2.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

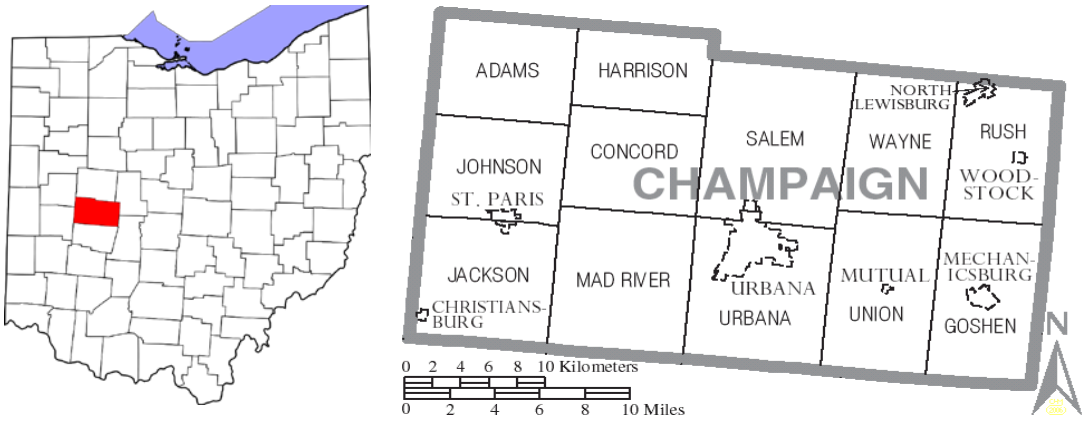
The Hazard Identification and Risk Assessment (HIRA) identifies the type and frequency of disasters that affect Champaign County and the risk to people and property created by those hazards. The HIRA is addressed in four sections:

- County Profile: provides general information on Champaign County and its jurisdictions.
- Hazard Identification: describes hazards that threaten Champaign County and provides a brief history of significant past occurrences of each identified hazard.
- Vulnerability Assessment: discusses each jurisdiction's vulnerability to specific hazards.
- Risk Analysis: evaluates and ranks the hazards Champaign County must address through mitigation efforts.

2.1 COUNTY PROFILE

Champaign County is located in west central Ohio. This rural county has a land area of 430.0 square miles (of which 428.6 square miles is land and 1.2 square miles is water) and an estimated population of 38,840. The county is bordered by Logan, Union, Madison, Clark, Miami, and Shelby counties. The closest major city, Columbus, is approximately 45 miles to the east.

Map 2-1: Champaign County Map



2.1.1 Demographics

According to US Census QuickFacts data, the 2018 population estimate for Champaign County is 38,840. The population base in 2010 was 40,097 so the county is experiencing a slight loss in population, a trend that is expected to continue for the next several decades. This slight decrease is common in Ohio's rural communities and represents an elderly population decrease through death and a challenging job environment for younger workers. 12.7% of the population under 65 years old has some sort of disability. 1% of the population is foreign-born and 9.2% are military veterans.

Table 2-1: County Population Statistics

Statistic	Figure
Population Density	93.5/sq. mile
Female Population	50.2%
Male Population	49.8%
Number of Households	15,274
Population under 18	22.5%
Population over 65	17.8%
Median Age	41.6 years
White	94.6%
Black or African American	2.2%
Hispanic or Latino	1.6%
Other	1.6%
Average Household Size	2.50 persons
Median Household Income	$54,495
Persons in Poverty	11.0%

Champaign County has 16,809 housing units; owner-occupied housing rate is 72.7%. The median value of owner-occupied units is $126,700. Multi-unit housing structures such as apartment buildings account for 12% of all housing units. There are 13 manufactured and mobile home parks in Champaign County that hold at least 850 of the county's 1,005 mobile or manufactured homes. There is a sporadic presence of mobile homes outside mobile home parks, but this constitutes a very small number of structures. The median gross rent for all types of rental properties is $720 per month while the median cost for homes with mortgages is $1,145 per month.

Roughly 87.5% of households have a computer. Broadband Internet subscriptions are in place for approximately 79.9% of the households.

Several special residential housing facilities, such as nursing homes and assisted living facilities, exist across the county. As of 2016, the types of facilities and statistics for each type are as follows:

Table 2-2: Special Residential Facilities

Facility	Facilities	Beds
Nursing Home Facilities	4	266
Residential Care Facilities	3	125
Jails and confinement	1	206
Residential college students	1	990

2.1.3 Incorporated Jurisdictions

Champaign County has one city and six villages. All municipalities participated in the county's 2019 mitigation planning efforts.

Cities

The City of Urbana, the only city in the county, is the county seat and largest municipality. It is home to Urbana University and Mercy Health Urbana Hospital.

Table 2-3: City Population and Demographics

City	Population	Households	Median Income	Persons Below Poverty
Urbana	11,793	4,940	$39,259	20.5%

Villages

Champaign County has six incorporated villages, all of them small and rural. By definition, a village in Ohio has fewer than 5,000 residents.

Table 2-4: Village Population and Demographics

Village	Population	Housing Units	Median Income	Persons Below Poverty
Christiansburg	526	228	$47,500	16.0%
Mechanicsburg	1,644	679	$52,232	12.4%
Mutual	104	55	$67,917	0%
North Lewisburg	1,490	674	$54,063	6.1%
St. Paris	2,089	896	$49,856	13.2%
Woodstock	305	99	$59,375	11.7%

2.1.4 Unincorporated Areas

The unincorporated areas of Champaign County are divided into townships. In Ohio, townships are governed by an elected board of trustees. They meet monthly, at a minimum, and are responsible for the health, safety, and welfare of the township residents. Townships also have elected Fiscal Officers who manage the township's finances. Because townships are unincorporated, they are considered part of the county for the purpose of hazard mitigation planning and activities. Champaign County has twelve townships.

Table 2-5: Township Population Statistics

Township	Population
Adams	1,110
Concord	1,408
Goshen	3,696
Harrison	932
Jackson	2,644
Johnson	3,506
Mad River	2,821
Rush	2,613
Salem	2,539
Union	2,210
Urbana	14,795
Wayne	1,809

Township trustees and fiscal officers manage the business affairs of the township, which consist mostly of maintaining the roads, cemeteries, and critical facilities, and clearing debris from township ditches. Some townships have their own fire department while others are part of a fire district or shared service agreement with another department in the area. For law enforcement purposes, rural townships are covered by the Champaign County Sheriff's Office.

Unincorporated Communities and Neighborhoods

Champaign County has 19 unincorporated communities and one census-designated place. These small, informal neighborhoods are not organized municipalities nor do they have an official form of government. Instead, they function as part of the township in which they are located. In many instances, the locations have historical significance or were formerly incorporated but have ceased to have enough population to be considered a jurisdiction. Local residents generally still recognize the neighborhoods by their previous names. Cable, Mingo, and Westville have post offices and unique zip codes, but they are unincorporated and have no form of government.

2.1.5 Institutions and Special Facilities

Residents in Champaign County have access to abundant educational and healthcare resources. These services contribute to the quality of life for residents and the successful development of Champaign County's economy.

Education

Families in Champaign County have access to multiple educational opportunities. Students are served by five public school districts and one private school. Vocational education is provided by Ohio Hi-Point Career Center, located in Bellefontaine slightly north of Champaign County. Urbana University is located in Urbana with undergraduate enrollment of approximately 700 students.

Table 2-6: Champaign County Schools

Public School Districts	Private/Parochial Schools
Graham Local School District	Victory Christian School
West Liberty Salem Local School District	Operation Rebirth (boarding school)
Triad Local School District	
Urbana City School District	
Mechanicsburg Exempted Village School District	

Healthcare

Throughout Champaign County, residents have access to healthcare services. Within Champaign County, residents have access to comprehensive medical care at Mercy Health Urbana Hospital in Urbana. Memorial Urgent Care has a new facility in Urbana that provides urgent care and specialty services. Mercy also provides sports medicine and rehabilitation services as well as diagnostic services. There is one urgent care center in Urbana. Mary Rutan Hospital from Bellefontaine provides various specialty services in Urbana. There are approximately 266 nursing home beds across the county, the majority of those in Urbana. There are approximately 149 assisted living occupants in the county. There are various facilities that provide special services like rehabilitation, dialysis, physical therapy, and diagnostic services, and there are primary care physicians in multiple communities in Champaign County.

2.1.6 Infrastructure

Infrastructure and related systems provide residents, workers, and visitors with access to critical services. This section describes the county's road and rail infrastructure, airports, and utility systems.

Transportation Systems

Champaign County has a strong highway system connecting the county to cities and regions across Ohio. This includes more than 407 miles of U.S. and state highways and 104 bridges. Ohio Department of Transportation District 7 covers Champaign County; a district facility houses 15 vehicles and additional maintenance equipment in Urbana. There are outposts in both Mechanicsburg and St. Paris.

The Champaign County Engineer is responsible for maintaining and repairing 239 miles of county roads, 213 bridges, and hundreds of culverts. There are 340 miles of township roads maintained by the various townships in the county. Urbana has 62.6 miles of city streets.

Table 2-7: Champaign County Highways

Interstates	U.S. Highways	State Highways		
None	36	4	161	507
	68	29	187	559
		54	235	560
		55	245	814
		56	296	

Rail

Rail is another transportation system in Champaign County. The WESTCO Line operates rail that crosses north to south from Bellefontaine in Logan County to the south, running through Urbana into the west side of Springfield in Clark County. Another WESTCO line runs northeast out of Springfield to its end in Mechanicsburg. There are 21 active WESTCO railroad crossings in Champaign County. The Indiana and Ohio Railway operations a line that comes into Champaign County in Mad River Township, runs northwest through St. Paris and through Johnson and Adams Township.

Airports

Champaign County has five airports, including the Champaign County Airport in Urbana, commonly known as Grimes Field Airport. Mercy Memorial Hospital maintains a heliport at its hospital in Urbana. Weller Airport (Urbana), Dad Field Airport (Christiansburg) and Reeds Airport (St. Paris) round out the air traffic facilities in the county.

Utilities

The majority of homes in Champaign County, approximately 38.4%, are heated with natural gas. An additional 23.8% utilize electric heat. These utilities are provided by multiple private providers; there are no municipal electric providers in the county. The Public Utilities Commission of Ohio regulates private companies that provide public utility services. These companies, along with municipal electric utilities, are identified in the table below.

Table 2-8: Champaign County Utility Providers

Electric Service	Natural Gas Service
Dayton Power and Light Inc.	Columbia Gas of Ohio
Pioneer Rural Electric	Vectren Energy Delivery of Ohio

The remaining properties in the county are heated by other sources, including:

- Bottled, tank, or LP gas 21.8%
- Fuel oil, kerosene 7.7%
- Coal, coke or wood 5.9%
- Solar energy or other fuel 2.1%
- No fuel used 0.3%

Champaign County is home to two approved and potential windfarm projects, Buckeye I and Buckeye II. Combined, the two projects are approved for 110 wind turbines.

While not for distribution, there are two major hazardous liquid pipelines that cross the western third of the county. One runs from east of Christiansburg about five miles, to the north through St. Paris, to the northwest through the unincorporated area referred to as Rosewood, and into Logan County near Quincy. A second line enters Champaign County in mid-Mad River Township and goes northwest into St. Paris; it then follows the other line up through Rosewood and into Logan County. A gas transmission line runs from the southern border in Mad River Township just west of SR 68 to the north into Urbana.

Water and wastewater services are provided by municipal services. Mechanicsburg provides water and sewer services. Their water system includes three wells, one tower, 8 miles of distribution lines and 67 hydrants. The wastewater system includes one treatment facility, eight miles of lines, and two lift stations.

North Lewisburg provides water and wastewater facilities. The water system is fed by three wells and includes two towers, 9.8 miles of distribution lines, and 74 hydrants. The wastewater facility treatment plant serves 8.6 miles of lines and treats 140,000 gallons per day.

St. Paris provides wastewater treatment and sanitary sewers. They operate a sewage treatment facility and maintain over 65,000 feet of lines. The water treatment system consists of one pump house, three wells, two towers, 66,000 feet of water lines, and distribution lines.

The City of Urbana provides water, wastewater and sanitary sewer services for residents. They maintain 87 miles of water mains, four water towers and 5 wells. They have one treatment facility. The city's water and sewer systems serve both residents and businesses, including several major industrial customers. The sanitary sewer system has two pump stations with the recent addition of a new station on Three Mile Road near the former Robert Rothschild Farm. The other pump station is located near Vancrest Nursing Home. The city also has a wastewater treatment facility. They maintain 77 miles of sanitary sewer lines, 1,200 manholes, and one pump station. They accept septic system waste from professional haulers on a contractual basis for homes with septic systems. Their stormwater management program provides storm sewer lines and containment with 34 miles of storm sewer lines. The city provides a compost facility for yard waste and tree debris.

Christiansburg operates a sanitary sewer system with a treatment facility, and they have a municipal water system. Mutual and Woodstock do not provide utility services for the village residents. North Lewisburg provides sanitary sewer services for Woodstock.

According to census figures, 79.9% of the households in the county have broadband service and 87.5% have a computer.

2.1.7 Topography and Climate

The terrain in Champaign County is flat to slightly rolling, with steeper terrain in a few limited areas. Between the highest and lowest points, there is approximately 741 feet of difference. The county's highest point is approximately 1,437 feet above sea level, and is in Johnson Township. The lowest elevation is 696 feet above sea level.

Soil Types

There are eight soil associations in Champaign County. Most soils are deep to very deep. There is also a glacial boulder belt which is an area where the melting glaciers left boulders and stone on the surfaces, as well as depositing stone pieces in the soils. The soil associates are as follows, as taken from the Soil Survey of Champaign County by K.L. Powell and VL Siegenthaler in 1966:

- Brookston-Crosby: nearly level and undulating, very poorly drained, moderately fine texture
- Crosby-Brookston-Celina: nearly level and undulating, moderately well drained to very poorly drained, medium textured and moderately fine textured
- Miami-Celina-Brookston: undulating to steep, well drained and moderately well drained, medium-textured and nearly level or depress, very poorly drained, and moderately fine textured on uplands;
- Miami: nearly level to undulating, well-drained, medium textured on uplands
- Miami (Steep): sloping to steep, well-drained, medium textured on uplands
- Fox-Lippincott: nearly level to sloping, well-drained, medium textured on stream terraces, and nearly level or depressed, moderately fine textured on stream terraces
- Miami-Fox-Casco: gently sloping to steep, well-drained, medium textured on moraines and kames
- Patton: level or depressed, very poorly drained, moderately fine textured on old glacial lakebeds

Climate
Like most of Ohio, Champaign County experiences cold winters and hot summers. The mean annual temperature is 53° F. July has an average high temperature of 85° F, making it the warmest month. January is generally the coldest month with an average low temperature of 22° F. Average rainfall is approximately 36.92 inches per year. July is typically the wettest month with average precipitation of 2.76 inches of rain.

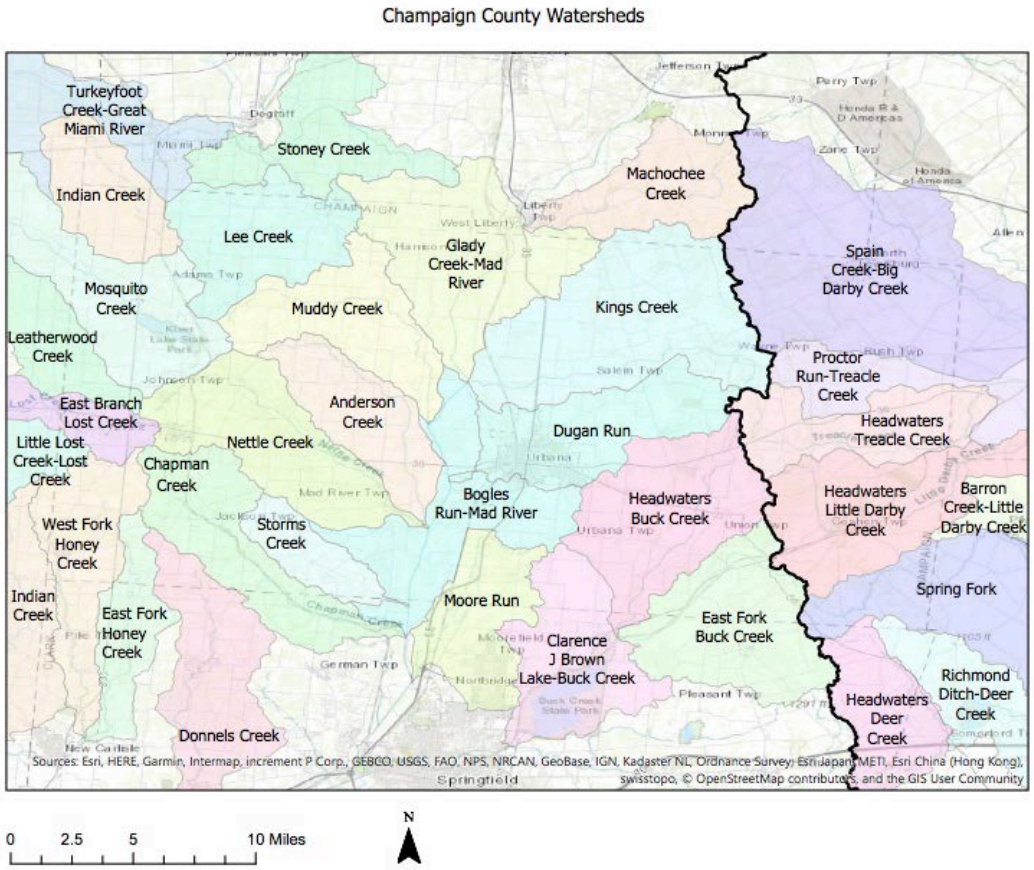
2.1.8 Waterways and Watershed

Champaign County is part of two distinct watersheds as the county's water drains south towards the Ohio River. The majority of the county falls in the Great Miami Watershed. This large watershed includes portions of fifteen Ohio counties and drains 3,802 square miles of land. This watershed is broken down into several sub-watersheds, two of which include Champaign County. The Mad River sub-watershed includes 657 square miles of Champaign, Logan, Clarke, Miami, Greene, and Montgomery counties. It flows southwest until it joins the Great Miami River in Dayton. This sub-watershed encompasses the majority of Champaign County, including most of the western two-thirds of the county. A small section in the northwest corner of Champaign County is located in the Great Miami River (Upper) sub-watershed. This large sub-section drains 748 square miles at the top of Great Miami watershed and flows into the Ohio River west of Cincinnati.

The remainder of Champaign County is located in the Scioto River watershed, which includes all or part of 31 counties in central and southern Ohio and drains 6,513 square miles. The eastern third of Champaign County falls in the Big Darby Creek sub-watershed. This basin also includes portions of Logan, Union, Clark, Madison, Franklin, and Pickaway Counties. A small section in the far southeast corner of Champaign County falls in the Deer Creek sub-watershed.

Map 2-2 identifies the watershed sub-basins on Champaign County. The heavy black line that runs through the county depicts the border between the Great Miami and Scioto watersheds.

Map 2-2: Champaign County Watersheds



2.1.9 Land Use

With 190,060 acres of farmland, agriculture is the predominant land use in Champaign County. Cultivated crops account for 72% of all land use in the county. Countywide, there are 873 farms with an average size of 218 acres. Individuals and families operate 91.6% of the farms. Farmers cultivate approximately 69,450 acres of corn, 82,913 acres of soybeans, and 5,602 acres of wheat. Orchards make up just 81 acres of the county. Farmers also raise poultry, cattle, and dairy cows.

The forested areas, grassland, and wetlands in Champaign County include 2,082 acres of state parks, forests, nature preserves and wildlife areas. This includes the Cedar Bog Dedicated Nature Preserve (Urbana Township), Urbana Wildlife Area (Salem Township), Davey Woods Dedicated Nature Preserve (Concord Township), Seigenthaler-Kaesther Esker Dedicated Nature Preserve (Harrison Township), Kiser Lake State Park and Kiser Lake Wetlands (Johnson Township).

