2014 Montgomery County Natural Hazard Mitigation Plan

View from Woodland Hills (looking north to downtown Dayton), Miami Valley Conservancy District Special Collections

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Chapter 1 Introduction

The mission of the Montgomery County Natural Hazard Mitigation Planning Team is to create a comprehensive research-based hazard mitigation plan to reduce the risk, damage to life and property, and public cost to Montgomery County communities, agencies, businesses and natural resources caused from the effects of natural hazards like earthquake, wind, rain, flood, hail, snow and heat.

Montgomery County is the fifth largest populous county in the State of Ohio and is subject to flooding, hail, earthquakes, severe winter storms, and tornados or windstorms. It is impossible to predict exactly when these disasters will occur, or the extent to which they will affect the county's 535,153 residents, but with careful planning, it is possible to minimize the losses that could result from natural disasters.

Montgomery County most recently experienced severe wind damage resulting from the remnants of Hurricane Ike. In September of 2008 winds equal to a Category 1 hurricane (winds up to 74 mph) caused at least $553.1 million in insured losses, rivaling Ohio's largest natural disaster in recent history since the Xenia tornado of 1974. Wide-spread power outages crippled transportation routes, disrupted businesses, and put residents in jeopardy as most homes were without power, many for more than a week.

Montgomery County was one of several counties that sought and received a Presidential Disaster Declaration to obtain federal assistance for its recovery efforts. The cost of recovery from this wind storm was estimated at approximately $53 million for the 33 Ohio counties eligible for federal reimbursement.

Montgomery County was reimbursed 75 percent of eligible costs for Public Assistance from this declaration which totaled approximately $6.4 million according to FEMA.

Why Does Montgomery County Need this Plan?

Mitigation is the cornerstone of emergency management. It's the ongoing effort to lessen the impact disasters have on people's lives and property through damage prevention and flood insurance. Through measures such as, building safely within the floodplain or removing homes altogether; engineering buildings and infrastructures to withstand earthquakes; and creating and enforcing effective building codes to protect property from floods, hurricanes and other natural hazards, the impact on lives and communities is lessened.[1]

The rising cost of natural disasters has led to a renewed interest in identifying effective ways to reduce vulnerability to disasters.

[1] http://www.fema.gov/about/divisions/mitigation.shtm

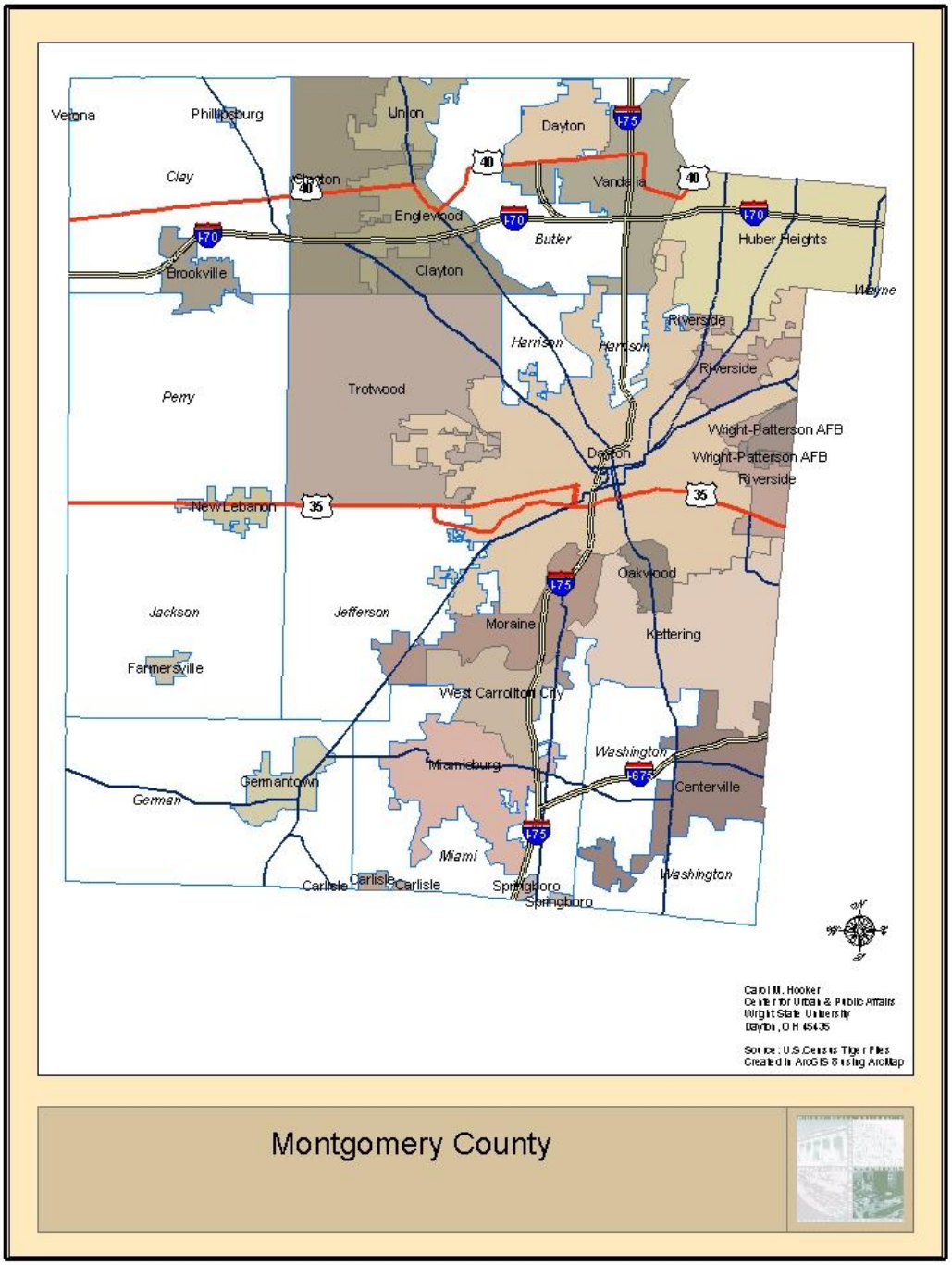
A Mitigation Plan is a plan that identifies mitigation priorities and projects for all communities within the county. The need for a county mitigation plan need came to light following an amendment to the Stafford Act in February of this 2002. It now mandates that after November 1, 2003, a local government must have a mitigation plan on file with the State in order to receive mitigation funding for any declared disaster.

Communities have the option to either adopt, through resolution, the countywide plan or create their own independent plan. A natural hazard mitigation plan sets the ground work for communities to reduce their risk from natural hazards by identifying resources, information, and strategies for risk reduction, while helping to coordinate mitigation activities throughout the county.

Montgomery County Office of Emergency Management partnered with WSU, in 2004, for the completion of a Countywide Comprehensive Natural Hazard Mitigation Plan. In order to create this comprehensive plan, a hazard analysis was completed that identified natural risks threatening each political jurisdiction within the county. This hazard analysis is the foundation upon which all emergency planning efforts in the community are built and provides an understanding of potential threats facing the communities.

The plan provides a set of action items to reduce risk from natural disasters through education and outreach programs, to develop partnerships, and to implement preventative projects. The information within the Mitigation Plan: (1) establishes the foundation for coordination and collaboration among agencies and the public in Montgomery County; (2) identifies and prioritizes future mitigation projects; and (3) assists in meeting the requirements of federal assistance programs. The mitigation plan does not stand-alone — it works in conjunction with other jurisdictional plans.

The Montgomery County Natural Hazards Mitigation Plan affects all areas of the county: incorporated urban areas, and the rural, unincorporated areas of the county. Figure 1-1 shows cities, urban unincorporated areas, and major roads and rivers in Montgomery County. While this plan does not establish requirements for the cities in the county, the resources and background information in the plan is applicable county-wide. It does provide suggestions for lessening the impact of natural hazards and recommendations for local mitigation efforts and partnerships.



- Figure 1-1: Montgomery County

All property mitigation lies with the local jurisdictions, and the primary responsibility for development and implementation of risk reduction strategies and policies lies with these jurisdictions.

Who does this plan cover?

The Montgomery County Natural Hazard Mitigation Plan was created for the benefit of all jurisdictions in the county. Upon adoption, the plan will apply to the following jurisdictions:

Montgomery County Jurisdictions	
Butler Township	City of Union
City of Brookville	City of Vandalia
City of Centerville	City of West Carrollton
City of Clayton	Clay Township
City of Dayton	German Township
City of Englewood	Harrison Township
City of Germantown	Jackson Township
City of Huber Heights	Jefferson Township
City of Kettering	Miami Township
City of Miamisburg	Perry Township
City of Moraine	Village of Farmersville
City of Oakwood	Village of New Lebanon
City of Riverside	Village of Phillipsburg
City of Trotwood	Washington Township

- Figure 1-2: Montgomery County Jurisdictions

The 2014 Mitigation Plan Update

To seek support for updating the existing mitigation plan, the Montgomery County Office of Emergency Management focused on the resources needed to update the existing hazard mitigation plan. Essential steps included identifying, organizing and re-assembling members of the community as well as technical expertise required during the plan update process.

As a result, the Montgomery County Office of Emergency Management sought support and information from various jurisdictions, business, industry, non-profit organizations, other interested organizations and individuals. Obtaining the support of community and organizational leaders was the best foundation for the plan update effort. Pending Federal approval, the County and its participating jurisdictions intend to formally adopt this plan by passing a Resolution or Ordinance.

The 2012-2013 Mitigation Planning Team was formed by notifying and assembling individuals and organizations that previously served on the team when the plan was first drafted for 2006 and invited them to participate in updating the plan:

County Organizations
Montgomery County Commissioners
Miami Valley Regional Planning Commission
Montgomery Co. Community and Economic Development
Ohio State University Extension
Montgomery Co. Department of Public Works
Montgomery Co. Building Regulations Dept., Floodplain Manager

Major Employers
AES Corp/Dayton Power & Light
Behr Dayton Thermal Products LLC
Dayton City Schools
DMAX Limited
GE Capital
Jones Warner Consultants
Kettering Health Network
PNC Financial Services Group
Premier Health Partners Inc
Reed Elsevier/LexisNexis
Reynolds & Reynolds Co Inc
SBC Ameritech, Damage Prevention Council

Colleges and Universities
Kettering College
Sinclair Community College
University of Dayton
Wright State University

Non-Profit Organizations
Dayton Area Chapter of the Red Cross
Great Miami Watershed Enhancement Program
Little Miami River Partnership
Miami Conservancy District
Upper Little Miami & Caesars Creek 319

Other
Wright-Patterson Air Force Base

Not every agency that was invited attended the meetings to discuss the revision to the plan. The following organizations had members present, to provide input, during these meetings:

- *88th Readiness Flight ABW/CECMX*
- *Amateur Radio/RACES*

- *American Red Cross*
- *Box 21 Rescue Squad*
- *Butler Township*
- *City of Dayton*
- *City of Huber Heights*
- *City of Miamisburg*
- *City of Union*
- *City of Vandalia*
- *Dayton Metropolitan Housing Authority*
- *Dayton Power & Light*
- *Dayton Regional Hazardous Material Response Team*
- *EMS Council/Medical Society*
- *Greater Dayton Area Hospital Association*
- *Greater Dayton Regional Transit Authority*
- *Harrison Township*
- *Levin Family Foundation*
- *Miami Valley EMS/Fire Alliance*
- *Miami Valley Fire District*
- *Miami Valley Regional Planning Commission*
- *Miller Valentine Group*
- *Montgomery County Administrative Services*
- *Montgomery County Animal Resource Center*
- *Montgomery County Board of Elections*
- *Montgomery County Commissioner's Office*
- *Montgomery County Community Development*
- *Montgomery County Coroner/Crime Lab*
- *Montgomery County Engineer*
- *Montgomery County Office of Emergency Management*
- *Montgomery County Public Works*
- *Montgomery County Safety Office*
- *Montgomery County Sheriff's Office*
- *Ohio Task Force One – USAR*
- *Public Health – Dayton & Montgomery County*
- *SBC Communications*
- *VA Medical Center*
- *Vectren Energy*
- *Washington Township*
- *Wright Patterson Air Force Base*

The full list of individuals representing these organizations and their contact information can be found in Appendix A.

Engaging the Public

Public participation and input to the planning process was first announced through a press release to new media outlets. The Dayton Daily News picked up the press release and ran a notice on February 8, 2012. The article directed the attention of the public to the Montgomery County Office of Emergency Management website to review the 2006 mitigation plan online and provide feedback by phone or e-mail. No comments were received by the public. A copy of the news release is shown in Appendix A of this plan.

Throughout the plan development phase, the public was invited to attend and participate in Mitigation Planning Team meetings. Meeting locations, dates and times were made to the public and announcements were posted at meeting locations. A copy of the announcement is shown in Appendix A of this plan.

After the planning process was finished, the public had the opportunity to review and comment on the revised plan. These methods followed the same as those listed above when the public reviewed the previous plan. A screen shot of the website featuring the revised plan, available for public review, is exhibited in Appendix A of this plan.

Though the public had the opportunity to comment on the plan before it was sent for State and Federal review, no comments were received.

Conducting the Hazard Analysis

Hazard analysis is the foundation upon which all emergency planning efforts in the community are built and provides an understanding of the potential threats facing the community. By pinpointing the exact location, extent and magnitude of past disasters, and by examining new or emerging risks, it is possible to determine the probability of such events occurring and the vulnerability of people and property. By reviewing this information along with available land use, geographic, economic, and demographic information, the pre-mitigation planning team developed priorities and goals for mitigation for the segments of the community, which might be adversely impacted by various types of hazards.

Hazard analysis can be broken into four basic steps:

- Develop a community profile
- Identify the hazards
- Profile each hazard
- Conduct a vulnerability analysis and estimate losses

Develop community profile

To develop a community profile, the key areas in the community were identified such as historical resources, industries, critical facilities, present and future land uses and development. Information regarding geography, climate, and demographics were also included in this profile.

Identifying and profiling hazards

The next step in hazard analysis involved the identification of those natural hazards to which the community is susceptible. Montgomery County is susceptible to a number of natural hazards. The following natural hazards were determined to be the most pervasive and concerning hazards to mitigate for:

- Tornados and Wind
- Severe winter storms
- Flood
- Severe summer heat and drought
- Hail
- Earthquakes

In the identification process the research team found no record of the following natural hazards, these hazards were not considered to adversely affect the community on a regular or recurring basis.

- Wildfires
- Landslides
- Land subsidence

The following sources assisted in the hazard identification process.

Historical records

The pre-mitigation planning team researched local historical data (such as newspaper accounts) to determine the types of hazards the community either has experienced or to which the county is susceptible. In addition, long-term community residents were interviewed as a good source of information regarding historical natural hazard events. Another resource utilized was the local historical societies and local historical special collections and archives. Drawing from local information sources is important because it provides information on those events that may not have been widespread or severe enough to receive national attention, but nonetheless had a significant impact on the community.

Existing plans and reports

The pre-mitigation planning team reviewed existing reports and plans such as state mitigation plans, hazard identification reports, studies, local emergency response plans, and local comprehensive plans, etc. However, these plans were lacking in information regarding mitigation for natural hazards.

The planning team in 2012 reviewed and incorporated into the mitigation plan all local and county building codes, fire codes, zoning regulations, floodplain ordinances and/or regulations, Comprehensive Land Use Plans, and the Flood Insurance Study Jan 6, 2005. The Montgomery County Emergency Operations Plan and the Montgomery County Hazardous Materials Contingency Plan (which includes Hazard Analysis for all EHS Facilities), as well as local emergency operations plans, were reviewed also.

Internet websites

Information on hazards was also obtained through Internet websites.

Hazard Research

After the completion of the initial hazard identification of Montgomery County, the pre-mitigation planning team focused on identifying the most prevalent hazards.

- Tornados and Wind
- Severe winter storms
- Flood
- Sever summer heat and drought
- Hail
- Earthquakes

A hazard event profile was developed for each potential hazard that was identified as a threat to Montgomery County.

Flood hazard information was obtained from the boundaries of the Flood Insurance Rate Map (FIRM) as translated by the Ohio Department of Natural Resources (ODNR).

Earthquake hazard information was collected from the http://usgs.gov website and OhioSeis maps and data.

All weather hazard information was obtained from the http://www.ncdc.gov and www.fema.gov website.

Population and business figures were collected from the U.S. Census and Ohio Bureau of Employment Services.

During this step the Pre-mitigation Planning Team determined how much property and what segment of the population are located in probable hazard areas. To complete this step the committee needed to:

- Determine the total number of buildings in the community. The information was obtained from Census 2010 and tax assessment maps, Geographic Information Systems (GIS), Aerial Photographs and local planning documents.

- Determine the total estimated value of buildings in the community. When available, this information was obtained from tax assessments of individual buildings.

- Determine the total number of people in the community. This information was obtained from census data and local data. Noted were any large seasonal or daily population changes.

- Determine the total number of buildings inside the hazard areas. The information was obtained from tax assessment maps, GIS, and/or aerial photographs.

- Determine the total estimated value of buildings inside the hazard areas. This information was obtained from tax assessment values and from estimating whole areas from Census figures.

- Determine the total number of people inside the hazard areas. This information was obtained from census data and local data. Noted were any large seasonal or daily population changes.

- Determine the location of expected growth in the community by consulting local officials.

- Complete vulnerability analysis and estimate losses

To complete the hazard analysis, the vulnerability of the community to various hazards needed to be determined. A hazard is only a problem when it can cause harm to people or damage property. In determining the communities' vulnerability the Pre-mitigation Planning Committee:

- Identified and mapped community hazard areas

- Developed and applied hazard-specific disaster scenarios to determine critical issues that needed to be addressed pertaining to specific community sectors, safety, loss of critical functions or facilities, public health impacts, economic impacts, and short and long-term recovery

- Determined who had the emergency response authority for each identified vulnerability

- Determined planning and resource allocation needs and considerations for implementing priority activities identified in the previous steps.

The final step in the hazard analysis process is estimating losses that would occur during a hazard event and creating a composite map of the loss areas. The expected percentage of damage to structures will vary greatly, based upon the age of the building, construction materials used and severity of the hazard. In this step our committee needed to:

- Determine the extent of damage from floods.
- Determine the extent of damages from earthquakes.
- Determine the extent of damages from tornadoes. The percent of losses are based upon worst-case scenarios developed from regional past occurrences.
- Determine the extent of damages from all other hazards identified as a threat to the community.

Information in the Mitigation Plan is based on research from a variety of federal, state, and local resources. The Center for Urban and Public Affairs (CUPA) at Wright State University conducted data research and analysis, facilitated Pre-mitigation Planning Team meetings, held public informational sessions, and developed the final mitigation plan.

CUPA collected data and compiled research on all of the hazards identified in the FEMA – Understanding Your Risks Guide: flood, landslide, severe winter storm, windstorm, wildfire, earthquake, and volcanic eruption. Research materials came from Federal, State of Ohio, and local agencies including:

- Federal Emergency Management Agency
- United States Department of the Interior, United States Geological Survey
- National Climatic Data Center
- National Oceanic and Atmospheric Administration
- National Parks Service
- Ohio Department of Natural Resources (ODNR)
- Ohio Department of Public Safety (ODPS), Emergency Management Agency (EMA)

In addition, CUPA staff and students conducted research by referencing historical local newspapers and documents and locating County information in recent and historical scientific documents.

Estimated Hazard Costs

Wherever possible in this analysis and plan, costs are expressed in terms of "real dollars," and have been adjusted for inflation so that all dollar figures are expressed using the value of

money in 2003. Dollar figures have been calculated to 2003 values using the Consumer Price Index for all urban consumers (CPI-U) as provided on the Bureau of Labor Statistics website, http://www.bls.gov/ and/or the Federal Reserve Bank website, http://minneapolisfed.org/research/data/us/calc/index.cfm.

Some figures in this report are expressed in "nominal dollars" (without adjusting for inflation), because estimates for disaster declarations were expressed for several disasters over a multiple years without a specific year breakdown, and therefore could not be adjusted. These figures are represented with an asterisk (*) behind the dollar figure.

Selecting and Ranking the Problem Statements

The core group brainstormed and outlined every problem statement. Problem statements with insufficient data to support them were then removed. Problems beyond the influence of the core group, or poorly defined problems were also removed Once this phase was complete, the planning team ranked the problems considering the impact each problem has on the community.

Setting Goals

Once the group had a clear understanding of community hazard problems, the next step is to identify the goals, which would most effectively minimize or eliminate the problems.

CUPA examined existing mitigation plans from around the country, current planning and regulation documentation from the County's many jurisdictions, current FEMA planning standards, and the National Flood Insurance Program's Community Rating System. Statewide reference materials consisted of community and county mitigation plans.

CUPA conducted interviews with and collected data from local jurisdictions. Research identified common concerns related to natural hazards and identified existing and potential activities to reduce risk from natural hazards. A complete listing of all stakeholders is located in Appendix B.

Stakeholders interviewed for the plan included representatives from:

- City Government
- Township Government
- Regional Planning Organizations
- Fire Departments
- Utility Providers

In the final step, the planning team developed the goals - general guidelines that explain what you want to achieve - and the activities - strategies or implementation steps to attain the identified goals.

Plan Roadmap

Chapter 1: Introduction

The Introduction describes the background and process of developing the Mitigation plan for Montgomery County

Chapter 2: Community Profile

This section illustrates the history, geography, demographics and socioeconomics of Montgomery County.

Chapters 3 through 10: Natural Hazard Risk Assessment

These chapters provide the hazard identification, vulnerability and risk associated with natural hazards in Montgomery County.

Chapter 11: Multi-Hazard Goals and Action Items

This section provides information on the process used to develop the goals and action items to address the problems faced from natural hazards.

Chapter 12: Plan Maintenance

This section provides information on implementing, monitoring, and updating the plan.

Appendices

Appendix A: Public, Private, and Governmental Participation in the Process

This section provides the documentation of all correspondence during the planning process. In addition, meeting minutes and rosters are documented in this section. It also contains the resolutions passed by the individual jurisdictions supporting the plan.

Appendix B: Critical Facilities

This section provides detailed information regarding the critical facilities inventory as required by the State of Ohio Emergency Management Agency and FEMA Region V. These documents were not included in the general text of the plan for security reasons, but can be provided on a need-to-know basis.

Appendix C: List of Acronyms and Definitions

This section provides a list of acronyms for the organizations and plans referenced in this Mitigation Plan.

Chapter 2 Hazard Analysis

Floods, earthquakes, tornadoes and high winds, thunderstorms, snowstorms, droughts, and temperature extremes — Montgomery County has them all. These events can damage and even incapacitate a community for an extended period of time. Knowing the likelihood of a disaster is the best protection from a disaster. Learning to live with the natural forces, which surround us, minimizes the outcome of natural disasters.

Building a home or business on a fault line or the floodplain of a river that repeatedly exceeds its banks *is a disaster waiting to happen*. Furthermore, demonstrated during the snowstorms of 2003, people consistently interfered with disaster response. Many accidents could have been avoided and snowplows would have been more effective, if people would have remained in their homes rather than traveling to work, school, or recreation.

Major weather disasters in the U.S. have caused billions of dollars in damages over the past twenty-five years. Drought caused $62 billion in damages in 1988; Hurricane Andrew, $32.7 billion; the floods of 1993, $15 billion; and the list goes on.

Since 1964, federally declared disasters in Ohio (excluding insurance) have cost more than $622.2 million dollars in damages. In 1964, 1968, and 1989 Presidential disaster declarations covered over $10.9 million dollars in flood damages statewide, which included awards to Montgomery County. The blizzard of 1978 affected all 88 counties in Ohio and $9.9 million was awarded to the State to cover damages. A tornado ravaged portions of the city of Xenia in the tornado super outbreak of 1974. Presidential declarations to fourteen counties as a result of this outbreaks amounted to $45.5 million dollars in damages. On September 20, 2000 high winds and tornadoes caused over $4.8 million dollars in damages in Xenia and Greene County and again a Presidential disaster declaration was issued.

Since 1950, the county has encountered over 375 storm or earthquake related events, the most prevalent being thunderstorms. Two hundred and nineteen thunderstorms have produced damaging lightning, high winds, flooding, and/or hail and spawned a total of seven tornadoes. These events caused property damage ranging from $1,000 to $72.6 billion. In addition, these same events caused 15 injuries and 10 deaths.

The purpose of this hazard analysis is to lay the foundation for setting priorities and identifying mitigation projects in the next phase, The Mitigation Plan. The statistics in the following chapters illustrate the existing conditions (population, housing, and economics) and show the types of natural disasters, which have occurred in Montgomery County over the last fifty years and in some cases, further back in history. This historical information illustrates when events are likely to occur and the possible damages, injuries, and fatalities, which may result.

Chapter 3 Inventory of Existing Conditions

Montgomery County is located in the southwestern part of Ohio, bordered on the east by Greene County, the north by Miami and Darke Counties, the west by Preble County, and south by Butler and Warren Counties. Established in 1803, these 461.7 square miles were named for General Richard Montgomery, a veteran of the Revolutionary War.

Montgomery County was home to Dayton poet and novelist Paul Laurence Dunbar. Dunbar at the age of seventeen published his own newspaper, the *Dayton Tattler*, an African-American newspaper printed by his high school classmate and friend, Orville Wright. From the bicycle shop of Wilbur and Orville Wright came the beginnings of powered flight. Today, known as the "Birthplace of Aviation," Montgomery County is home to the Wright-Patterson Air Force Base. Other attractions in the county include the Dayton Art Institute, Dayton Museum of Discovery, Paul Laurence Dunbar House, Aullwood Audubon Center, Germantown's Covered Bridge, Cox Arboretum, and Hawthorn Hill, home to Orville Wright. In addition, Montgomery County's natural attractions include Sycamore State Park, Eastwood Lake, and Carillon Historical Park.

As shown in Figure 1-1, the county is bisected north to south by Interstate 75 and east to west by Interstate 70. I-75 runs from Miami, Florida in the southern United States to Sault St. Marie in Michigan at the Canadian border and provides the primary north/south transportation through the county. I-70 runs from the East Coast to the West Coast of the United States and provides the primary east/west transportation through the county. North and south transportation through the county is also provided by State Routes 4, 48, 49, 201, and 202. East and west transportation through the county is also provided by U.S. Route 40 through the northern edge of the county, U.S. Routes 35 through the middle of the county, and State Route 725 through the southern portion of the county

Along with the major highways that run through the county, major railroad lines provide freight transportation and Dayton International Airport provides the bulk of the freight and passenger air transportation for the county.

The County is home to 19 cities or villages, 9 townships, and sixteen public school districts encompassing 166 public schools and 35 non-public schools, four public libraries with twenty-two branches, one private four-year university, and one two-year public college.[2]

At the start of 2010, much of the county's labor force was employed in the Service Industry (31.7%). Trade and manufacturing were other major areas of employment, employing approximately 22.8 percent and 20.9 percent of the county's work force, respectively.

[2] Ohio County Profiles, Montgomery County, 2010. Ohio Department of Development.

Geography and Environment

Montgomery County is situated within the Miami Valley, which is known for its water supply, industries, and productive farmland. Montgomery County is home to Dayton, a major industrial city in the region. Located along the Great Miami River, Montgomery County is in the Miami River Watershed and has an area of about 462 square miles. Four major river basins run into the Great Miami River, the Mad River, the Stillwater River, Wolf Creek, and Twin Creek. The Great Miami River is a major tributary that runs into the Ohio River in Cincinnati. The elevation above the mean sea level ranges from 1,550 feet in the northern portions to about 450 feet at the confluence of the Great Miami River in Hamilton County. Within the watershed there are approximately 2,360 miles of rivers and streams. The land use within the watershed is organized into eight major categories: urban, agriculture, shrub/scrub, wooded, open water, non-forest wetlands, and barren. According to the Ohio Department of Strategic Research, only 113,000[3] acres of land area remain agricultural in Montgomery County. Montgomery County lies within the Eastern Corn Belt plains eco-region, which is characterized by flat to gently rolling terrain underlain by glacial till and rich soils. These conditions should be considered in planning for natural hazards.

