3,787,000.00	1	2,158	728
AGRICULTURAL	3	1	0	\$92,489,610.00	\$31,192,000.00	7	89	30
GOVERNMENT	19	6	0	\$14,712,300.00	\$4,962,000.00	1	944	318
EDUCATION	12	4	0	\$43,940,400.00	\$14,819,000.00	3	213	72
Total	13,432	4,530	34	\$434,040,430.0	\$146,381,000.00	34	28,836	9,725

## MAPPING

See the Carroll County Wildfire Map for a graphical representation of hazard areas with respect to wildfires. The areas shaded in green represent “low hazard areas,” the yellow areas represent “moderate hazard areas,” the areas shaded in orange represent “high hazard areas,” and the red areas represent “extreme high hazard areas.”

# Wildfire



R.D.Zande  
& Associates



## LEGEND

- Roads**
- County Route
  - State Route
  - Highway
- Carroll County
  - Low Hazard
  - Moderate Hazard
  - High Hazard