Table 2-9: Champaign County Land Use

Use Category	Percentage
Cultivated Crops	72.45%
Forest	9.99%
Pasture/Hay	8.32%
Developed, Lower Intensity	6.78%
Shrub/Scrub and Grasslands	1.43%
Open Water	0.45%
Developed, Higher Intensity	0.44%
Wetlands	0.11%
Barren (strip mines, gravel pits, etc.)	0.03%

2.1.10 Regulation

Building regulations are enforced by several entities across Champaign County. LUC Regional Planning Commission is a three-county entity that provides regional planning for the contiguous counties of Champaign, Logan, and Union. The Commission is responsible for approving subdivisions in unincorporated areas and reviewing and recommending zoning amendments for township zoning commissions.

Zoning regulations are in place in most municipalities and all townships in Champaign County. Each municipality or township is responsible for adopting and enforcing these regulations through their local zoning inspector and zoning board or commission. Rules are adopted and enforced by each individual municipality or township. The zoning status for all jurisdictions in the county is listed in table 2-10 below.

The Champaign County Building Regulations department conducts inspections, issues building permits, and enforces commercial and residential building codes. The County Engineer serves as the county's floodplain manager and is in charge of regulating development in special flood hazard areas. The City of Urbana Zoning official enforces floodplain regulations within the city.

Table 2-10: Champaign County Zoning Status

Zoned Municipalities	Zoned Townships	Not Zoned
Mechanicsburg	Adams	Christiansburg (village)
North Lewisburg	Concord	Mutual (village)
St. Paris	Goshen	Woodstock (village)
Urbana	Harrison	
	Jackson	
	Johnson	
	Mad River	
	Rush	
	Salem	
	Union	
	Urbana	
	Wayne	

2.1.11 Economy and Development

Champaign County is part of the Dayton-Springfield Metropolitan Statistical Area. Its proximity to Columbus also allows for an easy exchange of business with the state's capitol, providing a wide array of resources, products and services for county residents and businesses.

Community development is accomplished through the collaborative efforts of multiple entities and organizations. Township trustees, municipal officials and employees, and county workers work together to recruit new business, retain current ones, and make changes to regulations that result in wise development that protects the built community and natural resources. In various documents, these professionals are referred to as "plan partners".

Regional planning is conducted by LUC Regional Planning, a three-county office that represents Logan, Union, and Champaign counties. It is funded in part by Champaign County. Other key development organizations include the Champaign Economic Partnership and the Champaign County Chamber of Commerce. Township trustees, village councils, city councils and county officials belong to these three organizations. Businesses also participate, creating an effective and active public-private land use and community development consortium.

The plan partners have established several categories of land use: agricultural preservation areas, existing residential areas, preferred rural residential areas, commercial areas, industrial areas, public and semi-public areas, conservation areas, rural centers, urban service areas, aquifer protection areas, and incorporated areas. Each category is classified into prime, suitable, and marginal areas.

Champaign County development goals, objectives, and policies address a wide array of concerns and express the county's intent to protect the health, safety and welfare of residents, protect agricultural land, and preserve streams, wooded areas, groundwater aquifers and environmentally sensitive land. A few specific items are of particular relevance to hazard mitigation. These include the effort to maintain zoning regulations and construction standards and avoid variances and exceptions that could lead to unwise use of land or development contrary to the overall well-being and intention of the land use planning partners. Several places in the plans outline and confirm the intent to preserve natural resources, including the soils, waterways, and natural habitat in the county.

The plan partners' intent to protect and preserve agriculture, which is the leading industry in Champaign County, is clear. The documents refer to support for the Clean Ohio Fund Agricultural Easement Purchase Program, avoidance of urban sprawl into productive land, and minimizing the use of any land that results in compromise to farming purposes in either crop or livestock production.

Commercial growth is focused on areas in proximity to transportation routes, infrastructure that supports growth, and where necessary services and utilities can be provided. The plan partners speak frequently about preservation of recreational areas, parks and other scenic areas, selecting alternate locations for the addition of new business and industry in an effort to

preserve natural resources. They recognize the effects of commercial development on drainage patterns, and advocate and require the use of structurally engineered components of construction to avoid flooding, flash flooding or other modifications of the natural drainage process.

Plan partners intend to conserve, maintain, and restore the natural environment through protection of soils, waterways, water sources, minerals, and other environmental components. They collaborate with the Champaign County Soil and Water Conservation District, Champaign County Engineer, Urbana floodplain administrator, waterway conservation groups, and others to achieve these goals. They recognize that they play an important role in flood prevention and protection, and that they share responsibility for protection of the quality of water in the county.

An updated countywide comprehensive plan is in process with completion in late 2019 or early 2020.

Major Industries and Employment

Key industries in Champaign County include aerospace leaders Honeywell Aerospace (aviation lighting), Hughey and Phillips, LLC (obstruction lighting) and Sarica Manufacturing (LED lighting board assembly). In addition to many corporate and family farms, the agribusiness community includes Freshwater Farms (indoor fish hatchery), Heritage Cooperative (farm cooperative sales and services), Michael Farms (vegetable production), and Old Souls Farm (hydroponic produce). Automotive industries include Johnson Welded Products (brake components), KTH Parts Industries (frame components), and Parker Trutec Industries (industrial coatings). Logistics and warehousing leaders include Dingledine Trucking Co. (distribution services), Navistar (packaging), and WCA Logistics, LLC (freight brokerage). Advances materials and advanced manufacturing includes Bundy Baking Solutions (commercial baking equipment), ColePak (packaging partition manufacture), Desmond Stephan (grinding wheel dressers), Eisenworks (machining), The Hall Company (human machine interfacing), Hughey & Phillips LLC (obstruction lighting technology), Rittal Corporation (industrial control and electrical enclosures), Rosewood Machining and Tool (tractor part machining), Ultra-Met Company (custom-molded tungsten carbide products), and WEIDMANN Electrical Technology (transformer board production). Polymer industry includes ORBIS, a manufacturer of plastic returnable and reusable packaging systems. Table 2-11 lists the county's major employers. Table 2-12 includes employment statistics by industry

Table 2-11: Major Employers

Employer	Sector
Honeywell Aerospace	Manufacturing
Hughey & Phillips, LLC	Manufacturing
Sarica Manufacturing	Manufacturing
Freshwater Farms	Agriculture
Heritage Cooperative	Agriculture
Michael Farms	Agriculture
Old Souls Farm	Agriculture
Johnson Welded Products	Manufacturing
KTH Parts Industries	Manufacturing
Parker Trutec Industries	Manufacturing
Dingledine Trucking	Transportation/Logistics
Damewood Enterprises	Warehousing
Navistar	Technology
WCA Logistics, LLC	Transportation/Logistics
Weidmann Electrical Technology	Manufacturing
Orbis	Manufacturing

Table 2-12: Employment by Industry

Employment Sector	Average Employment
Manufacturing	28.6%
Healthcare and Social Assistance	12.8%
Educational Services	8.4%
Retail trade	9.6%
Accommodation and Food Service	6.7%
Professional, Scientific, Technical	3.4%
Administrative Support, Waste Mgt.	2.5%
Transportation and Warehousing	4.2%
Utilities	1.3%
Other services, not public admin	5.1%
Construction	4.5%
Finance and Insurance	3.4%
Agriculture, Forestry, Fishing, Hunting	2.2%
Public Administration	2.6%
Wholesale Trade	1.8%
Information	1.0%
Other	1.9%

Champaign County's unemployment figures have dropped steadily since 2013, as described in Table 2-13. As of May 2018, the rate had dropped to 4.3%.

Table 2-13: Employment Statistics

	2013	2014	2015	2016	2017
Total Labor Force	20,000	19,900	19,900	19,800	19,900
Employed	18,700	18,900	19,000	19,000	19,000
Unemployed	1,400	1,000	900	900	800
Unemployment Rate	6.9%	5.1%	4.4%	4.5%	4.2%

2.1.12 Development Trends

Champaign County is primarily an agricultural community and many families who live in the county have been residents for multiple generations. Some families have a history of skilled and unskilled labor work and are employed by businesses like Honda, and Navistar. Development professionals reported that there are 4,200 “bread and butter” industries in the county. Some historic century homes are found in Urbana and other villages. In the rural areas, many farm families reside in long-standing farm homes or in newer homes built on the family farm.

The county has experienced well-planned and managed residential development due to business growth and job availability in the county and surrounding communities. Over the past twenty years, there have been efforts to develop multi-family housing in municipalities, and to create frontage lots with private wells and septic system in rural areas on rural roadways.

Industrial growth has focused on recruitment or expansion of mid-sized companies with fewer than 500 employees, use of vacant locations within existing industrial park areas, and new facilities in areas where other manufacturing is located. Developers have concentrated on filling empty buildings when possible and adapting vacant locations to meet the needs of new tenants. They have worked to save jobs, add high paying skilled labor jobs, and increase the viability of professional and technical support and service businesses.

The county airport has been upgraded to provide improved access and support of local industry. Grants and other funding sources have been used to make improvements that help the airport serve potential industries and to provide transportation for existing ones. Similarly, the county has worked to expand healthcare options to support new employees and families, and they’ve worked to establish the infrastructure necessary to serve an expanded population.

Development activities in Champaign County have followed specific goals and objectives, and locations where various kinds of development have taken place were planned and executed according to plan. The municipalities and townships are active in the creation of development plans, as are county departments and private partners. They have determined specific details of development prior to implementing a plan.
Housing needs have been met based upon industrial and manufacturing growth, and the types of housing created (single family, multi-family, single lots vs. subdivisions and cost factors based upon income statistics) have been established based upon data. Developers and community professionals have established housing areas to avoid flood plains and other areas that incur damage from storms or have exceptional risk from identified hazards.

Industrial and manufacturing growth has been located in zones with access to highways and necessary transportation routes in an effort to keep the roadways as safe yet accessible as possible. They have considered transportation needs for raw materials and finished product and how those commodities might impact highway safety.

Champaign County has worked hard to protect its agricultural industry. They have considered the use of land as it affects farm production and have approached productive farmland as a currently used resource and have not attempted to remove land from production to satisfy industrial development needs. They have considered watershed factors, agricultural product management and transportation, and the need for access to farm supplies and markets as they have added agribusinesses to their county commercial community.

Building regulations, land use planning, and existing rules and regulations have been strictly enforced. The county has concentrated development away from areas that are vulnerable to flooding. Development officials have utilized Urbana University assistance to determine areas appropriate for housing and to determine the infrastructure necessary to support this growth and worked with municipalities and the county to establish infrastructure studies and improvements that will support growth in a sustainable manner than avoids building in floodplains or other areas prone to water problems. The use of green materials in development or maintenance, the employment of smart development concepts, and the use of damage resistant materials as they develop the community has been important to all parties involved.

In the process of development, floodplain regulations and NFIP participation has been enforced and maintained. Consideration has been given to waterway maintenance and infrastructure support in light of developing areas, projects, and structures. This has enabled the county to add homes, business, and industry without increasing the damages from disaster incidents.

In the coming years, Champaign County mitigation planning participants expressed an interest in maintaining the regulations in place, and even of improving regulation to be more supportive of wise and sustainable development. They expressed a desire to utilize regulation, as they have in the past, to prevent the addition of properties or structures that stand in the way of nature and encourage development that avoids high-risk and high-impact areas.

2.2 HAZARD IDENTIFICATION

Champaign County has experienced many disasters in its history, ranging from floods and tornadoes to blizzards and windstorms. In this section, the hazards that can impact Champaign County are defined and county's risk for each hazard is considered.

In developing this assessment, the Hazard Mitigation Planning Team analyzed the hazards and risks present throughout the county. The thirteen hazards identified as relevant to Champaign County are:

- Dam failure
- Drought/extreme heat
- Earthquake
- Flood
- Hazardous materials incident
- Invasive species
- Land subsidence
- Power outage
- Severe thunderstorm
- Tornado
- Water quality emergency
- Windstorm
- Winter Storm

Some hazards were excluded from this plan because they pose no risk to Champaign County. The excluded hazards and the justification for the exclusion are identified in table 2-14.

Table 2-14: Excluded Hazards

Excluded Hazard	Justification
Coastal Erosion	The county has no open coastline.
Tsunami	Geographically impossible
Volcano	Geographically impossible
Wildfire	Insufficient forested area

Champaign County does not have a long history of federal disaster declarations or assistance. The county has been included in eight federal declarations. The most recent federal disaster declaration for the county occurred in June 2012 after a severe thunderstorm and wind event. A comprehensive list of federal disaster declarations for Champaign County is provided in table 2-15.

Table 2-15: Federal Disaster Declaration History

DR/EM Number	Incident Date	Incident Type(s)
DR-90-OH	January 23, 1959	Flood
EM-3055-OH	January 26, 1978	Winter Storm
DR-1065-OH	August 7, 1995	Severe Storm, Flood
DR-1580-OH	December 22, 2004	Flood, Winter Storm, Mudslide
EM-3198-OH	December 22, 2004	Winter Storm
EM-3250-OH	September 14, 2005	Hurricane Katrina Evacuation
DR-1805-OH	September 14, 2008	Wind
DR-4077-OH	June 29, 2012	Severe Storm, Wind

To understand the risk posed by these hazards in Champaign County, it is important to examine the characteristics of each hazard and evaluate the local history of occurrences. Historical information was obtained from the National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) and supplemented with information from local officials. This section defines each hazard and describes Champaign County's history with each.

2.2.1 Dam Failure

A dam is an artificial barrier built across flowing water. This barrier directs or slows the flow of water and often creates a lake or reservoir. A dam is considered hydrologically significant if it has a height of at least 25 feet from the natural streambed and a storage capacity of at least fifteen acre-feet or an impounding capacity of at least 50 acre-feet and is six feet or more above the natural streambed. Dams are constructed for different purposes, such as flood control or to water storage for irrigation, water supply, or energy generation. They can be composed of earth, rock, concrete, masonry, timber, or a combination of materials.

Levees are embankments constructed to prevent the overflow of a river and subsequent flooding of the surrounding land. They can be built using earth, rock, or other materials. Levees constructed from concrete or masonry materials are referred to as floodwalls.

Many of the structures classified as dams or levees in Ohio are part of municipal water or wastewater treatment systems. These structures are often referred to as upground reservoirs or lagoons. According to ODNR, an upground reservoir is defined as a reservoir formed by artificial barriers on two or more sides and which impounds water or liquefied material pumped or otherwise imported from an exterior source. Lagoons are considered upground reservoirs.

Dam failure is defined as the uncontrolled release of the water held back by the structure. Depending on the storage volume of the dam and the types of structures surrounding it, a breach or failure can have a significant or limited impact on the surrounding community. In the most significant dam failure incidents, there can be substantial flooding downstream, damage to property, and loss of life. Potential causes of dam failure include, but are not limited to, sub-

standard construction, geological instability, spillway design error, poor maintenance, internal erosion, and/or extreme inflow.

The Ohio Department of Natural Resources (ODNR) is responsible for determining the hazard potential for dams through their Dam Safety Program. ODNR classifies dams based on this scale:

Classification	Description
Class I	High hazard dam; Probable loss of life, serious hazard to health, structural damage to high value property (i.e. homes, industries, major public utilities)
Class II	Significant hazard dam; Flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, only access to residential areas
Class III	Low hazard dam; Damage to low value non-residential structures, local roads, agricultural crops, and livestock
Class IV	Losses restricted mainly to the dam

Dam/Levee Failure Risk Assessment

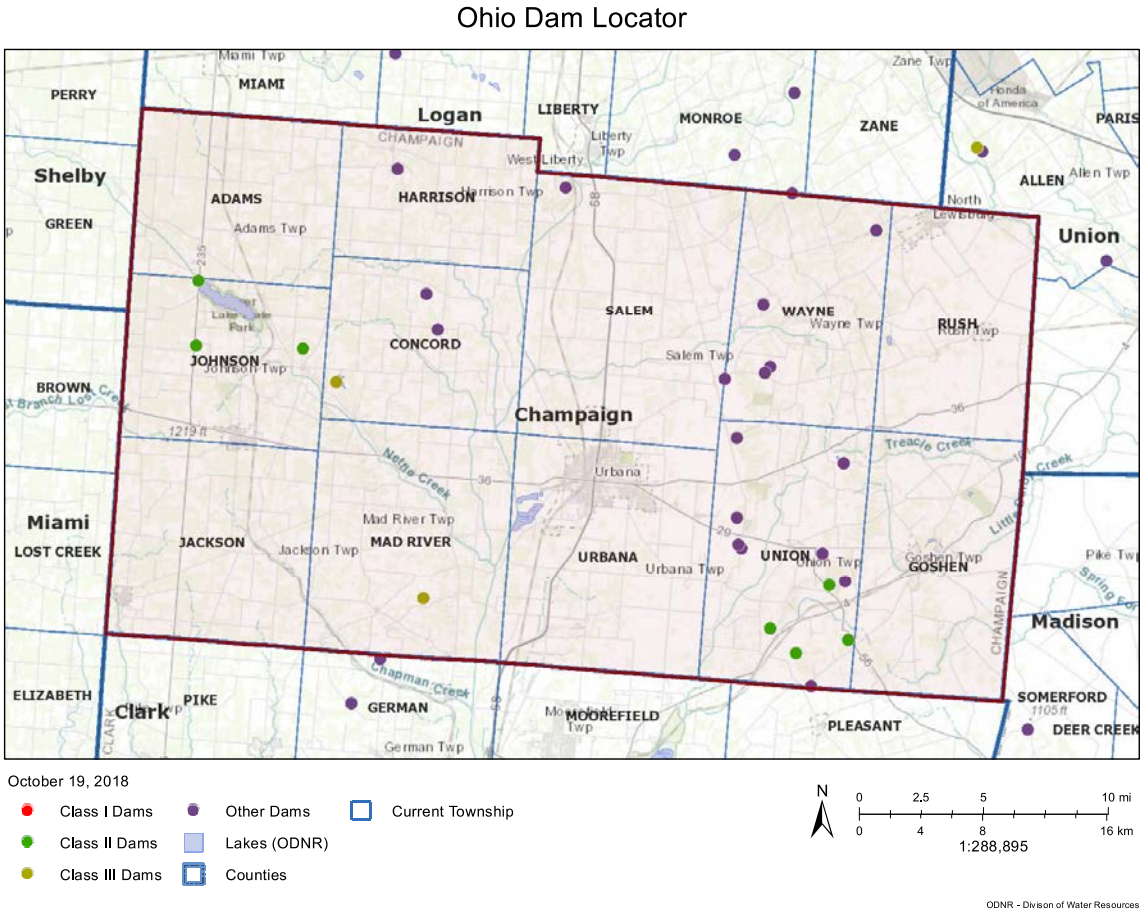
There are 26 dams in Champaign County and zero levees or upground reservoirs. No dams are considered Class I but there are 7 Class II, 2 Class III, and 17 Class IV dams. These structures function as water retention structures on waterways intended to hold back a recreational water supply, and are privately-owned structures that affect the flow of runoff waters. Dams and classifications for the county, according to the Ohio Department of Natural Resources, are identified in table 2-16. The only exception is Kiser Lake Dam, which is owned and operated by the Ohio Department of Natural Resources as a part of Kiser Lake recreational area.

Table 2-16: Champaign County Dams

Dam	Class	Location	Owner	EAP Status
Kiser Lake Dam	II	Johnson Township	ODNR	Not Approved
Runkle Farm Pond Dam	II	Johnson Township	Mark Runkle	Approved
Shore Lake Dam	II	Johnson Township	Estel Ray Shore	Not Approved
East Fork Buck Creek Structure III-A	II	Union Township	East Fork Buck Creek Conservation District	Not Approved
East Fork Buck Creek Structure IV-A	II	Union Township	East Fork Buck Creek Conservation District	Not Approved
East Fork Buck Creek Structure I-B	II	Union Township	East Fork Buck Creek Conservation District	Not Approved
East Fork Buck Creek Structure II-B	II	Union Township	East Fork Buck Creek Conservation District	Not Approved
Stroman Lake Dam	III	Concord Township	Jacob & Terrie Conley	Approved
Williams Lake Dam	III	Mad River Township	Robert Neff	Not Approved
Unknown	IV	Harrison Township	Unknown	N/A
Wilson Pond Dam	IV	Concord Township	Otto Wilson	N/A
Meadow Lake Dam	IV	Concord Township	Denton Calland	N/A
Cole Pond Dam	IV	Salem Township	Rick Cole	N/A
Bitzos-Bancroft Lake Dam	IV	Salem/Wayne Township	Frank Bitzos & Robert Bancroft	N/A
Bahan Pond Dam	IV	Wayne Township	Nelson Bahan	N/A
Unknown	IV	Wayne Township	Unknown	N/A
White's Pond Dam	IV	Wayne Township	Noel White	N/A
Schaffer's Pond Dam	IV	Wayne Township	Lorin Schaffer or RE Walter	N/A
Dowds Pond Dam	IV	Union Township	D.D. Dowds	N/A
Muirhead Pond Dam	IV	Union Township	Stan Muirhead	N/A
Denkewalter's Lake Dam	IV	Union Township	Dr. Fred Denkewalter	N/A
Eckert's Pond No. 2 Dam	IV	Union Township	Larry Eckert	N/A
Eckert's Pond No. 1 Dan	IV	Union Township	Larry Eckert	N/A
Whittaker Pond Dam	IV	Union Township	Mary Whittaker	N/A
East Fork Buck Creek Structure II-A	IV	Union Township	East Fork Buck Creek Conservation District	N/A
Grimes Point Dam	IV	Union Township	Burelson Grimes	N/A

Maps identifying the locations of all dams in table 2-16 are included in map 2-3. The map is provided by ODNR.