Major Rivers

Historically, the primary hazardous risk in Montgomery County has been flooding. Three major rivers in the watershed meet in downtown Dayton (located in Montgomery County). Specifically, the Mad and Stillwater Rivers converge into the Great Miami River, and the length of the river channel is about 170.3 miles. The confluence of these rivers caused a disastrous flood in 1913. Due to the influx of floodwater from the Mad and Stillwater Rivers, the Great Miami River flooded the City of Dayton. After the cleanup of the City was performed, a major dam and levee project was undertaken by the Army Corps of Engineers and the Miami Conservancy District. The project created earthen dams along the tributaries as well as widened and increased the height of banks of the Great Miami River. Retarding Basins were also created within the watershed to help prevent flooding.

Climate

Dayton is located near the center of the Miami River Valley, which is a nearly flat plain, 50 to 200 feet below the general elevation of the adjacent rolling country. Three Miami River tributaries, the Mad River, the Stillwater River, and Wolf Creek converge, fanwise, from the north to join the master stream within the city limits of Dayton. Heavy rains in March 1913 caused the worst flood disaster in the history of the Miami Valley. During the flood more than 400 people lost their lives and property damage amounted to $1.8 billion. After the 1913 flood, dams were built on the streams north of Dayton, forming retarding basins. No floods have occurred at Dayton since the construction of these dams.

[3] Ibid.

The elevation of the city of Dayton is about 750 feet. Terrain north of the city slopes gradually upward to about 1,100 feet at Indian Lake. Ten miles southeast of Indian Lake, near Bellefontaine, is the highest point in the state, with an elevation of about 1,550 feet. South of the city, the terrain slopes gradually downward to about 450 feet where the Miami River empties into the Ohio River. Precipitation, which is rather evenly distributed throughout the year, and moderate temperatures help to make the Miami Valley a rich agricultural region. High relative humidity during much of the year cause some discomfort to people with allergies. Temperatures of zero or below will be experienced in about four years out of five, while 100 degrees or higher will be recorded in about one year out of five. Extreme temperatures are usually of short duration. The downward slope of about 700 feet in the 163 miles of the Miami River may have some moderating influence on the winter temperatures in the Miami Valley.

Temperate continental characterizes the climate of the Great Miami Watershed. Extreme temperatures and precipitation can depict this type of climate, too. However, the adjustment to different seasons happens gradually. Due to its distance from the ocean, Montgomery County is hot in the summer and cold in the winter. The average last occurrence in the spring of freezing temperatures is mid-April, and the average first occurrence in the autumn is late October. The mean monthly temperature ranges from 68° to 75°F during the summer months and from 26°F to 33°F during the winter months. The temperature goes above 90°F about 16 days of the year and goes below 0°F about 7 days a year. Cold, polar air, flowing across the Great Lakes, causes much cloudiness during the winter, and is accompanied by frequent snow flurries. These add little to the total snowfall.

The majority of the precipitation comes from the tropical air masses in the Gulf of Mexico and the western Atlantic Ocean. According to the National Weather Service, the mean annual temperature ranged from 42°F to 60°F from 1961 to 1990.[4]

	High		Low		1-Day		1-Day	
Month	Mean°F	Year	Mean°F	Year	Max°F	Date	Min°F	Date
JAN	39.1	2006	11.6	1977	71	01/24/1943	-25	01/18/1994
FEB	39.2	1998	16.9	1978	73	02/11/1999	-16	02/02/1951
MAR	51.3	1946	26.7	1960	82	03/22/1938	-7	03/02/1980
APR	57.3	1941	45.0	1950	89	04/30/1962	15	04/08/1972
MAY	69.4	1965	55.8	1997	93	05/31/1937	26	05/01/1963
JUN	75.5	1943	66.5	1958	102	06/25/1988	40	06/11/1972
JUL	81.4	1936	69.3	1947	106	07/14/1936	44	07/06/1972
AUG	79.3	1936	68.2	1946	102	08/19/1936	40	08/03/1965
SEP	71.9	1939	60.5	1974	101	09/06/1954	32	09/23/1974
OCT	62.9	1971	47.1	1988	89	10/04/1954	21	10/26/1962
NOV	48.7	2001	35.2	1976	79	11/01/1950	-2	11/30/1958
DEC	39.6	1982	19.0	1989	72	12/02/1982	-20	12/22/1989

- Figure 3-1: Temperature Means and Extremes – Period of Record: 1935-2010[5]

[4] NCDC – Comparative Climate Data: http://www1.ncdc.noaa.gov/pub/data/ccd-data/CCD-2010.pdf
[5] NCDC – Historical Climate Data referenced from Weather Station 332075 Dayton WSO AP, OH

Month	High (in)	Year	Low (in)	Year	1-Day Max (in)	1-Day Date
JAN	12.41	1937	0.30	1981	4.16	01/21/1959
FEB	5.77	1990	0.14	1947	2.58	02/20/1951
MAR	7.65	1964	0.65	1941	2.95	03/24/1913
APR	9.20	1996	0.56	1962	3.10	04/02/1977
MAY	9.06	1995	0.90	1934	3.17	05/23/1989
JUN	10.89	1958	0.32	1962	3.76	06/05/1981
JUL	8.56	1990	0.33	1916	3.16	07/09/1955
AUG	8.03	1974	0.03	1996	3.38	08/05/1995
SEP	10.84	2011	0.27	1963	3.81	09/16/2005
OCT	7.08	1919	0.10	1944	3.54	10/05/1995
NOV	8.07	1985	0.34	1917	2.94	11/18/1938
DEC	10.04	1990	0.36	1955	2.85	12/30/1990

- Figure 3-2: Precipitation Extremes – Period of Record: 1911-2012[6]

Month	High (in)	Year	1-Day Max (in)	1-Day Date
JAN	40.2	1978	12.2	01/26/1978
FEB	23.1	2010	7.7	02/05/2010
MAR	15.8	2008	11.2	03/22/1968
APR	4.9	1974	4.7	04/08/1974
MAY	-	-	-	-
JUN	-	-	-	-
JUL	-	-	-	-
AUG	-	-	-	-
SEP	-	-	-	-
OCT	5.8	1989	4.8	10/19/1989
NOV	12.6	1950	8.0	11/25/1950
DEC	15.6	1960	7.0	12/26/2012
Season (Jul-Jun)	62.7	1977-78	12.2	01/26/1978

- Figure 3-3: Snowfall Extremes – Period of Record: 1911-2012[7]

Minerals and Soils

The vast majority of soils found in Montgomery County are derived from loess or glacial till. About 81 percent of the basin contains these types of soil. These soils tend to have poor to moderate drainage characteristics and high fertility. These types of soils could indicate whether the county is prone to flooding. The soils tend to have high lime content due to the limestone bedrock of the region. The Ohio Department of Natural Resources has conducted studies that depict about three percent organic material within the upper 10 inches of the soil profile.

Conducting a thorough and precise emergency mitigation plan requires the identification of hazardous soils within the county. These soils are major indicators of the feasibility of

[6] Ibid.
[7] Ibid.

flooding or erosion degradation hazards have moderate or severe engineering or flooding limitations. The following soils were identified by the Miami Valley Regional Planning Commission as possible hazardous areas in Montgomery County. Further information and description can be found in the Soil Survey[8] book for Montgomery County.

FaE2- Fairmount silty clay loam, 18-25 percent slopes, moderately eroded and **FaF2**- Fairmount silty clay loam, 25 to 30 percent slopes, moderately eroded.

This soil is in narrow bands around the sides of hills and is underlain by limestone bedrock. The profile of this soil is similar to the one described as representative for the Fairmount series, except that erosion has removed so much of the original dark surface layer that only 3 or 4 inches of it remains over the olive-brown subsoil. Rills have cut into the upper part of the subsoil in places. Surface runoff is rapid.

Included in this soil type are small areas of Milton and Ritchey soils and small areas of a soil that is similar to Fairmount soils but is up to 36 inches thick over bedrock. Also included are a few acres of Fairmount silty clay loam that has slopes of 6 to 12 percent and a few areas that are severely eroded.

The hazard of further erosion is the major limitation to use of this soil for farming and for most non-farm uses (Capability unit VIe-2).

FmD2- Fox silt loam, 12-18 percent slopes, moderately eroded.

This soil is on the outer edges of broad, rolling terraces of major streams and on hilly gravel deposits. It is eroded so much that only 2 or 3 inches of the original silt loam surface layer remains over the finer textured subsoil. Rills have cut into the subsoil in places.

Included are small, severely eroded areas where only the subsoil layer remains over the gravel and where spots of gravel are exposed. Also included are small areas of a soil that has a loam surface layer.

A very severe hazard of further erosion is the major limitation to the use of the soil for farming and many non-farm uses. Droughtiness is a secondary limitation (Capability unit IVe-1).

FuF- Fox-Urban land complex, steep.

These soils are moderately steep and are on kames and terraces that have been developed for residential use. Slopes are more than 12 percent. Areas of the soils in 50 percent of Fox-Urban Land Complex are so disturbed or buried by filling and other earth-moving operations that they can no longer be classified by natural characteristics.

Surface runoff typically is very rapid. A very severe hazard of erosion is the major limitation in areas being developed. Droughtiness is a limitation to use for ornamental trees and shrubs. Because sand and gravel is not far from the surface, it is desirable to stockpile topsoil for use after construction is completed. Slope is a severe limitation for many community uses. Underground water is highly susceptible to pollution because permeability is rapid in the underlying sand and gravel (Capability unit not assigned).

HeE2- Hennepin and Miamian silt loams, 18-25 percent slopes, moderately eroded.

[8] Soil Survey of Montgomery County, Ohio, June 1976

These soils are along the banks of the larger drainage ways in the rolling moraines and along the valley walls of most of the streams in the county. Some areas of this mapping unit are dominantly Hennepin soils, some are dominantly Miamian soils, and in some areas both soils occur.

Severe erosion hazard is the major limitation of these soils for farming and many non-farm uses. The soils are generally too steep for cultivation, but they are well suited to pasture (Capability unit Vie-3).

HeF2- Hennepin and Miamian silt loams, 25-50 percent slopes, moderately eroded

These soils are along the banks of the larger drainage ways and along valley walls of the larger streams in the county. Some areas are dominantly Miamian soils, some are dominantly Hennepin soils, and in some areas both soils occur. Each soil is described under its respective series heading.

Included in mapping are areas of a soil that is shallow to limestone or sand and gravel. Also included are small areas of escarpments.

The very steep slopes and the severe hazard of further erosion are the major limitations to use of these soils for farming and many non-farm uses. These soils are suited to pasture, but in the steeper areas the use of some kinds of modern machinery is hazardous (Capability unit VIIe-1).

HmF3- Hennepin and Miamian soils, 18-50 percent slopes, severely eroded.

These soils are on banks of the larger intermittent drainage ways and along valley walls of most of the larger streams in the county. Some areas are dominantly Miamian soils or Hennepin soils, and in some areas both soils occur. The profile of these soils is similar to that described as representative for the Hennepin and Miamian series, except that the surface layer and, in many places, the subsoil have been lost through erosion, and gullies are common. In many areas of these soils, the surface layer is calcareous loam till, and in other areas it is clay loam. In both kinds of areas, the soils are poor for growing plants. The Hennepin soils make up about 50 percent, the Miamian soils about 35 percent, and other soils about 15 percent.

The steep and very steep slopes and the severe hazard of further erosion are the major limitations to use of these soils for farming and many non-farm uses. However, it can be used for pastures, but growth of forage plants typically is slow (Capability unit VIIe-1).

LxD2- Lorenzo-Rodman complex, 12-18 percent slopes moderately eroded.

These soils are on terraces along the larger streams in the county. Any mapped area of these soils consists of about 50 percent Lorenzo soils, about 40 percent Rodman soils, and about 10 percent inclusions of similar though light-colored soils. They have a profile that differs from the one described as representative for their respective series by having a thinner loam surface layer because of loss through erosion. This loss results in a very low available moisture capacity and less available nutrients than in the un-eroded soil.

A severe erosion hazard is the dominant limitation to us of these soils for farming and non-farm uses. Slope and droughtiness are also limitations for LxD2 (Capability unit Vie-1).

MlD2- Miamian silt loam, 12-18 percent slopes, moderately eroded.

This soil is in strips along drainage ways on the moraines and dissected till plains. It is so eroded that material from the upper part of the subsoil has been worked into the surface layer by plowing, or the surface layer is so thin that such mixing would occur if this soil were plowed. This soil has less available moisture capacity than Miamian silt loam 0 to 2 percent slopes. Plowed areas have poor tilth. Surface runoff is rapid.

A severe erosion hazard is the major limitation of the soil if it is used for cultivated crops. Moderately steep slopes and moderately slow permeability are limitations for many non-farm uses (Capability unit IVe-1).

MnD3- Miamian clay loam, 12-18 percent slopes, moderately eroded.

This soil is in strips along the small streams on the moraines and stream-dissected till plains. It is eroded so much that most of the original surface layer has been lost, and the subsoil is exposed in many places. Even the underlying calcareous till is exposed in some places. The available moisture capacity and content of plant nutrients are low. The exposed clay loam subsoil or loam glacial till is unstable and susceptible to further erosion. Crusting is common. Vegetation is difficult to establish, and cover is sparse.

A severe erosion hazard is the dominant limitation to use of this soil for cultivated crops. Slope and severe erosion are the dominant limitations for many non-farm uses (Capability unit VIe-3).

MoE- Miamian-Urban land complex steep.

These soils are mainly well drained, are moderately steep and steep, occur on uplands, and are underlain by compact glacial till. In most places they have been so disturbed by earthmoving or other construction operations that soil characteristics have been obliterated and the soils cannot be precisely classified. The undisturbed spots are mainly a Miamian soil that has a profile similar to that described as representative for the series.

Moderately steep and steep slopes are the dominant limitation to use for farming. Surface runoff is very rapid, and the erosion hazard is very severe on construction sites and in other disturbed areas. On construction sites erosion control practices help to control sedimentation of adjacent drainage ways and lower lying areas.

MsD2- Milton silt loam, 12-18 percent slopes, moderately eroded.

This soil is in long, narrow areas along the walls of valley cut into bedrock. It is eroded, and the surface layer has higher clay content than un-eroded Milton soils. Rills have cut into the subsoil in places. This soil has lost much of its organic-matter content and, which soil has lost much of its readily available nutrients. This soil is droughty as a result of moderate depth to limestone and erosion.

Surface runoff is very rapid, and erosion is the dominant limitation to use for cultivated crops. Slope and the moderated depth to bedrock are limitations for most non-farm uses (Capability unit IVe-3).

MtD3- Milton silty clay loam, 6-18 percent slopes, severely eroded.

This soil is in narrow bands along the walls of valleys cut into bedrock. It is severely eroded, and all or most of the original surface layer has been lost. The limestone bedrock is exposed at the surface in a few places. The available nutrients and available moisture capacity are very low. Infiltration is slow, and runoff is rapid to very rapid. Plants are difficult to establish. This soil has slopes of 6 to 12 percent in most areas, though slopes are 12 to 18 percent in some places.

The steeper areas of this soil are not as well suited to cultivated crops as areas where the slopes are 6 to 12 percent; even in the more nearly level areas, however, cultivation should be only occasional. This soil is better suited to permanent vegetation than to cultivated crops.

Past erosion and the hazard of further erosion are the major limitations to use of this soil for farming, but droughtiness also is a limitation. Slope and bedrock near the surface are limitations for many non-farm uses (Capability unit IVe-3).

MuD- Milton-Urban land complex hilly.

These soils are moderately steep on uplands. Limestone and clay shale bedrock are at a depth of 20 to 40 inches. In most places the soils have been disturbed by earthmoving. The undisturbed spots are mainly a Milton soil that has a profile similar to the one described as representative for the series.

The soils in this unit are well drained and droughty. Because these soils have moderately steep slopes, surface runoff is rapid. Slope and bedrock near the surface are limitations to construction on these soils. Erosion is a very severe hazard on construction sites. Use of conservation practices on construction sites helps to minimize siltation and pollution of drainage ways downstream (Capability unit not assigned).

ReE2- Ritchey silt loam, 18-25 percent slopes, moderately eroded.

This soil is in narrow strips along the sides of limestone bedrock valleys. It has a profile similar to the one described as representative for the Ritchey series, except that only a few inches of the silt loam surface layer remains. If this soil is tilled, the plow layer is a mixture of the surface layer and subsoil. Rills expose the less organic matter and available nutrients from the surface layer of a less eroded Ritchey soil. The available moisture capacity is also slightly lower. Tilth is not as good as un-eroded or slightly eroded Ritchey soils.

Surface runoff is very rapid, and there is a severe erosion hazard unless a thick plant cover is maintained. Droughtiness is a secondary limitation. This soil is very poorly suited to cultivated crops, but it is suited to pasture. Slope and shallow depth to bedrock are the dominant limitations for most non-farm uses (Capability unit VIe-2).

ReF2- Ritchey silt loam, 25-50 percent slopes, moderately eroded.

This soil is in strips along the sides of very steep hills and valley walls. It is eroded so much in places that only 1 or 2 inches of the brownish silt loam surface layer remains. This soil has the profile described as representative for the series.

Surface runoff is very rapid, and the erosion hazard is severe unless a thick plant cover is maintained. Operating equipment on the steeper slopes is extremely hazardous. Slope and shallow depth to rock are severe limitations for practically any use of this soil (Capability unit VIe-2).

RfD3- Ritchey silty clay loam, 6-18 percent slopes, moderately eroded.

This soil is in narrow strips along the sides of limestone bedrock valley. It is so eroded that the entire original dark grayish-brown silt loam surface layer is gone and the present surface layer is clayey subsoil material. The depth to bedrock is less than 10 inches in many places. The few inches of clayey subsoil remaining are very low in nutrients, organic-matter content, and available moisture capacity. Vegetation is generally scanty, and cover plants are hard to establish on this soil.

A very severe hazard of further erosion is the major limitation to use of this soil for cultivated crops. The steeper areas of this soil are poorly suited to cultivated crops, and a thick plant cover helps to control erosion. Droughtiness is a serious secondary limitation. Slope, severe erosion, and shallow depth to bedrock are limitations for most non-farm uses (Capability unit IVe-2).

RlE2- Rodman and Fox soils, 18-25 percent slopes, moderately eroded.

These soils are in narrow strips on stream terraces and are in hilly gravelly areas of the uplands. Some mapped areas consist mostly of Rodman soils, some mostly of Fox soils, and some consist of both soils. These soils can be mapped separately, but they have such steep slopes that showing them separately would serve no useful

purpose for use and management. Part of the surface layer has been lost through erosion. The present surface layer is loam or gravelly loam. Because these soils are thinner than those described as representative for the series, they have less available nutrients and lower available moisture capacity.

A very severe erosion hazard and droughtiness are the major limitations to use of these soils for pasture. These soils are better suited to permanent pasture or trees than to improved pasture, though slopes permit equipment to be operated for pasture improvement. Slope and droughtiness are the dominant limitations for most non-farm uses (Capability unit VII e-2).

RlF2- Rodman and Fox soils, 25-50 percent slopes, moderately eroded.

The soils in this unit are very steep and occur in narrow strips on stream terraces and on hilly, gravelly uplands. Some mapped areas consist mostly of Rodman soils, some mostly of Fox soils, and some consist of both soils. These soils could be mapped separately, but they have such steep slopes that showing them separately would serve no useful purpose for use and management. Part of the surface layer of these soils has been lost through erosion. Texture is loam or gravelly loam. These soils have less available nutrients and a lower available moisture capacity than the soils described a representative for the series. An un-eroded profile of the Rodman part of this mapping unit is described as representative for the series.

These soils are, in most places, too steep for use of ordinary tractors and other wheeled vehicles. They are better suited to permanent pasture or trees. Steep slopes are a severe limitation for most non-farm uses (Capability unit VIIe-2).

RvD2- Russell-Miamian silt loams, 12-18 percent slopes, moderately eroded.

These soils are in narrow strips adjacent to larger drainage ways in rolling areas. The depth of the loess capping varies within short distances, and both Russell and Miamian soils occur in about equal acreages. Both soils are moderately eroded. Surface runoff is very rapid, and the surface layer is highly erodible.

A very severe hazard of further erosion is the major limitation to use of these soils for cultivated crops. Slope is the dominant limitation for many non-farm uses (Capability unit IVe-1).

Soils with Low Bearing Strength

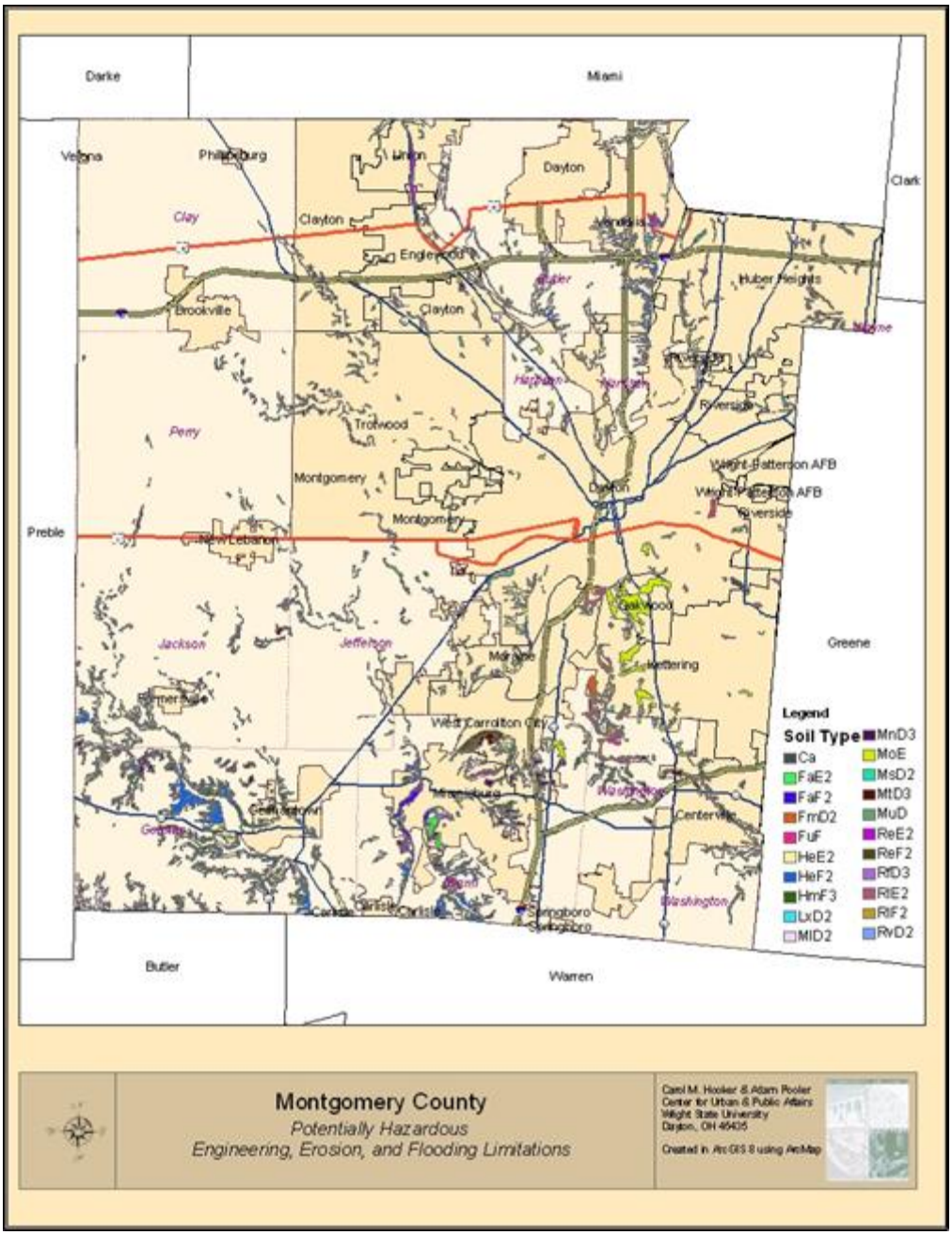
A limited range of particle sizes dominate soils with low wet bearing strength. They are pliable and deform easily under pressure when wet. Quicksand is an example. If poorly drained, they can be unsuitable for foundations and have poor trafficability when wet. Low wet bearing strength soils often suffer severe structural damage if cultivated or mechanically disturbed when wet.[9]

Ca - Carlisle Muck

This nearly level soil is in depressions on the flood plains and terraces. It is adjacent to Ross and Medway soils on the flood plains and to Montgomery soils on the terraces.

A water table that stays high for long periods is the major limitation to use of this soil for farm and non-farm purposes. Even if drained, this soil is subject to oxidation and subsidence unless the water table is controlled. It is subject to soil blowing and fire damage if it is allowed to become too dry. This soil can be readily drained by tile if outlets can be established (Capability unit IIw-4).

[9] http://www.planning.nsw.gov.au/LinkClick.aspx?fileticket=yFyxuYGZhYo%3D&tabid=447&language=en-US



- Figure 3-4: Potentially Hazardous Soils

Geology

The geology of the watershed where Montgomery County lies consists of relatively young glacial deposits that overlie a thick sequence of much older sedimentary rocks. The present landscape of today was formed by the erosion of three different sedimentary rock units; Ordovician, Silurian, and Devonian units. All of these rock units were deposited in a shallow inland sea during the Paleozoic Era. During the time of glaciations, the glaciers eroded these deposits into what the county looks like today. The glaciations of the area changed the

drainage patterns of the watershed. Understanding these geologic characteristics of Montgomery County is an important step in hazard mitigation to avoid unnecessary risks.

Other Significant Geologic Features

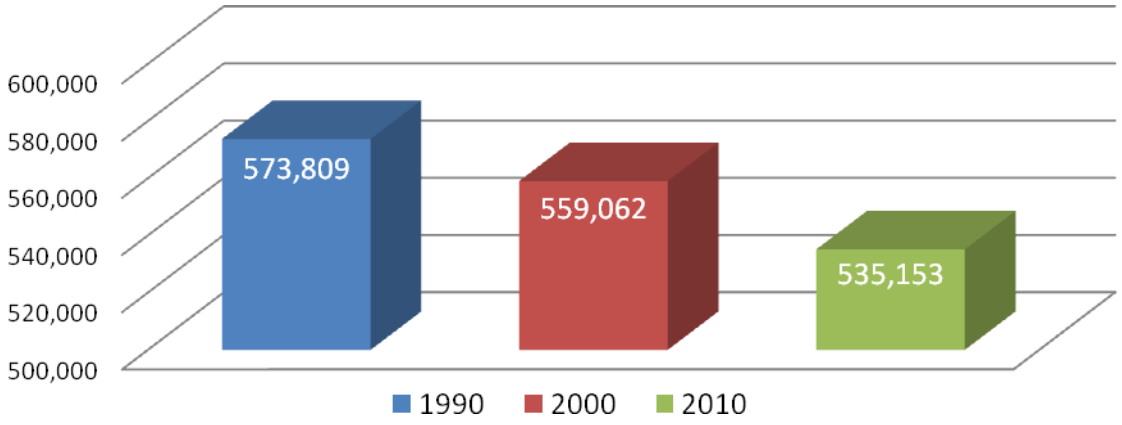
Montgomery County lies on two major geologic features that exist throughout the Great Miami River Watershed. The two features that influence drainage in the county are the Cincinnati Arch and the Teays River Valley. The Cincinnati Arch can be described as a broad uplift in the sedimentary rock strata that traverses southwest Ohio in a north-south orientation. During the Paleozoic Era erosion occurred, which caused the older rocks to be found in the center of the arch and younger rocks outcrop along the flanks. The Teays River Valley is an ancient valley that contains sand and gravel deposits, which can reach a maximum of 300 feet. This valley helps make up an extensive buried valley aquifer system that helps with drainage of the area and provides the region's water supply.

Population & Households

Population

In 2010, 535,153 people lived in 223,943 households across Montgomery County. Of the total population, 14,142 resided in group quarters. Of all Montgomery County residents, 395,272 (73.9%) were white and 111,870 (20.9%) were African-American.

The county has seven cities with a population greater than 20,000 – Dayton, Centerville, Huber Heights, Kettering, Miamisburg, Riverside and Trotwood. Dayton is the county's largest city with a population of 141,527. Over one quarter of Montgomery County's population resides in the City of Dayton (See Figures 1-1 and 3-6). Kettering is the second largest city with a population of 55,696 (See Figure 3-6).



- Figure 3-5: Montgomery County Population Trends

As shown in Figure 3-5, the county's population decreased 4.28 percent from 2000 to 2010 and 6.74 percent from 1990 to 2010.

Geography 2010	Total Population		Pop. Change (%)
	2000	2010	2000-2010
Ohio	11,353,140	11,536,504	183,364 (1.62%)
Montgomery County	559,062	535,153	-23,909 (-4.28%)
Brookville city	5,289	5,884	595 (11.25%)
Carlisle village (part)	245	205	-40 (-16.33%)
Centerville city	23,024	23,997	973 (4.23%)
Clayton city	13,347	13,209	-138 (-1.03%)
Dayton city	166,179	141,527	-24,652 (-14.83%)
Englewood city	12,235	13,465	1,230 (10.05%)
Farmersville village	980	1,009	29 (2.96%)
Germantown village	4,884	5,547	663 (13.57%)
Huber Heights city	38,177	37,142	-1,035 (-2.71%)
Kettering city	57,502	55,696	-1,806 (-3.14%)
Miamisburg city	19,489	20,181	692 (3.55%)
Moraine city	6,897	6,307	-590 (-8.55%)
New Lebanon village	4,231	3,995	-236 (-5.58%)
Oakwood city	9,215	9,202	-13 (-0.14%)
Phillipsburg village	628	557	-71 (-11.31%)
Riverside city	23,545	25,201	1,656 (7.03%)
Springboro city (part)	153	1,218	1,065 (696.08%)
Trotwood city	27,420	24,431	-2,989 (-10.9%)
Union city	5,570	6,395	825 (14.81%)
Vandalia city	14,603	15,246	643 (4.40%)
Verona village (part)	55	79	24 (43.64%)
West Carrollton city	13,818	13,143	-675 (-4.88%)

- Figure 3-6: 2010 Population, Montgomery County by Jurisdiction[10]

As of 2010, the largest age group was age 65+ (15.14% - see Figure 3-7). The second largest age group was between 45-54 years of age (14.75%). The number of county residents 25 years and older who have graduated from high school is 86.7 percent, about the same as the state of Ohio's 86.8 percent in the same category. County residents 25 years and older who have a bachelor's degree or higher is 23.9 percent, slightly higher than Ohio's 23.6.

Age Range	Population	% of Total Population
Montgomery County Total	535,153	100%
Under 5 years of age	33,446	6.25%
5 to 14 years of age	67,976	12.70%
15 to 24 years of age	72,973	13.64%
25 to 34 years of age	67,089	12.54%
35 to 44 years of age	65,645	12.27%
45 to 54 years of age	78,920	14.75%
55 to 64 years of age	68,063	12.72%
65 years of age or older	81,041	15.14%

- Figure 3-7: Percent of Population by Age, 2010[11]

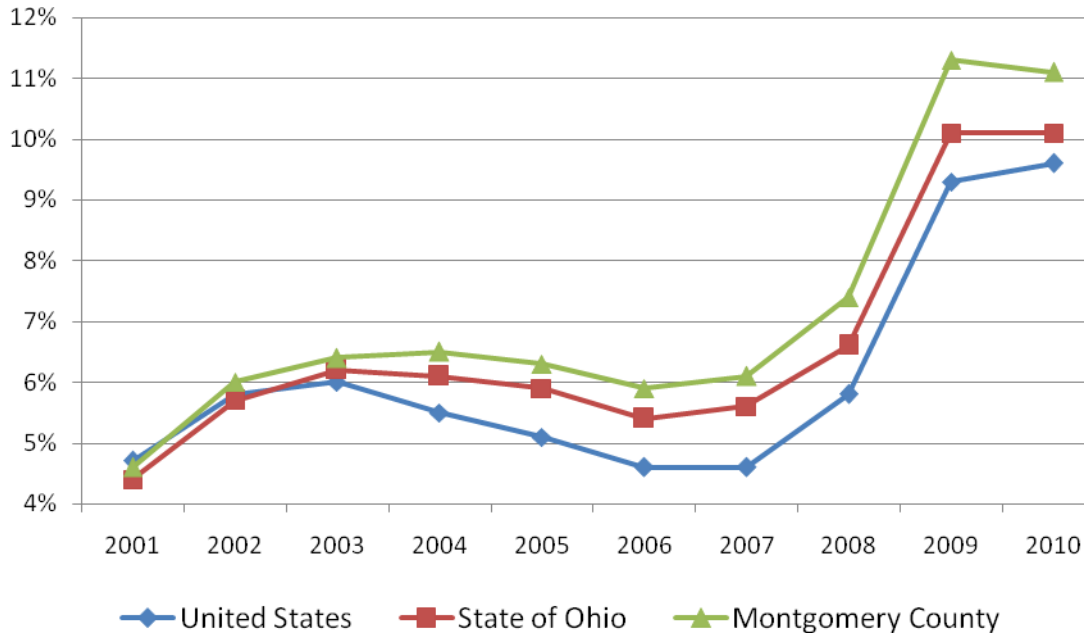
[10] 2011 Population and Household Counts for Governmental Units, Ohio Department of Development
[11] Ibid.

Of the 145,330 residents enrolled in school over the age of 3: 8,655 (5.96%) were enrolled in nursery or preschool, 7,435 (5.12%) in kindergarten, 54,506 (37.50%) in elementary (grades 1-8), and 29,821 (20.52%) in high school, and 44,913 (30.93%) in college graduate school.

According to the 2010 U.S. Census of Housing and Population, Montgomery County had 254,775 housing units. Almost two-thirds of these units were owner occupied (64.4%) units and the median value was $117,700. Conversely, approximately 79,647 units in Montgomery County were rental units and the median contract rent was $517.

Industry and Labor Force

In 2010, Montgomery County's civilian labor force was made up of approximately 269,979 residents. During that same time, the county's civilian unemployment rate was roughly nine percent (24,298 unemployed). Figure 3-8 shows a comparison of unemployment rates between 2001 and 2010 for Montgomery County, Ohio and the United States. Between 2001 and 2010 Montgomery County witnessed an increase in unemployment rates and unemployment in the county remained above both the national and state average.

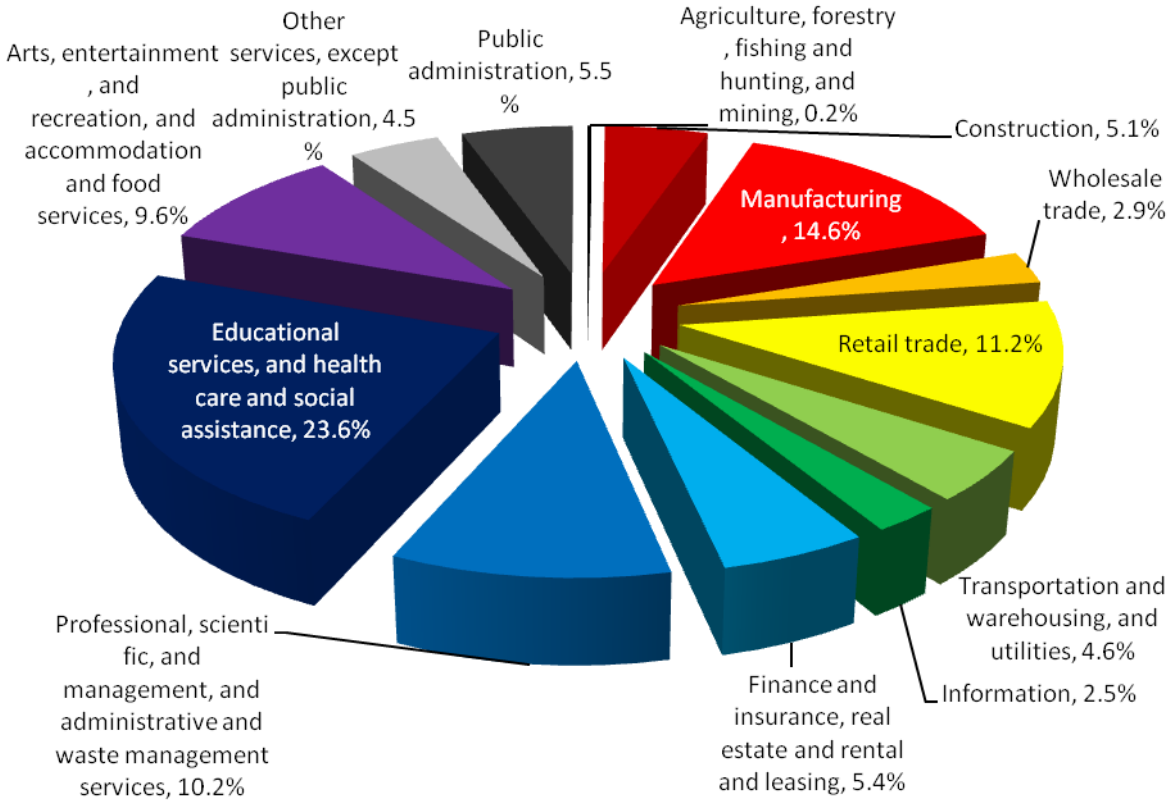


- Figure 3-8: Unemployment Rates in the U.S., Ohio and Montgomery County[12]

As noted earlier in this report, educational services, health care and social assistance was the largest workforce category for the county, employing 57,860 workers or 23.6 percent of the workforce (see Figure 3-9). The manufacturing industry is the second largest workforce category in Montgomery County, employing 35,752 workers or 14.6 percent of the

[12] Ohio Department of Job and Family Services Local Area Unemployment Statistics (LAUS) Program

workforce. The retail industry was the third largest category, employing 27,509 individuals, approximately 11.2 percent. In 2010, the average weekly earnings for individuals employed by all industries in the county were $782.87 (see Figure 3-10). Management of companies and enterprises paid the highest average weekly wage at $ 1,624.94. The utilities industry yielded the second highest average weekly wage at $ 1,494.48, and the information industry paid the third highest weekly wage at $ 1,230.81. Individuals employed in the accommodation and food services had the lowest average weekly earnings in Montgomery County, earning $ 256.46 a week on average.



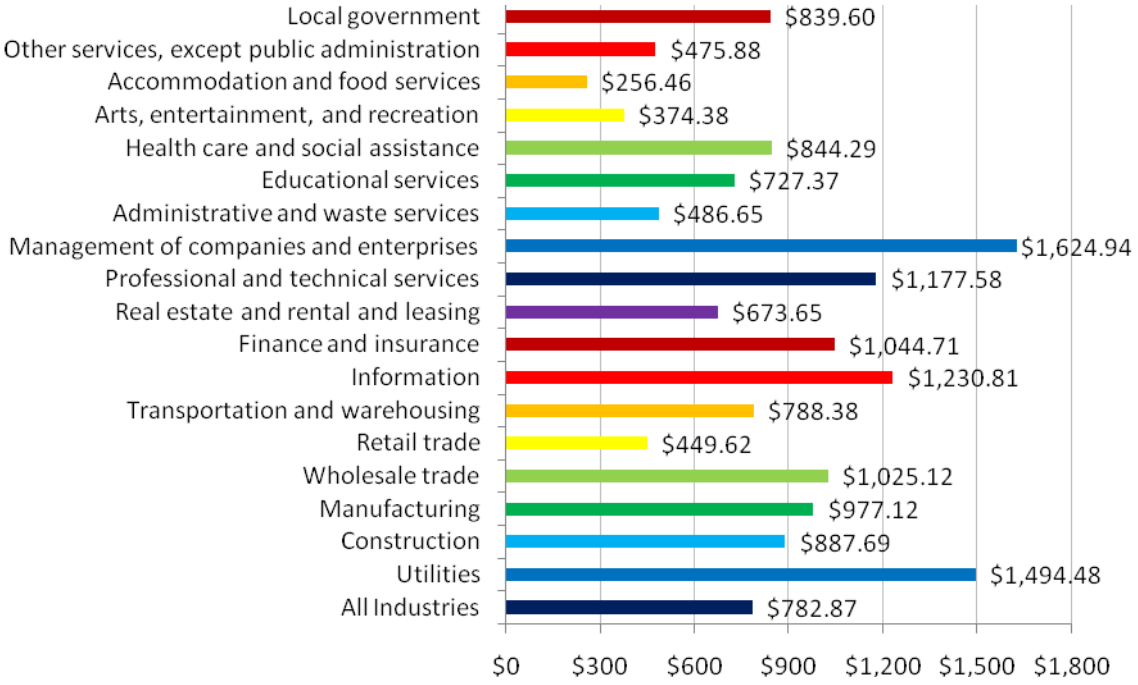
- Figure 3-9: Montgomery County Employment by Industry, 2010[13]

Business	Industry	# of Employees
Premier Health Partners	Health care provider	11,300
Kettering Health Network	Acute care provider	5,425
LexisNexis	Online information services and publishing	3,000
National City	Bank	2,100
AT&T	Data and voice communication services	1,500
Cox Ohio Publishing	Media	1,300
DMAX Ltd.	Diesel engine manufacturer	1,159
Green Tokai Co.	Automotive part, injection molding	1,142
DPL Inc.	Holding company for Dayton Power & Light	1,029
Behr Dayton Thermal Products	Manufacturer of heating/cooling products	900

- Figure 3-10: List of Top Ten Employers in Montgomery County[14]

[13] U.S. Census Bureau Data Set: 2005-2009 American Community Survey 5-Year Estimates
[14] Montgomery County Economic Development Department

Figure 3-10 presents a list of the top ten employers in Montgomery County and approximately how many individuals they employ. Figure 3-11 presents the average weekly earnings for Montgomery County in 2010, broken down by industrial sector.



- Figure 3-11: Average Weekly Earnings by Industrial Sector, 2010[15]

According to the Ohio Department of Development, Montgomery County work force spends an average of 20.7 minutes traveling to work.

Critical Facilities

Critical facilities are those facilities that can impact the delivery of vital services, can cause greater damages to other sectors of your community, or can put special populations at risk and should include, but are not limited to the following:

- Fire stations
- Police stations
- Sewage treatment plants (included in this study under Government Facilities)
- Water treatment plants and pumping stations (included in this study under Government Facilities)
- Schools
- Day care centers
- Hospitals

[15] Ohio Department of Jobs and Family Services, Report # RS 203.3-BN, 2010

- Retirement homes and senior care facilities
- Critical utility sites such as telephone switching stations or electrical transformers
- Hazardous material storage areas.

In Montgomery County, we have also included facilities which house a large number of individuals attending special functions because these populations can drastically impact rescue attempts if packed to capacity.

Montgomery County Critical Facilities	
Law Enforcement	31
Fire Service	73
Hospitals	11
Schools	142
Private Schools	53
Shelters	69
Childcare Centers	180
Dams	50
Health Facilities	78
Government Buildings	34
Court Buildings	4
Jails	7
Fairgrounds and Arenas	5

- Figure 3-12: Critical Facilities

Chapter 4

Floods

"Floods are the most common and widespread of natural disasters."[16] Floodwaters can move at rapid speeds and can be quite destructive. Moving water can tear out mature trees, bridges and buildings. Most communities in the United States experience some annual flooding after rains, which at times mix with rapidly melting snow during the spring thaw.

Flooding occurs when it rains or snows. Some of the water is retained by the soil and vegetation and the remainder, which cannot be absorbed, runs off the land in quantities that cannot be carried in stream channels or retained in natural ponds and constructed reservoirs or dams. Floodplains are areas where flooding occurs naturally. Rivers and streams within floodplains overflow their banks due to heavy rain or melting snow.

In Montgomery County, flooding is most common from April to August when severe storms bring heavy rain over a short period of time or extended periods of rain over a several days, which causes standing water and/or runoff problems. As such, all jurisdictions in the County are susceptible to flooding and participate in the National Flood Insurance Program.

Montgomery County has several rivers with smaller tributaries that are susceptible to annual flooding. Since 1964, the county has been fortunate in that no deaths or injuries have been reported due to flooding, but over $1.5 million in damages has occurred in that same period (refer to Figure 4-1).[17] Though the county has a history of flooding, recent events consist of little or no damage. In the last 100 years, the county has had nine major flood events. In the last 10 years there have been five flood events, or one event every two years, thus there will be a 50 percent chance a flood event will occur within the county each year.

Year	Estimated Damages	Presidential Disaster Declaration		Year	Estimated Damages	Presidential Disaster Declaration
1913	$1,800,000,000	No		**2001**	$7,264	No
1964*	$3,400,000	Yes		**2002***	$63,300	No
1968*	$3,200,000	Yes		**2003**	$170,000	No
1989*	$4,300,000	Yes		**2005**	$30,000	No
1993	$6,359	No		**2007**	$5,000	No
1994	$6,200	No		**2008**	$6,000	No
1995	$23,000	No		**2009**	$2,000	No
1996	$228,400	No		**2011**	$5,000	No
2000	$19,200	No		**2012**	$4,000	No

*Indicates multi-county events

- Figure 4-1: Historical Damages (not adjusted): Annual Total Flood Damage[18]

[16] http://www.fema.gov/hazard/flood/index.shtm
[17] In some instances, damages for events are not necessarily reflective of Montgomery County estimates alone. Damages are reported for all areas listed under one reported event and may include several counties.
[18] Ohio Emergency Management Agency, National Climatic Data Center

History of Flooding in Montgomery County

According to the National Climatic Data Center (NCDC), Montgomery County was most recently affected by damages caused during heavy rainfall on September 27, 2002 due to the inland remains of Tropical Storm Isidore. A large area of tropical rains was dumped onto southwest and west central Ohio, the heaviest rainfall occurring in Butler, Clark, Clermont, Clinton, Greene, Hamilton, Miami, Montgomery, Preble, and Warren counties. Rainfall amounts for Greene and Montgomery Counties were between four and six inches over a several hour period causing numerous problems on area roadways. Increased water pressure in the City of Dayton sewer system, blew off manhole covers throughout the city. One man had to be rescued from his vehicle when he drove his car into a flooded retention pond near the Dayton Mall.

The damage for the areas affected by this storm was estimated at $25,500, but most damage occurred in the Cincinnati area where a roof collapsed over an antique store and motorists were stranded in their automobiles requiring rescue services.

Thunderstorms producing torrential rains in the amounts of four to six inches in four hours were reported in Clinton, Fayette, Montgomery, and Warren counties on July 27, 2002. These storms caused many creeks to flow out of their banks and damages were reported on the south side of Dayton and throughout Montgomery County. Total damages caused by this storm were estimated at $23,500 (Over $8,200 in damages reported in Montgomery County).

On June 13, 2002 multiple thunderstorms developed over Clark, Greene, Montgomery, Preble, and Ross counties producing heavy amounts of rainfall in a brief period of time. This series of storms caused several road closures throughout the area and basements were flooded in the Kettering and Miamisburg areas, but there was no reported estimate dollar amount of property damage.

One June 12, 2001 severe rainfall caused two feet of water on roadways across the eastern portion of the county.

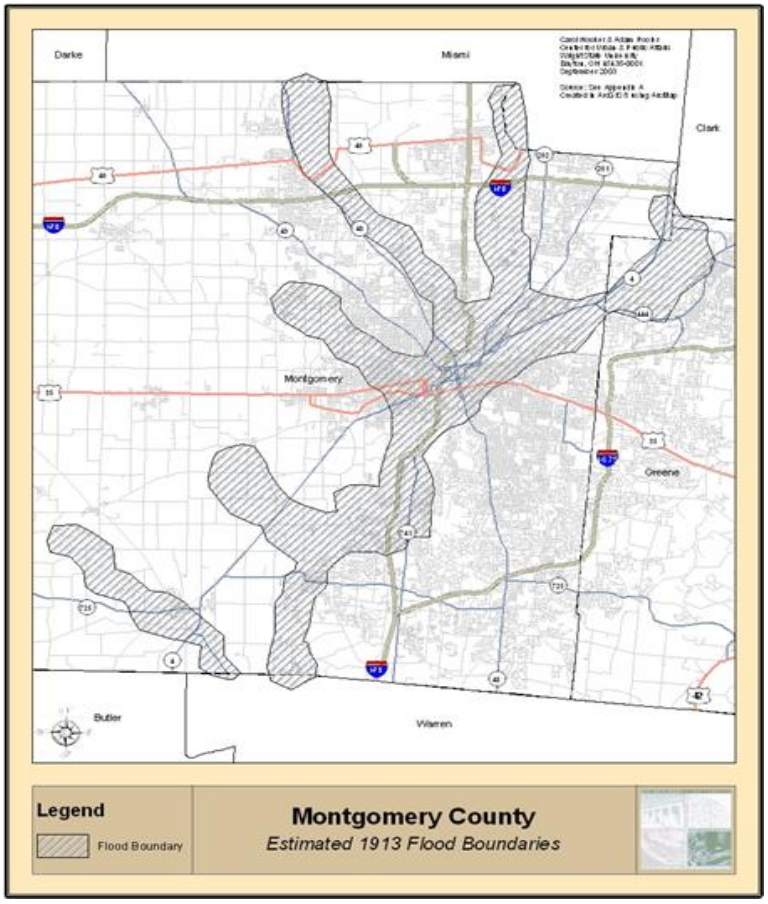
In January 1996, melting snow and heavy rainfall produced widespread tributary flooding and significant flooding along the Miami River. $219,000 dollars in damages were incurred in fifteen counties, including Montgomery.

On August 08, 1995 thunderstorms produced two to four inches of rainfall in a two hour period resulting in flooding in low lying areas and areas with poor drainage. Water collecting on the roof of an unoccupied building in Trotwood caused the building to collapse. In northern Dayton, roads collected up to four feet of water rendering them impassable.

No information is available for occurrences prior to November 1993 from the NCDC, but record of three Presidential disaster declarations were available from the Ohio EMA. A

Presidential disaster declaration was issued in June 1989 because severe storms caused flooding in Butler, Coshocton, Cuyahoga, Franklin, Geauga, Greene, Lake, Licking, Lorain, Mercer, Montgomery, Preble, and Warren counties with an estimated $4.3 million in damages. In June, 1968 a Presidential disaster declaration was issued to thirty-one Ohio counties including Montgomery for $3.2 million in damages caused due to flooding on June 5th. Last, but not least a Presidential declaration was issued for the estimated amount of $3.4 million for damages as a result of flooding in forty-seven counties in Ohio, including Montgomery, on March 24, 1964.

In March 1913, the citizens of the Miami Valley witnessed a natural disaster unparalleled in the region's history. Within a three-day period, 8 to 11 inches of rainfall fell throughout the Great Miami River Basin Watershed. This rainfall, coupled with frozen ground, produced over 90 percent runoff, and caused the Great Miami River and its tributary streams to overflow. Consequently, every city along the river was inundated with floodwaters. The amount of water that passed through the river channel in Dayton equaled the amount of water that flows over Niagara Falls in a 30-day period.



- Figure 4-2: 1913 Flood Boundaries

The cost of this tragic event was extremely high. Over 360 people lost their lives; property damage exceeded $1.8 billion.

In the wake of this tragedy, the citizens of the Miami Valley rallied to initiate plans for the prevention of future flooding. Some 23,000 citizens contributed over $2,000,000 to begin a comprehensive flood protection program on a valley-wide basis.[19]

[19] http://www.miamiconservancy.org/about/1913.asp

If the Great Flood of 1913 were repeated today, (estimated boundaries from historical maps overlaid with 2000 Census Data, the best available data) there are a potential 168,382 individuals in 67,537 households who reside in the 1913 flood area (See Figure 4-2). However, validity of this data is tenuous. The total population of those in the flood area is listed as the total of all individuals in the census blocks that intersect the flood area in any capacity, not just those individuals who actually live in the flood area. In other words, the total number of individuals living in the flood area is likely overstated.

- Figure 4-3: Miami Conservancy District Dam and Levee System

However, Southwest Ohio and Montgomery County are protected by the flood management system created by the Miami Conservancy District as a result of the Great Flood of 1913. "The system is comprised of five dams and features (11,800 acres along 55 miles of river channel) in eleven communities along the Great Miami River."[20]

Life and Property

Property is at risk due to flooding, resulting from rapid water movement. Rushing waters can tear out or down trees and utility poles. Saturated soil can cause trees to lose their ability to stand and fall across roadways or on houses, cars, utilities, and other property. Floodwaters can move with enough force to move buildings from their foundations or cause structural integrity failure or damage internal systems, i.e. electrical system damage and gas line ruptures. Foundations and basements can be severely damaged or cracked. Structures can be weakened and, even collapse.

Currents as a result of flooding are deceptive. Many of the deaths and injuries occur when individuals misjudge the force at which currents are moving. Six inches of water can move

[20] http://www.miamiconservancy.org/flood/index.asp

with enough force to sweep an adult off his feet and drag him to more treacherous areas. Two feet of moving water can sweep away an automobile, trapping the motorist and passengers inside. Either episode could ultimately involve the drowning death of the victim.

The Federal Insurance and Mitigation Administration's Hazard Mapping Division maintains and updates the National Flood Insurance Program (NFIP) maps. The Federal Emergency Management Agency (FEMA) mapped the Floodway boundary, the 100-year floodplain boundary, and the areas of 500-year flood (areas subject to the 100-year flood with average depths less than 1 foot or with contributing drainage areas of less than 1 square mile and areas protected by levees from the 100-year flood) as illustrated on the NFIP maps.

CID	NAME	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg - Emer Date	Sanction Date	Does Not Participate
390775	Montgomery County	6/2/1978	12/15/1981	1/6/2005	12/15/1981		
390407	City of Brookville	2/15/1974	10/15/1981	1/6/2005	10/15/1981		
390606	City of Carlisle	7/25/1975	4/3/1984	12/17/2010	4/3/1984		
390408	City of Centerville	5/17/1974	11/18/1981	3/17/2011	11/18/1981		
390821	City of Clayton (1)	11/10/1978	1/6/2005	1/6/2005	11/10/2005		
390409	City of Dayton	3/15/1974	12/4/1979	1/6/2005	12/4/1979		
390828	City of Englewood	5/24/1974	1/6/2005	1/6/2005	1/6/2005		
390411	City of Germantown	6/28/1974	7/2/1981	1/6/2005	7/2/1981		
390884	City of Huber Heights		12/11/1984	8/2/2011	12/11/1984		
390412	City ofKettering	5/31/1974	10/15/1980	3/17/2011	10/15/1980		
390413	City of Miamisburg	3/1/1974	6/15/1981	1/6/2005	6/15/1981		
390414	City of Moraine	3/1/1974	10/15/1981	1/6/2005	10/15/1981		
390415	City of Oakwood		1/6/2005	1/6/2005		1/6/2006	
390416	City of Riverside	2/15/1974	12/15/1981	1/6/2005	12/15/1981		
390564	City of Springboro	4/12/1974	2/4/1981	12/17/2010	2/4/1981		
390417	City of Trotwood	2/15/1974	12/18/1979	1/6/2005	12/18/1979		
CID	NAME	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg - Emer Date	Sanction Date	Does Not Participate
390704	City of Union	2/14/1975	1/6/2005	8/2/2011	8/24/1981		
390418	City of Vandalia	6/7/1974	11/4/1981	1/6/2005	11/4/1981		
390419	City of West Carrollton	2/8/1974	10/15/1981	1/6/2005	10/15/1981		
395436	Village of Farmersville		1/6/2005	1/6/2005		1/6/2006	
395435	Village of New Lebanon		1/6/2005	1/6/2005		1/6/2006	
	Village of Phillipsburg						X
390464	Village of Verona	5/28/1976	3/2/2010	3/2/2010		5/28/1977	

(1) Clayton is applying to join the NFIP. ODNR approved the ordinance and resolution of intent to join on 9/7/2005. The application was forwarder to FEMA on the same dates. The ordinance includes 1.5 feet of freeboard and 2 feet of A zone (no BFE) free.