Map 2-3: Champaign County Dam Locations



Kiser Lake Dam is located at the north end of Kiser Lake and holds the water in this recreational area at a level conducive to boating and fishing. Kiser Lake is, by far, the largest recreational body of water in the county; all other private lakes are considered ponds, and are small and privately used. Kiser Lake is an open recreational area used by the local and non-local recreational community. The dam inundation zone is drained by Mosquito Creek, and most of the inundation zone is some distance from any structures. State Route 235 crosses the dam via a bridge and the road is vulnerable to flooding should the dam fail under extremely high precipitation and flooding conditions. Under the most extreme and unusual of circumstances, the roadway could be damaged or destroyed as water inundated the bridge and causeway area. A major failure would result in farm crops in adjacent fields being flooded and destroyed. There are no permanent homes in the area of the dam.

The other Class II dams are privately owned, much smaller than Kiser Lake, and used privately. They are near county roadways that could experience some flooding but would likely be temporary and quickly resolved. Most of the Class II dams are surrounded by farmland and away from highly populated areas. Crop loss would be a reasonable expectation if a breach occurred, especially, during times of high precipitation and ground saturation.

The Class III and IV dams are all on private property and serve as private recreational areas on creeks and streams that flow through private property. They pose little risk to any structures and roadways have minimal vulnerability to flooding. The structures are located in rural areas of very low-density population. Most damage would be to farm crops, and likely crops owned by the same owner as the dam.

Local Dam Failure History
There is no known local dam failure history.

2.2.2 Drought and Extreme Heat

A drought is a deficiency of moisture that adversely impacts people, animals, and vegetation over an area of significant size. Because drought is a creeping phenomenon characterized by the absence of water, there is no defined beginning or end, nor is there a specific amount of time required for an extended dry period to be considered a drought. An event is considered a drought when the dry period lasts long enough to impact the environment and economy of a region, typically several months or years.

Drought severity is measured using the Palmer Drought Severity Index (PDSI). The PDSI measures dryness based on recent precipitation and temperature statistics. Drought classifications are identified in the chart below:

Measurement	Description
-4 or less	Extreme Drought
-4 to -3	Severe Drought
-3 to -2	Moderate Drought
-2 to -1	Mild Drought
-1 to -0.5	Incipient Dry Spell
-0.5 to 0.5	Near Normal
0.5 to 1	Incipient Wet Spell
1 to 2	Slightly Wet
2 to 3	Moderately Wet
3 to 4	Very Wet
4 or more	Extremely Wet

A heat wave is a period of abnormally hot and unusually humid weather, typically lasting for two or more days. This can be an extended period of time with higher than normal temperatures or a shorter period of time with abnormally high temperatures. Regardless of the duration or exact temperatures, heat waves are a safety hazard to anyone exposed to the high heat. People are at risk for heat exhaustion and heat stroke, which can be fatal in the most serious cases. When heat waves are accompanied by drought conditions, the potential for a serious natural disaster increases. Between injuries, fatalities, and crop/property damage, these disasters can significantly impact the economy of a region.

Heat waves can occur anywhere in Ohio, including Champaign County, but are typically brief, lasting only a few days. Extreme temperatures are considered anything above 90 degrees Fahrenheit. In the humid climate of the Midwest, these temperatures are often accompanied by high humidity. Temperatures rarely exceed the mid-90s, although the region does occasionally experience temperatures in the upper 90s or slightly higher. These brief heat waves are not uncommon, but rarely last more than a few days. A heat wave lasting longer than a week is extremely rare.

Table 2-17: Average Temperatures and Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	33°	36°	46°	59°	69°	79°	82°	81°	75°	63°	50°	37°
Avg. Low	19°	20°	28°	38°	49°	59°	63°	61°	54°	42°	34°	24°
Avg. Precip.	2.32”	2.01”	2.56”	3.54”	3.82”	4.21”	3.9”	3.62”	2.35”	2.76”	3.07”	2.76”

Drought/Extreme Heat Risk Assessment

Drought and extreme heat are uncommon in Champaign County but are countywide hazards and can affect all areas and jurisdictions. Brief spells of abnormally dry conditions can last for several weeks but most months have sufficient rainfall to support crop growth. Drought conditions, when they do occur, have a significant impact on the county’s significant agriculture industry.

During the primary growing season, Champaign County can experience short periods of unusually dry conditions. Champaign County does not have a history of extended drought that would cause casualties or property damage. The most common drought-related loss is a reduction in crop yields for a single growing season and endangerment of any livestock that could not get water for survival.

Based on the 2012 Census of Agriculture published by the U.S. Department of Agriculture, Champaign County’s agriculture industry has a total market value of $130,414,000. In a drought, the significant crop and livestock operations across the county would be exposed to loss. Table 2-18 identifies the quantities of the primary agricultural commodities in the county that could be impacted by drought-related loss. While many farmers insure their crops, it is not possible to determine how extensive crop insurance coverage is across the county. Insurance would only partially replace the economic loss caused by severe drought.

Table 2-18: Drought Vulnerability Assessment

Top Commodities	Crop Acres	Livestock Inventory
Soybeans	82,913	
Corn	69,450	
Wheat	5,602	
Hogs/Pigs		24,030
Cattle		7,830
Poultry		3,705

Local Drought/Extreme Heat History

Drought is not common in Champaign County. Per official NDCD records, the county has experienced two official droughts as indicated in table 2-19 below. The United States Department of Agriculture issues drought declarations and provides farmers and ranchers with disaster relief funding. According to USDA records, Champaign County has been included in several significant drought incidents.

Table 2-19: Champaign County Drought/Extreme Heat History

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Drought	2	0	0	0	0
Extreme Heat	0	0	0	0	0

One of Ohio's more significant droughts was the 1988-1989 North American Drought. This event was preceded by droughts in the Southeastern United States and California the year before. The 1988 was widespread and intense. It included heat waves that killed thousands of people and substantial livestock nationwide. One of the underlying causes of the drought was the nationwide use of marginally arable land for agriculture production and continued pumping of groundwater near the depletion mark. This major drought was catastrophic for the agriculture industry, destroying crops across the country. Water use restrictions were put in place across many jurisdictions. The drought continued to impact the Midwest and Northern Plains states during 1989 and was not declared over until 1990.

In the summer of 2012, Ohio was impacted by another severe drought, the 2012 North American Drought. This incident was an expansion of the 2010-2012 United States drought that began in the spring of 2012. Lack of snowfall in the United States caused very little melt water to absorb into the soil. The drought included most of the United States and all of Ohio. Champaign County, along with 84 other counties in the state, was designated with moderate drought conditions by mid-June of 2012. This drought has been compared to similar droughts in the 1930s and 1950s but did not last as long. The drought caused catastrophic economic ramifications. According to most measures, this drought exceeded the 1988-1989 North American Drought, which is the most recent comparable drought. On September 5, 2012, the USDA issued a disaster declaration for all counties in Ohio affected by the drought; Champaign County was included as a primary county.

The most recent drought to affect Ohio occurred in 2016. On January 6, 2017, the USDA issued a disaster declaration for drought conditions experienced from May through October 2016. The primary declaration was issued for five Ohio counties; ten contiguous counties were also included in the declaration. While Champaign County was not identified as a primary or contiguous county and did not experience complete drought conditions, the greater west central Ohio region was impacted by abnormally dry conditions.

2.2.3 Earthquake

An earthquake occurs when two of earth's plates move past one another beneath earth's surface. The location where the plates meet is called a fault. The shifting of the plates causes movement along the fault line. This movement can often be felt in areas surrounding the earthquake's epicenter and can cause damage ranging from insignificant to devastating. Damage caused by an earthquake can include rattling foundations, falling debris, and, in the most severe cases, toppling buildings, bridges, and culverts. The severity of earthquake movement is measured using the Modified Mercalli Index scale as defined in this chart:

Intensity	Shaking	Description/Damage
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on building upper floors.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Earthquake Risk Assessment

Ohio has experienced more than 120 earthquakes since 1776. While only a few of these events have caused structural damage, Ohio does have some earthquake risk, more than many people realize. West central Ohio is the region of the state with the highest earthquake risk. Because Champaign County is located in the west central Ohio, there is some earthquake risk in the county.

Earthquakes are geologically possibly but extremely rare in Champaign County. Earthquake is a countywide hazard and can affect all areas and jurisdictions. The county has experienced two very minor earthquakes in the past, as detailed in table 2-21 below. Neither of these incidents caused property damage. Therefore, there is little data to support committing extensive resources to earthquake-proofing buildings and other structures.

Because of the low risk and high cost of implementing earthquake mitigation strategies, the planning team did not identify any such actions. As they arrived at this decision, they considered historical earthquake damage data and HAZUS loss projections for a 5.0 magnitude earthquake with an epicenter in Urbana. Table 2-20 is the vulnerability analysis made available to the committee.

Table 2-20: Earthquake Scenario Vulnerability Analysis

Building Type	Number of Buildings	Exposure
Residential	2,047	$520,057,881
Non-Residential	1,246	$221,326,139
Critical Facilities	58	$10,302,500
Totals	*3,351*	*$751,686,521*

Local Earthquake History

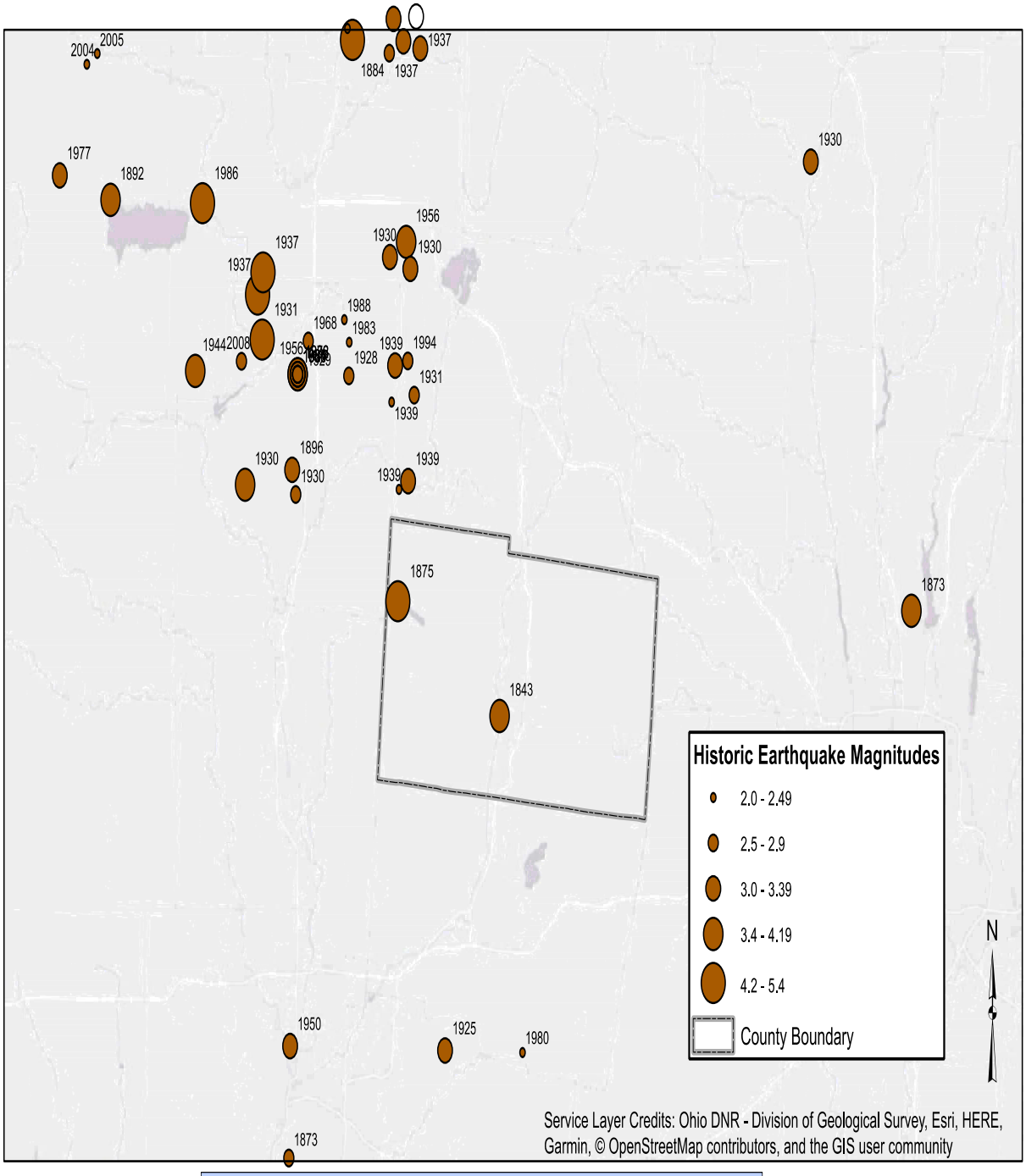
Records from the Ohio Department of Natural Resources indicate that Champaign County has experienced two earthquakes with epicenters in the county. These earthquakes were moderate in magnitude, ranging between 3.5 and 4.7 on the Richter scale. Both occurred in the late 1800s. There is no documented evidence of structural damage in the county. Shelby County to the northwest and Logan County to the north have both experienced several minor earthquakes, ranging in time from the late 1800s to the mid-1900s. Like the Champaign County incidents, these occurrences have been low in magnitude and caused no structural damage. Union, Madison, Clark and Miami Counties, the other adjacent counties, have no earthquake history.

Table 2-21: Champaign County Earthquake History

Date	Location	Magnitude	Modified Mercalli
6/18/1875	Adams Township	4.7	VII
6/19/1843	Urbana Township	3.5	IV

The following map provides locations for the incidents in table 2-21 and the surrounding region.

Map 2-4: Champaign County Earthquake Epicenters



The strongest earthquake recorded in Ohio occurred in Shelby County, adjacent to Champaign County's northwest border, in 1937 and was estimated to have a magnitude of 5.5 on the Richter Scale. This incident caused some damage in Anna and surrounding west central Ohio communities. The same area in Ohio also reported earthquake activity in 1875 and 1884. Residents in Anna also reported minor quakes in 1930 and 1931.

The Pomeroy area, southeast of Columbus, experienced an earthquake in 1926. All of these earthquakes caused only minor damage, primarily shaking buildings, crumbling mortar with limited or no property damage. Impacts were only felt locally; no statewide damages were reported.

2.2.4 Flood

According to the National Weather Service, a flood is defined as an overflow of water onto typically dry land. The inundation of a normally dry area is caused by rising water from a nearby waterway, such as a river, stream, or drainage ditch. Flooding generally occurs subsequent to a meteorological event such as substantial precipitation, rapid snowmelt, or extreme wind events along coastal waterways. This type of flooding, also known as riverine flooding can last days or weeks.

A flash flood is caused by heavy or excessive rainfall over a short period of time, typically less than six hours. These events are often characterized by raging torrents after heavy rains impact river beds, streets, or low-lying areas and can occur within minutes or hours of excessive rainfall. Flash flooding can also occur when the ground is too saturated, impervious, or flat to drain rainfall into waterways through storm sewers, ditches, creeks, and streams at the same rate as the precipitation falls.

Floods are the most common and costly disaster worldwide, resulting in significant loss of life and property. They have a substantial impact on infrastructure, including roadway breeches, bridge washouts, roadway wash away, and water-covered roadways. Fast-moving floodwater can wash away the surface and sub-surface of roads, creating holes, ruts, and other problems for vehicles. Floodwater that is one foot deep is strong enough to carry vehicles away, often with occupants inside. Rescuers are powerless against rapid, rising water because they are unable to exert enough strength to counteract the physics of moving water.

Floodwaters seek the path of least resistance as they travel to lower ground and will seep into and occupy any structure in their path. Basements and lower levels of buildings can become inundated with floodwater. Installing sandbags along the exterior of a building can be a temporary stopgap measure but, if floodwaters do not recede quickly, the force of the water will move through the sandbags and enter the structure.

The aftereffects of flooding can be just as damaging as the flood itself. Cleanup is often a long, protracted activity with its own set of hazards. Standing flood water can become contaminated with household and industrial chemicals, fuel, and other materials that have leaked into the

water. All floodwater is considered contaminated, either from germs and disease or hazardous materials. This creates a hazard for responders and residents throughout the cleanup phase.

Flood Risk Assessment

Flooding is considered a significant risk in Champaign County. This risk includes riverine flooding and flash flooding. The county's combination of flat and rolling terrain and the number of rivers, streams, creeks, and ditches contribute to the local flood risk. The county is located in two different watersheds: Great Miami River and Scioto River. The Great Miami watershed includes the central and western sections of the county. The east section falls in the Scioto River watershed. Flooding is a countywide hazard and can affect nearly all jurisdictions. Champaign County experiences a combination of riverine and flash flooding.

The soil types in Champaign County are mostly poorly drained soils that retain water for a period of time, and that are prone to surface drainage in the absence of engineered tiling systems. With heavy or hard rain, the soils can become hardened and water runs across the surface into swales and ditches. In the flatter areas, some swales and French drains have been installed to guide and direct wastewater to the creeks and ditches. Some roadways have ditches alongside the pavement to contain runoff from the roads. Some production land areas are tiled; these areas are the flatter and more productive soils that produce grain. The county has facilitated drainage in some areas by installing what is referred to as a "county tile" which is a drainage main that is maintained by the county engineer. Other more rolling areas that make up ditch-bottoms and waste land along waterways are grazing land for cattle and other livestock, and natural habitat due to the frequent flooding and standing water.

Flash flooding occurs in much the same way. There are many roads that are closed after heavy rain due to a low-lying bridge, or a winding turn in the road that is flooded over in one section or another. The water collects quickly in these areas as it runs across clay soils that harden and drain poorly. If ground is frozen or already saturated, this occurs very quickly. This can last for several days, impeding transportation and movement of goods and services within the county for an inconvenient length of time.

Flood damage in Champaign County could include damage and destruction of physical buildings, infrastructure, crops, and livestock. Residential structural damages could include single and multi-family homes, group living facilities, and multi-family housing complexes. Commercial and industrial structural damages could include buildings used for manufacturing, product handling, transportation, warehousing, retail, business, and industrial, and the capital equipment associated with those uses. Agricultural structures would include barns used for livestock, storage buildings, equipment, and machinery. Grain bins and elevator systems could be damaged very easily by the force of water. Government, nonprofit, and educational institutions include critical structures like fire stations, police stations, hospitals, offices, schools, and special facilities like garages and maintenance buildings, and the capital contents of those structures. This damage would result in large amounts of debris to manage, including finish, structural, and foundation materials. It is unlikely that loss of life would be attributed to

flooding. If a death were to occur, it would likely be the result of two or more combined threats, such as lightning, tornado, or driving into standing water.