- Figure 4-4: Jurisdictions Participating in NFIP

Floodplain maps underwent modernization from July 2003 to early January 2005. These maps were adopted by Montgomery County effective as of January 6, 2005 and are used to determine which structures are located in Special Flood Hazard Areas. Additionally, Resolution No. 04-2258 established Flood Damage Prevention Regulations. Section 3.1 of the regulations establishes the position of the County Floodplain Administrator. Section 3.2 specifies the duties of this position which includes enforcement, monitoring the floodplain and providing community assistance."

For the purposes of this study, we will examine the structures in the Special Flood Hazard Area (SFHA) and the households and infrastructure, which lie in the 100 and 500-year floodplain. The 100-year floodplain is that area which has a one percent chance, on average, of flooding in any given year. The 500-year floodplain has a 0.2 percent chance, on average.

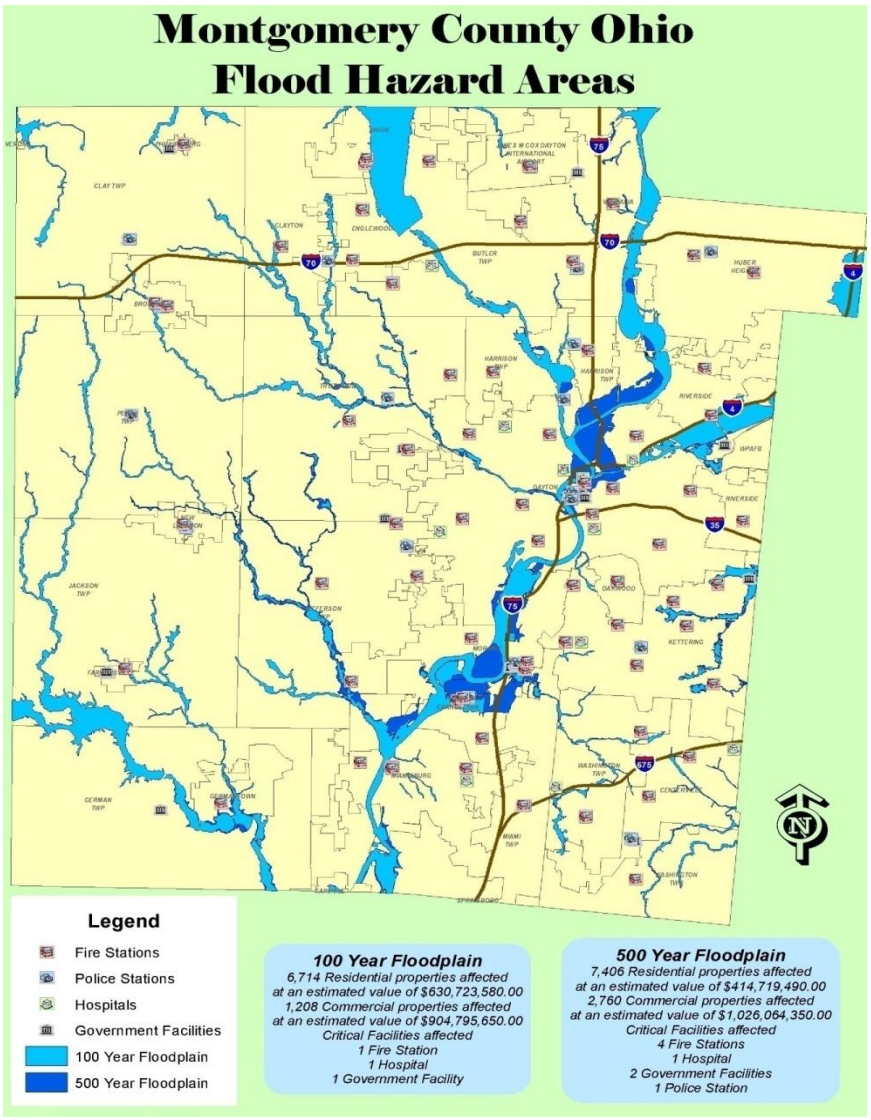
Based on the most recent data, Montgomery County is subject to weather related and repeated flooding, and a total of 10,166 structures exist in the special flood hazard areas in Montgomery County, eight of which are repetitive loss properties (see Figure 4-5). According to records from the State of Ohio, there are twelve repetitive loss structures in Montgomery County, however the accuracy of that number is uncertain. More information regarding repetitive loss structures can be found in Chapter 10: Goal & Action Items. In the 100-year flood plain, 6,714 structures are classified as residential, and at a 100 percent loss would have an estimated value of $630,723,580. An additional 1,208 commercial properties, valued at $904,795,650, also sit in this area, meaning a 100 percent loss due to flooding in the 100-year flood plain could cause over $1.5 billion in damages. The 500-year flood plain has 7,406 residential properties and 2,760 commercial properties with an estimated value of $1.44 billion. If a flood of both flood plains were to take place, a 100 percent loss would be valued at close to $3 billion. In addition, there are five fire stations, two hospitals, three government facilities and one police station that would also be affected.

Animals also suffer during flooding events. To some people, pets are a member of the family and to others animals are an important way to earn a living. One way or another, animals are a large part of our lives; and their lives are frequently lost during flooding. Pet owners have been known to risk their own lives, refused to evacuate a disaster area, and/or hinder emergency rescue efforts to remain with or rescue their animals.

According to the American Pet Products Manufacturing Association (APPMA) 2011-2012 survey, 62 percent of American households own at least one pet. Of those households, 39 percent own at least one dog and 33 percent own at least one cat. The Humane Society of the United States reports pet owners own, on average, 1.7 dogs per household and 2.2 cats per household. In the survey, pet owners were asked what they would do with their pets if they were faced with a disaster situation. For most species, the majority of owners would take their pet with them. In the event a pet owner would have to choose between their dog's or cat's medical treatment and their own, 16 percent of dog owners and 13 percent of cat owners stated their pet's medical treatment would take priority over their own treatment.

Roads and Bridges

There are 356.30 miles of Montgomery County roads in the 100-year floodplains as seen in Figure 4-6. However, insufficient data is available at this time regarding whether these road/road systems exist in the floodplain or over/above the floodplain.



- Figure 4-5: Structures in the Special Flood Hazard Area

Historically, flooded roadways have been the major cause of service interruption during storms. Roads are frequently flooded due to rapidly rising water. Roads are also often blocked by fallen trees during a flooding event, either directly caused by the flooding weakening the root system or by storm events leading to the flooding occurrence. Roadways can be uplifted and broken and as a result, impassable. Blocked roadways may have tragic consequences for people who need access to emergency services. The ability to travel after a natural hazard event is a priority issue for county residents, organizations, and providers of essential services such as hospitals and utilities.

Type	Miles
Interstate	9.96
U.S. Freeway	2.87
Ohio State Route	13.75
Local Roads	329.72
Total	356.30

- Figure 4-6: Montgomery County Roadways located in the 100-year Floodplain

Power Lines

Historically, falling trees have been the major cause of power outages resulting in interruption of services and damaged property. In addition, falling trees can bring electric power lines down, creating the possibility of lethal electric shock. Rushing water can also damage utility lines and cause prolonged power outages. Floods may inundate substations, forcing them to be shut down for extended periods of time to prevent major damage to the system. Rising population growth and new infrastructure creates a higher probability for damage to occur from water damage as more life and property are exposed to risk.

Water

The most frequent water system problem related to flooding is a backup of the storm water sewer system. Backups frequently occur during severe thunderstorms, which cause flooding. The storm water backup can cause water and sewage to backup into basements or facilities. Floodwaters pick up sewage and chemicals from roads, farms and factories and can contaminate building finishes and worst of all, drinking water.

Chapter 5 Tornado & Winds

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Every state is at some risk from this hazard. Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others. Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible. Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.[21]

The United States experiences an average of 100,000 thunderstorms each year and approximately 1,000 tornadoes develop from these storms. In the United States, tornadoes occur in all 50 states. However, tornadoes are most frequent in the Midwest, where conditions are most favorable for the development of the severe thunderstorms that produce tornadoes.

Tornadoes can be nearly invisible, but become visible when a funnel forms of water vapor or by swirling debris at the base of the funnel. Extremely violent tornadoes may break into several smaller funnels.

Fujita Scale		Enhanced Fujita Scale* * In use since 2007	
F–0	40–72 mph winds	EF–0	65–85 mph winds
F–1	73–112 mph	EF–1	86–110 mph
F–2	113–157 mph	EF–2	111–135 mph
F–3	158–206 mph	EF–3	136–165 mph
F–4	207–260 mph	EF–4	166–200 mph
F–5	261–318 mph	EF–5	>200 mph

- Figure 5-1: Enhanced Fujita Tornado Scale[22]

The worst tornado disasters in the United States have claimed hundreds of lives. The Tri-State Outbreak of March 18, 1925, had the highest death toll: 740 people died in 7 tornadoes that struck Illinois, Missouri, and Indiana. The Super Outbreak of April 3-4, 1974, spawned

[21] http://www.ready.gov/tornadoes
[22] Tennessee State Library and Archives: http://www.tn.gov/tsla/exhibits/disasters/tornadoes.htm

148 tornadoes (the most in any known outbreak) and killed 315 people from Alabama north to Ohio. From 1950 to 2011 a total of 42 tornadoes of F4 or F5 intensity have struck in the State of Ohio and killed 143 people, injuring 2,959, and causing property damages in excess of 1.4 billion dollars.[23]

Two of these killers have destroyed property and lives in Greene County, the county neighboring Montgomery County directly to the east. The first, part of the Super Outbreak of April 3-4, 1974, killed 36 and injured 1,150. A $45.5 million Presidential Disaster was declared for 14 counties in Ohio affected by the tornadoes on April 3-4. The second such event occurred September 20, 2000. An estimated $16 million in damages were incurred and one person was killed and 100 were injured. Again a Presidential disaster was declared in Xenia totaling $13 million.

Tornado Hazard Assessment

Nine tornadoes were reported in Montgomery County, Ohio from 1950 to 2011. These tornadoes caused 25 injuries and $12.8 million in property damage. All of the injuries and the majority of the property damage was the result of one tornado that occurred in 1969. Only two tornadoes have been reported since 1982. The following is a list of the tornadoes that have occurred in Montgomery County since 1950:

TORNADOES AND FUNNEL CLOUDS EVENT RECORD[24]

May 25, 2011 TORNADO

A tornado briefly touched down in Centerville, Ohio Montgomery County. There were no injuries, fatalities and damages were limited to minor wind and hail damage estimated at $5,000.

July 11, 2006 TORNADO

A tornado touched down near the Dayton Mall to the east of Miamisburg and was on the ground for just under a mile. The tornado caused minor damage to a strip mall, a carpet business, a restaurant and a municipal bus outlet. A few trees were downed along the track of the tornado as well. Damages were estimated at $75,000.

June 15, 1982 TORNADO

A tornado briefly touched down in Montgomery County. There were no injuries or fatalities reported. The property damage caused by the tornado and the storm was estimated at $47,600.

[23] http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms. Total damage has not been adjusted to 2011 dollar values.
[24] Ibid.

June 13, 1981 TORNADO

A tornado touched down for a mile with a width of 100 yards. It caused $50,500 in property damage. There were no injuries or fatalities.

August 8, 1974 TORNADO

A tornado touched down in Carlisle, Warren County and proceeded northeast through Montgomery County near the Miamisburg corporation limit.

May 8, 1969 TORNADO

A severe tornado caused 25 injuries and extensive property damage, limbs down, and some power outages during the 1969 tornado that struck parts of the county. Fortunately, no lives were lost. The tornado touched down for 2 miles. The property damage was estimated at $12.5 Million.

June 28, 1967 TORNADO

A tornado touched down briefly causing $13,700 in property damage. There were no injuries or fatalities.

July 19, 1963 TORNADO

A tornado touched down causing $15,000 in property damage. There were no injuries or fatalities.

May 20, 1960 TORNADO

A tornado and the storm that accompanied it caused $155,200 in property damage. There were no injuries or fatalities.

Hazard and Vulnerability Assessment

According to the Disaster Center, Ohio is ranked 5th in the nation when considering frequency of tornadoes, number of fatalities, number of injuries, and cost for damages for tornado disasters.[25] The Disaster Center bases its risk assessment on data collected from 1950-1995, dividing the square mileage of each state against the frequency of death, injury, number of tornadoes, and cost of damages for each state.

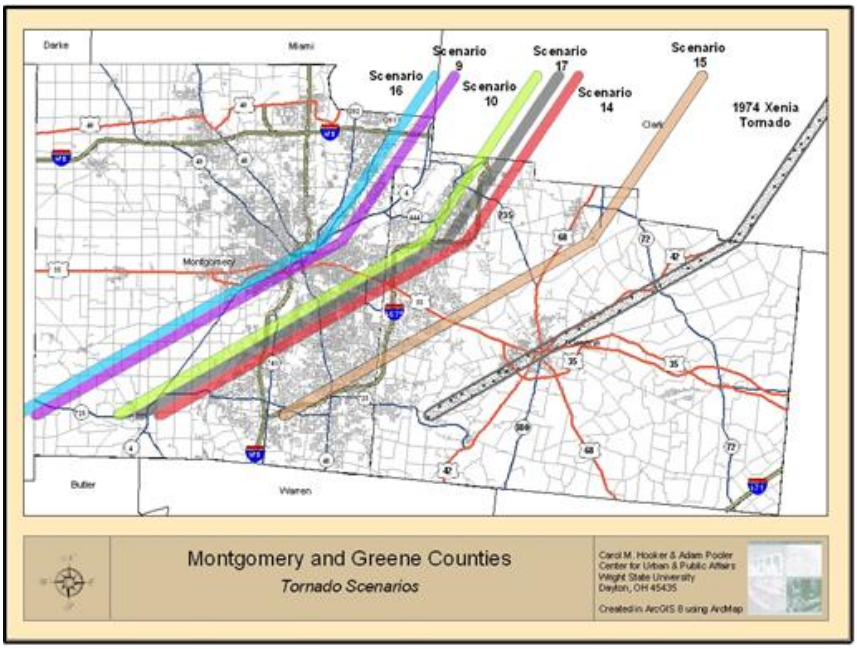
Tornadoes do not discriminate. They strike everything in their path, potentially destroying everything along the way — homes, loved-ones, livelihood, infrastructure & natural areas. When we consider tornado risk, it is impossible to consider the likelihood of a tornado striking a particular area because tornado strikes are random events, but the risks of death,

[25] http://www.disastercenter.com/tornado/rank.htm

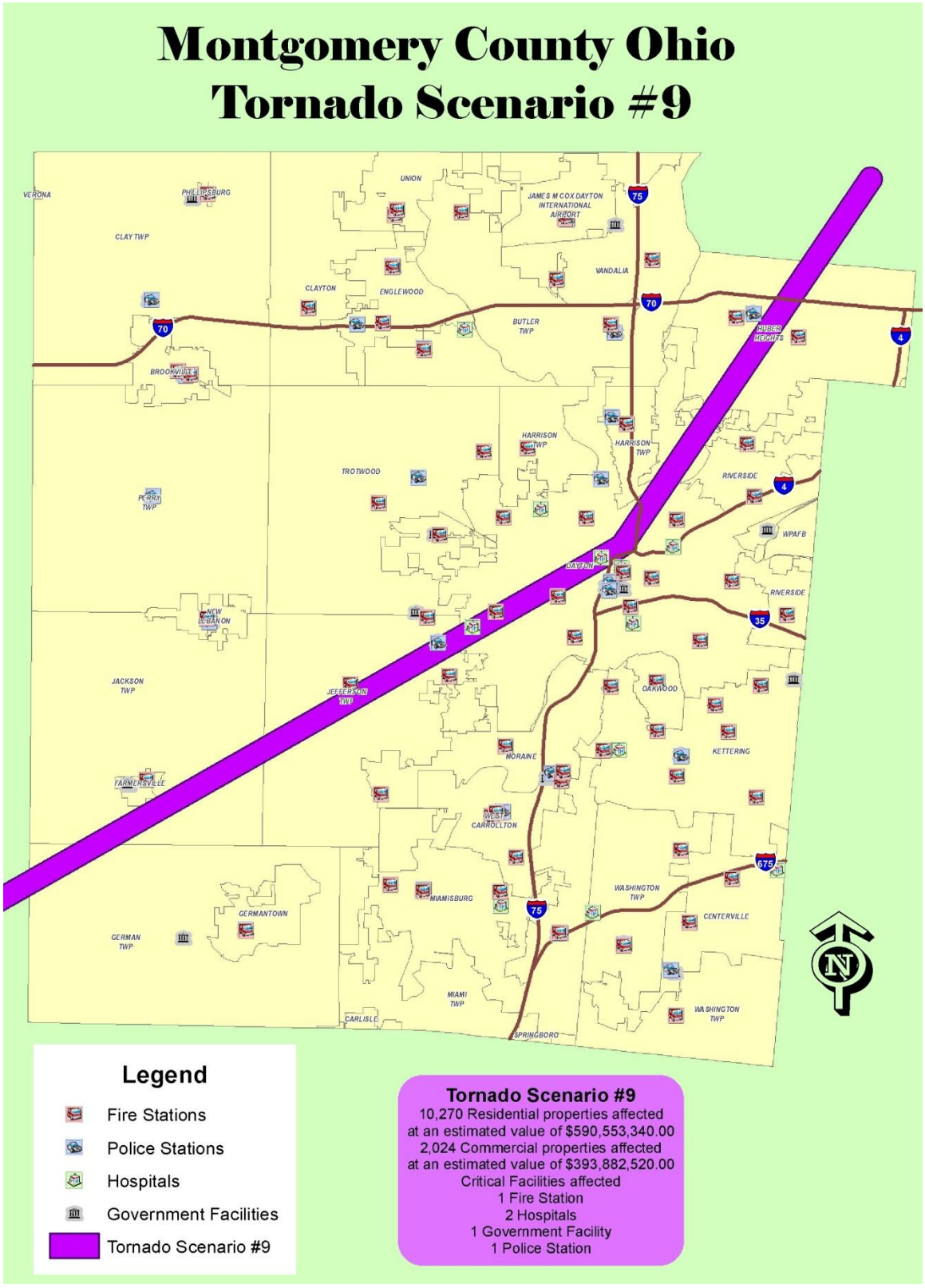
injury and the costs of tornadoes for locations can still be hypothesized and estimated. Tornadoes cannot be predicted but the conditions that cause them can be identified; as such no location in Montgomery County is safe. In the last 62 years, Montgomery County has experienced nine documented tornadoes. Using the simplest formula possible, the number of events divided by the number of recorded years, there is a 14.5 percent chance a tornado will occur somewhere in Montgomery County every year.

In order to analyze what the worst case tornado scenario for the county would be, we arrayed the 1974 (Xenia Tornado) F5 path and width thirty times across Montgomery County. Six of those scenarios are mapped in Figure 5-2 to demonstrate the technique used. Of the thirty scenarios, scenario #9 had the most devastating losses. If an EF5 tornado were to strike on a path similar to the one mapped in scenario #9 (see Figure 5-3), the tornado's path would go through Dayton, Farmersville, German Township, Harrison Township, Huber Heights, Jackson Township, Jefferson Township, and Riverside. If such an event were to occur, approximately 10,270 residential properties would be in this path, properties which if lost would cost $590,553,340.00. In addition, 2,024 commercial properties (both retail and industrial) would be in this path, valued at approximately $393,882,520.00. This path also includes two hospitals (Grandview and the VA Hospital), the Jefferson Township Sheriff's station and municipal offices, and one of the Dayton fire stations. This scenario estimates the losses as a direct result of the tornado, not including the potential losses from the accompanying storm.

Validity of this data is tenuous. The total population of those in the tornado's path is listed as the total of all individuals in those 2000 Census blocks that intersect the path in any capacity; not just those individuals who actually live in the path. In other words, the total number of individuals living in the tornado's path is likely overstated.



- Figure 5-2: F5 Tornado Model across Montgomery County's Population Center



- Figure 5-3: Tornado Scenario Model #9

Chapter 6

Hail

Thunderstorms occasionally produce damaging hail. While fatalities and injuries rarely occur, hailstorms are the cause of millions of dollars in damage each year. To create pea-size hail (about 1/2 inch in diameter) winds within the thunderstorm updraft will generally be around 20 miles per hour. Quarter size hail (3/4 of an inch in diameter) requires updrafts of about 40 miles per hour. Golf ball size hail (1 3/4 inches in diameter) needs updrafts of around 55 miles per hour.

Hail is precipitation in the form of a chunk of ice that can fall from a cumulonimbus cloud. Usually associated with multicell, supercell and cold front induced squall line thunderstorms, most hail falls from the central region of a cloud in a severe storm.

Hail begins as tiny ice pellets that collide with water droplets. The optimum freezing level for the formation of hail is from 8,000 to 10,000 feet. The water droplets attach themselves to the ice pellets and begin to freeze as strong updraft winds toss the pellets and droplets back up into the colder regions of the upper levels of the cloud. As the attached droplets freeze, the pellets become larger. Both gravity and downdraft thunderstorm winds pull the pellets back down, where they encounter more droplets that attach and freeze as the pellets are thrown, once again, back up through the cloud.

Hailstones

The more times a hailstone is tossed up and down through the cloud, the larger the hailstone will be. Hailstones the size of softballs had many more trips up and down through the cloud than pea-sized hailstones. Large hailstones are an indication of powerful updraft and downdraft winds within a thunderstorm. This is why large hail is associated with severe thunderstorms. The largest hailstone ever measured in the United States fell at Coffeyville, Kansas, on September 3, 1970. It weighed 1.67 pounds and measured 17.5 inches in circumference.

The Great Plains states, especially northeastern Colorado and southeastern Wyoming, receive more hail yearly than any other part of the United States. Hail in this area of the country is most likely to fall late in the afternoon during the months of May and June and is often responsible for extensive crop loss, property damage and livestock deaths.[26]

A hail storm cannot be predicted but the conditions that cause them can be identified, as such no location is safe from hail and Montgomery County and all of its jurisdictions are susceptible to hail damage.

[26] http://www.weather.com/encyclopedia/thunder/hail.html

Hail Hazard Assessment

Montgomery County has reported 117 hailstorms since 1950. Of these storms, only 20 of the hailstorms reported property damage and there were no reports of serious injuries or deaths. A single hailstorm occurring on April 9, 2001 caused $72.6 million of the $74,148,000 reported for all the hailstorms combined. Listed below are the twenty hailstorms that caused property damage.[27] Using the simplest formula possible, the number of events divided by the number of recorded years, there is a 94.3 percent chance hail will occur somewhere in Montgomery County twice every year.

DAMAGING HAIL STORMS IN MONTGOMERY COUNTY

May 25, 2011 HAIL

A storm with hail caused approximately $10,000 worth of property damage to the county. Most of the damage occurred in the southeast area of the county.

April 13, 2009 HAIL

A storm with hail caused approximately $1,000 worth of property damage to the county.

June 25, 2008 HAIL

A storm with hail caused approximately $8,000 worth of property damage to the county.

June 22, 2008 HAIL

A storm with hail caused approximately $2,000 worth of property damage to the county.

May 31, 2008 HAIL

A storm with hail caused approximately $3,000 worth of property damage to the county.

April 28, 2008 HAIL

A storm with hail caused approximately $1,000 worth of property damage to the county.

July 18, 2007 HAIL

A storm with hail caused approximately $1,000 worth of property damage to the county.

April 11, 2007 HAIL

A storm with hail caused approximately $2,000 worth of property damage to the county.

[27] National Climatic Data Center (NCDC)

April 14, 2006 HAIL

A storm with hail caused approximately $6,000 worth of property damage to the county.

June 25, 2005 HAIL

A storm with hail caused approximately $10,000 worth of property damage to the county, primarily in Kettering.

May 10, 2003 HAIL

A storm with hail caused approximately $20,000 worth of property damage to the county.

June 5, 2002 HAIL

A storm with hail measuring .75 inches caused $2,043 worth of property damage to the region. Most of the damage occurred in Vandalia.

April 28, 2002 HAIL

A storm with hail measuring .75 inches caused an estimated $5,100 in property damage to the region. Most of the damage occurred in Centerville.

June 12, 2001 HAIL

A hailstorm with hail measuring .75 inches caused an estimated $3,110 in property damage to the region. Most of the damage occurred in Huber Heights.

April 9, 2001 HAIL

A severe storm brought golf ball sized hail caused numerous reports of structural damage across the eastern part of the county, especially in Kettering. The property damage was estimated at $72.6 million.

June 13, 1999 HAIL

A storm with hail measuring .75 inches brought down several trees and power lines. The storm was located near Kettering and caused an estimated $3,300 of property damage.

June 21, 1995 HAIL

Large hail measuring up to 1.75 inches damaged automobiles and destroyed crops. The property damage was estimated at $12,000 and the crop damage was also estimated at $12,000. This was the second hailstorm to hit the county that day.

June 21, 1995 HAIL

A severe storm with hail measuring .75 inches caused $6,000 in property damage and several large trees fell.

June 9, 1995 HAIL

Large hail measuring up to an inch and a half in diameter destroyed crops and damaged automobiles. The property damage was estimated at $7,200 and the crop damage was also estimated at $7,200.

June 21, 1994 HAIL

A severe hailstorm with hail measuring 1.25 inches caused extensive damage to crops, estimated at $62,000 for the region. Strong winds also reportedly blew a barn roof off.

Estimated Losses

On April 9, 2001, a "rare, but costly hailstorm in the Dayton-Kettering area, which caused at least $70 million in insured losses, according to an Ohio Insurance Institute (OII) survey of its members. Losses from the golf ball-sized hail that reigned over the Dayton suburb for several minutes resulted in insurance losses exceeding the damage caused by the September 20, 2000 Xenia tornado. The OII survey found that at least 27,600 claims were filed from the hailstorm."[28]

In 2003, OII reported the average homeowner's claim in Central Ohio from hail damage to be $5,386 and the average automobile claim was $2,309. Using these figures, the estimated dollar amount for a hail storm similar to the storm in 1991 is listed for each jurisdiction in figure 6-1.

Businesses also submitted average claims of $7,424 in 2003. However, the number of business establishments per jurisdiction is not available and the estimate could only be calculated for the County as a whole. If every business establishment in the County were affected by a similar hail storm, 13,084 establishments would likely file claims, costing $97.1 million in damages.

Due to the unique nature of hail storms, it is difficult to accurately predict potential losses within Montgomery County. The most significant hailstorm to date cost $72.6 million in damages. The total property value for Montgomery County is just over $26 billion. A hailstorm could potentially affect any portion of that total value. At 100% losses, Montgomery County would lose over $409 million in agriculture, $19.4 billion in residential, $835.7 million in industrial and $5.3 billion commercial losses. These numbers include almost $1 billion in critical infrastructure, including $763.5 million from hospitals, $175.6 million in government facilities, $27 million in law enforcement and over $20 million in fire

[28] Cost of Catastrophes. Ohio Insurance Facts 2002. Ohio Insurance Institute, Columbus, OH.

department losses throughout the county. Even a severe hailstorm that only affected 10% of the county would still cost over $2.6 billion, a potentially devastating total.

	Estimated Personal Property Losses			
Jurisdiction	Owner Occupied Residential Structure	$5,386 loss x Owner Occupied Structures	Vehicles	$2,309 loss x Vehicles
Brookville	1,510	$8,132,860	3,647	$8,420,923
Butler Twp.	2,772	$14,929,992	7,031	$16,234,579
Carlisle	1,474	$7,938,964	3,861	$8,915,049
Centerville	7,441	$40,077,226	17,976	$41,506,584
Clay Twp.	2,541	$13,685,826	6,443	$14,876,887
Clayton	4,238	$22,825,868	10,437	$24,099,033
Dayton	35,536	$191,396,896	89,456	$206,553,904
Englewood	3,674	$19,788,164	8,827	$20,381,543
Farmersville	264	$1,421,904	683	$1,577,047
German Twp.	2,371	$12,770,206	6,157	$14,216,513
Germantown	1,425	$7,675,050	3,597	$8,305,473
Harrison Twp.	6,538	$35,213,668	16,341	$37,731,369
Huber Heights	10,373	$55,868,978	27,808	$64,208,672
Jackson Twp.	1,942	$10,459,612	5,132	$11,849,788
Jefferson Twp.	2,222	$11,967,692	4,847	$11,191,723
Kettering	17,082	$92,003,652	43,344	$100,081,296
Miami Twp.	12,734	$68,585,324	33,103	$76,434,827
Miamisburg	5,365	$28,895,890	13,587	$31,372,383
Moraine	1,754	$9,447,044	4,846	$11,189,414
New Lebanon	1,156	$6,226,216	3,146	$7,264,114
Oakwood	3,029	$16,314,194	6,464	$14,925,376
Perry Twp.	1,939	$10,443,454	5,030	$11,614,270
Phillipsburg	184	$991,024	474	$1,094,466
Riverside	6,512	$35,073,632	16,867	$38,945,903
Springboro	3,646	$19,637,356	8,783	$20,279,947
Trotwood	6,950	$37,432,700	17,940	$41,423,460
Union	1,767	$9,517,062	4,071	$9,399,939
Vandalia	4,086	$22,007,196	11,042	$25,495,978
Verona	119	$640,934	307	$708,863
Washington Twp.	16,470	$88,707,420	41,273	$95,299,357
West Carrollton	3,673	$19,782,778	10,338	$23,870,442
Wright-Patterson AFB	84	$452,424	3,346	$7,725,914
Montgomery County	**170,871**	**$920,311,206**	**436,204**	**$1,007,195,036**

- Figure 6-1: Estimated Hail Residential and Personal Property Losses

Chapter 7 Severe Winter Storm

Severe winter storms pose a significant risk to life and property in Montgomery County by creating conditions that disrupt essential regional systems such as public utilities, telecommunications, and transportation routes. Severe winter storms can produce freezing rain, ice, snow, cold temperatures, and wind. Ice storms accompanied by high winds can have destructive impacts, especially to trees, power lines, and utility services. Severe freezes occur when high temperatures remain below freezing for more than five days. Severe snowstorms occur less frequently, but have a widespread impact on people and property in Montgomery County.

Severe Winter Storm Issues

Life and Property

Winter storms are deceptive killers. Many of the deaths that occur are indirectly related to the actual storm, including deaths resulting from traffic accidents on icy roads, heart attacks while shoveling snow and hypothermia from prolonged exposure to the cold.

Property is at risk due to flooding and landslides resulting from heavy snow melt. Ice, wind, snow, and falling trees and limbs can impact trees, power lines, telephone lines, and television and radio antennas. Saturated soil can cause trees to (1) lose their ability to stand and (2) fall on houses, cars, utilities, and other property. Similarly, if streets are icy, it is difficult for emergency personnel to travel and may pose a secondary threat to life if police, fire, and medical personnel cannot respond to calls.

Property is also at risk when snow loads cause structural integrity failure. Roofs can collapse under the additional weight of heavy snow. Snow banks also collapse causing road hazards or even burying individuals.

Roads and Bridges

Snow and ice events resulting in icy road conditions can lead to major traffic accidents. Roads blocked by fallen trees during an ice storm or windstorm may have tragic consequences for people who need access to emergency services. The ability to travel after a natural hazard event is a priority issue for county residents, organizations, and providers of essential services such as hospitals and utilities.

Power Lines

Historically, falling trees have been the major cause of power outages resulting in interruption of services and damaged property. In addition, falling trees can bring electric

power lines down, creating the possibility of lethal electric shock. Snow and ice can also damage utility lines and cause prolonged power outages. Rising population growth and new infrastructure in the county creates a higher probability for damage to occur from severe winter storms as more life and property are exposed to risk.

Water Lines

The most frequent water system problem related to cold weather is a break in waterlines. Breaks frequently occur during severe freeze events when water expands in the pipes as it freezes (these are most likely to occur during the coldest months of the year, January and February. Another common problem during severe freeze events is the failure of commercial and residential water lines. Inadequately insulated potable water and fire sprinkler pipes can rupture and cause extensive damage to property.

Severe Winter Storm Hazard Assessment

Hazard Identification

A severe winter storm is generally a prolonged event involving snow, ice, and or extended periods of extreme cold. The characteristics of severe winter storms are determined by the amount and extent of snow or ice, air temperature, wind speed, and event duration. If a severe ice storm occurs in Montgomery County, there may be prolonged power outages over widespread areas. The following is a list of the severe winter storms that affected our region including snowstorms, ice storms and extreme cold. Since 1950 there have been 15 snowstorms, seven ice storms, and three extreme cold events. Using the simplest formula possible, the number of events divided by the number of recorded years, there is a 40.3 percent chance one of these three types of storms will occur in Montgomery County each year.

WINTERSTORM AND FLOODING

February 2005 WINTERSTORM

Following a severe winter storm in December 2004, west central Ohio counties experienced significant amounts of icy conditions that caused damage to trees, snapping power lines and causing widespread power outages. Snowfall records were set in Dayton with 16 inches of snow. After the storm, a record low was set on Christmas Day when the temperature fell to ¯17° Fahrenheit. A warming trend followed as rainfall brought rapid snow melt accelerating runoff to many rivers and streams. Another storm in early January produced heavy rainfall across the state. Debris on road systems caused by the ice storm restricted traffic, hindering public access and other roads were closed due to standing water. Log jams caused backup in streams that resulted in flooding and blocked roads along the Wolf Creek Watershed, the Great Miami River at Miamisburg and areas in Miami Township. Montgomery County was granted $1,045,497.62 in public assistance funds for this event. **(DR-1580).**

WINTERSTORM

January 2005 WINTERSTORM

In January 11, 2005, a clipper system passed through the Ohio Valley on the evening of the 11th. By the morning of the 12th, there was a swath of 6 to 7 inches of snow extending from Greenville, through Dayton, Xenia and Wilmington, to Scioto County in south central Ohio. Outside of this line, most areas received from 4 to 5 inches of snowfall. The county and its jurisdictions were granted $1,200,029.00 in public assistance funds for this emergency. **(EM-3198).**

February - April 2003 WINTERSTORM

In mid-February 2003, a weather system the included heavy snowfall to the majority of Ohio and freezing rain coupled with snow along major river and stream systems caused widespread power outages, road closures, business, church and school closures, and isolated tens of thousands of households. Later in the month, additional show showers and freezing rain increased snow, ice and rain levels another six inches following the initial system. This exacerbated the already precarious situation. Montgomery County was granted $833,364.06 in public assistance funds for emergency protective measures. **(DR-1453).**

SNOWSTORMS

February 14-17, 2003 SNOWSTORM

A blizzard brought over twelve inches of snow for most parts of Southern Ohio. Some areas had snow accumulations of 12 inches and there were wind gusts of up to 35 mph at times. On March 14, 2003 the president approved the request for federal disaster aid. Local government incurred costs of at least 17 million and more than $500,000 dollars was awarded in aide to homeowners.

January 19-20, 2000 SNOWSTORM

A fast-moving low-pressure system brought a band of heavy snow across central and southern Ohio. Many locations received 5-6 inches while the heaviest band of 7 inches fell from Dayton to Xenia to Chillicothe. No injuries or property damages were reported.

March 9, 1999 SNOWSTORM

Low pressure brought abundant moisture northward into an arctic air mass producing very heavy snow. The heaviest snow fell between midnight and 8:00 am with snowfall rates of 1-2 inches an hour at times. The snow continued into the daylight hours but it was generally much lighter. Accumulations ranged from 5 to 10 inches with the highest amounts occurring

on a line from Hamilton to Wilmington to Chillicothe. No injuries or property damage were reported.

January 13-14, 1999 SNOW AND ICE STORM

A low-pressure system brought abundant moisture northward from the Gulf of Mexico. At the same time, an arctic high-pressure system forced low-level cold air southward. The rain changed to freezing rain first across the northern Miami Valley where up to 1 inch of ice accumulations occurred. Then, the freezing rain changed to snow with 3 to 6 inches of accumulations occurring. Around Dayton and Columbus, the rain changed to freezing rain with up to ½ inch of ice accumulation occurring. Eventually, the freezing rain changed to sleet with up to ½ inch of accumulation occurring. No injuries or property damage were reported.

January 7-9, 1999 SNOWSTORM

A weak low-pressure system brought an area of wintry precipitation to parts of central and southern Ohio. The precipitation began as a period of snow with 2 to 4 inches of accumulation occurring. After a period with no precipitation, freezing rain began with some significant accumulation occurring. No injuries or property damage were reported.

January 1-2, 1999 SNOWSTORM

A major winter storm affected much of Ohio beginning late on the 1st and continuing through much of the 2nd. Heavy snow fell initially with some areas receiving greater than 1 inch an hour rates. Some thunder was reported with some of the heaviest snow around Cincinnati and Dayton. By early afternoon on the 2nd, much of the snow had changed to a mixture of sleet and freezing rain. However, by that point the snow had accumulated to 6 to 10 inches. No injuries or property damage were reported.

March 19-21, 1996 SNOWSTORM

On the first day of spring a major winter snowstorm struck the region. Low-pressure moving slowly across Pennsylvania was responsible for snow, and this also brought strong winds with gusts up to 40 mph. It was heavy wet snow, which ripped down power lines and trees. Highways became snow covered and slippery causing numerous traffic accidents. Snow amounts ranged between 4 and 8 inches.

January 11-12, 1996 SNOWSTORM

A fast moving low-pressure system tracked from the Mid Mississippi Valley to the Kentucky Tennessee border. This storm brought a fairly wet snow to the area. Total snow accumulations were near 4 inches. No injuries were reported, but property damage for the region was reported at $30,500.

January 6-8, 1996 SNOWSTORM

The Blizzard of 1996 developed near the Gulf Coast and moved up the East Coast. This massive system produced accumulations of snow over 14 inches in some areas. The average snowfall for our area in an entire season is 23 inches areas making this blizzard the worst storm since 1978. By the end of the storm many homes and businesses had their roofs collapse or partially collapse from the weight of the new snow, and snow from a storm earlier in the week. By late in the day on the seventh arctic air was pouring into the region. Some areas had 30 continuous hours of snowfall and wind gusts approaching 60 miles an hour causing extensive damage and two fatalities in our region. The property damage for the region was estimated at $16.8 million.

January 2-3, 1996 SNOWSTORM

Low pressure strengthening in the Tennessee valley passed southeast of Ohio. There was a messy mix of precipitation. Roads oriented east to west were quite hazardous with wind gusts from the north up to 40 mph causing snowdrifts shortly after these roads were plowed. Some areas had drifts between 3 and 5 feet. Temperatures during much of this event were in the upper teens and 20s. The property damage for the region was estimated at $878,500.

December 19, 1995 SNOWSTORM

The first major SNOWSTORM of the season developed as a deep low-pressure system tracked from the Lower Mississippi Valley to the Mid-Atlantic States. Rain changed to snow, with a period of sleet and freezing rain. Snow accumulations ranged between 4-5 inches. Blizzard conditions were experienced in some areas. This caused many power outages and the damage for our region was estimated at $120,600. No injuries were reported.

January 21-22, 1995 SNOWSTORM

An extended period of snow accumulated three to six inches. Northwest winds caused blowing and drifting snow and made travel on secondary roads difficult and dangerous. There were power outages from downed wires due to wind and snow. Numerous traffic accidents were reported. There were six injuries and two fatalities reported for our region and the property damage were estimated at $603,000.

March 9-10, 1994 SNOWSTORM

Snow accumulated an average of four to six inches with some higher hills receiving eight inches. Snow occasionally mixed with sleet and freezing rain. Some trees and power lines were downed due to the weight of the ice and snow. Property damage for the region was estimated at $620,000.

January 26-28, 1978 SNOWSTORM

This blizzard began in the early morning of January 26, and was accompanied by winds exceeding 70 mph creating 12-foot snowdrifts. This blizzard is referred to as the "Blizzard of 1978." The entire state was declared by the president as a federal disaster area with damages estimated at $9.9 million. 2,000 National Guard troops evacuated thousands of Ohioans. The American Red Cross Shelters and hotels were filled with stranded motorists.

November 1950 SNOWSTORM

No description for this event was included in the NCDC Database.

ICE STORMS

February 1, 2011 ICE STORM

An ice storm hit Montgomery County, knocking out power for approximately 80,000 homes. Kettering and Oakwood suffered the largest outages. Union had 0.8 inches of ice accumulation, and Centerville, Vandalia, and Huber Heights each recorded 0.5 inches of ice.

March 26, 2002 ICE STORM

A warm front bisected the state of Ohio along and just south of the I-70 corridor. A low-pressure system moved along the boundary, bringing widespread freezing rain. Numerous areas received a half-inch of ice that brought down trees and power lines, and caused several accidents due to slippery roads.

December 13-14, 2000 ICE STORM

A week low-pressure system brought freezing rain to the region. Widespread ice accumulations of one-quarter to one-half inch occurred. No injuries or property damage was reported.

January 13-14, 1999 SNOW AND ICE STORM

A low-pressure system brought abundant moisture northward from the Gulf of Mexico. At the same time, an arctic high-pressure system forced low-level cold air southward. The rain changed to freezing rain first across the northern Miami Valley where up to 1 inch of ice accumulation occurred. Then, the freezing rain changed to snow with 3 to 6 inches of accumulation occurring. Around Dayton and Columbus, the rain changed to freezing rain with up to ½ inch of ice accumulation occurring. Eventually, the freezing rain changed to sleet with up to ½ inch of accumulation occurring. No injuries or property damage were reported.

January 24, 1997 ICE STORM

An ice storm occurred after a strong surge of moisture moved north into the Ohio valley during the morning hours. Temperatures were at or just below the freezing mark for several hours while rain fell. Roads quickly became icy during the morning rush hour causing numerous traffic accidents. Several roads were closed due to one-quarter inch of ice accumulation. In Montgomery County alone, over 80 accidents were reported.

March 6-7, 1996 ICE STORM

North winds behind a cold front sagging across the region caused a shallow layer of below freezing air to penetrate deep into the Ohio Valley. Precipitation falling over the region changed from rain and drizzle to freezing rain and freezing drizzle, and then eventually to sleet and snow from north to south. Total snow accumulations were light, ranging from less than an inch to 3 inches. Numerous accidents occurred.

January 6-7, 1995 ICE STORM

Much of the area received one-quarter to one-half inch glaze of freezing rain and sleet. Some snow mixed in near the end of the event. It was the first major winter storm of the season and traffic accidents were widespread, many of which brought traffic to a stand-still and effectively closed roads. Localized power outages resulted from downed trees and wires. Although no direct fatalities occurred, at least four fatalities were the result of traffic accidents. 26 injuries were reported and the property damage was estimated at $482,400.

Extreme Cold

February 1-5, 1996 EXTREME COLD

Arctic high pressure brought the coldest air of the season to the Ohio Valley. The extreme cold was entrenched for 5 days, freezing and bursting numerous water pipes and an extremely high number of cars that would not start because of the cold weather. The property damage for the region was reported at 1.5 Million dollars.

December 9-11, 1995 EXTREME COLD

The first arctic air outbreak of the season occurred across the state on the 9th, lingering through the 11th. Temperatures plummeted to overnight lows from the single digits below zero to the single digits above accompanied by 10-15 mph winds. The strong winds combined with the low temperatures produced wind chills as cold as 35 below zero. Property damage for the region was estimated at $2,400 and an 82-year-old women was found dead of exposure in her car on the morning of the 10th.

February 11-13, 1995 EXTREME COLD

After air spread across all of Ohio on the 11th producing low temperatures between zero and about 10 below on the morning of the 12th and close to zero on the 13th. There were four fatalities in the region caused by exposure and a number of water line breaks occurred. The property damage for the region was estimated at $120,600.

Life and Property

Montgomery County is subject yearly to winter weather related fatalities and losses. All of Montgomery County is vulnerable to winter weather and treacherous conditions.

Property is at risk due pipes breaking caused by the freeze/thaw action frequently experienced in the winter months. Ice or snow loads can damage or tear out trees and down utility lines. Snow loads can severely damage roofs and they can be weakened and, even collapse.

Winter travel can be deceptive due to sleeting or ice storms. Many of the deaths and injuries occur when individuals misjudge the road and travel conditions, which can even lead to fatal automobile accidents.

For the purposes of this study, we will examine the claims reported to the Ohio Insurance Institute (OII) as they relate to winter hazards. OII loss estimates include the storm that passed through the state over President's Day weekend starting on February 14, 2003 and a subsequent winter storm the following week. The storms caused power outages, freezing pipes, and structural damage from ice, wind, water and heavy snow accumulation. As a result, insurance companies reported approximately 6,900 insured claims from the storms. Approximately 59 percent of the claims made as a result of this storm were made by homeowners and renters. The average residential claim amounted to $2,252.

Approximately 36 percent of the claims were filed by automobile owners. However, fewer auto claims were filed than anticipated from of a storm of this size—possibly because several Ohio counties designated Level 2 and 3 emergencies. Losses were estimated at approximately 2,500 claims for a total of $6 million—and estimated average of $2,400 per claim.

Businesses also suffered losses. Commercial property losses amounted to 136 claims and were estimated at slightly under $1 million (Approximately $7,353 per claim). Total losses could possibly range up to $96.2 million if every business in the county filed a claim, at an average of $7,353.

Schools, some businesses, and local and state governments were closed on Ohio's heaviest snow day and in addition to property losses, businesses also suffer economic losses due to the periods in which they remained closed, lost sales, and lost production. None of which cannot be calculated here.

The Ohio and Federal Emergency Management Agencies and US Small Business Administration surveyed damage in southern Ohio, making a preliminary assessment of $17 million in disaster related costs. These costs include snow and debris removal, emergency loss prevention and public utilities repair, none of which will be estimated in this chapter. For a more detailed look by jurisdiction of the estimated residential losses (expressed in number of residential units and estimated dollars), please refer to following table:

	Estimated Personal Property Losses			
Jurisdiction	Owner Occupied Residential Structure	$2,252 loss x Owner Occupied Structures	Vehicles	$2,400 loss x Vehicles
Brookville	1,510	$3,400,520	3,647	$8,752,800
Butler Twp.	2,772	$6,242,544	7,031	$16,874,400
Carlisle	1,474	$3,319,448	3,861	$9,266,400
Centerville	7,441	$16,757,132	17,976	$43,142,400
Clay Twp.	2,541	$5,722,332	6,443	$15,463,200
Clayton	4,238	$9,543,976	10,437	$25,048,800
Dayton	35,536	$80,027,072	89,456	$214,694,400
Englewood	3,674	$8,273,848	8,827	$21,184,800
Farmersville	264	$594,528	683	$1,639,200
German Twp.	2,371	$4,339,492	6,157	$14,776,800
Germantown	1,425	$3,209,100	3,597	$8,632,800
Harrison Twp.	6,538	$14,723,576	16,341	$39,218,400
Huber Heights	10,373	$23,359,996	27,808	$66,739,200
Jackson Twp.	1,942	$4,373,384	5,132	$12,316,800
Jefferson Twp.	2,222	$5,003,944	4,847	$11,632,800
Kettering	17,082	$38,468,664	43,344	$104,025,600
Miami Twp.	12,734	$28,676,968	33,103	$79,447,200
Miamisburg	5,365	$12,081,980	13,587	$32,608,800
Moraine	1,754	$3,950,008	4,846	$11,630,400
New Lebanon	1,156	$2,603,312	3,146	$7,550,400
Oakwood	3,029	$6,821,308	6,464	$15,513,600
Perry Twp.	1,939	$4,366,628	5,030	$12,072,000
Phillipsburg	184	$414,368	474	$1,137,600
Riverside	6,512	$14,665,024	16,867	$40,480,800
Springboro	3,646	$8,210,792	8,783	$21,079,200
Trotwood	6,950	$15,651,400	17,940	$43,056,000
Union	1,767	$3,979,284	4,071	$9,770,400
Vandalia	4,086	$9,201,672	11,042	$26,500,800
Verona	119	$267,988	307	$736,800
Washington Twp.	16,470	$37,090,440	41,273	$99,055,200
West Carrollton	3,673	$8,271,596	10,338	$24,811,200
Wright-Patterson AFB	84	$189,168	3,346	$8,030,400
Montgomery County	170,871	$384,801,492	436,204	$1,046,889,600

- Figure 7-1: Estimated Winter Storm Related Residential and Personal Property Losses

Due to the unique nature of winter storms, it is difficult to accurately predict potential losses within Montgomery County. The total property value for Montgomery County is just over

$26 billion. A winter storm could potentially affect any portion of that total value. At 100% losses, Montgomery County would lose over $409 million in agriculture, $19.4 billion in residential, $835.7 million in industrial and $5.3 billion commercial losses. These numbers include almost $1 billion in critical infrastructure, including $763.5 million from hospitals, $175.6 million in government facilities, $27 million in law enforcement and over $20 million in fire department losses throughout the county. Even a severe winter storm that only affected 10% of the county would still cost over $2.6 billion, a potentially devastating total.

Chapter 8 Summer Heat and Drought

Excessive heat occurs from a combination of high temperatures (significantly above normal) and high humidity. At certain levels, the human body cannot maintain proper internal temperatures and therefore may experience heat stroke. The "Heat Index" (HI) is a measure of the effect of these combined elements on the body.[29]

A daytime HI reaching 105°F or above with nighttime lows at or above 80°F for two consecutive days may significantly impact public safety and, therefore, generally requires the issuance of an advisory or warning by local national weather service's offices.

Sudden rises in temperature, when people don't have a chance to acclimatize, or prolonged heat waves increase death rates. During 1979 to 1998 (the most recent years for which national data are available), 7,421 deaths in the United States were heat-related with a median of 274 deaths per year (range: 148-1700), and there was a median heat-related death rate of 0.1 per 100,000 population (range: 0.1-0.8). Heat-related death rates appear to be stable over time in all age groups with the highest mortality among persons over 65.[30]

Drought is generally a prolonged event involving drier-than-normal conditions and the possibility of excessive heat or periods of extreme cold that results in water-related problems. The amount of precipitation at a particular location varies from year to year but, over a period of years, the average amount is fairly constant.[31] Even if rainfall for a year is about average, rainfall shortages can occur during a period of excessive heat or when rainfall is crucial for plant and crop growth.

When there is little or no rainfall for short periods of time, soils can dry out and plants can die, but when rainfall is short for prolonged periods of time (several weeks, months, or years), water levels in wells, lakes reservoirs streams and rivers fall and flow declines. If dry conditions persist, water-supply problems develop and the dry period can become a drought. The following is a list of different definitions for drought provided by the National Drought Mitigation Center:

- Meteorological drought: "A period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area." (Huschke, R.E., ed., 1959, Glossary of meteorology: Boston, American Meteorological Society, 638 p.)

[29] www.crh.noaa.gov
[30] Reported by: L Sathyavagiswaran, MD, Dept of the Coroner, Los Angeles County; JE Fielding, MD, D Dassy, MD, Los Angeles County Dept of Health Svcs. Health Studies Br, Div of Environmental Hazards and Health Effects, National Center for Environmental Health; and EIS officers, CDC.
[31] U.S. Geological Survey Open File Report 93-642

- Agricultural drought: "A climatic excursion involving a shortage of precipitation sufficient to adversely affect crop production or range production." (Rosenberg, N.J., ed., 1979, Drought in the Great Plains--Research on impacts and strategies: Proceedings of the Workshop on Research in Great Plains Drought Management Strategies, University of Nebraska, Lincoln, March 26-28: Littleton, Colorado, Water Resources Publications, 225 p.)

- Hydrologic drought: "A period of below average water content in streams, reservoirs, ground-water aquifers, lakes and soils." (Yevjevich Vujica, Hall, W.A., and Salas, J.D, eds., 1977, Drought research needs, in Proceedings of the Conference on Drought Research Needs, December 12-15, 1977: Colorado State University, Fort Collins, Colorado, 276 p.)

Some areas of the country are more likely to have droughts than other areas. In **humid** or wet regions, a drought of a few weeks is quickly reflected in a decrease in soil moisture and in declining flow in streams. People who use water from streams in these areas may face water shortages. In **arid** or dry regions, people rely on ground water reservoirs to supply their needs. They are protected from short-term droughts, but may have problems during long dry periods because they may have no other water source if wells or reservoirs go dry.

Hazard Assessment

Hazard Identification

Since 1930 there have been seven droughts and one extreme heat events. In the last 156 years there have been 17 drought events, thus there is approximately an 11 percent chance a drought could occur within the county each year.

Excessive Heat

July 20-31, 1999 EXCESSIVE HEAT

The last part of July was very hot and humid across the state with temperatures reaching into the 90s most days and above 100° for a few days. The dew points and overnight lows were in the 70s through much of the period. The excessive heat contributed to three deaths in the Dayton metro area. Excessive heat contributed to substantial crop loss across much of Ohio.

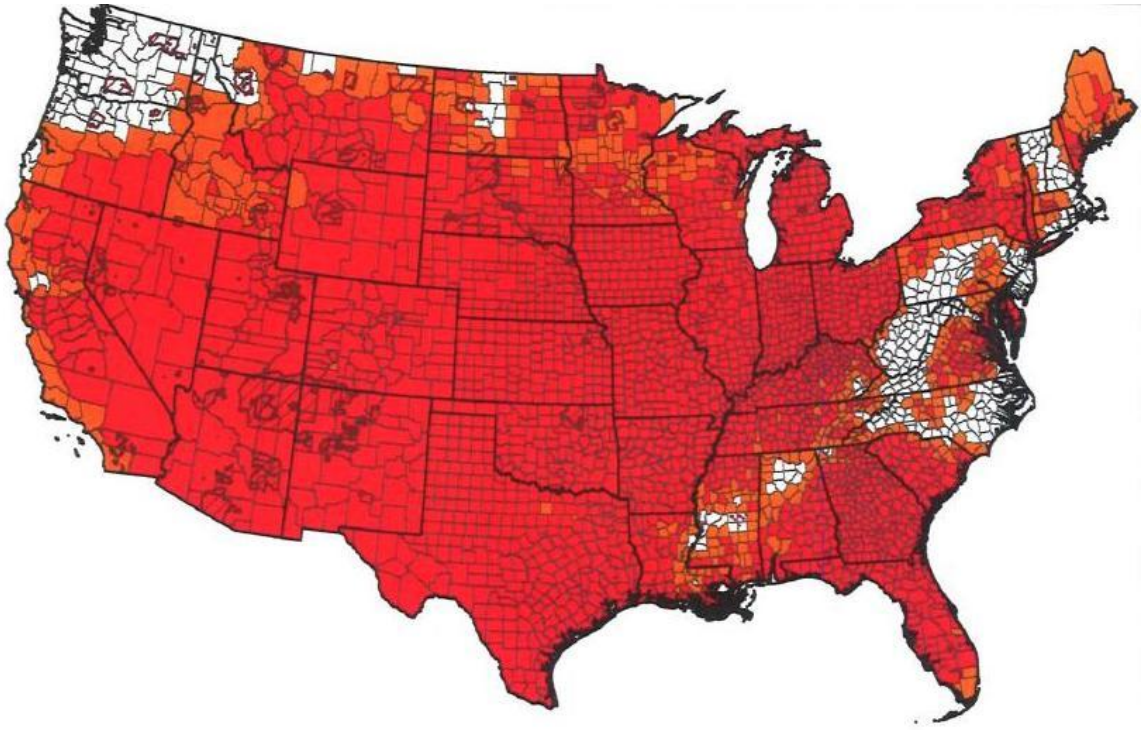
Drought Events

2012 DROUGHT

2012 North American Drought
The 2012-2013 North American Drought is an expansion of the 2010-2012 United States drought which began in the spring of 2012, when the lack of snow in the United States caused very little melt water to absorb into the soil. The drought includes most of the US and included Ohio. Among many counties, Montgomery County was designated with

moderate drought conditions by mid-June. It has been equaled to similar effects as droughts in the 1930's and 1950's but it has not yet been in place as long. However, the drought has inflicted, and is expected to continue to inflict, catastrophic economic ramifications. In most measures, the drought has exceeded the 1988-1989 North American Drought, which is the most recent comparable drought.