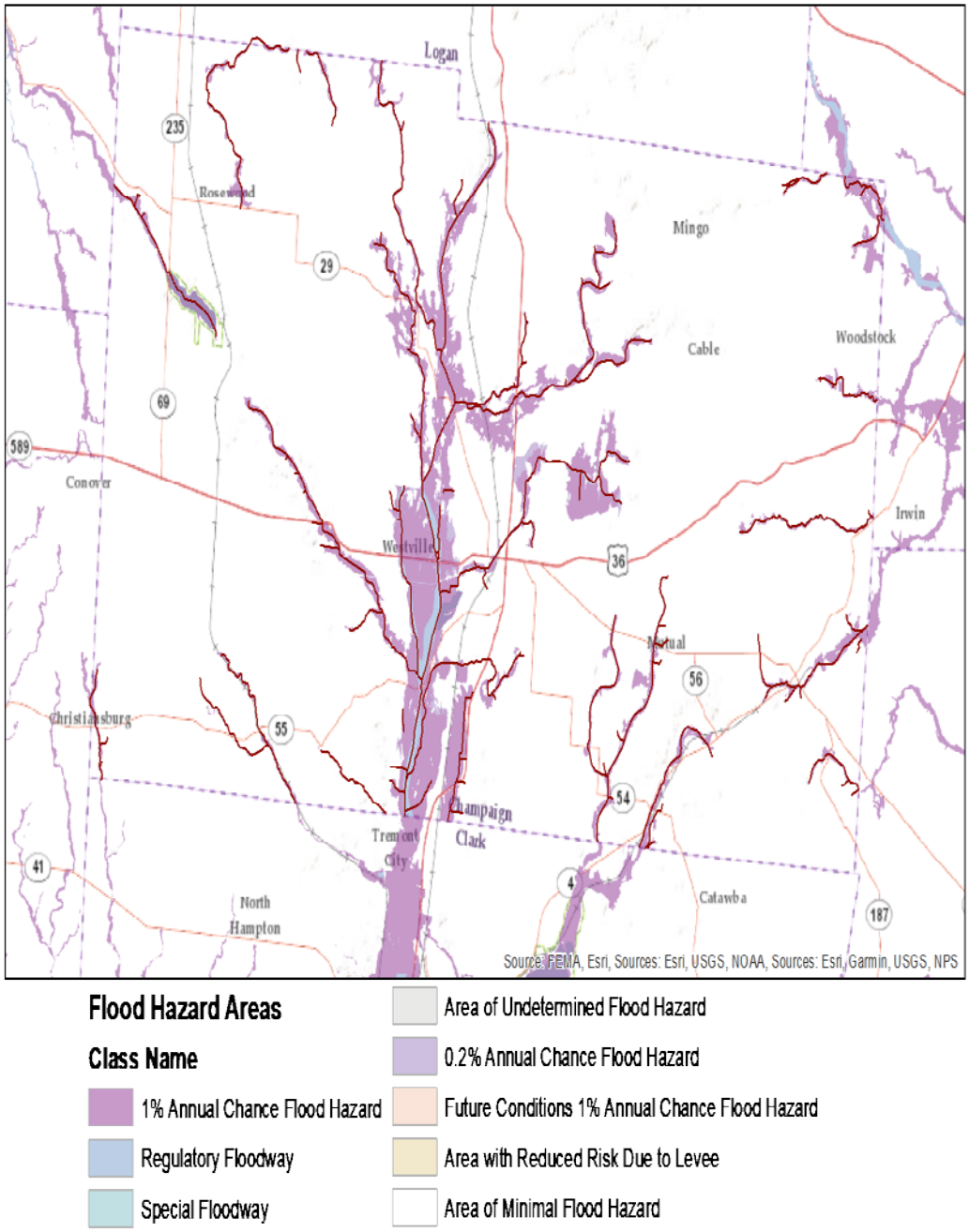
Table 2-22: 100-Year Flood Scenario Vulnerability Analysis

Building Type	Number of Buildings	Exposure
Residential	3,024	$796,846,000
Non-Residential	661	$174,826,000
Critical Facilities	85	$22,234,000
Totals	*3,769*	*$993,906,000*

Floodplain Mapping and National Flood Insurance Program

Champaign County's floodplain maps were updated in 2009 as part of FEMA's Map Modernization Program. The current floodplain maps became effective 11/18/2009. Map 2-5 below identifies floodplain areas in the county.

Map 2-5: Champaign County Floodplain



The table below provides information on participation in the National Flood Insurance Program for communities in Champaign County. The information is from FEMA's Community Status Book for Ohio. The communities listed participate in NFIP and are considered to be in good standing with the program. All communities except Woodstock participate in NFIP. Woodstock does not currently participate because it does not have any identified floodplain areas.

Table 2-23: NFIP Participating Communities

Community	Initial FHBM Identified	Initial FIRM Identified	Current Map Effective Date	Reg-Emer Date
Champaign County	12/23/77	04/03/85	11/18/09	04/03/85
Christiansburg	01/25/74	11/02/84	11/18/09 (M)	11/02/84 (M)
Mechanicsburg	02/01/74	09/01/86	11/18/09 (M)	09/01/86
Mutual	Unknown	11/18/09	(NSFHA)	05/13/83
North Lewisburg	04/05/74	12/07/84	11/18/09 (M)	12/07/84
St. Paris	06/07/74	11/18/09	(NSFHA)	05/29/79
Urbana	06/07/74	04/03/84	11/18/09	04/03/84

Repetitive and Severe Repetitive Loss Structures

Throughout Champaign County, there is only one known repetitive loss structure as of June 30, 2018. This structure is identified as a business-nonresidential building that has incurred three separate incidents. There are no severe repetitive loss properties that have been identified in Champaign County.

Table 2-24: Repetitive Loss Properties

Community	Properties	Losses	Building Payments	Contents Payments	Total Payments
Urbana	1	3	$56,204.61	0	$56,204.61

Local Flood History

Champaign County has experienced 23 floods and 9 flash floods since 1950., per NCDC records. Property damage from these incidents has been relatively low, limited to approximately $164,000.

Table 2-25: Champaign County Flood History

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Flood	23	$54K	0	0	0
Flash Flood	9	$108K	0	1	0

Champaign County has experienced multiple flooding events but the majority have caused little to no property damage. Of the 32 document incidents, 26 have caused less than $5,000 in property damage. One of the more damaging and costly floods occurred on June 1, 1997 when a system of thunderstorms moved across southern and central Ohio. These storms brought heavy precipitation onto ground that was already saturated, causing streams and creeks to overflow. The eastern part of Champaign County was the hardest hit. An apartment complex was evacuated in North Lewisburg and several roads were washed out. Flooded roadways were a problem across the county. In total, Champaign County received nearly 5 inches of rain in less than 24 hours and suffered $75,000 in property loss.

On January 4-5, 2005, a stationary front stalled across central Ohio and dropped heavy rain across the region for nearly 24 hours. Because the ground was already saturated from recent

snowmelt, the additional four inches of rain caused widespread flooding. The event caused more than $600,000 in damage across central Ohio. In Champaign County, property damage was limited to $20,000 but many roads were flooded.

2.2.5 Hazardous Materials Incident

A hazardous materials spill or release occurs when a hazardous substance breaches its container. The release can occur during operations at a fixed facility or during transportation of the substance, which can occur via ground or rail transport. Hazardous substances are stored in numerous types of containers, including drums, cans, jars, pipes, and other vessels. Some releases are incidental and can be safely cleaned up by on-site facility personnel. An incidental release does not threaten the health or safety of the immediate area or community because the spill involves only a small quantity. If the release involves a larger quantity than can be handled by facility personnel and requires action by first responders or agencies outside of the spiller's facility, the incident is considered an emergency response. To protect the community, evacuation from the facility or area surrounding the spill may be necessary.

Every hazardous substance is unique and can have toxic, flammable, explosive, and/or corrosive properties. Each material is assigned a class based on these properties; hazardous materials classifications are described in table 2-27 below. When a hazardous substance is released into the environment, it can negatively impact the safety and health of the community by contaminating the air, water, and/or ground.

Table 2-26: Hazardous Material Classifications

Class	Description
1	Explosives
2	Gases
3	Flammable liquids and combustible liquid
4	Flammable solid, spontaneously combustible, dangerous when wet
5	Oxidizer and organic peroxide
6	Poison (toxic) and poison inhalation hazard
7	Radioactive
8	Corrosive
9	Miscellaneous

Traffic accidents on roadways can cause the vehicles carrying hazardous substances to overturn, collide with other vehicles, or ignite and burn. The runoff caused by chemical spills, the vapors created as a chemical dissipates, or the burning of a substance can expose anyone in the immediate vicinity of the incident to extreme danger. Vehicular accidents compound the vulnerabilities of people and the environment to include both traumatic injury due to the crash or kinetics of the incident and the negative effects of absorbing the chemical that is released into the atmosphere.

Injuries from exposure to hazardous substances can involve direct contact with the substance and traumatic injuries from explosions or fires. Most hazardous materials releases involve the breech of a container or the unintended combining of chemicals. These spills and leaks can occur in businesses, homes, and industries or anywhere else that hazardous substances exist.

There is no unified reporting system for hazardous materials incidents. Industrial spills involving reportable quantities are documented in accordance with state and federal regulations. Smaller spills often go undocumented unless someone is hurt and requires medical attention. Large industrial spills and leaks are investigated by local hazardous materials teams, regulators, and government responders. Spills that occur on highways and railroads become known because local first responders and emergency management officials are involved in responding to the incident. Incidents of non-lethal exposure, such as a small chemical spill in a residence or a broken mercury thermometer, may not even be recognized as an emergency. Individuals do not always know the risks associates with these incidents so they clean up the spill as best they can without any additional reporting.

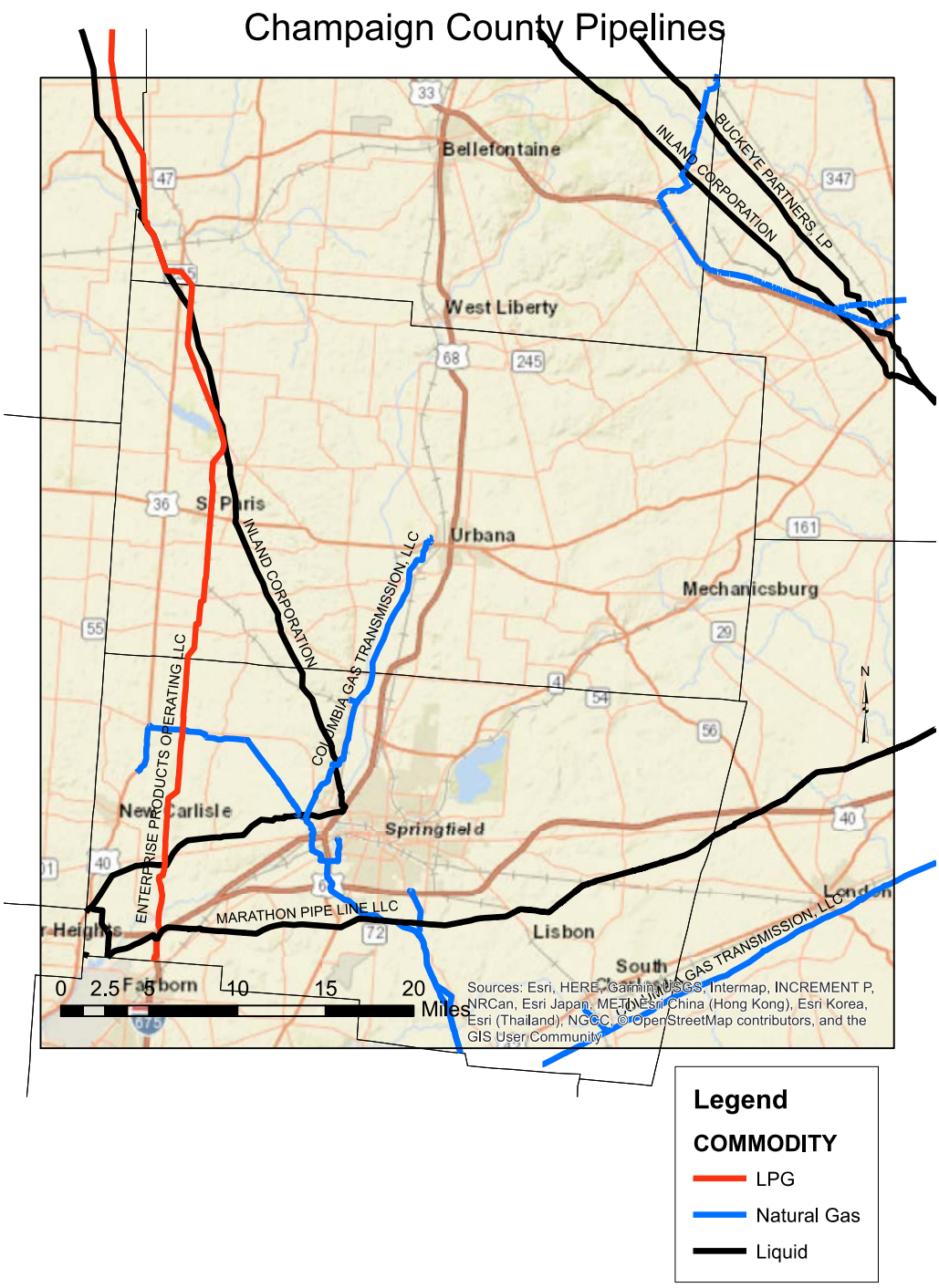
Hazardous Materials Incident Risk Assessment

Champaign County has a moderate risk for hazardous materials incidents. The county is home to numerous facilities that manufacture, utilize, and/or store hazardous substances. There are also numerous grain and livestock farms that use fertilizers, pesticides, and other agricultural chemicals in the course of production. Anhydrous ammonia and other agricultural chemicals are often transported across county and township roads, and occasionally on a state highway. Individual homes have substances to care for their property, including large lawns and lush landscaping. There are parks and recreational areas, as well as golf courses and other areas that boast of recreational use with well groomed and richly fertilized grass. Hazardous substances are transported on county roads and state highways. Populated jurisdictions along these highways and railroads are particularly vulnerable to hazardous materials incidents because of their proximity to the major transportation routes on which these substances are carried.

Pipelines are also present throughout Champaign County, particularly in the western portion of the county. Map 2-6 identifies the most significant pipelines in the county. These pipelines carry natural gas, petroleum products, and other substances. In the St. Paris area, there is a large natural gas storage facility. While it is believed that the pipelines and storage areas are well maintained, there is always a risk for an incident. First responders participate in training to prepare for these potential responses.

Because of the movement of hazardous materials on different types of transportation systems throughout the county, hazardous materials incidents are a countywide hazard and can affect all areas and jurisdictions.

Map 2-6: Champaign County Pipelines



Local Hazardous Materials Incident History

According to the Pipeline and Hazardous Materials Safety Administration (PHMSA), Champaign County has experienced 8 hazardous materials spills or releases on highways or rail between 1978 through April 2019. These incidents all occurred at a location with an Urbana zip code, likely because of the concentration of highways in central Champaign County. All incidents except one were associated with highway transportation by a commercial carrier. The substances being hauled were mostly petroleum-based products or anhydrous ammonia. Losses were minor, with a range from zero to $1,300 per incident. There were no deaths or injuries associated with the PHMSA data. Champaign County LEPC maintains additional records on hazardous materials spills in the county.

2.2.6 Invasive Species

An invasive species is a plant or animal species that is not native to the local ecosystem and whose introduction is likely to cause economic or environmental harm or harm to human life. Across the United States, more than 5,000 species are recognized as invasive. Invasive species are classified as terrestrial plants, terrestrial wildlife, insects and diseases, and aquatic species.

Invasive terrestrial plants can displace native species, impact the wildlife that rely on native species as a source of food or shelter, or form monoculture plant communities that reduce biodiversity. While more than 25% of the plant species in Ohio originate from other areas, most are not invasive; fewer than 100 species are actually considered invasive.

Invasive terrestrial wildlife is much less common than other types of invasive species but can still cause significant damage to natural habitats. Aquatic invasive species are plants and animals that impact the quality of waterways. These can affect large bodies of water, such as Lake Erie and the Ohio River, and much smaller rivers, lakes, and streams. Invasive insects and diseases are insects, fungus, and other small organisms that can negatively impact plants, forests, and the health of wildlife. Table 2-29 identifies the invasive species across these categories that have the greatest impact in Ohio.

Table 2-27: Invasive Species in Ohio

Species	Type
Asian Carp	Aquatic
Curlyleaf Pondweed	Aquatic
Hydrilla	Aquatic
Round Goby	Aquatic
Ruffe	Aquatic
Red Swamp Crayfish	Aquatic
Sea Lamprey	Aquatic
White Perch	Aquatic
Zebra Mussel	Aquatic
Asian Longhorned Beetle	Insects & Diseases
Emerald Ash Borer	Insects & Diseases
Gypsy Moth	Insects & Diseases
Hemlock Wooly Adelgid (HWA)	Insects & Diseases
Walnut Twig Beetle	Insects & Diseases
Japanese Honeysuckle	Terrestrial Plant
Japanese Knotweed	Terrestrial Plant
Autumn-Olive	Terrestrial Plant
Buckthorns	Terrestrial Plant
Purple Loosestrife	Terrestrial Plant
Common Reed or Phragmites	Terrestrial Plant
Reed Canary Grass	Terrestrial Plant
Garlic Mustard	Terrestrial Plant
Multiflora Rose	Terrestrial Plant
Bush Honeysuckles	Terrestrial Plant
Feral Pig	Terrestrial Wildlife

Invasive Species Risk Assessment

Like most counties in Ohio, Champaign County has many trees and wooded areas, all of which are vulnerable to damage from invasive species. When trees that are dead or weakened from invasive species fall, they become storm debris and can damage homes, buildings, vehicles, and anything else in their path. Diseases trees also fall into rivers, creeks, and streams, clogging the waterways and impeding drainage and increasing the county's vulnerability to flooding.

The most recent invasive species to impact Ohio, including Champaign County, is the Emerald Ash Borer. The county is equally vulnerable to damage caused by other tree-infecting insects. Waterways could also be impacted by invasive plant and animal species. An infestation of any type would cause damage across Champaign County, making invasive species a countywide hazard that can affect all areas and jurisdictions.

The cost to a community from invasive species is difficult to quantify because it comes from the long-term effects and cleanup costs rather than direct property damage. Actions like removing and disposing of diseased trees and vegetation, repairing damage caused by falling trees,

cleaning and dredging debris-filled waterways, and repairing infrastructure damaged by the infestation are all costs associated with invasive species. These tasks are extremely expensive and can cost jurisdictions hundreds of thousands of dollars.

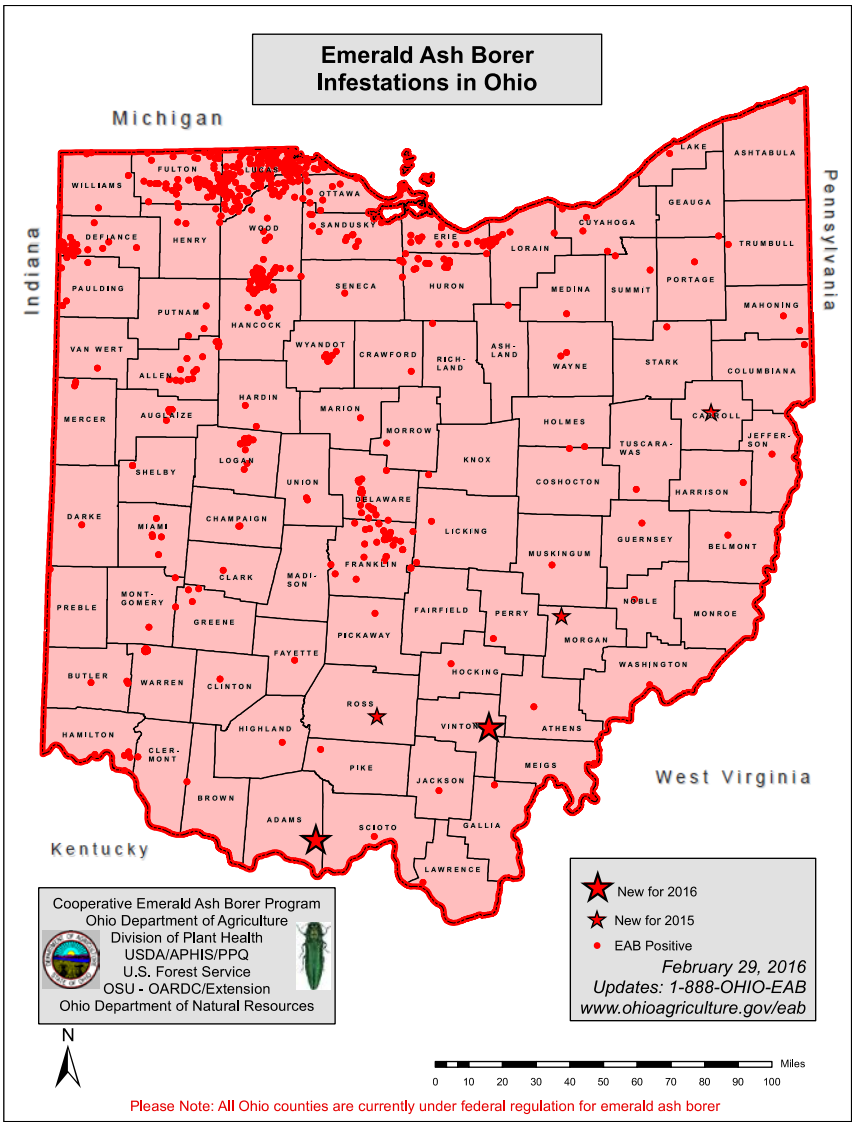
Local Invasive Species History

Emerald Ash Borer (EAB) is the most recent invasive species to impact Ohio, including Champaign County. EAB is an ash-tree killing insect native to Asia that kills trees within three to five years of infestation. It was first discovered in Ohio in 2003. To mitigate EAB impact, the Ohio Department of Agriculture and partner agencies worked to protect the state's 3.8 billion ash trees. Map 2-7 identifies EAB infestation areas in Ohio. Champaign County was not one of the most heavily affected areas of the state but was impacted by the infestation and statewide quarantine on ash wood. The quarantine was lifted in 2011, indicating that the worst of the infestation has passed. While the infestation threat has passed, most communities are still dealing with the thousands of dead and diseased trees that have not been removed. It will take individual property owners and communities thousands of dollars and years of time to remove these trees. From a disaster perspective, these weakened trees create an increased risk for property damage from high wind events. Dead and diseased trees are extremely susceptible to wind damage. Along waterways, diseased trees also increase flood risk as they fall into streams and impeded drainage.

Other invasive species that are currently under quarantine in parts of Ohio include the Gypsy Moth, Walnut Twig Beetle, and Asian Longhorned Beetle.

Across Champaign County, all jurisdictions have experienced significant effects from the EAB infestation. As diseased trees along rivers and streams have died, they have fallen into waterways, impacting drainage and the flow of water. Diseased trees along the public right-of-way have also impacted infrastructure, as they are more likely to fall during a storm or high wind event. The county engineer and municipal street and road departments have aggressively removed diseased trees along the public right-of-way. This has been effective at reducing the impact on utility lines and other infrastructure but has been a significant financial burden for jurisdictions. Public agencies are also not able to remove trees from private property. Individual landowners are responsible for removing dead and diseased trees from their personal property. Because this does not always occur, there are still hundreds of dead and diseased trees that will continue to cause problems across the county.

Map 2-7: Emerald Ash Borer Infestation Map



2.2.7 Land Subsidence

Land subsidence is the gradual or sudden sinking of the Earth's surface caused by subsurface movement of earth materials. Subsidence is an issue that develops over time. The primary causes are aquifer-system compaction, underground mining, drainage of organic soils, natural compaction, sinkholes, and thawing permafrost. Land subsidence affects more than 17,000 square miles across the United States, an area equivalent to the size of New Hampshire and Vermont. For more than 80% of this area, subsidence is the result of groundwater exploitation and overuse.

Karst is a specific type of topography that can contribute to land subsidence issues. While Champaign County has some known karst areas, few known problems have occurred. Karst is a landscape shaped by the dissolution of limestone or dolomite layers of bedrock. Surface water

percolates through these layers, slowly dissolving the limestone or dolomite and creating voids. The voids may be visible or invisible, depending on their depth. Visible voids can allow surface water to flow directly into the water table. Deeper voids are not visible at the surface. Over time, the water table can change, potentially destabilizing the deeper voids. Much of southwest Ohio features karst topography, as identified on the map below.

Map 2-8: Ohio Karst Areas

Land Subsidence Risk Assessment
Champaign County is located in an area identified as having some karst topography. Per the map above, the east and northwest areas of the county are identified as having Silurian and Devonian age carbonate bedrock overlain by more than 20 feet of glacial drift and/or alluvium. The southwest portion of the county is Interbedded Ordovician-age limestone and shale overlain by more than twenty feet of glacial drift and/or alluvium. From a risk perspective, this means that these areas are at slight risk to develop voids below the surface where soft rock has been washed away by the water table over thousands of years. This creates open areas that become unstable and result in shifting and moving, creating sink holes and settling where no apparent reason for it exists. Because of unseen voids and areas that seem to open up, direct openings into the aquifer can develop and result in a direct route for contaminants to enter the water source. Septic system contaminants and application of ground chemicals in these areas can leech into the aquifer through these openings and cause water quality problems.

Local Land Subsidence History
Planning team members do not report known incidents involving land subsidence. In Urbana, however, the northwest quadrant of the city is known to have a very high water table that is more susceptible to contamination than other areas of the county. There are no known cases of sink hole development or land deterioration in other areas of the county, including those identified as having karst characteristics on current ODNR maps.

Because identification of unstable karst formations is expensive and time-consuming, the Ohio Department of Natural Resources Division of Geological Surveys has not fully mapped all areas. Because of this, Champaign County is not fully aware of the extent of their land subsidence risk. More risk assessment will continue in the future as the Ohio Department of Natural Resources and the Miami River Watershed Conservancy District to develop projects and preserve natural resources. This mapping falls under the umbrella of ODNR.

2.2.8 Power Outage
While electrical system failures can occur because of a disaster or storm, breakdown of this critical utility can also occur independent of another hazard. When this happens, it is often the result of system overload or lack of improvements, updates, and maintenance to the system's infrastructure. Residents and businesses rely on electricity to support basic daily functions. When the system fails or service is interrupted, the effects are felt immediately. Populations with special needs, including children, the elderly, and those with serious medical conditions, suffer the most during electrical system failures.

Power failures do not generally cause significant structural damage. The greatest risk for physical damage is from broken distribution lines, poles, and substations. The most significant impact is the hardship for the people and businesses affected by the outage, including the potential economic impact. If businesses are unable to operate for several days or longer until power is restored, the negative effect would quickly ripple across the community. Power outages are a countywide hazard and can affect all areas and jurisdictions.

Local Power Outage History

The most significant utility failures to impact Champaign County were the direct result of natural disasters. In September 2008, the county was impacted by a major power outage. As the sub-tropical remnants of Hurricane Ike traveled north from the Gulf of Mexico, heavy winds affected significant portions of the Midwest. In Ohio, the sustained 75 mph winds caused an estimated 2.6 million power outages. While some outages were brief, more than 300,000 people were without power for more than a week. Businesses were shut down, leading to significant economic loss.

On June 29, 2012, the area again experienced power outages as the result of a major storm system when a derecho moved across the Midwest and Mid-Atlantic states. This massive storm system caused power outages across two-thirds of Ohio; more than one million people were without power, some as long as five days.

2.2.9 Severe Thunderstorm

A thunderstorm is a local storm produced by a cumulonimbus cloud accompanied by a combination of thunder, lightning, and hail. Lightning is a brief, naturally occurring electrical discharge that occurs between a cloud and the ground. Hail is frozen rain pellets that can damage buildings, vehicles, and other structures as they fall. Hail forms in the higher clouds and accumulates size as it falls as precipitation. If temperatures close to the ground are warm, the hail can partially melt or become freezing rain. Most thunderstorms include heavy precipitation and wind. These storms can produce hail, lightning, flash floods, tornadoes, and damaging winds that pose significant risk to people and property in the area. A thunderstorm that produces a tornado, winds of 58 mph or greater, and/or hail with a diameter of at least 1”, is considered a severe thunderstorm. These storms typically develop as part of a larger storm front and are preceded and followed by regular thunderstorms.

Severe Thunderstorm Risk Assessment

Thunderstorms occur frequently in Champaign County, especially during the spring and summer. In these months, heat warms the atmosphere throughout the day, creating an atmosphere ripe for thunderstorms with hail, lightning, heavy rain and wind. Microbursts often include strong straight-line winds that can damage or destroy standing crops and develop quickly with little warning. Most thunderstorms include heavy precipitation, wind, and thunder. Hail and lightning are possible but are less frequent. Thunderstorms are a countywide hazard and can affect all areas and jurisdictions. These storms range from minor to severe, although the most are minor or moderate. Thunderstorms are relatively frequent but generally result in limited property damage.

Even minor thunderstorms can damage property and infrastructure. Hail typically damages vehicles, roofs, and siding although injuries or loss of life are rare. Thunderstorm winds can damage standing crops, especially those at a vulnerable growth stage. Damage to crops can drastically reduce yields, causing significant or even extreme loss to farmers for that year’s crop.

Table 2-28 describes the overall vulnerability of countywide property to worst case severe thunderstorm damage, including hail, wind, heavy precipitation and lightning. The HAZUS analysis property values for flood were used as the basis, maintaining consistency from one hazard vulnerability description to another, and damage estimates were calculated at a 25% damage factor as a worst-plausible case scenario for widespread severe thunderstorm damage. This 25% was based upon comparative data between flood and severe thunderstorm loss statistics from a variety of past incidents. The HAZUS MH Loss Estimator calculation tool was used to develop this table.

Table 2-28: Thunderstorm Scenario Vulnerability Analysis

Building Type	Number of Buildings	Exposure
Residential	756	$199,211,000
Non-Residential	168	$44,455,000
Critical Facilities	21	$5,557,000
Totals	*945*	*$249,223,000*

Local Severe Thunderstorm History

Thunderstorms are a frequent hazard in Champaign County. According to NCDC records, the county has experienced more than 195 incidents since 1950. While thunderstorm occurrences are minor and cause little or no damage, a few have caused considerable property damage. Collectively, thunderstorm incidents have caused nearly $1,000,000 in property damage.

Table 2-29: Champaign County Severe Thunderstorm History

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Thunderstorm Wind	137	$914K	0	0	1
Hail	57	$38K	0	0	0
Lightning	1	0	0	0	3

While thunderstorms are common in Champaign County and rarely cause significant damage, there are exceptions. One of the more damaging thunderstorm events to impact the county occurred on June 29, 2012. A very large and unstable air mass produced a derecho in northern Illinois. This super-size thunderstorm moved across Illinois, Indiana, and through central Ohio. The storm produced extreme winds, hail. and rain and caused widespread damage and power outages. In some areas of Ohio, power outages lasted nearly two weeks. In Champaign County, significant tree damage occurred, causing power outages and damage to some homes and buildings. In total, the county experienced $137,000 in property loss. Across the state, damage totals reached more than $1,5000,000.

On August 7, 2011, another severe thunderstorm caused significant damage in the county. A cluster of severe thunderstorms moved into Ohio from Indiana in the late afternoon. The storm system produced high winds and precipitation that damages trees and power lines. A mobile home in the Northville are as destroyed, as were multiple trailers and vehicles. Damage from the incident totaled $70,000.

2.2.10 Tornado

A tornado is an intense, rotating column of air that protrudes from a cumulonimbus cloud in the shape of a funnel or rope whose circulation is present on the ground. If the column of air does not touch the ground, it is referred to as a funnel cloud. This column of air circulates around an area of intense low pressure, almost always in a counterclockwise direction. Tornadoes usually range from 300 to 2,000 feet wide and form ahead of advancing cold fronts. They tend to move from southwest to northeast because they are most often driven by southwest winds.

A tornado's life progresses through several stages: dust-whirl, organizing, mature, shrinking, and decay. Once in the mature stage, the tornado generally stays in contact with the ground for the duration of its life cycle. When a single storm system produces more than one distinct funnel clouds, it is referred to as a tornado family or outbreak.

Tornado magnitude is measured using the Enhanced Fujita scale, abbreviated as EF. The ratings range from EF-0 to EF-5 and are based on wind speeds and related damage. The Enhanced Fujita Scale has been used as the official tornado rating scale since 2007. The following table is provided by FEMA and indicates the type of damages typically caused by a tornado according to the Enhanced Fujita Scale.

EF-Scale	Wind Speed	Typical Damage
0	65 – 85 mph	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over,
1	86 – 110 mph	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	111 – 135 mph	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
3	136 – 165 mph	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
4	166 – 200 mph	Devastating damage. Whole frame and well-constructed houses completely leveled; cars thrown and small missiles generated.
5	>200 mph	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters; high-rise buildings have significant structural damage; incredible phenomena will occur
No rating		Inconceivable damage. Should a tornado with the maximum wind speed in excess of EF-5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. Will create serious secondary damage on structures.

Tornadoes are the most damaging of all atmospheric phenomena. While their frequency is low, the probability of significant damage is high. Because tornadoes occur as part of a storm

system, they rarely occur as independent incidents. Emerging out of a storm front or super cell, the tornado can be extremely damaging, especially when accompanied by heavy rain, straight-line wind, lightning, and hail. Effects of a tornado include uprooted trees, damaged or destroyed buildings, and smashed vehicles. Twisting and flying debris turns into projectile weapons, which can cause injuries and fatalities.

Tornado Risk Assessment

Unlike in the Great Plains states, tornadoes in Ohio are typically narrow and do not reach width of the mega-tornadoes frequent in other parts of the country. Locally, tornadoes are generally 25-500 yards wide and stay on the ground for a few miles. Ohio ranks among the top twenty states in injuries, fatalities, and property damage from tornado events. Tornadoes are not a frequent occurrence in Champaign County but their severity and impact can be substantial. The magnitude of past tornadoes has ranged from F/EF0 to F/EF3; two of the county's five incidents have been classified as F/EF-2. Tornadoes are a countywide hazard and can affect all areas and jurisdictions.

Most residential buildings in the county are constructed from wood, concrete, brick, and stone. Older homes are typically constructed using limestone and other masonry materials and built on traditional foundations with basements or crawl spaces. Newer residential construction is frequently built on concrete slabs without basements or crawl spaces. These homes are most prone to superficial damage, roof damage, and falling trees during tornadoes and severe windstorms. Mobile homes are more vulnerable to wind damage because they are less secured to the ground than buildings with foundations, are lighter weight, and constructed of less wind-resistant material than traditionally built homes.

Property damage from tornadoes can include damaged roofs, gutters, downspouts, and trees. Outbuildings, barns, and storage buildings are at risk for damage because these structures are less resistant to wind damage and are frequently built on concrete slabs or dirt foundations.

Table 2-30 describes the overall vulnerability of countywide property to worst case tornado damage. The HAZUS analysis property values for flood were used as the valuation basis, maintaining consistency from one hazard vulnerability description to another, and damage estimates were calculated at a 10% damage factor as a worst-plausible case scenario for tornado damage that historically hits isolated and sporadic areas. This 10% was based upon comparative data between flood and tornado loss statistics from a variety of past incidents. The HAZUS MH Loss Estimator calculation tool was used to develop this table.

Table 2-30: Tornado Scenario Vulnerability Analysis

Building Type	Number of Buildings	Exposure
Residential	302	$79,684,000
Non-Residential	67	$17,782,000
Critical Facilities	24	$6,520,000
Totals	*394*	*$6,520,000*

Local Tornado History

Champaign County has experienced 5 tornados according to NCDC records. Most of these have resulted in limited property damage although they have rated high on the Enhanced Fujita scale. The map below identifies the location of tornado incidents in Champaign County.

Map 2-9: Tornado History

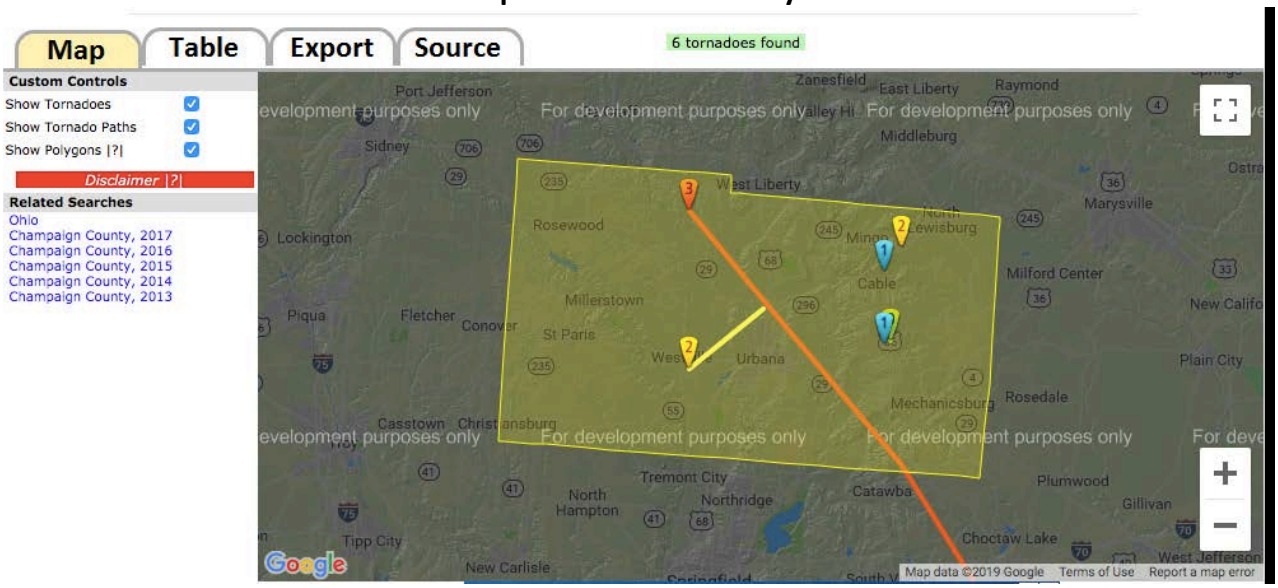


Table 2-31: Champaign County Tornado History

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Tornado	5	$592K	0	0	4

Of the five tornadoes in Champaign County's history, two have caused significant damage. On June 13, 1958, a tornado originated in Mad River Township and moved northeast of Urbana, leaving a 5-mile path of damage. The tornado was classified as F2 on the Fujita scale and caused $250,000 in property damage. On April 9, 1999, the county was hit by a F1 tornado in the northeast section of the county. The storm damaged multiple houses and mobile homes and downed trees. Total property damage was $300,000.

2.2.11 Water Quality Emergency

Water quality refers to the chemical, physical, biological, and radiological characteristics of water. It is a measure of the water relative to the requirements of one or more biotic species and human need or purpose. A water quality emergency occurs when the quality of water available for human consumption is compromised. In recent years, water quality has become a growing concern in northwest Ohio as Lake Erie and its associated rivers and streams have been affected. Other areas of the state have also experienced water quality issues in inland lakes and reservoirs, making water quality a growing concern statewide. Algal blooms are one of the more common causes of water quality issues. Algal blooms occur when colonies of algae grow

out of control and produce toxic harmful effects on people and animals. In Lake Erie, high phosphorous levels caused by runoff are considered a contributing factor to these harmful algal blooms. Some algal blooms produce microcystin, which is a poisonous bacterium that can sicken or kill people, fish, birds, and other animals. When microcystin or other toxins infiltrate a public water supply, the water becomes contaminated and unsafe for consumption. These incidents can have a drastic human and economic toll on the affected area.
In addition to harmful algal bloom risk, water treatment and distribution systems are susceptible to infrastructure failure. This can include anything from long-term lack of repair, maintenance and/or upgrade to contamination from lead pipes and other substances.

Water Quality Emergency Risk Assessment
Because a water quality emergency can occur in any source body of water or water treatment facility, water quality is a countywide hazard that can affect all areas and jurisdictions. When water quality is compromised, risks to the community include public health and the economy. From a public health perspective, contaminated water can cause serious illness when consumed. Persons with special medical needs, compromised immune systems, the elderly, and children are most susceptible to this. Animals, including family pets and livestock, are also susceptible to illness from contaminated water. If the water supply is contaminated, residents lose access to drinking water in their homes and restaurants, grocery stores, and businesses that use water in their regular operations are forced to close until water service is restored. Retail and service businesses may be affected if the public travels to other communities for shopping and food service needs during the emergency. This revenue loss, even if only for a short duration, can have a significant economic impact. Businesses lose critical revenue which quickly leads to reduced wages for employees. The longer the emergency lasts, the more significant the economic impact. Any compromise in the water supply also affects the public's trust of government officials. If the public is concerned about the safety of their water and doesn't feel local officials are being transparent and fully communicating about the issue, they may question the information provided by local officials.