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



USDA FSA
FARM SERVICE AGENCY

USDA Farm Service Agency
Production, Emergencies and Compliance Division
Washington, D.C.
December 12, 2012

Total All Crop Approved Designations

State Boundary
County Boundary
Tribal Lands

December 12, 2012

Primary Counties: 2300
Contiguous Counties: 435

1:23,520,203

2002 DROUGHT

Dry conditions that began in the spring and early summer continued through August with most areas receiving well below normal rainfall for the month. US Department of Agriculture Secretary Ann M. Veneman's designated 77 of Ohio's counties as part of a statewide disaster area due to agricultural losses caused by drought and other extreme weather meeting the criteria to be recommended for disaster designations, including Clark, Clermont, Clinton, Darke, Greene, Miami, Montgomery, Preble, and Warren. The USDA's damage assessments in August estimated that almost half the counties expected total crop losses of 30 to 50 percent, and 17 counties losses of 50 percent or more.[32]

July 1- August 31, 1999 DROUGHT

Dry conditions that began in the spring and early summer continued through August with most areas receiving well below normal rainfall for the month. Rainfall was widely scattered and did little to help farmers. Most counties in southwest Ohio were declared Federal Disaster Areas by the US Department of Agriculture.

1988 DROUGHT

1988-1989 — North American Drought
The drought of the late 1989s followed a milder drought in the Southeastern United States and California the year before. This drought spread from the Mid-Atlantic, Southeast, Midwest, Northern Great Plains and the Western United States. It was widespread, unusually intense and accompanied by heat waves which killed around 4800 to 17000 people across the United States and also killed livestock across the county. One particular reason that the Drought of 1989 became very damaging was farmers might have farmed on land which was marginally arable. Another reason was pumping groundwater near the depletion mark. The Drought of 1989 destroyed crops almost nationwide, residents' lawns went brown and water restrictions were declared in many cities. This drought was very catastrophic for multiple reasons; it continued across the Midwest States and North Plains States during 1989, not officially ending until 1990.

For Montgomery County this was a statewide drought that was short but severe and resulted in rapid declines in stream flow, ground-water and reservoir levels. During this period a mandatory water-use restriction was instituted in many municipalities.

1959-1968 DROUGHT

Statewide drought that affected east-central and northwestern Ohio most severely.

1952-1957 DROUGHT

More severe in southwestern Ohio the balance of the state.

[32] http://www.state.oh.us/gov/releases/082302usda.htm

1939-1946 DROUGHT

Statewide serious water shortages.

1930-1936 DROUGHT

Regional and statewide drought with serious water shortages and of gross farm income estimated at $58 million in 1930.

List of the driest 12-month periods in Ohio, 1854-1992, as measured using monthly precipitation data. The precipitation amount is the 12-month sum of the monthly statewide precipitation average obtained using all available cooperative weather stations. The list presents the lowest 12-month averaged value occurring during a period when several adjacent 12-month periods may have also had less than 29 inches of precipitation (approximately two standard deviations below normal). The list continues with amounts above 29 inches until the 1991-1992 droughts, shown for comparative purposes.

Time Period: Precipitation Total[33]

- April 1930 - March 1931: 21.93 inches
- November 1894 - October 1895: 25.56 inches
- January - December 1963: 26.50 inches
- January - December 1934: 26.69 inches
- February 1953 - January 1954: 27.44 inches
- February 1856 - January 1857: 27.81 inches
- September 1987- August 1988: 28.33 inches
- May 1874 - April 1875: 28.44 inches
- April 1863 - March 1864: 28.49 inches
- February 1960 - January 1961: 28.53 inches
- April 1871 - March 1872: 28.60 inches
- December 1900 - November 1901: 28.60 inches
- July 1924 - June 1925: 28.66 inches
- June 1940 - May 1941: 28.74 inches
- May 1904 - April 1905: 29.33 inches
- August 1943 - July 1944: 29.58 inches
- May 1991 - April 1992: 29.97 inches

Estimated Losses

Montgomery County is frequently subject to summer heat and drought related losses and when these events occur, they affect all of Montgomery County. Property is at risk due to periods of excessive heat and little or no rain.

[33] http://thoth.sbs.ohio-state.edu/faculty/rogers/drought.html

For the purposes of this study, we will examine the possibility of agricultural economic losses due to extreme heat and drought events. According to the U.S. Census, of the 295,500 acres in Montgomery County, approximately 35 percent (101,912) is agricultural in nature. Over 700 farms in the county report crop production at a total of approximately $28,831,000 per year. Of these, only 34 report irrigation capabilities leaving 79,632 acres of cropland unprotected from drought conditions. Total losses could possibly range up to $26.5 million, if non-irrigated crops in the county suffered total losses due to drought on any given year.

Residences, some businesses, schools districts, and local and state governments also suffer economic losses due to the periods in which properties suffered damages due to extreme heat and drought. Businesses, schools, and governmental which remain closed during periods of extreme heat or drought, also lose sales and production. None of which can be calculated here.

Chapter 9

Earthquake

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates.[34]

Earthquakes are one of the most dangerous and damaging hazards and strike without warning. In any given year, there are approximately 500,000 detectable worldwide and 100,000 of those can be felt, and one percent of them cause damage.

Charles F. Richter developed the Richter magnitude scale in 1935 to measure and compare the magnitude of earthquakes, but this method is not used to express damage. The magnitude is determined from measurements recorded by seismographs. The following is a chart illustrating the various ranges and the associated levels and severity of damage.

There are 45 states and territories in the United States at moderate to very high risk from earthquakes (areas with peak acceleration greater than 2%), and they are located in every region of the country.[35] California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter Scale. These earthquakes were felt over the entire Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.[36] In March 1975, Professor Edmund F. Pawlowicz published "Earthquake Statistics for Ohio" in the Ohio Journal of Science. His entry for the April 1950 earthquake noted that "sudden earth tremors were felt in Dayton and surrounding area. Some dishes were broken. Thought to be a low flying aircraft."

Although most people do not think of Ohio as an earthquake-prone state, at least 120 earthquakes with epicenters in Ohio have been felt since 1776. In addition, a number of earthquakes with origins outside Ohio have been felt in the state. Most of these earthquakes have been felt only locally and have caused no damage or injuries. However, at least 14

[34] http://www.fema.gov/hazards/earthquakes/quake.shtm
[35] The peak acceleration is the largest acceleration recorded by a particular station during an earthquake. http://geohazards.cr.usgs.gov/eq/html/info.html
[36] http://www.fema.gov/hazards/earthquakes/quake.shtm

moderate-size earthquakes have caused minor to moderate damage in Ohio. Fortunately, no deaths and only a few minor injuries have been recorded for these events.

Scale		
Magnitude	Mercalli	Description
0-2.9	I	Detected only by sensitive instruments
	II	Felt only by a few persons at rest, especially on upper floors of buildings; delicately suspended objects may swing
	III	Felt noticeably indoors, especially on upper floors of buildings, but not always recognized as earthquake; standing autos may rock slightly; vibrations like a passing truck
2.9-4.1	IV	During the day, felt indoors by many, outdoors by few; at night, some awakened; dishes, windows, doors disturbed; walls make creaking sound; sensation like heavy truck hitting building; standing autos rock noticeably
	V	Felt by most people; some breakage of dishes, windows, and plaster; unstable objects overturned; disturbance of trees, poles, and other tall objects
4.1-5.4	VI	Felt by all, many frightened and run outdoors; some heavy furniture may move; falling plaster and chimneys, damage slight
	VII	Everyone runs outdoors; damage to buildings varies depending on quality of construction; noticed by people driving autos
5.4-7.3	VIII	Panel walls thrown out of frames; walls, monuments, chimneys fall; sand and mud ejected; drivers of autos disturbed
	IX	Buildings shifted off foundations, frame structures thrown out of plumb; ground cracked; underground pipes broken
	X	Most masonry and frame structures destroyed; ground badly cracked, rails bent, landslides; sand and mud shift; water splashes over river banks
7.3+	XI	Few structures remain standing; bridges destroyed; broad fissures in ground, pipes broken, landslides, rails bent
	XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into the air

- Figure 9-1: Seismic Magnitude/Intensity Scales[37]

However, at least 14 moderate-size earthquakes have caused minor to moderate damage in Ohio. Fortunately, no deaths and only a few minor injuries have been recorded for these events.

Ohio is on the periphery of the New Madrid Seismic Zone, an area in Missouri and adjacent states that was the site of the largest earthquake sequence to occur in historical times in the continental United States. Four great earthquakes were part of a series at New Madrid in 1811 and 1812. These events were felt throughout the eastern United States and were of sufficient intensity to topple chimneys in Cincinnati. Some estimates suggest that these earthquakes were in the range of 8.0 on the Richter scale.

[37] http://www.dnr.state.oh.us/Portals/10/pdf/GeoFacts/geof03.pdf

A major earthquake centered near Charleston, South Carolina, in 1886 was strongly felt in Ohio. More recently, an earthquake with a Richter magnitude of 5.3 centered at Sharpsburg, Kentucky, in 1980 was strongly felt throughout Ohio and caused minor to moderate damage in communities near the Ohio River in southwestern Ohio. In 1998 a 5.2-magnitude earthquake occurred in western Pennsylvania, just east of Ohio, and caused some damage in the epicentral area.

Earthquake regions

Three areas of the state appear to be particularly susceptible to seismic activity: the northeastern, northwestern, and southwestern areas of the state (See Figure 9-2).

Southeastern Ohio has been the site of at least 10 felt earthquakes with epicenters in the state since 1776. The 1776 event, recorded by a Moravian missionary, has an uncertain location. Earthquakes in 1901 near Portsmouth (Scioto County), 1926 near Pomeroy (Meigs County), and in 1952 near Crooksville (Perry County) caused minor to moderate damage.

Causes of Ohio Earthquakes

The origins of Ohio earthquakes, as with earthquakes throughout the eastern United States, are poorly understood at this time. Those in Ohio appear to be associated with ancient zones of weakness in the Earth's crust that formed during continental collision and mountain-building events about a billion years ago. These zones are characterized by deeply buried and poorly known faults, some of which serve as the sites for periodic release of strain that is constantly building up in the North American continental plate due to continuous movement of the tectonic plates that make up the Earth's crust. [38]

History of Earthquakes in Montgomery County

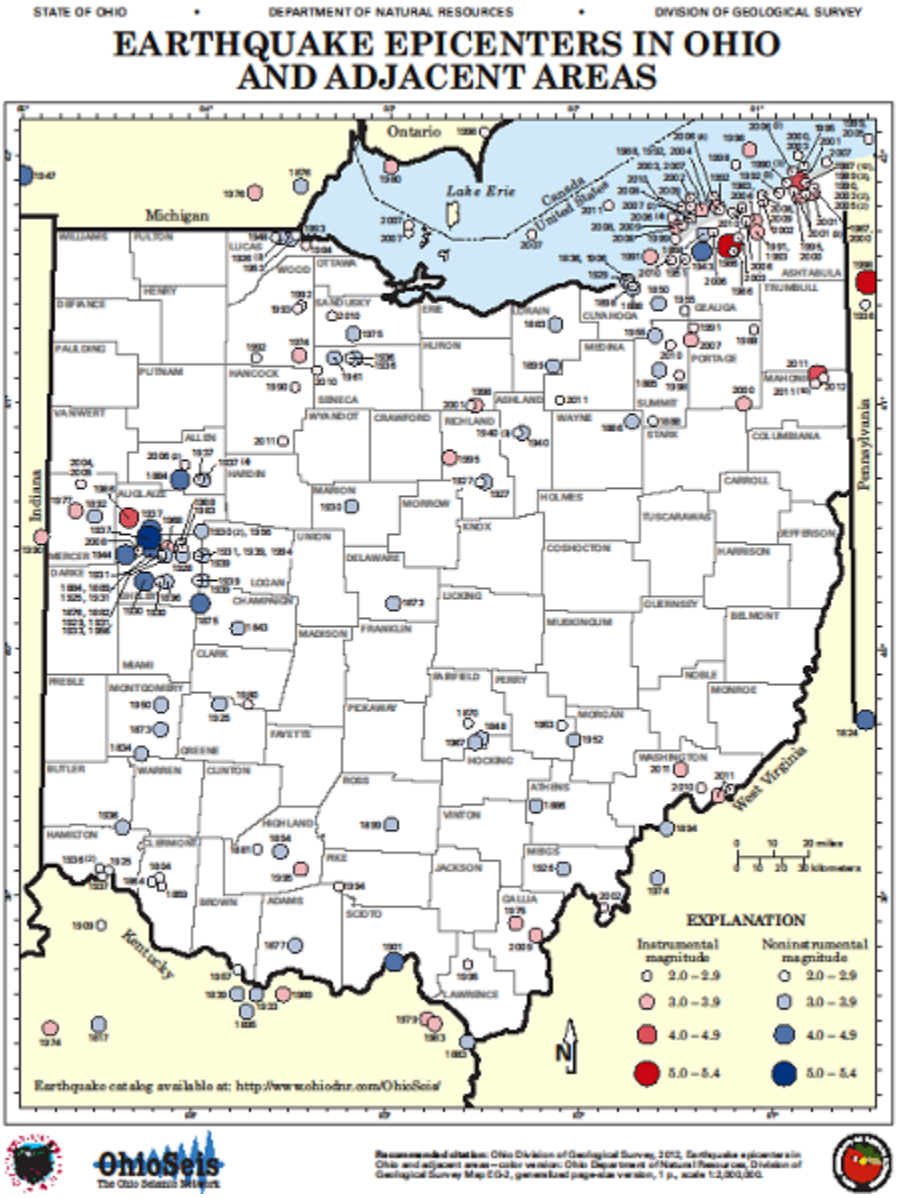
Social and geological records indicate that Montgomery County has little seismic history adversely affecting the economics or population of the county.

Three earthquakes have occurred in Montgomery since 1776 (Refer to Figure 9-2). The first quake, November 20, 1834 had an epicenter near the southern Montgomery County border between what is now Miamisburg and Carlisle in Warren County. The earthquake rated a 3.5 on the Richter Scale. At this level a quake is capable of producing moderate damage, which can be felt indoors and may break dishes and windows. Using the simplest formula possible, the number of events divided by the number of recorded years, there is a 1.7 percent chance an earthquake epicenter will occur somewhere in the county every year.

[38] http://ohiosharpp.ema.state.oh.us/OhioSHARPP/Documents/SHMP/2-HIRA/SOHMP_Sec_2_9.pdf

The second quake to be recorded in Montgomery County happened on April 23, 1873 and the epicenter was at the Kettering-Moraine boundary near South Dixie Drive and Dorothy Lane. This quake was rated 3.0 on the Richter Scale and is very similar to the first in severity.

The last earthquake recorded for the Montgomery County area occurred April 20, 1950. Its center was located on the north side of Dayton and was similar in severity to both previously mentioned earthquakes.



- Figure 9-2: Historical Earthquakes in Ohio[39]

[39] www.ohiodnr.com/OhioSeis

Risk Assessment

Seismic Risk

Seismic Risk in Ohio is difficult to evaluate because earthquakes are generally infrequent in comparison to plate-margin areas such as California. Active faults do not reach the surface in Ohio and therefore cannot be mapped without the aid of expensive subsurface techniques.

A great difficulty in predicting large earthquakes in the eastern United States is that the recurrence interval--the time between large earthquakes--is commonly very long, on the order of hundreds or even thousands of years. As the historic record in most areas, including Ohio, is only on the order of about 200 years--an instant, geologically speaking--it is nearly impossible to estimate either the maximum magnitude or the frequency of earthquakes at any particular site.

Earthquake risk in the eastern United States is further compounded by the fact that seismic waves tend to travel for very long distances. The relatively brittle and flat-lying sedimentary rocks of this region tend to carry these waves throughout an area of thousands of square miles for even a moderate-size earthquake. Damaging ground motion would occur in an area about 10 times larger than for a California earthquake of comparable intensity.

An additional factor in earthquake risk is the nature of the geologic materials upon which a structure is built. Ground motion from seismic waves tends to be magnified by unconsolidated sediments such as thick deposits of clay or sand and gravel. Such deposits are extensive in Ohio. Buildings constructed on bedrock tend to experience much less ground motion, and therefore less damage. Geologic maps, such as those prepared by the Ohio Division of Geological Survey, delineate and characterize these deposits. Geologic mapping programs in the state geological surveys and the U.S. Geological Survey are therefore critical to public health and safety.[40]

The brief historic record of Ohio earthquakes suggests a risk of moderately damaging earthquakes in the western, northeastern, and southeastern parts of the state. Whether these areas might produce larger, more damaging earthquakes is currently unknown, but detailed geologic mapping, subsurface investigations, and seismic monitoring will greatly help in assessing the risk. Earthquakes vary in intensity. Some can only be detected with special equipment; others can destroy entire suspension bridges, city blocks, and lives.

At this time it is almost impossible to determine to what extent an earthquake may actually affect the County. If recent events were repeated today, the entire county would likely feel the effects of an earthquake, but would sustain very little damage to personal property and public infrastructure. However, it is conceivable that personal property (the contents of the structure) may be damaged. Dishes, unsecured collectibles, and picture frames may be disturbed and/or broken. Windows and doors may also be disturbed.

[40] Ibid.

Earthquake Hazard Assessment

Due to the infrequent and unpredictable nature of earthquakes, it is difficult to do a proper hazard and vulnerability assessment for Montgomery County. However, software provided by FEMA called HAZUS-MH has been used to generate a scenario in which an earthquake would occur in downtown Dayton and that would affect the entire county.

In the earthquake scenario run by HAZUS-MH, there are 228,000 buildings in the region which could be affected by an earthquake with a total replacement value of $45.5 billion. Wood frame construction makes up 71 percent of the building inventory, with the remaining percentage distributed between the other general building types. In addition, there are 11 hospitals, 35 government facilities and over 50 law enforcement and fire facilities with a combined value of over $987 million. There are six utility systems including potable water, wastewater, natural gas, crude and refined oil, electric power and communications. The value of these utilities is over $6 billion which includes 411 kilometers of highways, 572 bridges, and 10,341 kilometers of pipes. Lastly there are 16 dams in the county, eight of which are classified in this scenario as "high hazard."

In the scenario run, 74 percent of single family residences would be completely destroyed, as would eight percent of commercial buildings, two percent of industrial buildings, and 14 percent of "other residential" buildings. Eighty-nine percent of unreinforced masonry would be completely destroyed in this scenario. This same scenario would cause 171 potable water leaks, 135 waste water leaks, and 145 natural gas leaks as well as 43 potable water breaks, 34 waste water breaks, and 36 natural gas leaks. In the first day following the earthquake, over 156,000 households of the 229,000 would be without power and it would likely take over 90 days before power was completely restored to parts of the county.

Secondary fires, common after earthquakes, would also occur, and may displace an additional 5,170 people and burn about $378 million worth of buildings in Montgomery County. The earthquake would produce 1.17 million tons of debris, 59% of which would be brick/wood and the rest being reinforced concrete/steel. At 25 tons/truck, it would take approximately 46,720 truckloads to remove the debris generated by the earthquake.

The worst time for the earthquake to occur as it relates to casualty estimates would be at approximately 2:00 p.m. At this time, there would be approximately 952 injuries requiring medical attention but not hospitalization, 201 injuries requiring hospitalization that would not be life-threatening, 26 injuries requiring hospitalization that would be considered life-threatening if not treated promptly, and 50 deaths.

The scenario likely cause income losses of $159 million to single family homes, $81 million to other residential, $370 million in commercial losses, $24 million in industrial losses, and $48 million in "other" losses for a total $683 million in income losses. The total building-related losses would be almost $4 billion.

Chapter 10 Other Events

Montgomery County has been susceptible to a multitude of natural disasters throughout its history. Many of these disasters have resulted in Disaster Relief Funds to be granted. In addition to the natural disasters there have been events that do not fall within the categories addressed in this document but have also resulted in Disaster Relief Funds being granted. Hurricanes are not considered in most disaster response plans within Ohio but events in the past have caused that thinking to be reconsidered.

September 2008 HURRICANE

The remnants of Hurricane Ike made its way across Ohio packing winds at speeds equal to a Category 1 hurricane. Strong winds moved diagonally across the state from southwest to northeast over a four-hour period. Losses compiled by insurance companies and state government mounted over time, capping Ohio's largest natural disaster in recent history - the Xenia Tornado of 1974. Strong winds of 40 to 50 miles per hour were sustained for several hours. The Dayton International Airport measured a gust to 69 mph while a 60 mph gust was recorded in Vandalia. Widespread damage occurred across the region including trees falling on power lines, significant crop losses and structural damage at an estimated $63.7 million.

According to Property Claim Services, Ohio's insured losses from Hurricane Ike were approximately $1.255 billion. State and Federal agencies quoted local government costs for protection and clean up at an additional $38.6 million. According to the Ohio Insurance Institute, total damages from the Xenia Super-outbreak are about $1 billion in 2008 dollars. Montgomery County was granted $6,373,612.64 in public assistance funds for this event. **(DR-1805).**

September 2005 HURRICANE

Hurricane Katrina, which struck the gulf coast in August 2005, has had lasting and far-reaching effects. Katrina caused massive flooding in the city of New Orleans and catastrophic damage along the gulf coasts of Alabama, Mississippi, and Louisiana. As a result, Katrina caused one of the largest relocations of people in U.S. history.

The President declared ordered Federal aid to supplement state and local response efforts to assist evacuees from the area struck by Hurricane Katrina and to provide emergency assistance to those areas beginning on August 29, 2005, and continuing. The President's action makes Federal funding available to the State and all 88 counties. Montgomery County was granted $6,720.00 in public assistance funds for this event. **(EM-3250).**

Chapter 11 Goals & Action Items

This Chapter provides information on the process used to develop the goals and action items pertaining to the natural hazards identified in the previous chapters.

As the planning group met certain issues and trends emerged from the natural hazard data reviewed in Chapters Three through Nine and the Inventory of Existing Conditions in Chapter Two. This chapter provides information on the process used to develop and set the priorities, summarizes the information from the preceding seven chapters and presents how these issues and trends determined the development of priorities, strategies and outcomes.

In general, four priorities emerged: educating the public; protecting life and property; creating and/or strengthening partnerships, and creating a safer environment through construction or installation projects of natural hazard safety systems.

Most of our focus was on priority one, educating the public and can be applied to all of the hazards identified during the analysis stage. The projects developed reach citizens countywide and affect the entire population.

The second priority consists of various activities, which reduce or limit the risk faced by the public as a result of natural disaster. One activity pertains to plans and codes and another pertains to construction or installation projects and requires a significant investment to launch and generally affects only a limited group of the population.

The third priority was to create or strengthen partnerships. This priority is addressed by the formation of the Mitigation Planning Team and the outreach to local jurisdictions, partnering organizations, and the public.

A fourth priority was created for the longer-term construction projects. In order to create a safer environment, several construction or installation projects based on natural hazard safety systems were submitted by the local jurisdictions.

Identifying the Problem(s)

In the first stage of the plan's development, the Pre-mitigation Planning Team (PmPT) reviewed the data provided in the Hazard Assessment/Analysis and examined the problems caused by natural hazards in the county. The purpose of this analysis is to determine priorities for mitigation spending. The group focused their attentions to those events, which frequently trouble the area. Based on the information provided, the following hazards were

summarized for Montgomery County and were presented only for the impact of the specified natural disaster and not potential mitigation plans.

Tornadoes and High Winds – Montgomery County has experienced nine tornadoes over the past 52 years, or an average of approximately one tornado every six years. There were no recorded injuries or deaths from these tornadoes, but each caused some property damage. The average annual damage from tornadoes in Montgomery County is $247,346.

Winter Storms – Although some years pass without winter storms, on average there are several occurrences per year. Unlike tornadoes and floods, winter storms typically impact every part of the county. In a heavily urbanized county like Montgomery County, this translates into hundreds of thousands of people, thousands of miles of streets and roads, dozens of schools and hundreds of businesses that are impacted. The data suggests that on average there is approximately one death and three injuries per year from winter storms, but these numbers probably do not reflect traffic accidents. The statistics also do not include heart attacks, which are often directly caused by heavy snowfall and attempts to shovel it. Winter storms often require a significant investment for local governments: snow removal, traffic control, EMS runs for accident and heart attack victims, water line breaks, etc. However, because of their frequency, most jurisdictions plan for the effects of winter storms.

Floods – Localized flooding will likely occur somewhere in the county every year. Flooding is likely to occur in densely developed areas as a result of rapid rainfall over a very short period of time causing urban runoff. Flooding generally occurs in low-lying areas along rivers and tributaries, and often will occur along several unconnected waterways simultaneously. Montgomery County cities enjoy a high level of flood protection along the major rivers and tributaries, but many miles of small tributaries can overflow and affect urbanized areas. Flooding can cause death and injury but the likelihood is low if commonly recognized precautions are taken. Local zoning and building authorities as well as the real estate, banking and insurance industries exert significant effort in managing development in floodplain areas, but flood losses continue to rise every year.

Severe Heat and Drought Events – This category has the smallest amount of available data but can cause devastating impacts, particularly on agriculture and water supply. Like winter storms, some years pass without incident, but severe heat and drought impacts the entire county also translating into the possibility of hundreds of thousands of people affected. National data suggests that on average there are approximately 0.1-0.8 deaths per 100,000 population per year caused by summer heat. In Montgomery County, this means we can expect up to 4 deaths (0.56-4.47) annually directly caused by summer heat. It seems reasonable to expect severe heat and drought events at least every 10 to 15 years, if not more often.

Hail Storms – Hailstorms, like floods, can be expected to occur every year. Most cause little damage, but the data suggest that the risk of injuries and deaths is very low but there will be some property damage from hail storms. Most of the hailstorms average approximately

$12,000 in damages per year, but the April 2001 event reportedly caused $72.6 million in damages.

Earthquakes – Earthquakes can be felt and even cause damages for hundreds of miles. There have been 3 reported earthquakes that originated in Montgomery County in the past 175 years. All were of a great enough magnitude to cause items to be shaken from shelves and minor damages but no damage amounts are documented.

Determining the "as-is" condition of the county was a multi-stage process. This process included indentifying how many of the participating jurisdictions had an Emergency Mitigation Plan, Emergency Response Plan, Storm Water Management Plan, Floodplain Management Plan, Storm Drainage Improvement Plan, Soil Management Plan, Erosion Control Plan, and Building Codes. Once that information was compiled a determination could be made on which areas to focus mitigation efforts.

The Planning Team then determined the "as-is" state of the county or the vulnerability that existing hazards present. As a result, the hazard events were ranked not only by frequency, but the group also considered factors such as number of deaths, injuries, and total dollar loss for each event type (Refer to the following table).

Hazard Ranking				
	Frequency	Impact Injury	Death	Overall Rank
Tornado & Wind	1	2	2	1
Severe Winter	4	1	1	2
Flood	3	4	3	3
Severe Summer	5	3	4	4
Hail	2	6	5	5
Earthquake	6	5	6	6

- Figure 11-1: Hazard Ranking

Select the Best Activities and Develop Action Plans

The Pre-mitigation Planning Team identified the plan goals, which would most effectively minimize or eliminate problems caused by natural hazards in the county by working through a multi-stage process over a period of several weeks.

To complete this process, the Planning Team first brainstormed to identify the goals, objectives, and identified problem areas concerned with each hazard. To develop the best solution the Pre-mitigation Planning Team found it important to consider many possible solutions. All of the solutions were recorded and evaluated during the brainstorming session.

A priority needed to be established in order to implement these goals, objectives and projects. The priority was determined first by the goal, then the objective and last the project proposed. The priority of each goal, objective, and project is for planning purposes

only and does not describe a time line for implementation. For example if a project in Goal Two is identified and the jurisdiction chooses to implement it that does not compromise the intended prioritization.

The resulting goals set by the Planning Team are listed and apply to all natural hazards.

Goal One: Increase Public Awareness

Develop and implement educational programs to increase the community's awareness of the risks associated with natural hazards affecting the County and provide information on weather-related-preparedness tools and resources.

Goal Two: Protect Life and Property

Encourage the government, the public, builders and other construction industry workers to utilize construction methods, which protect lives by making new and existing structures safer or resistant to damage typically caused by natural hazards.

Improve hazard assessment information

Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards

Goal Three: Create and/or strengthen Partnerships

Create a County Hazard Mitigation Committee/Team to develop a strategy for coordination and participation by public entities, the business community, non-profit organizations, and residents of the county to develop sustainable mitigation activities.

Goal Four: Create a safer environment through construction or installation projects of natural hazard safety systems

Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards.

Identify Potential Projects

To identify potential projects the Pre-mitigation Planning Team worked through an additional three-week multi-stage process in which the Team brainstormed a list of potential projects based on the itemized goal and problem list developed in the previous sessions. Most of the projects identified could feasibly be applied to all hazards.

Once the Pre-mitigation Planning Team identified all of the possible activities that could reduce hazard damage in Montgomery County, the Team identified the criteria to evaluate each set of activities. The criteria considered were:

- Cost effectiveness
- Feasibility
- Social impact (How well the activity addresses the problem and reduces the risk)

First, the group looked at public information and education programs because the largest audience could effectively be reached for the smallest amount of initial funding. This process can be achieved relatively inexpensively and quickly through the reproduction and distribution of materials in the public libraries, at community events, on the public access Internet and television sites. These activities will increase public awareness to their vulnerability and property risk and will increase public awareness of possible preventative steps each can employ to reduce personal risk.

Second, the team focused on preventative activities, which are considered both short and long term projects, for example encouraging jurisdictions to enforce or enhance building, zoning, and planning codes and/or code enforcement.

An additional tool considered is new or ongoing natural resource protection/planning. Several communities in the Montgomery County area utilize wetland planning/restoration as a natural solution to storm water runoff and should be encouraged to mentor other communities in successful wetland/natural resource planning.

Another preventative approach considered by the Pre-mitigation Team was the installation of tornado siren systems or tornado safe rooms/shelters. These are long-term actions and very costly to install, not to mention involve ongoing maintenance costs. As a result, tornado sirens and tornado safe room construction were moved to a lower priority on the project lists. Because repetitive loss properties were not identified in the hazard assessment, a building-by-building or parcel basis construction action plan was not a consideration.

In addition, the Planning Team considered requesting snow level emergencies to protect Montgomery County citizens during hazardous winter storms, but the Montgomery County Sheriff does not initiate snow level emergencies because of opposition from the business community. This activity was also removed from the potential project list.

As a result the following list of goals, strategies, and action items was developed.

Please note that each project identified below applies to both the county and the jurisdictions. For example, if the county identified Public Awareness as a goal then the goal applies to every jurisdiction within the county and any present or future projects.

Goal One: Increase Public Awareness

Situational Analysis: Floods, earthquakes, tornadoes and high winds, thunderstorms, snowstorms, droughts, and temperature extremes — every resident, employee, and business face the possibility of experiencing them all. These events can damage and even incapacitate a community for an extended period of time.

Knowing the likelihood of a disaster is the best protection from a disaster. Learning to live with the natural forces, which surround us, minimizes the negative impact from natural disasters.

Objective: Educate the public to protect the public.

Strategy: *Increase the community's awareness of the risks associated with natural hazards affecting the County and provide information on weather-related-preparedness tools and resources by developing and implementing educational programs.*

Activities:

Project #1: Develop and distribute information about risks associated with the identified natural disasters affecting the County.
2013 Status: Completed - Pinwheels were designed and purchased that describe each hazard for distribution to the public. This project is an ongoing project.

Project #2: Develop and distribute informational brochure on the types of homeowners hazard insurance, e.g. flood, fire, earthquake, etc. Explaining what is required and what is not, but should be.
2013 Status: Completed – Distributed information materials on hazard insurance to the public. This is an ongoing project.

Project #3: Launch educational campaigns through public/government cable channels and newsletters, websites, street festivals, libraries, school functions, etc.:

- Utilize FEMA's educational tools (pamphlets, brochures, etc.)
- Utilize the materials developed by the American Red Cross, including the business contingency plans
- Utilize programs developed by national network and cable channels
- Utilize the American Humane Society's educational materials

2013 Status: Completed – Distribute and utilize all the aforementioned materials in each format identified. This is an ongoing project.

BUTLER TOWNSHIP
Project: Identified a need to educate the public about the dangers when driving a vehicle in the snow or fog and intend to develop and launch an educational campaign for the public.

Champion: Butler Township Trustees
Est. Cost: $5,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Unchanged

HUBER HEIGHTS
Project: Snow Emergency Educational Campaign
Champion: Huber Heights Mayor
Est. Cost: $5,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Unchanged

JEFFERSON TOWNSHIP
Project: Snow Emergency Route Information and Public Education Campaign
Champion: Jefferson TWP Trustees
Est. Cost: $5,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Unchanged

Project #4: Develop and distribute information/education on weather-related-preparedness tools and resources, i.e. sources to purchase such material, etc.

ENGLEWOOD
Project: Identified need for the comprehensive Severe Weather Package and Fire Safety House. As a result, the city is in the planning process to obtain funding to acquire a mobile educational trailer.
Champion: Englewood Mayor
Est. Cost: $25,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Unchanged

TROTWOOD
Project: Public Information Campaign about winter storm preparedness.
Champion: Trotwood Mayor
Est. Cost: $5,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Unchanged

Project #5: Develop and launch awareness/educational campaigns to increase knowledge of weather alert methods (alert radios, e-mail, cell phones, etc.).

HARRISON TOWNSHIP
Project: Educational campaign promoting the usage of tone-activated weather radios.
Champion: Harrison TWP Trustees
Est. Cost: $5,000

Timeline: Oct 2012 to Oct 2015
2013 Status: Unchanged

Project #6: Educate the public on the importance of properly trimming and maintaining the trees on their property (may be included in materials about natural hazard risk).

Project #7: Educate the public, businesses and residents, of the importance of creating hazard contingency plans (may be included in materials about natural hazard risk).

Project #8: Develop and complete baseline survey to gather citizens' perceptions of the risks associated with natural disasters and the tools and services available to the public to reduce risk.

Project #9: Develop and complete a periodic post-educational campaign surveys to gather citizens' perceptions of the risks associated with natural disasters and the tools and services available to the public to reduce risk (develop a method to measure the effectiveness of educational campaigns).

Project #10: Make the County Natural Hazard Mitigation Plan available to the public by publishing the plan on public website(s).
Champion: Montgomery County Office of Emergency Management, Local Jurisdictions Mayors/Managers/Trustees, and Mitigation Planning Team
Cost: (Excluding specific jurisdiction estimates) $30,000
Timeline: Oct 2012 to Oct 2017
2013 Status: Ongoing – the Plan was posted on the Montgomery County Office of Emergency Management Website. The Plan is continually being revised.

Goal Two: Protect Life and Property

Situational Analysis: Losses endured because of natural disaster continues to rise every year.

Objective: Build safer communities.

Strategy #1: *Encourage the government, the public, builders and other construction industry workers to utilize construction methods which protect lives by making new and existing structures safer or resistant to damage typically caused by natural hazards.*

Activities:

Project #1: Encourage the use of wind and impact resistant building components designed to withstand tornado strength winds:

- Shingles capable of staying attached in a 110-mph wind
- Roofs held down by metal strapping (hurricane strapping), and a spray adhesive applied to the roof sheathing to improve the wind resistance

- Wall strapping systems to hold the roof and wall system to the foundation (New and rehab construction only)

- Insulated, reinforced concrete form wall systems designed to meet the wind-load and impact resistance of tornado strength winds (New and rehab construction only)

- Reinforced garage doors

Project #2: Appeal to the State to enhance or create wind/impact resistant Ohio Basic Building Code(s):

- Shingles capable of staying attached in a 110-mph wind

- Roofs held down by metal strapping (hurricane strapping), and a spray adhesive applied to the roof sheathing to improve the wind resistance

- Wall strapping systems to hold the roof and wall system to the foundation (New and rehab construction only)

- Insulated, reinforced concrete form wall systems designed meets the wind-load and impact resistance

- Reinforced garage doors (New and rehab construction only)

- Re-evaluate wind-load requirements for new construction on a regular basis

Project #3: Require compliance and enforcement of existing building codes.

Project #4: Encourage mitigation measures for existing development in areas vulnerable to natural hazards.

Project #5: Encourage jurisdictions to prevent or prohibit new development in areas vulnerable to natural hazards.

Project #6: Encourage watershed and wetland planning, as well as natural resource management in conjunction with land-use planning for natural hazard mitigation.

Project #7: Encourage regular and periodic pier inspections for bridges.

Project #8: Update dam maintenance programs and services.

Project #9: Develop a set of planned alternative routes and gate frequently flooded areas and inform the citizens.

Project #10: Encourage the use of vinyl siding to reduce dent damage due to hail incidents.

Project #11: Request legislation requiring tornado safe rooms in new mobile home communities and new residential communities without basements.

Project #12: Encourage code enforcement and engineering practitioners to enroll in seminars/classes offered by accredited building training centers that showcase the latest materials and techniques in natural hazard resistant construction.

Project #13: Encourage utility companies to hire tree trimming contractors who are capable of a more citizen friendly trimming service
Champion: Montgomery County Office of Emergency Management and Mitigation Planning Team
Cost: $15,000
Timeline: Oct 2012 to Oct 2017
2013 Status: Unchanged

Strategy #2: *Improve hazard assessment information*

Activities:

Project #1: Local jurisdictions should conduct and maintain an initial damage assessment using all available sources (fire, police, etc.) as soon as possible following a natural event affecting or impeding daily life and business, i.e. road closures due to flooding, winter storms, etc. relative to their jurisdiction as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, pg L-3.
2012 Status: Completed – this activity was completed by the revision of the Montgomery County Emergency Operations Plan and the use of Damage Assessment Forms. Additionally, training was provided to local jurisdictions on Damage Assessment and the use of Damage Assessment Forms in the field.

Project #2: County Emergency Management Agency should collect a detailed damage assessment as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, PG L-3 (consolidated for the unincorporated jurisdictions and separately for the incorporated areas of the county). Detailed reports should include:

- Area – extent of the damage
- Debris – the cost of removing it, does it pose a health hazard, prevent access to homes, businesses, or block roads
- Damage to roads and/or bridges
- Damage to water control facilities
- Damage to utilities (public, private, and non-profit)
- Damage to public buildings
- Emergency work performed
- Damage to parks and recreational facilities
- Death/injury
- Budget information

- Nature of the threat
- Personal property – estimate of losses
- Businesses – estimates of losses and unemployment
- Estimate of insurance coverage
- Agricultural losses – crops, livestock, equipment

2013 Status: Completed – by the creation of Damage Assessment forms that are used by the Montgomery County Office of Emergency Management and the local jurisdictions.

Project #3: Two maps should be generated as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, PG L-5. One map should graphically display Public damage where the worst damage is located and where minimal damage is located. The second should address the same for Private damages.
2012 Status: Completed – The capability to produce Damage Assessment maps in the Montgomery County Emergency Operations Center has been established and tested in disaster exercises. A plotter was purchased for the purpose of creating these maps on a large scale.

Project #4: County Emergency Management Agency should retain a natural disaster activity log of all events, damage assessment reports, and a detailed accounting of emergency fiscal expenditures as established in the Miami Valley Emergency Operations Plan, 1993, Annex L, *Damage Assessment*, pg L-5.
2013 Status: Completed – The Montgomery County Office of Emergency Management maintains all documentation related to disaster events occurring within the county.

Project #5: Montgomery County is in the process of completing a comprehensive GIS data system and when complete, should assess the proximity of any structures to the soil types susceptible to landside as identified in the Minerals and Soils section of Chapter Two, Inventory of Existing Conditions.
Champion: Montgomery County Auditor and GIS System, Montgomery County Office of Emergency Management
Cost: $10,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Completed – The Auditor and Engineer's offices have a comprehensive GIS data system and information can be shared with all county departments.

Strategy #3: *Encourage the government, the public, and businesses to create and maintain a sense of safety from natural hazards.*

Activities:

Project #1: Establish clearly identified places of refuge within public facilities and spaces, neighborhoods, and businesses.

Project #2: Establish and encourage the use of weather warning radios in all public spaces.

Project #3: Test the effectiveness of tornado sirens.

Project #4: Establish and encourage the use of weather warning radios in all businesses and residences.

Project #5: Provide water and shade at all public outdoor events during extreme heat.

Project #6: Establish program(s) providing air conditioning to at-risk populations.

Project #7: Encourage increased use of cold/heat shelters for the homeless.
Champion: Montgomery County Office of Emergency Management, local jurisdictions, mayors/managers/trustees
Cost: $ 10,000
Timeline: Oct 2012 to Oct 2016
2013 Status: Completed – The Montgomery County Office of Emergency Management maintains a Heat Emergency Plan and a Cold Weather Plan that addresses sheltering for the public.

Goal Three: Create and/or strengthen Partnerships

Situational Analysis #1: The Plan needs a permanent body to supervise the plan activities. The permanent committee/board would be responsible for implementation of the plan, evaluating progress, and updating the plan as necessary.

Objective: To create a living and sustainable plan.

Strategy: *Create a County Hazard Mitigation Committee/Team to develop sustainable mitigation activities.*

Activities:

Project #1: Create a County Hazard Mitigation Committee, a partnership of citizens, government, businesses, non-profit organizations – Red Cross, Chamber of Commerce, etc., and social groups, such as the Boy Scouts, Girl Scouts, YMCAs, Eagles, etc.
2013 Status: Completed – by the formation of the Natural Hazard Mitigation Planning Committee.

Project #2: Appoint a Chairperson for the County Hazard Mitigation Committee.
2013 Status: Completed – by the formation of the Natural Hazard Mitigation Planning Committee.
Situational Analysis #2: Property loss, injury, and loss of life are prevented by coordinating efforts to fill the gaps in services, both pre- and post-disaster.

Objective: To involve the community in mitigation and response activities.

Strategy: *Create a County Hazard Mitigation Committee/Team to develop a strategy for coordination and participation by public entities, the business community, non-profit organizations, and residents of the county to develop sustainable mitigation activities.*

Activities:

Project #1: Partner with organizations and citizens to identify grant programs and foundations to support mitigation activities.

Project #2: Work with County Volunteer Corps and other community groups to establish community response teams:

- Establish a Citizen Corps Subcommittee specifically designed as a volunteer organization to check-in on the shut-in and frail elderly population
- Establish a Citizen Corps Subcommittee specifically designed as a volunteer organization to move necessary personnel during a natural disaster

Project #3: Partner with organizations whose mission is to restore or preserve beneficial natural systems (wetlands, watersheds, etc.).

Project #4: Encourage the cooperation of neighbors to include, but not limited to:

- Contingency plans for the evacuation and care of neighboring families and pets, and communication among neighbors in the event of a natural hazard

Project #5: Contingency plans for checking-in on the shut-in and frail elderly neighbors
Champion: Montgomery County Office of Emergency Management, Mitigation Planning Team
Cost: $7,000.00
Timeline: Oct 2012 to Oct 2017
2013 Status: Ongoing

Goal Four: Create a Safer Environment

Create a safer environment through construction projects or installation projects of natural hazard safety systems

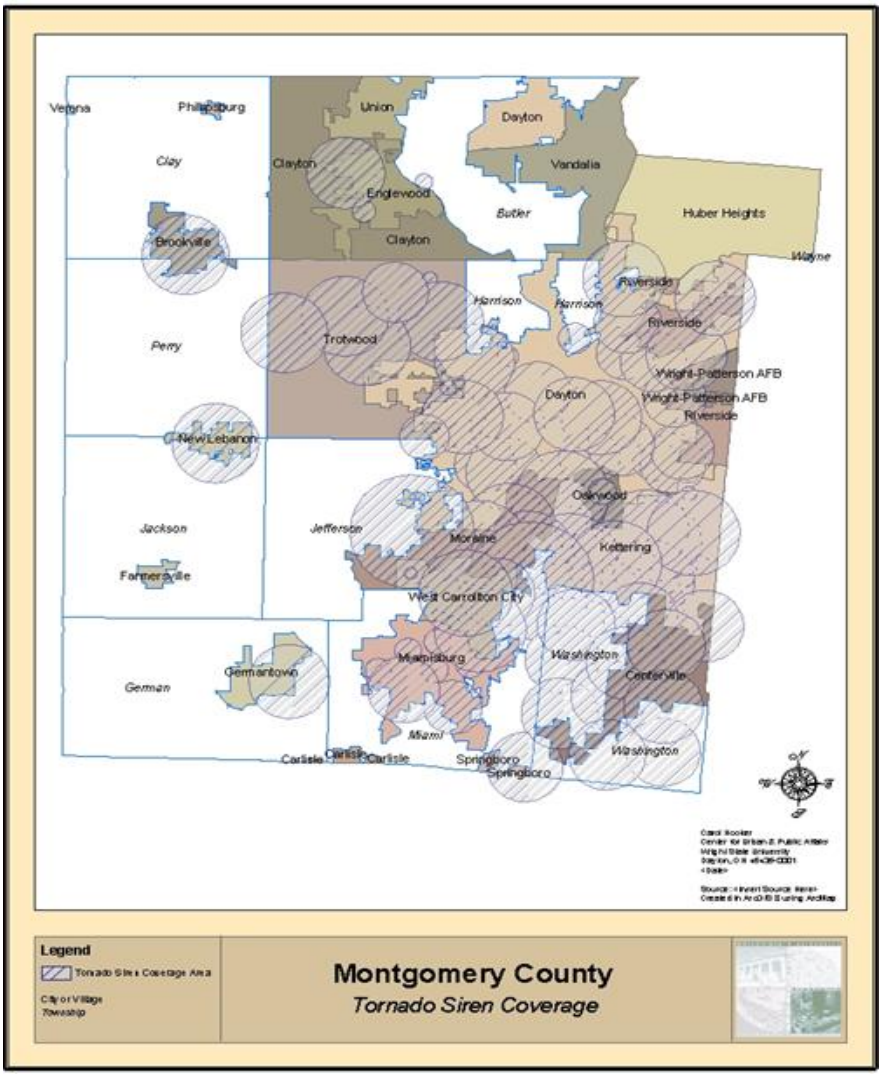
Situational Analysis:

Tornado: Ohio is ranked 5th in the nation when considering frequency of tornadoes, number of fatalities, number of injuries, and cost for damages for tornado disasters. Yet, communities in Montgomery County do not have adequate tornado siren systems and some

communities have no tornado siren systems at all (Refer to Figure 10-1). Public areas and neighborhoods without basements offer little or no shelter from tornado force winds.

An overlay of the effective siren signal strength identified the following list of communities with inadequate or no tornado siren coverage (Refer to Figure 10-2):

- Clayton
- Union
- Englewood
- Phillipsburg
- Trotwood
- Vandalia
- Huber Heights
- Riverside
- West Dayton
- North Dayton
- Clay Township
- Perry Township
- Jackson Township
- German Township
- Jefferson Township
- Miami Township
- Butler Township
- Harrison Township



- Figure 11-2: Tornado Siren Coverage

Flooding: In Montgomery County, flooding can be expected every year but is most common from April through August when severe thunderstorms bring heavy amounts of rain over a very short period of time or extended periods of rain over a several day period, which cause standing water and/or runoff problems. There were eight repetitive flood loss structures identified in the National Flood Insurance Program database. Of those six three have been purchased by Five Rivers Metroparks and have been either destroyed or are no longer occupied. The remaining three are still active flood loss structures at this time. As new information is made available this plan will reflect those updates.

Winter Storms: Montgomery County also faces the real possibility of yearly heavy snowfall, ice-storms, and blizzard conditions. Winter storms are most common during the months of January and February and most damages are incurred because of lack of preparation.

Objective: Develop and implement programs to identify and address the problems of at-risk structures.

Strategy: *Install or construct structures and systems, which protect lives by making new and existing structures and areas safer or resistant to damage typically caused by natural hazards.*

Activities (listed in order of prioritization):
Project #1: Install tornado warning sirens with battery backup and command centers, where necessary, countywide in all communities with inadequate coverage or no tornado siren systems desiring tornado warning systems (Huber Heights requested that the jurisdiction be exempt from tornado siren installation and excluded from the tornado siren installation portion of the plan.)

- Butler Township
- Clay Township
- Clayton
- Englewood
- German Township
- Harrison Township
- Jackson Township
- Jefferson Township
- Miami Township
- North Dayton
- Perry Township
- Phillipsburg
- Riverside
- Trotwood
- Union
- Vandalia
- West Dayton

Champion: Montgomery County Office of Emergency Management
Estimated Cost: $1.5 million for countywide installation of tornado sirens and command centers in each jurisdiction without adequate warning systems.
Timeline: Oct 2012 to Oct 2017
2013 Status: Ongoing – Portions of this project have been completed. The communities of Englewood, German Township, Miami Township, Trotwood, and Vandalia installed tornado sirens. In addition to the communities identified in this project Brookville, Miamisburg, and Washington Township also installed tornado sirens. In all a total of 32 additional sirens were installed in Montgomery County.

MONTGOMERY COUNTY

Project: Distribute NOAA Weather Radio featuring SAME technology to Very Low Income[41] and Extremely Low Income Households.[42]

Champion: Montgomery County Office of Emergency Management

Estimated Cost: Approximately $905,000 for countywide distribution of weather radios to Extremely Low Income Households and an additional $400,000 to distribute radios to the County's Very Low Income Households.

Timeline: Oct 2013 to Oct 2018

2013 Status: Ongoing

GERMANTOWN AND GERMAN TOWNSHIP

Project: Identified a need for integrated siren alert system for severe weather for both Germantown and German Township.

Champion: Germantown Administration and German Township Board of Trustees

Estimated Cost: $160,000 for installation of tornado sirens and a command center jointly owned by the Village and the Township.

Timeline: Oct 2013 to Mar 2017

2013 Status: Ongoing – Portions of this project have been completed with the installation of three tornado sirens in the township.

VANDALIA

Project: Vandalia wishes to distribute NOAA Weather Radio featuring SAME technology to Extremely Low Income Households[43] and Very Low Income[44].

Champion: City of Vandalia

Estimated Cost: Approximately $131,000 for citywide distribution weather radios to Extremely Low and Very Low Income Households.[45]

Timeline: Oct 2013 to Mar 2017

2013 Status: Ongoing

OAKWOOD

Project: Identified need for the replacement of their existing tornado siren (within city building project). This project is currently in the planning process

Champion: Oakwood Mayor

Cost: $10,000

[41] Very low-income households are defined as those households whose income is above 30 percent but at or below 50 percent of the County's median income. In 2003, this means that to be considered a very low-income household in Montgomery County the household would earn annually at least $12,859 but not more than $21,430.

[42] Extremely low-income households are those households whose income is at or below 30 percent of Montgomery County's median income. In 2003, the median income for Montgomery County is $42,861 and extremely low-income households earn at or below $12,858.

[43] Extremely low-income households are those households whose income is at or below 30 percent of Vandalia's median income. In 2003, the median income for the City of Vandalia is $49,073 and extremely low-income households earn at or below $14,722 – approximately 1,114 households.

[44] Very low-income households are defined as those households whose income is above 30 percent but at or below 50 percent of the City's median income. In 2003, this means that to be considered a very low-income household in Vandalia the household would earn annually at least $14,723 but not more than $24,537 – approximately 1,501 households.

[45] $131,000 is necessary to provide a weather station model with SAME technology at the retail cost of $49.99 dollars charged by Lowe's Home Improvement Centers.

Timeline: Oct 2013 to Mar 2015
2013 Status: Ongoing

Project #2: Identify at-risk structures in Special Flood Hazard Area[46]

Jurisdiction	Structures in the SFHA	Repetitive Loss Structures	Jurisdiction	Structures in the SFHA	Repetitive Loss Structures
Brookville	80	0	**Jefferson Twp.**	42	0
Butler Twp.	66	1	**Kettering**	774	0
Carlisle	1	0	**Miami Twp.**	273	0
Centerville	89	0	**Miamisburg**	134	0
Clay Twp.	67	0	**Moraine**	371	0
Clayton	33	0	**New Lebanon**	4	0
Dayton	308	0	**Perry Twp.**	44	1
Englewood	21	0	**Riverside**	315	0
German Twp.	21	0	**Trotwood**	264	0
Germantown	204	0	**Union**	22	0
Harrison Twp.	201	1	**Vandalia**	75	1
Huber Heights	59	3	**Washington Twp.**	193	1
Jackson Twp.	61	0	**West Carrollton**	719	0
			TOTAL	4,441	8

- Figure 11-3: At-risk structures in Special Flood Hazard Area

Project #3: Prioritize removal and/or relocation of at-risk structures or construction of improved or new storm drainage systems or levees to protect at-risk structures.

Project #4: Seek funding for the acquisition, elevation, or retrofit of structures with repetitive loss flood insurance claims through voluntary (owner) mitigation activities.[47]

Project #5: Seek funding for removal and /or relocation of at-risk structures or construction of improved or new storm drainage systems or levees to protect at-risk structures.

Project #6: Remove and/or relocate at-risk structures Kettering.

Project #7: Seek funding for new storm drainage systems or levees to protect at-risk structures.

Project #8: Construct or repair storm drainage systems and or levees.

WEST CARROLLTON/MIAMI TOWNSHIP/MIAMISBURG/MIAMI CONSERVANCY DISTRICT

Project: Owl Creek Watershed – The Owl Creek watershed is a 4.7 sq. mile area that includes a portion of West Carrollton /Miami Township and a portion of the city of Miamisburg. This

[46] Refer to Figure 4-3: Structures in the Special Flood Hazard Area
[47] Voluntary Mitigation Activities means the owner voluntarily agrees to sell the property when the cost of elevating the structure or retrofitting the structure exceeds 50% of the structure's value.

area runs from the Great Miami River upward toward the Dayton Mall. The City of West Carrollton and Miami Township have recently entered into an agreement with the Miami Conservancy District for a hydrological and hydraulic study of the watershed to determine what measures can be taken to reduce flooding within the watershed. Columbus, DLZ Engineering, has been selected for that work, and the contract has been entered into with the firm to complete this work. The cost of the study is approximately $40,000. The study is to be completed in December of this year. Once this study is completed, the City will have a better understanding of what level of flood protection can be completed, the associated costs, and in essence what is feasible to do within this watershed to reduce the risk of flooding. The goal is to remove people from the one hundred year flood plain who are currently paying the FEMA flood insurance rates, which are very high and detract from property values. There are approximately 410 houses subject to flooding from Owl Creek within our city.