To protect the community's water supply, jurisdictions must continually monitor, repair, and upgrade water treatment infrastructure. Because this is costly, jurisdictions must plan and budget for it. If the infrastructure is not well maintained and emergency work must be completed when a water quality emergency occurs, the economic cost is higher than if work is completed as part of ongoing maintenance and upgrades. In addition to the direct economic loss resulting from the emergency, the jurisdiction must immediately identify funds to make the repairs. These costs are often recouped through increases in the fees charged to consumers, ultimately costing residents more money through increases to water rates, user fees, and local taxes.

Local Water Quality Emergency History
The most significant water quality emergency in Ohio occurred on August 3, 2014.This incident did not directly impact Champaign County but garnered national attention and forced municipalities statewide to consider the impact a similar situation would have on their community. In the early morning hours of August 3, the water treatment plant for the city of

Toledo, northwest of Champaign County, detected microcystin from a toxic algal bloom in their water supply and declared the water unsafe to drink. The Toledo water system supplies municipal water to approximately 400,000 people in the northwest Ohio region. Local emergency management and government officials scrambled to provide drinking water to the affected communities. Within hours, stores across the region sold out of bottled water as residents scrambled to purchase critical water supplies. Restaurants and food service businesses were forced to close until safe water could be provided and hospitals experienced a surge of patients who believed they were ill from consuming contaminated water. Within three days, Toledo's water was declared safe to drink but the economic and political ramifications lasted much longer. Five years later, the city is still determining how to fund critical improvements to their water treatment infrastructure and the municipalities who purchase water from Toledo are exploring alternate water sources.

Champaign County has not experienced a water crisis to this extent but municipalities do have concerns about their water supply. Inland lakes and reservoirs in other areas of the state have experienced toxic algal blooms and other water quality issues. Across Ohio, research is underway to determine the root cause of the increase in toxic algal blooms and identify actions that can be taken to reduce their occurrence.

2.2.12 Windstorm

A windstorm is a weather event with very strong winds but little to no precipitation. Wind speed in this type of event typically reaches at least 34 mph but can be any speed that causes light or greater damage to trees and buildings. Damage can be caused by gusts, which are short bursts of high-speed wind, or longer periods of sustained wind.

A derecho is a widespread, long-lived windstorm. It is often associated with bands of rapidly moving thunderstorms. This type of storm can produce damaging straight-line winds over extremely large areas, sometimes spanning hundreds of miles. To be classified as a derecho, the storm must produce damage over at least 250 miles, have wind gusts of at least 58 mph across most of the storm's length, and multiple gusts of 75 mph or greater. The destruction produced by a derecho can be very similar to that of a tornado. However, the damage from this type of storm generally occurs in one direction along a straight path.

Windstorm Risk Assessment

The slightly rolling topography of west central Ohio is vulnerable to damage from high wind incidents, making windstorms are a countywide hazard that can affect all areas and jurisdictions. Most severe wind events are part of larger storm systems that typically include heavy rain, hail, ice, snow, or thunderstorms. Extreme winds can also occur independent of other hazards.

The most frequent damage from windstorms is downed trees, which can cause power outages and obstruct roadways. Damage to agriculture industry during the growing season when fields

are planted is also a risk. High winds can damage crops and reduce yields, which has a negative effect on the county's economy.

Table 2-30 describes the overall vulnerability of countywide property to worst case wind storm damage. The HAZUS analysis property values for flood were used as the valuation basis, maintaining consistency from one hazard vulnerability description to another, and damage estimates were calculated at a 2% damage factor as a worst-plausible case scenario for wind damage that historically hits very isolated and sporadic structures. This 2% was based upon comparative data between flood and wind loss statistics from a variety of past incidents. This vulnerability does not take in account multi-hazard damage from storms that combine wind with precipitation, tornadoes, ice, or heavy snow. The HAZUS MH Loss Estimator calculation tool was used to develop this table.

Table 2-32: Wind Storm Scenario Vulnerability Analysis

Building Type	Number of Buildings	Exposure
Residential	605	$159,369,000
Non-Residential	134	$35,554,000
Critical Facilities	17	$4,428,000
Totals	*756*	*$199,351,000*

Local Windstorm History

Champaign County has experienced 9 high wind incidents since 1950, according to NCDC records. Of these incidents, only one caused significant damage.

Table 2-33: Champaign County Windstorm History

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
High Wind	9	$4.75M	0	0	0

The most severe windstorm in the county's history occurred on September 14, 2008 when the remnants of Hurricane Ike moved across Ohio. Damage across Ohio exceeded $500,000,000. In Champaign County, sustained winds of 40-50 mph and gusts of 60 mph caused extensive damage to tree and utility poles, leading to widespread multi-day power outages. Because the incident occurred as crops were ready for harvest, agricultural losses were significant. According to most estimates, corn and soy bean yields were reduced by at least 3-5% as a result of the storm. Statewide, losses from the event exceeded $581,300,000. In Champaign County property loss was estimated to be $4,700,000.

2.2.13 Winter Storm

A winter storm is a weather event that includes several winter weather hazards and can develop anytime between late fall and early spring. These storms can include any combination of extremely cold temperatures, wind, snowfall, sleet, ice, rain, or freezing rain. These severe winter storms are frequent in Ohio but the specific components of each storm depend on the weather conditions at the time. Winter temperatures can be mild and relatively warm (above

freezing), or they can fall below zero and stay there for several days. A winter season may include several fluctuations between cold and warm spells or be relatively constant.

A blizzard is a specific type of winter storm characterized by sustained winds or frequent gusts of 35 mph or greater and falling or blowing snow that reduces visibility to less than ¼ mile; both of these conditions must be present for at least three hours to be considered a blizzard.

A non-blizzard version of a severe winter storm often begins with warmer air followed by very cold temperatures and heavy precipitation. An initial blast of warm air can cause temperatures to hover at the freezing point as precipitation falls, causing ¼ "to ½" ice (or more) to form on roads, trees, electrical lines, gutters and roofs, and vegetation. The precipitation starts out as freezing rain and/or sleet and, as the temperatures drop, turns to snow that adheres to the ice and forms heavy clumps that bring down power lines and trees. As the storm system moves through and winds kick up, temperatures drop and the heavy falling snow drifts across roads, ice damages trees and buildings, and road conditions becomes treacherous. This type of storm can drop several inches of heavy, wet snow across the county.

Another type of severe winter storm that can affect northwest Ohio begins with extremely cold weather (below 10 degrees Fahrenheit) and heavy snowfall, high winds, and extreme cold. A severe storm of this nature would likely pack sustained winds of 15-25 miles per hour, over ten inches of snow, and temperatures below ten degrees Fahrenheit for more than 24 hours. This kind of storm can easily dump a foot or more of snow on Champaign County and disrupt daily activities for several days. Because the ice is not part of this kind of storm, damages are generally less as power lines are not destroyed and structural damage is not severe. However, the amount of snow is challenging in light of the extreme low temperatures. The snow tends to be fluffy and creates deep snowdrifts and blocks roads.

Ice storms are another type of winter storm event that can impact the area. An ice storm occurs when damaging ice accumulations occur during freezing rain situations. The accumulated ice can cause trees and utility lines to come down, resulting in loss of utilities and communications systems. As ice accumulates on roadways, travel also becomes dangerous. A significant ice accumulation is considered anything ¼ "or more.

Winter Storm Risk Assessment

Severe winter weather is a risk across all of Ohio. Winter storms range from short, mild bursts of snow and ice to multi-day events incidents with significant snowfall. In Champaign County, winter storms are a countywide hazard and can affect all areas and jurisdictions.

Winter storms often include multiple hazards, such as ice and snow. Ice accumulates as temperatures fall then turns to snow, creating a dangerous layer of snow-covered ice, increasing the potential for vehicular accidents. Road crews work continuously to clear roadways. Occasionally, ice storms occur independent of other winter weather hazards. Although rare, when this occurs it can have a significant negative effect on the community. Power outages are a frequent outcome of ice storms when precipitation accumulates on trees

and power lines causing them to break. Extremely cold temperatures can also occur without other accompanying winter weather hazards, although this is infrequent. These incidents are typically very short, lasting only a day or two, and are an inconvenience to residents and businesses more than the direct cause of property loss.

Across the county, the greatest risk from winter storms is the loss of utilities. Power outages can occur during ice storms or winter storms that include significant wind or snowfall. Because most electric lines are above ground, they are vulnerable to damage from wind and ice. While many electric providers have improved their distribution systems in recent years and new construction generally includes underground utilities, the main transmission lines are still above ground and vulnerable to weather-related damage. In spite of this, power outages are infrequent and generally not widespread outside of an extreme ice event.

Anticipated losses from winter storms include content loss, such as food and perishables due to power interruptions, and minor economic loss due to short-term business closures. Except for the extreme but rare blizzard, loss of residential and commercial structures or infrastructure is not expected. Most winter storms are a short-term inconvenience that make residents uncomfortable but last for a few hours up to several days. Casualties are extremely rare, with the exception of traffic accidents resulting from dangerous road conditions.

Table 2-30 describes the overall vulnerability of countywide property to worst case winter storm damage. The HAZUS analysis property values for flood were used as the valuation basis, maintaining consistency from one hazard vulnerability description to another, and damage estimates were calculated at a 2% damage factor as a worst-plausible case scenario for tornado damage that historically hits isolated and sporadic areas. This 2% was based upon comparative data between flood and tornado loss statistics from a variety of past incidents. The HAZUS MH Loss Estimator calculation tool was used to develop this table.

Table 2-34: Winter Storm Scenario Vulnerability Analysis

Building Type	Number of Buildings	Exposure
Residential	60	$15,936,000
Non-Residential	13	$3,556,000
Critical Facilities	2	$443,000
Totals	*76*	*$19,935,000*

Local Winter Storm History

Champaign County has experienced 30 winter storm-related incidents since 1950, according to records maintained by NCDC. These incidents caused limited property damage and no loss of life.

Table 2-35: Champaign County Winter Storm History

Hazard	Incidents	Property Loss	Crop Loss	Deaths	Injuries
Blizzard	1	0	0	0	0
Extreme Cold/Wind Chill	1	0	0	0	0
Ice Storm	7	0	0	0	0
Winter Storm	21	$525K	0	0	0

In Ohio, the most significant historical winter weather event is the Blizzard of 1978. On January 26, 1978, two low-pressure systems combined over Ohio to produce record-breaking snowfall, winds of up to 70 mph, and extremely low temperatures. Most areas received fifteen inches of snow or more, in addition to the significant accumulation already on the ground. High winds caused severe blowing and drifting, making roads impassable and burying buildings and vehicles. Across the county, many roads were blocked for almost a week, forcing schools and businesses to close. Statewide, 50 people lost their lives and damages exceeded $100,000,000. To date, this remains one of the most significant winter weather events in Champaign County history.

Another significant winter storm incident occurred on January 6, 1996, also known as the Blizzard of 1996. A massive winter storm produced nearly 14 inches of snowfall across southwest and central Ohio. Wind gusts of 50 mph caused whiteout conditions over a 24-hour period. Some structures suffered roof collapses from the weight of accumulated snowfall. In Champaign County, property loss was $500,000.

2.3 VULNERABILITY ASSESSMENT

The Vulnerability Assessment addresses each jurisdiction's vulnerability to the identified hazards.

2.3.3 Countywide Vulnerability

Champaign County mitigation planning participants identified the risks associated with severe storms as the county's biggest threat. This group of high-rated hazards includes severe thunderstorms, power outages, windstorms, tornadoes, and winter storms. These incidents can disrupt daily activities, damage property, and cause significant loss of revenue and income. As a small rural county, the damages can be significant but there the likelihood of receiving outside financial recovery assistance is limited because the total number of structures destroyed is not likely to be high. That places extensive recurring cost of repairs and replacement on individuals, families, and small businesses. Flooding was rated sixth, closely following the severe weather incidents. Although flooding was ranked lower, the damages caused by heavy precipitation often occurs during those severe weather events. It can be difficult to separate the hazards because they often occur simultaneously and increase damages.

These storms can develop suddenly, and frequently there is little warning time before damaging cells cross the county. Champaign County weather in the spring and fall can change drastically, sometimes within the same day, and this facilitates the development of severe storms. Most of these severe storms include high wind, heavy rain, and sometimes hail. On occasion they develop into high-powered cells that include rotating tornadoes and strong straight-line winds. Because tornadoes in Ohio generally have a relatively narrow pathway, part of the county can easily be affected by a tornado while the rest of the county gets just heavy rain and wind, or straight-line wind damage. In the more severe cases, damages spread consistently through the county; in other more concentrated storms, damages can be confined to one part of the county or another. Trees are downed, structures are damaged, grain operations and other outdoor equipment facilities are destroyed, and there could be an excessive amount of tree debris strewn across the county. Crop damage could be extensive, especially when hail occurs. Hail is a major risk to corn and other crops and can easily destroy entire fields. If corn is flattened by wind or hail, there is little that can be done to restore it and the farmer can suffer significantly reduced yields, and therefore income, from even a brief severe storm. There is deep concern over mobile homes in the county and their easy destruction by high wind.

The ranking of the storms related mostly to frequency. Because severe thunderstorms happen most often, they ranked first. Windstorms are more frequent than tornadoes, so they ranked third and tornado was fourth.

Damages from these storms include flash flooding of streets, highways and rural roads. In a gently rolling topography, the low-lying areas flood first. Intense rain, or rain that totals two to three inches in a day or two can cause significant road flooding. If the storm comes in the spring when the ground is frozen, the flooding can be severe because the water cannot percolate into the soils and all becomes surface runoff, flooding fields, roads, and even basements and

driveways to homes. When temperatures rise and precipitation is combined with snow and ice melt, the rivers overflow, the creeks and streams far out-reach their banks, and flooding is widespread. People lose the use of their property, farmers cannot easily feed pastured livestock, and roads are closed. When flooding is extensive, the county struggles to be able to mark all the closed and flooded roadways due to not having enough signage.

These severe storms and heavy precipitation can cause damage to buildings, including roof, siding, and window breakage and flooding of lower floors and basements. Storm water that is unable to drain naturally ends up in basements, under the foundation of mobile homes, and even seeps through foundations and washes away the supporting soils around buildings. Roadways deteriorate under the constant water, and berms become drainage pathways for pavement runoff. This eventually affects the pavement itself, causing edge deterioration, potholes, and cracks in the surface of the roads.

Flooding is a concern in some areas; in some locations, basements can fill with water, destroying appliances, furnaces, other mechanical systems, and possessions. Crop debris clogs sewers and makes water drain poorly. Cemeteries are strewn full of crop and lawn fodder and have to be cleaned up. Some houses have no recourse, and suffer loss of use, damage to foundations, and destruction of all contents. Debris in yards, on roadways, and simply cluttering and clogging everything is common once floodwaters recede.

There are many areas in the county that are tiled, at least to some extent, which helps facilitate drainage. Much of the tile, especially those referred to as “county tiles” are old and of clay composition. Over the years, the constant wear and tear on the tiles due to excessive drainage and heavy equipment driving over them has deteriorated the condition of the tiles. The broken tiles do not carry water away and ponding results as the water drains gravitationally instead. There are several locations where railroad track s and underpasses have tile that is old and undersized, and this causes back up of water. Although the county engineer has replaced culverts and bridges with upsized structures, the broken tiles diminish the effectiveness in some areas.

There are only 21 miles of ditch on county maintenance so property owners are responsible for maintaining many ditches and streams. This leads to inconsistency in the maintenance both in quality and methods, and an inconsistent monitoring of damage due to heavy precipitation or rapid flow of water. Some owners don’t have the capability to maintain the ditch that flows through their property, so it gets clogged with debris and obstructions., and backs up regularly into yards and basements. Others maintain their ditches very well and do not have many flooding problems. In some areas the county has installed tiles many years ago to facilitate this drainage, and the tiles that lead to the ditches are old, cracked and collapsed. Sometimes these tiles cause more water back up into surface ponds than they prevent due to deterioration.

It is suspected that there are areas where heavy rain flow through the waterways is causing a deterioration and erosion of the ditch banks that is not yet noticed or is not considered a problem by property owners until it is bad enough to impinge upon the lawns and areas of the

property that is used on a regular basis. The unfortunate part of this kind of damage is that it goes unnoticed and unchecked for years, and when it finally is identified, the damage is extensive and difficult to repair.

There are no storm sewer districts in the county and limited options for the county to manage drainage. Improvements in the rural and unincorporated areas are nearly impossible; within municipalities, storm water is by the individual jurisdiction. This causes a lack of consistency and collaboration in storm water management practices.

Planning participants ranked power outages as their second concern. Most of these outages are the consequence of severe storms and/or wind, but the outages can occur due to many reasons. Vehicular crashes, equipment failure, and other technological failures can cause outages as well. When power fails, everything stops in Champaign County. Alternate power supplies are limited, and most business and personal activity is based upon electrical service. Not all critical facilities are generator powered, including emergency shelters. Some of the generators that are in place need to be upgraded, or replaced. Without generators, a return to normal daily activities and function is slow, expensive, and tiring.

The weather in Champaign County requires the use of heating or air conditioning for most of the year. Temperatures in the spring and fall are so varied that few days are comfortable without one or the other, making power outages very uncomfortable and disruptive. When power is out, farmers are unable to care for livestock, operate grain systems, feeding equipment, and conduct regular operations in their farm shops. Just like other business and industry, they are severely crippled by the lack of electrical power. This can cause the loss of farm products, disease in livestock, and damage to grain and other crops. Planning team participants were very concerned about power outages for all these reasons.

The vulnerability to winter storms was exemplified through stories about the Blizzard of ’78 and how Champaign County was simply shut down for an extended period of time until snow could be removed from highways and private property, utilities restored, and damages to structures repaired. Those memories are easily rekindled when several inches of snow falls, winds kick up, and visibility disappears. Roads become drifted and impassable, power outages occur, and daily activities are interrupted. Schools close, highway accidents increase in frequency, and people are unable to get to work or other commitments in Dayton, Columbus or locations within the county. With manufacturing giants such as Honda in the county, this causes a great deal of financial strain and loss in addition to property damage as people try to navigate impassable roadways.

Hazardous materials incidents are of moderate to low concern in Champaign County. While they are fortunate to have a great deal of manufacturing in the county, most of it does not involve hazardous materials. They do have farms that use anhydrous ammonia and other agricultural chemicals, which are often transported by tractor along county and township roads. The low volume of traffic allows this to result in few spills and releases due to crashes. A hazardous materials incident inside Urbana, especially on the city square, could result in a

significant evacuation, but other than that area, most incidents would have low impact. There is always the remote possibility of an incident near a school or a hospital, or near the tri-county jail in Mechanicsburg, that would cause a difficult evacuation. This would affect the entire county as evacuees were transported and housed, secured and cared for, and the clean up meant that there would be extensive traffic and activity that would interfere with daily activities. Should a spill occur in proximity to a waterway, or if the runoff from a spill were to reach a waterway, there is concern of contamination. If this happened during heavy precipitation or after a heavy storm, the draining runoff could facilitate the contamination of a waterway.

Drought and excessive heat are not of high concern. So long as electricity flows, the county can operate, as high temperatures do not usually exceed 90 degrees Fahrenheit. Schools and healthcare residential facilities that are not air-conditioned suffer in these situations and either close or make adaptations. Extended hot spells can be very disruptive. If the water supply is sufficient and power stays on, the county can adapt and avoid damages. Some livestock may need to be brought inside, and a few crops may fail. Field fires can become common in extended dry spells, and since fire departments must haul water to fight these fires, the losses can be extensive as they struggle to get enough water fast enough to get the fire under control. Otherwise, damages are more of an inconvenience than actual loss.

Earthquake (#9) is not of high concern even though neighboring Shelby County is home to a high percentage of the earthquakes that have affected Ohio over the years. Very few rumbles from those have been felt in the county, and there is an extremely low incidence of damages. If an earthquake were to occur that was of damaging nature, the sewer lines, water lines, underground utilities, and buildings of masonry or stone would be the most damaged. Roads could be significantly damaged, and bridges and culverts would be unsafe or destroyed.

Champaign County has a dependable and steady groundwater supply. Many homes and businesses are dependent upon wells, and those wells are stable. The public water systems are also well supplied, and few planning committee participants could recall a time when there was a serious threat to the quality or quantity of water available to county residents. They are well aware of concerns over phosphorus and nitrogen runoff into waterways and the effect upon water quality. They also understand the increased threat to man-made lakes in Ohio including Champaign County's Kaiser Lake. However, since conservation efforts and agricultural attention to the potential problem is at the forefront in the county, concerns over potential water emergencies is very low.

Invasive species ranked low at #11. Most of the Emerald Ash Borer-affected trees have long been removed so there not current tree issues. However, that changes quickly and if other invasive species that affect pines, maples, and oaks that are starting to surface in Ohio migrate to the county, that situation could change quickly. A severe wind incident could quickly damage any tree affected even slightly, and cause a major debris management issue. Clearing roadways and public property after significant numbers of trees were to fall could be extremely

expensive, causing financial distress for jurisdictions as well as individuals. For the moment, zebra mussels in waterways do cause a few problems, such as near North Lewisburg.

Dam failure is of low concern since the dams in the county are, by and large, privately owned unclassified structures on private property. There is no location where a dam breech would cause loss of life, and property damage would be low. This hazard ranked #12.

Last on the hazard list was land subsidence. There is no known karst area, although the entire western side of Ohio does have mapped karst substructure. There are some documented problems near the Mad River and Spring Hills where some soil types allow for floating of roads and some deterioration. There are a couple roads that were built on timbers years ago, and they are at risk of damage in heavy rains. There are active mines in the eastern part of the county but there is no history of collapsing surfaces due to mines. Planning participants for the most part felt that sinkholes could occur in a new location but that is not supported by historic data. Therefore, possibility kept the hazard on the list and lack of substantiated damages make it the lowest ranking hazard.

2.3.2 Jurisdiction Vulnerability

Although jurisdictions in Champaign County share many characteristics, each individual jurisdiction is somewhat unique in how it is affected by the identified hazards. This section describes how each jurisdiction prioritized hazards and describes their impact.

Christiansburg

This village of just over 500 residents occupies one-quarter of a square mile in the far southwest corner of Champaign County. Christiansburg planning participants rated power outages as their greatest concern because the village is not adequately equipped with generators and is somewhat isolated from other municipalities. Without power, it is difficult to maintain daily activities and care for families. The fire department has a generator, and their station could be used as a shelter for residents. The village infrastructure includes a water system that sources water from wells which are considered stable and very dependable; this system is generator powered. There is a modified sewage treatment system where each house has a holding tank for sewage where the liquids are pumped off and sent to a treatment plant in the village. Areas in town have storm sewers, and other do not and drain gravitationally. There are two retail stores available for limited supplies, one inside the village and one just outside village limits.

Flooding was the second most-feared incident because the village does not have complete coverage by storm sewers, and some areas of the village drain gravitationally into the creek. The lowest elevation is on the west side of the village near Wilson Street where the West Fork of Honey Creek flows past town. The entire south side of the village is prone to surface flooding which affects streets, yards, and some basements. While there is not much serious flooding, it restricts access, damages vegetation, and destroys utilities, water heaters, appliances, furnaces

and other property in basements or lower levels. Residents cannot get to and from work and out-of-town relatives have difficulty coming to care for elderly in town.

Severe storms, including windstorms, thunderstorms, tornadoes, and winter storms interfere with daily activities. These incidents damage roofs, siding, windows, and outbuildings. Trees are damaged or destroyed, creating significant amounts of debris. When ice in involved in winter storms, residents must clear sidewalks and driveways and streets must be salted or brined. Without that maintenance, vehicle accidents occur and people are injured.

Village residents use village water that comes from wells for water and homes have a septic system for wastewater that pumps liquids off and sends it to a treatment facility. Heavy rain or drought can affect the function of these systems. If the water table were to be contaminated through a hazardous materials spill or toxic chemicals, the village water source could be ruined. This would cause extreme difficulty for residents. Extreme drought could cause the village wells to produce insufficient water to support the village's population.

While earthquake is possible, damages would be limited to structural damage to one and two-story homes, and roadway damage. Electrical supply lines would be damaged and require repair or replacement.

Because the sub-structure of soils in the general area includes isolated karst features, there could be land subsidence. While no incidents of sinkholes or other subsidence have been noted, the possibility exists that deteriorating karst pockets could cause an area to fail. This hazard rated very low on Christiansburg's prioritization because there is no history of this type of incident.

Mechanicsburg

This village in the southeast corner of Champaign County rated power outages as their top hazard. Power outages can occur with any storm that involves wind and/or ice or during high demand in extreme heat. Residents report lengthy outages and slow response, perhaps because the village is at the end of distribution zones. The distribution lines are all above ground on poles and vulnerable to weather conditions. Dayton Power and Light has recently replaced many poles and completed an aggressive tree-trimming program but transformers are in need of replacement and some distribution lines are still in bad condition. Residents report that storms cause the old transformers to fail, resulting in power outages. Two-way radio communication for first responders is severely impacted because the communications tower is not generator powered. Base radio operations in Champaign County are located in Urbana at a lower elevation than Mechanicsburg, which causes connectivity problems, especially when Mechanicsburg responders attempt to transmit on their radios. The signals are not able to reach the lower-elevation base stations from the main tower in Urbana. With a three-county jail at the outskirts of the village, there is a great deal of concern over inability to transmit messages by emergency workers when inmates are released at any time of night or day, have no transportation or supplies, and walk into the village upon release. This is especially problematic during adverse weather conditions. The village's primary emergency shelter is

located at a local church but the church is not generator powered so there is no disaster shelter site that is not dependent upon electricity to be operational.

Severe storms, including windstorm, winter storm, and thunderstorms, ranked as the next three areas of concern. Keeping streets, culverts, and storm drains clear of debris in storms is difficult and costly for the village as they pay workers overtime to manage this. Windstorms cause trees to fall, roof shingles to be damaged, and siding to be dented and destroyed. Debris blocks streets and bridges or culverts, closing off access to parts of the village and making travel difficult. Vehicles can be damaged by falling debris, and ditches are blocked by tree debris. Severe thunderstorms do all of that and more. Lightning strikes can cause fires in the village and damage property; hail damages homes, including roofs, siding and windows. Elderly and disabled residents become dependent upon the community for clean-up. Winter storms have the additional task of removing snow from sidewalks, streets, and parking areas. The combination of snow, ice, wind, and extreme cold causes roads to become impassible, school to close, power to be interrupted, and individuals to fall and be injured. The village experiences vehicle accidents, access interruptions, and business closures. Snow removal is a significant expense for the village due to the additional staff and equipment costs necessary to keep streets clear.

Drought and extreme heat are rare but can be very disruptive for the community. In the most extreme heat events, Mechanicsburg. Schools close when the heat index is high enough to create an unsafe environment for students and staff. The increased demand for electricity stresses the distribution system, leading to outages. Field fires are a greater risk in dry conditions and can be caused by a discarded cigarette, a lightning strike, or some other reason. These fires are difficult to fight as fire departments struggle to have adequate water supply to feed pumpers.

Mechanicsburg is vulnerable to hazardous materials spills and leaks. Several EHS-reporting facilities, including a farm cooperative and an industry, report chemicals stored and used to the Champaign County LEPC. Both facilities have anhydrous ammonia is large quantities, which poses an airborne and liquid threat. The state highways that cross the village and the tractors pulling anhydrous ammonia tanks can collide, creating an exposure risk for the community. Some officials are concerned about detours caused by hazmat spills and how this would take into consideration bridge capacity and weight limits for commercial traffic. A serious vehicle accident in the vicinity of the village’s water wells could expose the water supply to contamination if a large amount of a liquid were to leech into the soils. Residents and officials are concerned about the risk of chemical spills draining into catch basins. A more unusual concern is caused by a high presence of fentanyl in the jail, and the possibility that local areas could be contaminated with this potent and deadly chemical. In a disaster, there could be unanticipated release of inmates nearing the end of their incarceration period; these inmates would be a challenge to care for or serve because their personal history makes them inappropriate inhabitants of a community emergency shelter.

Officials ranked a water emergency caused by a compromise of the water supply, contamination of the village's three wells, problems with distribution lines, or malfunction of water treatment, as seventh out of thirteen hazards. While not highly likely, should this occur the impact would be significant. The elderly, children, and others with special needs would need immediate access to alternate water supplies. Schools and businesses could close and farmers would have a hard time watering livestock.
Flooding would also have serious consequences for the village. Little Darby Creek, which drains most of the village, is a protected waterway. Because of this protected status, officials are unable to remove the debris that blocks drainage and causes more debris to jam during high water levels. Elsewhere in town, clogged drainage tiles and other tiles and culverts are collapsing. With an old and unmapped storm sewer system, it is difficult for the village to anticipate tile collapse; instead they wait until a depression or large hole develops as a sign that tile has deteriorated to the breaking point. In some cases, those drains are as large as 24 inches in diameter, causing a huge hole. In other areas, catch basins clog with debris and prevent water from draining away, and flash flooding fills the streets, yards, and a few basements. Because homes were constructed in flood-prone areas well before floodplain management efforts began, there are residential structures in areas that flood, including one known structure within the flood zone. Some streets and ditch banks are damaged by fast-flowing flood water; curbs and banks are washed away, some streets are closed, and a few parking areas are flooded. If power fails, sump pumps don't work and living areas, basements, and other areas that are otherwise protected can flood. Water heaters, appliances, and furnaces can be damaged or destroyed when floodwaters overtake basements.

Mechanicsburg officials are concerned about tornadoes but the frequency of this hazard is low. If a tornado did occur, the impact would be severe and shelters would be necessary. Any property struck by a tornado is generally destroyed. Power poles, infrastructure, critical facilities, and equipment would also likely be impacted.

Hazards that rated at the bottom of the village's ranking include invasive species, earthquake, and land subsidence. Invasive species, should a new bug develop or move into the area, could devastate trees and vegetation, and possibly ruin food crops. Currently, the Emerald Ash Borer damage has been handled but new problems can develop. An earthquake would be low in severity and frequency. Ohio has never experienced a strong earthquake but Champaign County is close to Ohio's most-affected earthquake areas in adjacent Shelby County. Most buildings are one or two stories, so it is believed the effect would be minimal. However, a strong quake could destroy homes, businesses and other structures like sewer lines, roadways, and water towers. Mechanicsburg is not susceptible to dam failure.

Mutual

This small village is located between Urbana and Mechanicsburg where SR 161 ends at SR 29. It is just over one-tenth of a square mile in size. Officials ranked the hazards for Mutual the same as they ranked for Mechanicsburg, which is to be expected as the two jurisdictions are only three miles apart.

With 100 residents, power outages are a concern for Mutual. They experience high wind incidents that take down trees and power lines, and outages occur as a result. Because the village is somewhat isolated from other municipalities, repair of their power lines is often a low priority. Mechanicsburg provides public safety services for the so they experience the same radio and communications issues. They have difficulty maintaining emergency and crisis communications, which becomes a bigger concern when power is interrupted.
Severe storms, including windstorms, winter storms, thunderstorms, and tornadoes, affect Mutual by damaging homes, tearing off roofs, ripping off siding, and breaking windows. Homes could be rendered unlivable and residents have no local option for an emergency shelter. People would have to travel to Mechanicsburg or Urbana for sheltering. Vehicles can be damaged by hail and wind and trees are blown down, potentially striking houses and falling on other property. Vehicles travelling through the village on SR 29 can be blown off the road or collide due to wind, rain, snow or ice. The village does not provide services, so they depend on Champaign County and Union Township to plow roads and clear property of debris.

Drought and extreme heat can place additional burden on electrical service, cause medical emergencies, and compromise the function of individual wells and septic systems. The village does not provide water service so concerns about well water include drought and contamination by a hazardous spill or leak, as well as deteriorating equipment. One of the biggest concerns for the small community is the lack of a retail store in the village to provide bottled water, foodstuffs, and other necessary items for residents if they become isolated due to a storm.

Flooding in Mutual is mostly surface flooding. The center of the village is at the lowest immediate elevation so water pools on the alley ways that connect School Street to SR 29. The state highways are slightly elevated, and it’s anticipated that drainage from these main roads would inundate yards and driveways before draining gravitationally. All drainage in the village is gravitational because there are no storm or sanitary sewers.

Hazardous materials incidents in Mutual are a concern. Because the village relies on other communities for emergency services, the detection and the initial management of an incident could be challenging. Located at the juncture of two state highways and amid farmland, the chances of a hazmat incident are significant.

Invasive species, earthquake, and land subsidence are very low concerns for Mutual. Should another tree disease similar to the Emerald Ash Borer develop, more trees could be affected, and become debris after storms. An earthquake is possible because Champaign County sits near the highest earthquake risk area in Ohio but buildings are one and two stories high so damage would be manageable. There is no public water or wastewater infrastructure but wells and septic systems could be affected. Power lines would be vulnerable and roadways would be damaged. Again, isolation is one of the most concerning consequences. Land subsidence is possible as karst areas exist and are not completely mapped accurately, but the hazard is considered to be low-impact and not likely to occur. Mutual is not vulnerable to dam failure.

North Lewisburg

The village of North Lewisburg identified severe thunderstorms and windstorms as the two top concerns, followed by power outages and floods. Village officials pointed out that those four hazards can actually impact the village all at once. Rarely does high wind come without heavy rain, and the consequences include interrupted power and flooding.

There is no generator-equipped emergency shelter in the village and most homes do not have a basement. When power is out for an extended period of time, as happens in widespread storms, there is nowhere for residents to go that has electricity. This is life threatening for people who require regular use of medical equipment and those who need heating and cooling to remain well. Elderly and children are highly vulnerable to the impact of extreme heat and cold conditions.

Severe storms create significant amounts of debris. The village's picturesque landscape with shade trees and vegetation is highly vulnerable to wind. With minimal village staff, it is challenging to collect and dispose of debris in a timely manner after the storm. Severe thunderstorms and windstorms can damage mobile homes, manufactured homes and other structures. Roofs are damaged by wind and hail, siding is dented and torn off by wind and hail, and high winds cause trees, light poles, and other objects to fall onto houses and other buildings. Vehicles and outdoor equipment are easily damaged or destroyed by wind and hail.

Spain Creek runs through the village and exposed several apartments and properties to flash and riverine flood risk. The creek is filled with debris but is not part of the county ditch maintenance program. The village and private residents have done their best to clean debris from the waterway, but EPA regulations has prevented enough clearing of debris to improve water flow during and after heavy precipitation. It does not take much rainfall at all to cause street flooding and basements to hold water. Storm sewers are not able to carry enough water away; once the water gets to the creek, the debris jams prevent it from flowing freely. It is difficult in general for the village to manage any of the debris because the financial burden of overtime and additional disposal and equipment cost is overwhelming.

The few homes that do have basements experience sewer back up as well as seepage through walls, causing several inches of flooding. Some water heaters, furnaces, appliances and other possessions are destroyed. For all homes, yards become flooded and some low-lying first floor spaces are inundated with floodwater. On occasion, some residents are forced to leave their homes until the water recedes. Berms on streets are damaged, vehicles are stranded, and pavement can be lifted or broken apart by the water.

Winter storms increase the burden of snow management. Plowing sufficient to keep up with drifting streets and alleys is a full-time endeavor. The extreme cold, wind, low visibility, and ice underneath the snow makes managing of streets time consuming and expensive. If winter storm conditions cause power outages, the very old and the very young tend to be the most vulnerable. Businesses suffer because of closures, lost access, and the inability of employees to

report to work due to weather. Schools are often closed due to road conditions or power outages.

Extreme heat impacts the village as does as extreme cold. These incidents can place burden on electrical service and lead to outages. Elderly, disabled, and children need environmentally controlled residences so an extended outage could necessitate emergency sheltering for residents. The village faces the dilemma of not having a generator-equipped shelter. A water outage would worsen this situation worse by limiting the use of water during an extreme heat event. Water outages, in general, would impact the community abruptly because of the lack of adequate, on-site bottled water and the need to bring supplies to the village from outside sources. Any water emergency could negatively impact the ability to fight fires, especially if high wind, extreme heat, drought or very dry conditions, and a water compromise occurred simultaneously.

North Lewisburg has been impacted by tree damage from the Emerald Ash Borer but most of the ash trees have been removed. If another invasive species were to develop or find its way to the village, they could anticipate tree problems and vegetation management issues.

Village officials are concerned slightly about earthquake because of the history in adjacent counties, although an incident is not highly likely. Roads and infrastructure could be damaged or destroyed by a strong quake but residential structures are expected to withstand the forces of a mild earthquake. Trees, power lines, and other utilities could be destroyed.

Hazardous materials incidents are possible but participants rated the hazard low on the list of possibilities. The state highways that cross the village bring truck traffic and local farmers transport anhydrous ammonia through town. A collision or container failure could cause an incident but officials felt that first responders are able to handle most incidents.

Land subsidence is only a concern if undetermined karst or underground voids collapse. While there are no known areas of this substructure, the entire area is surrounded by karst features. Not all karst in Ohio is well-mapped, so officials feel there is some risk, although minimal. The village is not vulnerable to dam failure.

St. Paris

St. Paris is located on the west-central side of Champaign County and is home to slightly over 2,000 residents. Village officials rated power outages as their highest priority hazard. Planning participants said that outages are frequent and most likely caused by poor distribution lines and the village's location at the end of distribution zones. They indicated that residents endure lengthy outages when repairs are not made quickly. Power outages cause loss of foodstuffs, difficulty heating and cooling homes and businesses, and short-term business and school closures. Residents who require regular use of medical equipment are unable to stay at home. There are generators at the school, but the village does not have a generator to power the police department where emergency communications are housed. The school serves as a shelter when power outages are extended in duration.

Flooding is a high concern to St. Paris officials. The northeast quadrant of the village is prone to flooding as drainage flows through the Harmon Main Ditch, Sarah McMorran Ditch, McMorran Brothers Ditch, McMorran Ditch and Saint Paris Ditch. These waterways are too small for the amount of land that drains into them, and thus a back-up of floodwaters occurs. Roads are closed or partially closed, and debris collects in the area. There are no houses in this particular segment of the village but the impact on streets, roads, and clean-up efforts is significant. There are a few areas where water collects in basements, yards, and sidewalks. Recreational areas and parks are flooded and unable to be used. In extreme precipitation events, St. Paris does experience flooding inside homes. Basements are flooded and residents lose appliances, furnaces, water heaters, and possessions. Sometimes the interior flooding is seepage through the structures' walls and other times the sanitary and storm sewers back up into the homes. Outside, water spewing out of storm drains or catch basins can be observed in the heaviest part of the storm. Post-storm cleanup is difficult and some areas are inaccessible for quite some time due to standing water.

Severe thunderstorms, winter storms, windstorms, and tornadoes also concern St. Paris residents and officials. Storms involving wind take trees down, destroy roofs, siding and windows in homes and businesses, and damage vehicles. Streets can be blocked by debris, including vegetation and trees as well as remnants of homes or buildings. Critical communications are affected when power is out or towers have been damaged by wind. Mobile and manufactured homes are particularly susceptible to damage and often fare the worst. Winter storms bring ice, sleet, snow, and drifting that places additional burden on village services. Falls, injuries, medical emergencies, and vehicle accidents increase in extreme winter weather conditions, placing additional stress on first responders. Special populations require assistance and village crews are stretched to meet needs. The village incurs significant expense as they struggle to help residents recover and sustain village operations.

A water emergency in St. Paris would close many businesses and the school and impact residents without access to alternate water supplies. A malfunction of the water service could signal significant expense as the village completed repairs to an old and under capacity system. If the water source were contaminated and new wells had to be drilled, the expense would be devastating. Drought and heat incidents would have the most negative impacts if water supply were to be involved, independently and/or with a power outage. While most consequences would be inconvenience and nuisance, the elderly and children would suffer the most.

An earthquake is unlikely but could damage all infrastructure, including water treatment, wastewater treatment, distribution lines, electricity poles and lines, and roadways, bridges and culverts. Homes would be damaged but probably not destroyed; schools, police stations and other critical infrastructure would be severely damaged.

Hazardous materials incidents are considered another serious concern. In addition to highway and rail lines, there are numerous pipelines in the St. Paris area. These pipelines transport natural gas and petroleum products through 6" and 8" lines. Additionally, there is a 90,000-gallon propane storage facility just outside the village. As a rural community, agricultural

chemicals are also moved through town on a regular basis. There is also an agriculture facility just across the Clarke County border to the south. An incident at this facility would have a significant impact on St. Paris and the surrounding townships. All of these issues increase the village's risk for hazardous materials incidents.

Land subsidence and invasive species ranked as the lower concerns in St. Paris. Planning team participants did not feel it was a significant risk in the village but did recognize it as a possibility. They also felt that invasive species was not a significant risk because the trees damaged by the Emerald Ash Borer have been taken down in years past. The village is not susceptible to dam failure.

Urbana

Urbana officials ranked severe thunderstorms, winter storms, and windstorms as their major concerns. While tornado ranked lower on the hazard list, that is mostly because so few tornadoes have occurred in Urbana. Severe storms damage homes, commercial buildings, vehicles and landscape. Homeowners experience roof damage, dented and bent siding, downed trees, damaged landscaping, and large amounts of debris to clean up. Mobile and manufactured homes are more susceptible to wind damage because they have a less resistant foundation and are easier to tip over and pull off the foundation. Commercial buildings suffer structural losses such as roof damage, windows, siding, and exterior surface damage from pelting hail, high wind, or ice. Hail, ice and flying debris also damage to vehicles, and high-profile vehicles like box trucks and vans can tip over in wind and wind gusts. Trees will topple under extreme conditions, and smaller branches become flying debris that strikes buildings and vehicles, or anything else in the way.

In addition to property damage, smaller debris tends to collect in waterways and block storm drains, catch basins, culverts, and drainage ditches; these blockages prevent water from draining and cause or exacerbate flash flooding. In the most severe storms, streets can become blocked with branches and limbs that must be removed by city workers before streets can reopen. It is possible but infrequent for city workers or property owners to be injured lifting limbs or moving debris. The greatest risk to those cleaning up after storms is coming into contact with a live electrical wire.

Urbana officials are concerned about sheltering in severe storms. The city has many homes without basements, including slab construction and multi-family apartment buildings. They expressed concern for elderly, disabled, and low-income populations in the context of severe storms and storm clean up. Adequate warning and notification, protective actions, and clean-up activities can be difficult for these particular groups. They are often at higher risk due to health conditions or a lack of general resources and concern for their safety and well-being after storms is a concern of city officials.

The city is also concerned about the lack of warning and notification systems that make residents aware of dangerous weather situations. Urbana does not have outdoor warning sirens but does use an opt-in mass notification system. It is always difficult to convince all residents to

sign up for opt-in notification calls, and officials are concerned about those residents who do not register. Transient and non-residential people can be hard to reach as well, and often do not know anything about signing up for cell phone alerts. Alternate methods of personal notification are hard to identify, and even more difficult to implement. Outdoor warning sirens are very expensive to install and maintain; therefore, warning and notification are challenging in this small rural city. Severe weather can make communication between first responders difficult too. While the county has adopted the MARCS radio system, not all departments and disciplines are able to use it. There are some transmission problems in the county and officials are concerned that the statewide MARCS system will not have the capacity to serve everyone in a catastrophic incident. In general, they are very concerned about the lack of radio communication and warning/notification redundancy.

Power outages caused by severe storms, wind, ice, or excessive demand due to extreme temperatures are high on Urbana's disaster radar. The city has identified viable community shelters but many facilities do not have generators and would be hard pressed to meet housing needs for more than a few hours. While the university and schools have facilities that would be excellent storm shelters, they are not equipped with alternate power supplies with the exception of the Urbana Pre K – 8 building. Most city infrastructure is generator equipped but some generators are old or undersized and should be replaced. Because of this, their concern about power outages is high.

Urbana is vulnerable to flash flooding. Streets in some sections of town drain slowly, leaving ponded water that interferes with travel for a period of time after heavy downpours. Some basements experience water from seepage through the walls and some multi-family housing units have a history of floodwater in living spaces. In the northwest section of the city, the basement and living space water issues are caused by insufficient storm water infrastructure, varied land use within watershed basins, elevated roads and highways, low elevation of buildings compared to surrounding areas, and shallow water tables rather than a direct result of only heavy precipitation. This complex flooding issue causes the loss of furnaces, hot water heaters and appliances as well as possessions and furnishings in an area with concentrated population density. The parking area and helipad around the local hospital can flood during heavy rainfall, rendering that area inaccessible and unusable. The City Hall basement can flood under extreme conditions, causing operations to be relocated and materials stored there to be damaged. Some storm drains and storm sewers have been replaced, which has lessened the street flooding but there are still streets that become temporarily impassable.

Because of the major highways and thoroughfares that traverse Urbana, the city has significant risk for hazardous materials spills. Route 68 is a federal highway that crosses the center of Urbana, including the roundabout in the center of the downtown area. This roadway has especially high volume. At least 25,000 vehicles per day; at least 10% of these vehicles are trucks. When commercial traffic is combined with regular traffic, crashes can occur, creating the potential for a hazardous substance spill or leak. If this occurred in a highly populated area, evacuation would be necessary, and safe routes out of the area could be impacted and make it difficult for people to leave. While most truck and rail traffic transports farm products like grain,

the exception involving a chemical could have an impact. Many type of hazardous materials, including petroleum products, agricultural chemicals, and any other material hauled through the area, could cause significant problems if a crash were to occur that caused a tank to fail or a stem to breach.

An invasive species affecting trees or vegetation would cause debris and weakened trees, all becoming fodder and flying objects in storms. Officials have managed the Emerald Ash Borer outbreak and those trees have been removed, so they do not rank this high on their concern list.

An earthquake is highly unlikely but if a strong quake were to occur, damage could be significant. Infrastructure, including power lines, sewers and water lines, underground utilities, and roadways, could incur extensive damage. While there are few multi-story buildings, there are many buildings that would be vulnerable to shaking and rumbling because they are constructed of brick, stone and other masonry. Building damage could be significant. This ranked low not because there would be no damage, but, like tornado, because the incidence numbers are low.

Urbana utilizes underground well for water and there is a strong water supply available. While city officials recognize that contamination of groundwater or malfunction of a treatment plant could cause a water outage, the likelihood is low. They recognize than an incident would be difficult and require distribution of bottled water, adaptation of manufacturing process or closures, and cessation of business operations for schools and many others, they feel this is highly unlikely.

Land subsidence is possible in Urbana because the city is located in a part of Ohio with some karst sub-structure. There is ample limestone and dolomite deposits underground which can result in unanticipated voids developing. There is little elevation change that is sufficient to cause landslides or mudslides, but streams and creeks can be impacted by extremely fast and furious currents after heavy storms and significant rainfall or snowmelt. However, being located far enough at the high end of the watershed, the likelihood is lower than it would be in other counties. While not a significant concern, officials did recognize that land subsidence is possible in Urbana. The city is not susceptible to dam failure.

Woodstock

This tiny community ranked severe storms, including thunderstorms, wind, and winter weather events, of all type as their primary concerns. The village is vulnerable to wind damage such as roof, siding, and window damage in homes and structural damage to farm buildings, grain operations, and homesteads. The wind can cause trees to fall, blocking streets, driveways, and alleys. Rapid rainfall can cause streets to flood and houses to become surrounded by water. Homes with basements can experience some basement flooding, ruining furnaces, hot water heaters, appliances, and possessions. Driveways can be isolated from roadways, cars can be flooded in, and the highway can be covered in water. With almost completely flat elevations, water can take some time to naturally drain away.

Ice storms, wind, and vehicle accidents can cause power outages. The village has no generators, so they are forced to go to North Lewisburg or Mechanicsburg for sheltering. There is only one small food market in town so residents must travel to purchase supplies, food, and bottled water. There is no designated shelter in the village, but there could be an agreement with the Freewill Baptist Church if necessary. The church is not generator powered so the ability to provide refuge for affected residents would be diminished in a prolonged power outage.

It is difficult for the village to manage clearing streets amid heavy, blowing snow or huge amounts of debris. Workers are volunteers and have jobs elsewhere but work as available to meet the village's needs. Heavy debris or streets that need significant maintenance present a big challenge to the village officials.

Woodstock is an isolated rural community with one state highway that crosses town. Hazardous materials spills can result from vehicle accidents as trucks travel the area. Farmers and agricultural services haul anhydrous ammonia and other farm chemicals through town for field application and they can incur spills, leaks, and accidents as well. Woodstock is dependent upon a district fire service to manage these incidents and at times it takes expertise beyond the local capacity to handle a chemical incident. The resulting vulnerability of the air, land, and waterways is a concern, although not an incredibly likely incident.

Land subsidence could affect Woodstock if uncharted karst or limestone and dolomite characteristics actually exist. While nothing is currently charted, Champaign County is not fully documented with reference to this hazard. Woodstock is not vulnerable to dam failure.

2.3.3 Vulnerability Summary

Precipitation combined with wind is by far the most concerning event for county officials and residents. They experience storms that combine threats, such as severe thunderstorms that spawn tornadoes, have some lightning and hail during the storm, and include straight-line or rotating winds. Historically, rotational and straight-line winds have not resulted in extremely different consequences. Most storms that cause significant damages or expensive repairs involve both precipitation and wind. Most of these repairs are funded by either personal property owners or insurance companies. Damage occurs every year in every jurisdiction due to heavy precipitation and high wind. This includes damage to structures, vehicles, crops, equipment, and natural resources like trees and lawns.

Power outages were of concern because of the high disruption of daily activities, as well as the cost to business and industry. The failure of heating and air conditioning causes health concerns for elderly and children, as well as those who have special needs. Maintaining traffic without signals is dangerous and, when power takes the signals out of order, crash incidence increases.

Small hazardous materials incidents are relatively common in the county and that is mostly due to the combination of many miles of state and interstate highway and the prevalence of roadway traffic all across the area. Vehicular incidents and spills at fixed facilities keep first

responders busy. Rail incidents are minimal because there is not a great deal of rail in the county although there are several major pipelines that carry petroleum products and natural gas. Those lines, substations, and storage facilities pose a threat to nearby residents and businesses. As an agricultural county, many farm chemicals are transported across the county. Farm tractors and vehicles that move slowly typically carry these chemicals, increasing the risk of crashes as other vehicles pass and maneuver around them. Streams and rivers could easily be contaminated by any kind of hazardous materials spill; therefore, this ranked high as a threat of concern. The risk of evacuation and major inconvenience that interrupts business and life activities is significant. The biggest threat of evacuation was determined to be a hazardous spill and crash of some sort located in downtown Urbana where a round-about is located at the junction of several state highways. This kind of incident could cause major evacuation, including many city government officials and employees as well as residential neighborhoods. This commercial zone is home to a variety of businesses and offices, and is a hub of activity during business hours when most traffic passes through. The roundabout is difficult for navigation due to limited space and thus presents a significant risk.

Flooding is common in the context of closed rural roads and flooded rural properties. Most flooding causes a great deal of inconvenience but areas that flood do so regularly enough that they are not lands farmed for profit nor are they heavily populated residential areas. Damage results in closed roads, inaccessible resources and businesses, and extreme inconvenience to institutions and individuals due to impaired access and damaged infrastructure. Some damage is done to structures, road berms and foundations are weakened by the water, and bridges can become impassable. Travelers must take alternate routes, and the risk of a flooded highway that is not marked is the result of rapidly rising water from fast-falling precipitation.

Winter storms interrupt business, prevent transportation of goods, keep workers at home, and close the schools. Drifting roads and slippery pavement make travel difficult, and if winds increase and blow the snow around, drifting is a part of the problem. Snow management and removal inside the municipalities can be difficult when space to move the snow to is limited. The roundabout in downtown Urbana is one specific case where plowing the roadway open is relatively easily accomplished, but there is nowhere to go with the snow that was removed. It has to be hauled somewhere, causing difficulty in maintaining that section of road in a heavy snowfall high wind event. Management of blowing and drifting snow, both inside municipalities and in the rural areas, is a difficult undertaking in worst-case storms. Roads drift shut quickly and plows must constantly circulate to keep roadways open. While few roofs collapse under the weight of snow, many businesses and schools close due to road issues, and commerce in the county comes to a halt. Vehicle accidents are increased, causing injury, loss of work and medical costs.

Water emergencies are possible but not highly likely. Water retention, whether in dams or reservoirs, is done with attention to maintenance and repairs of the structures. Most dams are small farmstead structures with the exception of two low-head dams that do not change the flow or collection of water but instead hold back a pool of water mostly for recreational uses.

While the county is abundant production farmland, production practices prevent a great deal of contaminated runoff and pesticide pollution.

Invasive species has affected ash trees but most of those have been removed and cleaned up. The county is aggressive in detecting and treating infestations, and the consequence of invasive species is additional debris loads after storms. Weed type invasive species are treated chemically and removed from fields, preventing widespread prolific growth on production land or set aside natural plots. The entry of another form of insect or disease could cause big problems for Champaign County, but there has not been evidence of that circumstance. Participants pointed out that invasive species is a very dynamic kind of incident, and a new threat can appear almost out of nowhere, causing significant problems very quickly.

Drought and extreme heat result in inconvenience, and those without air conditioning sometimes go to comfort stations established by the EMA. There is little actual loss associated with this hazard. Most concern in this area was for power outages, not the heat or cold itself.

Dam failure is not a high concern. Most of the water retention structures are reservoirs that are well maintained and of little risk. The dams that do present risk are continually maintained and emergency action plans establish procedures for evacuation and recovery. The dam at Kaiser Lake is the only area officials expressed any concern over, and the dam is well maintained, has all necessary emergency plans, and the inundation zone is mostly farmland or natural habitat. The losses of a breech were estimated to be very low.

Earthquake would damage infrastructure, including roads, water towers and water lines, utilities, institutions and other critical infrastructure. Homes would be damaged and pipelines could rupture. Officials are aware that adjacent Shelby County has experienced the highest number of earthquakes of any Ohio area, but those quakes have been mild and not very destructive, ranking as mild earthquakes. There is little data documenting any quake effects in Champaign County. Therefore, they determined the likelihood of future incidents that cause any loss is extremely low. The risk is low enough that local officials feel little needs to be done but convey information about a response should the unlikely event ever take place., and do an inventory of what might be damaged.

Champaign County's major concerns will likely always involve the combination of wind and water. Incidents than involve those components can come fast and furious, and leave must destruction in their path. If temperature extremes are concurrent with heavy precipitation, the consequences can be worsened. That results in the most concerning hazard not being one single hazard by itself, but the combination of two, three or four at the same time.

Table 2-38 provides a summary of the hazard rank developed by each jurisdiction.

Table 2-38: Jurisdictional Vulnerability

Jurisdiction	Dam/Levee Failure	Drought/Extreme Heat	Earthquake	Flood	Hazardous Materials Incident	Invasive Species	Land Subsidence	Power Outage	Severe Thunderstorm	Tornado	Water Emergency	Windstorm	Winter Storm
Champaign County	12	8	9	6	7	11	13	2	1	4	10	3	5
Christiansburg	N/A	8	9	2	10	12	11	1	3	6	7	5	4
Mechanicsburg	N/A	5	11	8	6	10	12	1	4	9	7	2	3
Mutual	N/A	6	10	4	11	9	12	3	1	7	8	5	2
North Lewisburg	N/A	6	10	4	11	9	12	3	1	7	8	5	2
St. Paris	N/A	8	9	2	10	12	11	1	3	6	7	5	4
Urbana	N/A	5	10	6	8	9	12	4	1	7	11	3	2
Woodstock	N/A	5	11	8	6	10	12	1	4	9	7	2	3

2.4 RISK ANALYSIS

Based on the available hazard and vulnerability information, Champaign County has risk for damage from a variety of disasters. To determine the county's overall level of risk, each hazard was evaluated and scored based on common criteria. The criteria included frequency, response duration, speed of onset, magnitude, and impact on businesses, people, and property. Table 2-39 describes the overall scale used to score each hazard. Table 2-40 explains the scale used to measure magnitude. The composite scores and overall rank for each hazard are in table 2-41.

Table 2-39 Assessment Scale

Score	Frequency	Response Duration	Speed of Onset	Magnitude	Business Impact	Human Impact	Property Impact
1	None	< ½ Day	> 24 Hours	Localized	< 24 Hours	Minimum	< 10%
2	Low	< 1 Day	12-24 Hours	Limited	1 Week	Low	10-25%
3	Medium	< 1 Week	6-12 Hours	Critical	2 Weeks	Medium	25-50%
4	High	< 1 Month	< 6 Hours	Catastrophic	> 30 Days	High	> 50%
5	Excessive	> 1 Month	No warning				

Frequency
Hazard events that occur regularly are a higher risk than those that occur infrequently.

- 1 = None/Once in 100 years
- 2 = Low/Once in 50 years
- 3 = Medium/Once in 25 years
- 4 = High/Once in 1-3 years
- 5 = Excessive/More than annual

Response Duration
Response duration is defined as the amount time the response to a particular hazard is anticipated to last.

- 1 = Less than ½ day
- 2 = Less than 1 day
- 3 = Less than 1 week
- 4 = Less than 1 month
- 5 = More than 1 month

Speed of Onset
Speed of onset addresses the amount of advance warning before each hazard occurs.

- 1 = More than 24 hours
- 2 = 12-24 hours
- 3 = 6-12 hours
- 4 = Less than 6 hours
- 5 = No warning

Magnitude
Magnitude is rated using standard damage scales such as the Enhanced Fujita Scale, or through development of a local comparative scale that is comparable in damages at like levels using the established damage scales. Some scales from other geographic regions, such as the North East Snow Index Scale, were used as models to develop a comparative tool in Champaign County.

Table 2-40: Magnitude Scale

Score	Tornado	Windstorm	Flood	Earthquake	Drought	Winter Storm
1	EF-0/1	<65 mph	Minor	<5.9	D-0 Very Dry D-1 Moderate	<8” snow
2	EF-2	65-75 mph	Moderate	6.0-6.9	D-2 Severe	8-12” snow
3	EF-3	76-85 mph	Significant	7.0-7.9	D-3 Extreme	12-16” snow
4	EF-4/5	>86 mph	Major	>8.0	D-4 Exceptional	>16” snow

For all other hazards, the impact was measured as follows:

- 1 = < 10% of population affected directly
- 2 = 11-25% of population affected directly
- 3 = 26-50% of population affected directly
- 4 = > 50% of population affected directly

Business Impact

Business impact refers to the potential economic impact a hazard event is likely to have on a community. The definition of each score refers to the amount of time critical facilities are likely to be shut down in the impacted community.

- 1 = Less than 24 hours
- 2 = 1 week
- 3 = At least 2 weeks
- 4 = More than 30 days

Human Impact

Human impact is defined as the number of lives potentially lost for a particular hazard.

- 1 = Minimum/Minor injuries
- 2 = Low/Some injuries
- 3 = Medium/Multiple severe injuries
- 4 = High/Multiple fatalities

Property Impact

Property impact is defined as the number amount of property potentially lost during a given hazard event.

- 1 = Less than 10% damaged
- 2 = 10-25% damaged
- 3 = 25-50% damaged
- 4 = More than 50% damaged

The factors identified above were assigned values as described and rated against anecdotal analysis based upon history and past incidents. This scoring mechanism resulted in very similar assessment of risks and vulnerabilities for the countywide vulnerability analysis.

Table 2-41: Risk Analysis

Hazard	Frequency	Response Duration	Speed of Onset	Magnitude	Business Impact	Human Impact	Property Impact	Score	Rank
Severe Thunderstorm	5	4	5	4	1	2	4	25	1
Power Outage	5	3	5	4	2	2	3	24	2
Windstorm	5	4	3	3	2	2	3	22	3
Tornado	3	4	4	3	2	2	1	19	4
Winter Storm	4	3	1	3	2	2	2	17	5
Flood	4	3	2	2	1	2	2	16	6
Hazardous Materials Incident	4	2	5	1	1	2	1	15	7
Drought/Extreme Heat	3	3	1	2	1	3	1	14	8
Earthquake	2	1	5	1	1	1	2	13	9
Water Quality Emergency	1	1	4	3	1	1	1	12	10
Invasive Species	2	1	1	1	1	1	2	9	11
Dam Failure	1	2	1	1	1	1	1	8	12
Land Subsidence	1	1	1	1	1	1	1	7	13