The U.S. Army Corps of Engineers in Louisville, Kentucky has expressed interest in supporting and funding improvements in this watershed. An alternative would be to create a storm water management district through the Miami Conservancy District and use that mechanism for funding flood control improvements.

This is a joint project between the City of West Carrollton and Miami Township in conjunction with the Miami Conservancy District.

WEST CARROLLTON/MIAMI TOWNSHIP/MORAINE

Project: Holes Creek – This project is already underway by the U.S. Army Corps of Engineers and should be completed within the next year or two. This project involves the flood protection along Holes Creek. The area south of the creek has already been protected; however, the Corps of Engineers is seeking additional congressional funding to complete protection for the area on the north side of the creek. Senator Mike DeWine indicated that it appears the funding is progressing smoothly through Congress for this project. **This is a joint project with Miami Township and the City of Moraine.**

WEST CARROLLTON

Project: Allen Plat – The Allen Plat area is outside of the levee that was built to protect West Carrollton following the 1913 flood of the Great Miami River. The area consists of approximately 122 houses and some businesses. This area is subject to flooding from the Great Miami River and needs a levee system to protect it from flooding. The properties in this area are within the one hundred year flood plain and owners are currently paying flood insurance. The City of West Carrollton has been in contact with the U.S. Army Corps of Engineers concerning this matter and the Corps is in the proposing to conduct a feasibility study for constructing flood protection for Allen Plat. At this time, there is no estimated cost for that project.

Champion: West Carrollton Mayor, Miami Township Trustees, Moraine Mayor, Miami Conservancy District

Est. Cost: $100,000

Timeline: Oct 2012 to Oct 2017 for the above three projects.
2013 Status: Ongoing – Portions of the projects stated above have been completed. As more information on the status of these projects becomes available this plan will be update.

KETTERING
Project: There are 110 properties located in either the floodway or floodplain areas designated within the Wiles Creek neighborhood. Of the 110 properties, 45 are located within the floodway of the South Blvd creek, and 8 are located within the floodway of the Middle Branch of the Little Beaver Creek. Several of the homes have experienced years of flood damage approximately once every 10-15 years. Within the past 5 years, the City has purchased multiple homes in the floodway area adjacent to the Middle Branch Creek from willing sellers. The homes have been demolished and the area will remain open space.

The 8 remaining homes along the floodway of the Middle Branch of the Little Beaver Creek remain the City's top priority for acquisition and demolition. The eventual goal is to have all structures removed from the floodways of both creeks within the Wiles Creek neighborhood in order to restore both creek channels to their natural state. Property acquisition will depend on the availability of funds and the willingness of property owners to sell their property to the City. The estimated cost of acquisition and demolition of the 8 properties along the Middle Branch floodway is $800,000. The estimated cost of acquisition and demolition of the 45 properties along the South Blvd floodway is $4,500,000.
Champion: Kettering Mayor
Est. Cost: $5,300,000
Timeline: Oct 2012 to Oct 2017
2013 Status: Ongoing

DAYTON/RIVERSIDE
Project: Identified need for storm water drainage in Harshman/Brant Pike area. Scope of project to be completed in conjunction with the City of Riverside and the Miami Conservancy District.
Champion: Dayton Mayor
Est. Cost: $500,000
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

WEST CARROLLTON
Project: Farmersville-West Carrollton Road – The Farmersville-West Carrollton Road, which crosses the Great Miami River in West Carrollton is subject to flooding on the west side of the bridge. The bridge was designed it so that this area would serve as an overflow area when the river was high. This has become a major concern because of increased development and traffic in this area. It creates a great deal of inconvenience when this roadway has to be closed. It is also a potential safety hazard when the roadway is under water. The U.S. Army Corps of Engineers in the process of proposing to do a feasibility study on elevating the road to prevent it from flooding and improve safety in this area, as well as

the flow of traffic. It is unknown at this time what the estimated cost would be for this project.
Champion: West Carrollton Mayor
Est. Cost: $100,000
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

TROTWOOD
Project: Identified the need to elevate or move homes from the Wolf Creek flood plain. Upon completion of a cost benefit analysis intends to seek funding to complete this project.
Champion: Trotwood Mayor
Cost: $35,000 per home (between 10 and 100 homes depending study)
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

HARRISON TOWNSHIP
Project: Identified the need for storm water drainage in the following areas:

- Webster Street south of Needmore Rd.
- Eldorado Plat (Edgewater and Earlwood Area)
- Shiloh Dr. and Blue Ridge
- Keats St. and Keenan St.
- Walbrook Ave. and Notingham Rd.

Replacement of the 6th Area Pump Station because the storm sewer gravity system is ineffective.
Champion: Harrison Township Trustees
Est. Cost: $250,000
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

PERRY TOWNSHIP
Project: Installation of a storm drainage system to be built in the area bordered by:

- New Lebanon Municipal Limits on the south
- Diamond Mill Road on the east
- Little Richmond Rd. on the north
- Johnsville-Brookville Pike on the west

Champion: Perry Township Trustees
Est. Cost: $300,000
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

VANDALIA
Project: One property has been identified as a repetitive flood insurance loss property in Vandalia on Anglers Rd. near the Huber Heights Corporation Limit and two Huber Heights repetitive flood insurance claim properties.
Champion: Vandalia Mayor

Estimated Cost: Worst Case $26,940 for property acquisition at the current 100 percent assessed value plus the cost of structural demolition.
Timeline: Oct 2013 to Oct 2016
2013 Status: Completed based on present information, the Angler's Lane properties have been purchased by Five Rivers Metroparks and been either destroyed or boarded up. The location of the structures on Angler's Lane was originally stated as Huber Heights and it has been determined that they are in fact in the jurisdiction of Vandalia. After consultation with the local jurisdiction and the National Flood Insurance Program database it was determined that the Longford Road property was misidentified as a Repetitive Flood Loss Structure. See new projects for further information.

HUBER HEIGHTS
Project: Three properties have been identified as repetitive flood insurance loss properties in Huber Heights. One is located on Longford Rd. and two located on Anglers near the Vandalia Corporation Limit and Vandalia's repetitive loss properties on Anglers Rd.

- Anglers Rd Property 1: Worst Case $33,830 for property acquisition at the current 100 percent assessed value.
- Anglers Rd Property 2: Worst Case $35,640 for property acquisition at property value listed by Flood Insurance Documentation plus the cost of structural demolition. No property records could be obtained for this structure.
- Longford Road Property: Worst Case $94,350 for property acquisition at the current 100 percent assessed value plus the cost of structural demolition.

Champion: Huber Heights Mayor
Estimated Cost: $163,820
Timeline: Oct 2013 to Oct 2016
2013 Status: Completed based on present information, the Angler's Lane properties have been purchased by Five Rivers Metroparks and been either destroyed or boarded up. The location of the structures on Angler's Lane was originally stated as Huber Heights and it has been determined that they are in fact in the jurisdiction of Vandalia. After consultation with the local jurisdiction and the National Flood Insurance Program database it was determined that the Longford Road property was misidentified as a Repetitive Flood Loss Structure. See new projects for further information.

HARRISON TOWNSHIP
Project: One property has been identified as a repetitive flood insurance loss property in Harrison Township near the intersection of Cypress Drive and N. Birch Drive.
Champion: Harrison Township Trustees
Estimated Cost: Worst Case $65,100 for property acquisition at the current 100 percent assessed value plus the cost of structural demolition.
Timeline: Oct 2013 to Mar 2016
2013 Status: Ongoing

PERRY TOWNSHIP

Project: One property has been identified as a repetitive flood insurance loss property in Perry Township near the intersection of Thornapple Road and US 35.

Champion: Perry Township

Estimated Cost: Worst Case $93,300 for property acquisition at the current 100 percent assessed value plus the cost of structural demolition.

Timeline: Oct 2013 to Mar 2017

2013 Status: Ongoing

WASHINGTON TOWNSHIP

Project: One property has been identified as a repetitive flood insurance loss property in Washington Township near the intersection of Yankee and Mad River Rd.

Champion: Washington Township

Estimated Cost: Worst Case $196,000 for property acquisition at the current 100 percent assessed value plus the cost of structural demolition.

Timeline: Oct 2013 to Mar 2017

2013 Status: Ongoing

BUTLER TOWNSHIP

Project: One property has been identified as a repetitive flood insurance loss property in Butler Township near the intersection of Kinmont Road and Frederick Pike.

Champion: Butler Township

Estimated Cost: Worst Case $204,630 for property acquisition at the current 100 percent assessed value plus the cost of structural demolition (Average cost equals $0.25/ft.^{3} and will vary based on the number of structural levels above ground, building materials, and sublevels contained in the structure.)[48]

Timeline: Oct 2013 to Mar 2017

2013 Status: Ongoing

Project #9: The following projects are listed first by Goal Area, secondly by potential number of persons benefiting from action, and then in no particular order other than first come first listed.

GERMANTOWN AND GERMAN TOWNSHIP

Seek funding to construct tornado safe rooms in public areas and neighborhoods without basements

Champion: Germantown Administration and German Township Board of Trustees

Estimated Cost: $300,000

Timeline: Oct 2013 to Mar 2017

2013 Status: Ongoing

CLAY TOWNSHIP

Project: Identified the need for tornado shelters within their community.

[48] Stark Wrecking, 7081 Germantown Pike, Dayton, OH 45342, (937) 866-5032.

Champion: Clay Township Trustees
Estimated Cost: $150,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

FARMERSVILLE/JACKSON TOWNSHIP
Project: Identified the need for tornado shelters within their community and in partnership with Jackson Township are planning a tornado shelter on E. Walnut Street.
Champion: Farmersville Mayor / Jackson Township Trustees
Estimated Cost: $150,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

CENTERVILLE
Project #1: Safe room reinforcement for the Emergency Operations Center
Champion: Centerville Mayor
Estimated Cost: $150,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

Project #2: Installation of electronic storm window shutters for the Emergency Operations Center
Champion: Centerville Mayor
Estimated Cost: $50,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

Project #3: School window blast guards
Champion: Centerville Mayor
Estimated Cost: $50,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

VANDALIA
Project #1: Vandalia identified the need for a new Emergency Operations Center (transmitter) and radio repeaters to enhance communication quality at greater distances in the field. This project is currently in the planning stage.
Champion: Vandalia Mayor
Estimated Cost: $70,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

Project#2: Safe room reinforcement for the Emergency Operations Center and installation of electronic storm window shutters for the Emergency Operations Center. This project is in the planning stage.
Champion: Vandalia Mayor
Estimated Cost: $150,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

MORAINE
Project: Identified need for the construction of a floodwall in the West Moraine Plat from Dryden rd between the north lawn and south lawn.
Champion: Moraine Mayor
Estimated Cost: $100,000
Timeline: Oct 2013 to Oct 2017
2013 Status: Completed – A floodwall was constructed as described.

WASHINGTON TOWNSHIP
Project: Identified the need for a drainage project to alleviate some flooding problems in the area of Rahn Road and Grantland Drive.
Champion: Washington Township Trustees
Estimated Cost: $100,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

GERMANTOWN
Project #1: Channel clearing near bridge abutments (Big and Little Twin).
Champion: Germantown Administration and German Township Board of Trustees
Estimated Cost: $100,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

Project #2: Identified need for the construction of an elevated well in the well head area which is located within the 100 year flood plan
Champion: Germantown Administration and German Township Board of Trustees
Estimated Cost: $150,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

CENTERVILLE
Project: Identified the need to construct a water retention basin for the Chardonnay housing development to alleviate flooding problems in this neighborhood.
Champion: Centerville Mayor
Estimated Cost: $250,000
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

CLAYTON
Project: Identified the need to construct a storm drainage sewer system.
Champion: Clayton Mayor
Estimated Cost: $300,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

FARMERSVILLE
Project: Identified the need to purchase a water pump for the lift station at Hemple Road. Installation of a monitoring system for the water tower
Champion: Farmersville Mayor
Estimated Cost: $300,000
Timeline: Oct 2013 to Oct 2018
2013 Status: Ongoing

Project #10: Seek funding and install all weather or other projects

BUTLER TOWNSHIP
Project: Identified the need to purchase and install tire chains for all emergency response vehicles.
Champion: Butler Township Trustees
Estimated Cost: $500
Timeline: Oct 2013 to Mar 2018
2013 Status: Ongoing

VANDALIA
Project: Identified the need to replace or install new power hookups in severe weather shelters (public schools).
Champion: Vandalia Mayor
Estimated Cost: $10,000
Timeline: Oct 2013 to Mar 2018
2013 Status: Ongoing

ENGLEWOOD
Project: Identified the need to purchase and install power generators and power hookups for the severe weather shelters located in the public schools.
Champion: Englewood Mayor
Estimated Cost: $50,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

HUBER HEIGHTS
Project: Seeking funding and planning to install new communications equipment for the Emergency Operations Center (base station, dedicated fax machines, video monitors, and an

overhead projector). In addition, the City also identified the need for electronic storm shutters and this project is also in the planning stage.
Champion: Huber Heights Mayor
Estimated Cost: $100,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

UNION
Project: Identified the need to purchase and install power stations for the City's severe weather shelters. The City also identified the need to acquire power hookups for the following potential severe weather shelters:

- Union School
- Two city owned buildings at 216 Shaw Rd.

Champion: Union Mayor
Estimated Cost: $160,000
Timeline: Oct 2013 to Mar 2017
2013 Status: Ongoing

New Projects

HARRISON TOWNSHIP
Project #1: A Boulder Ave. property has been identified as repetitive flood insurance loss in Harrison Township.
Champion: Harrison TWP Trustees
Est. Cost: $100,000
Timeline: Oct 2013 to Oct 2016

Project #2: Multiple properties have been identified as repetitive flood insurance loss properties. This project would enable Harrison Township to purchase all properties in Eldorado plat and demolish them due to chronic river flooding.
Champion: Harrison TWP Trustees
Est. Cost: $300,000-$400,000
Timeline: Oct 2013 to Oct 2016

Project #3: Provide educational programs promoting storm water management best practices for the home owner to the public.
Champion: Harrison TWP Trustees
Est. Cost: $5000
Timeline: Oct 2013 to Oct 2016

OAKWOOD
Project: Identified need for the replacement of their existing tornado siren located at the city building.

Champion: Oakwood Public Safety Director
Cost: $10,000
Timeline: Oct 2013 to Oct 2015

VANDALIA
Project #1: Ensure that city's critical facilities are equipped with the capability to be connected to one of the city's portable emergency generators via a transfer switch (Public Works facility, Parks Maintenance Facility, and Vandalia Seniors Center facility). His is the last phase of a multi-year project that in recent years has been deferred. This project would be considered as "in the planning stage".
Champion: Vandalia City Council
Est. Cost: $35,000
Timeline: Oct 2013 to Oct 2017

Project #2: Vandalia has identified the need for an additional tornado siren. This project is currently in the planning process.
Champion: Vandalia City Council
Estimated Cost: Approximately $20,000
Timeline: Oct 2013 to Oct 2017

Chapter 12 Plan Maintenance

As illustrated in the Goals and activities, a permanent body, the Mitigation Planning Team (MPT), will be responsible for plan implementation, evaluation, and consequently updating the plan based on their findings. This board is an extension of the original Mitigation Planning Team and represents volunteer and resident interests.

The committee will oversee the implementation of this plan and review progress on county and jurisdictional projects. The committee will meet at the minimum, on an annual basis. Some jurisdictions report updating their projects on a quarterly basis and more frequent meetings will be scheduled as necessary to accommodate such changes.

In addition to the committee's responsibilities, local jurisdictions must also play their part. The hazard assessment provided in this report provides the ground work for the local jurisdictions to begin reviewing and revising local ordinances and code, as well as adopting the projects set forth by the planning committee into upcoming comprehensive plans and fiscal budgets.

The ideal venue for reviewing and incorporating the hazard analysis and plan might be the citizen planning commissions and zoning review boards This incorporates public involvement while helping to minimize the involvement of local government staff and cost in the process and formalizes the process for reviewing and adopting mitigation planning efforts. Citizen planning and zoning review boards would be responsible for making recommendations to the jurisdiction's Planning/Zoning staff and Council or Board. However, the method by which the review, revision and implementation process is formally adopted is up to the local jurisdictions.

Countywide projects will be championed by the Montgomery County Office of Emergency Management (MCOEM) and approved by the Board of County Commissioners. Jurisdictional projects will be submitted to the local jurisdictions to be approved by the City Council or the Township trustees and integrated into comprehensive plans, capital improvement plans, zoning and building codes, site reviews, permitting, and other planning tools, where such tools are the appropriate vehicles for implementation.

Yearly, the local jurisdictions must provide documentation to MCOEM of the process for which review, revision and implementation have occurred and an updated list of completed and proposed projects. In addition, the local jurisdictions will provide a complete record of storm events and the problems, which the community faced as a result of the storm event.

The responsibility for collecting the data on a regular basis and disseminating the research and documentation to the Mitigation Planning Team will be MCOEM's. The planning team

will then be responsible for implementing a program for the analysis of this data and consequently would also be responsible for updating the plan to reflect the new conditions. This planning team will also be responsible for involving the public in maintaining and updating the plan through regularly scheduled strategic meetings, and providing all changes to the plan on the website and in public libraries.

This plan will be reviewed by the planning team and revisions made at least every five years as required by Title 44 Code of Federal Regulations section 201.6(c)(4)(i).

As jurisdictions update or adopt new projects or as new hazard data becomes available the changes will be presented to the MCOEM for review. The completed projects will be removed, revisions will be updated, and new projects will be incorporated in the plan and submitted to the County Board of Commissioners and then the State EMA for approval as needed.

Appendix
A Public, Private, & Governmental Participation

2014 Natural Hazard Mitigation Plan Committee

The core planning team for the 2014 Plan Updates consisted of the following individuals:

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The Natural Hazard Mitigation Plan Committee, as listed on pages 5-6 includes:

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Participating Jurisdictions

Jurisdiction	Position/Title	Agency/Organization
Montgomery County	Sheriff	Montgomery County Sheriff
Montgomery County	Coroner	Montgomery County Coroner Office
Montgomery County	Manager	Montgomery County Planning Commission
Montgomery County	Manager	Montgomery County Building Regulations
Montgomery County	Engineer	Montgomery County Engineering
Montgomery County	Director	Montgomery County Community and Economic Development
Montgomery County	Director	Montgomery County Human Services
Montgomery County	Health Commissioner	Public Health – Dayton & Montgomery County
Miami Valley Region	Manager of Environmental Planning	Miami Valley Regional Planning Commission
City of Brookville	Police Chief	Brookville Police Department
City of Brookville	City Manager	Brookville General Officers
City of Brookville	Fire Chief	Brookville Fire Department
Butler Township	Township Administrator	Butler Township Trustees Board
Butler Township	Zoning Administrator	Butler Township Zoning Department
Butler Township	Police Chief	Butler Township Police Department
City of Centerville	City Manager	City of Centerville Administrative Offices
City of Centerville	Police Chief	Centerville Police Department
Clay Township	Township President	Clay Township Offices
Clay Township	Zoning Administrator	Clay Township Zoning Office
City of Dayton	Police Chief	Dayton Police Department
City of Dayton	City Manager	Dayton City Manager's Office
City of Dayton	Mayor	Dayton City Mayor's Office
City of Dayton	Director	Dayton Planning Board
City of Dayton	Engineer	Dayton Engineering Department
City of Dayton	Manager	Dayton Building Services Department
City of Dayton	Zoning Administrator	Dayton Zoning Department
City of Dayton	Fire Chief	Dayton Fire Department
City of Englewood	Police Chief	Englewood Police Department
City of Englewood	City Manager	Englewood City Manager's Office
City of Germantown	City Manager	Germantown Managers Office
City of Germantown	Zoning Administrator	Germantown Planning & Zoning Commission
City of Germantown	Fire Chief	Germantown Fire Department
City of Germantown	Police Chief	Germantown Police Department
City of Huber Heights	City Manager	Huber Heights Administrative Offices
City of Huber Heights	Zoning Administrator	Huber Heights Zoning Department
City of Huber Heights	Police Chief	Huber Heights Police Department
City of Huber Heights	Fire Chief	Huber Heights Fire Department
City of Kettering	City Manager	Kettering City Manager's Office
City of Kettering	Fire Chief	Kettering Fire Department

Jurisdiction	Position/Title	Agency/Organization
City of Kettering	Police Chief	Kettering Police Department
City of Miamisburg	City Manager	Miamisburg City Manager's Office
City of Miamisburg	Planning Director	Miamisburg Planning Department
City of Miamisburg	Mayor	Miamisburg City Mayor's Office
City of Miamisburg	Engineer	Miamisburg Engineering Department
City of Miamisburg	Police Chief	Miamisburg Police Department
City of Miamisburg	Fire Chief	Miamisburg Fire Department
City of Moraine	City Manager	Moraine City Office
City of Oakwood	City Manager	Oakwood City Administrative Offices
City of Oakwood	Director	Oakwood Personnel
City of Oakwood	Engineer	Oakwood City Engineer Office
City of Oakwood	Police Chief	Oakwood Public Safety
City of Oakwood	Zoning Administrator	Oakwood City Zoning & Inspections
City of Oakwood	Inspector	Oakwood City Inspector
City of Riverside	Fire Chief	Riverside Fire Department
City of Riverside	Police Chief	Riverside Police Department
City of Trotwood	City Manager	Trotwood City Offices
City of Trotwood	Fire Chief	Trotwood Fire Department
City of Trotwood	Police Chief	Trotwood Police Department
City of Union	City Manager	Union City Offices
City of Union	Public Safety Director	Union City Public Safety Department
City of Vandalia	City Manager	Vandalia City Hall
City of Vandalia	Engineer	Vandalia Engineering Department
City of Vandalia	Police Chief	Vandalia Police Department
City of Vandalia	Chief Inspector	Vandalia Inspection Department
City of West Carrollton	City Manager	West Carrollton City manager
City of West Carrollton	Engineer	West Carrollton Engineering Department
City of West Carrollton	Fire Chief	West Carrollton Fire Department
City of West Carrollton	Police Chief	West Carrollton Police Department
City of West Carrollton	Director	West Carrollton Planning & Development
German Township	Police Chief	German Township Police Department
German Township	Township President	German Township Office
German Township	Zoning Administrator	German Township Zoning Office
Harrison Township	Township Administrator	Harrison Township Administrator's Office
Harrison Township	Zoning Director	Harrison Township Zoning
Harrison Township	Fire Chief	Harrison Township Fire Department
Jackson Township	Township President	Jackson Township Trustees
Jackson Township	Police Chief	Jackson Township Police Department
Jackson Township	Zoning Administrator	Jackson Township Zoning
Jefferson Township	Township President	Jefferson Township Board of Trustees
Jefferson Township	Police Chief	Jefferson Township Police Department
Jefferson Township	Zoning Administration	Jefferson Township Zoning

Jurisdiction	Position/Title	Agency/Organization
Miami Township	Township Administrator	Miami Township Administrative Offices
Miami Township	Police Chief	Miami Township Police Department
Miami Township	Fire Chief	Miami Township Fire Department
Miami Township	Planning Director	Miami Township Planning Department
Miami Township	Zoning Administrator	Miami Township Zoning
Perry Township	Township President	Perry Township Office
Perry Township	Police Chief	Perry Township Police Department
Washington Township	Township Administrator	Washington Township Administrative Offices
Washington Township	Zoning Administrator	Washington Township Zoning
Washington Township	Fire Chief	Washington Township Fire Department
Village of Farmersville	Village Administrator	Farmersville Village Office
Village of Farmersville	Fire Chief	Farmersville Fire Department
Village of New Lebanon	Village Manager	New Lebanon Village Offices
Village of New Lebanon	Fire Chief	New Lebanon Fire Department
Village of Phillipsburg	Village President	Phillipsburg Municipal Offices
State of Ohio	On-scene Coordinator	Ohio Environmental Protection Agency

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MIAMISBURG, OH 45342
937-847-6456

MAYOR
MIAMISBURG CITY MAYOR
10 N 1ST ST
MIAMISBURG, OH 45342
937-847-6458

ENGINEER
MIAMISBURG ENGINEERING DEPT
20 E CENTRAL AVE
MIAMISBURG, OH 45342
937-847-6531

DIRECTOR
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MIAMISBURG, OH 45342
937-847-6532

POLICE CHIEF
MIAMISBURG POLICE DEPT
10 N 1ST ST
MIAMISBURG, OH 45342
937-847-6600

FIRE CHIEF
MIAMISBURG FIRE DEPT
10 N 1ST ST
MIAMISBURG, OH 45342
937-866-3344

CITY MANAGER
MORAINE CITY OFFICE
4200 DRYDEN RD
DAYTON, OH 45439
937-535-1000

VILLAGE MANAGER
NEW LEBANON VILLAGE OFFICES
198 S CLAYTON RD
NEW LEBANON, OH 45345
937-687-1341

FIRE CHIEF
NEW LABANON FIRE DEPT
115 S CLAYTON RD
NEW LEBANON, OH 45345
937-687-7510

INSPECTOR
OAKWOOD CITY INSPECTOR
30 PARK AVE
DAYTON, OH 45419
937-297-2920

DIRECTOR
OAKWOOD PERSONNEL
30 PARK AVE
DAYTON, OH 45419
937-298-0411

CITY MANAGER
OAKWOOD ADMINISTRATIVE OFCS
30 PARK AVE
DAYTON, OH 45419
937-298-0600

ENGINEER
OAKWOOD CITY ENGINEER
30 PARK AVE
DAYTON, OH 45419
937-298-0777

ZONING ADMIN
OAKWOOD ZONING & INSPECTIONS
30 PARK AVE
DAYTON, OH 45419
937-298-0777

POLICE CHIEF
OAKWOOD PUBLIC SAFETY
30 PARK AVE
DAYTON, OH 45419
937-298-2122

TOWNSHIP PRESIDENT
PERRY TWP OFFICE
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BROOKVILLE, OH 45309
937-833-3045

POLICE CHIEF
PERRY TWP POLICE DEPT
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BROOKVILLE, OH 45309
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VILLAGE PRESIDENT
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10868 BROOKVILLE PHILLIPSBG RD
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937-884-5594

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RIVERSIDE FIRE DEPT
1791 HARSHMAN RD
DAYTON, OH 45424
937-258-6460

POLICE CHIEF
RIVERSIDE POLICE DEPT
1791 HARSHMAN RD
DAYTON, OH 45424
937-233-1820

CITY MANAGER
TROTWOOD CITY OFFICES
35 OLIVE RD
TROTWOOD, OH 45426
937-837-7771

FIRE CHIEF
TROTWOOD FIRE DEPT
35 OLIVE RD
TROTWOOD, OH 45426
937-837-7777

POLICE CHIEF
TROTWOOD POLICE DEPT
35 OLIVE RD #1
TROTWOOD, OH 45426
937-837-7777

PUBLIC SAFETY DIRECTOR
UNION CITY
118 N MAIN ST
UNION, OH 45322
937-836-2678

CITY MANAGER
UNION CITY OFFICE
118 N MAIN ST
UNION, OH 45322
937-836-8624

POLICE CHIEF
VANDALIA POLICE DEPT
245 JAMES BOHANAN DR
VANDALIA, OH 45377
937-415-2269

ENGINEER
VANDALIA ENGINEERING DEPT
333 JAMES BOHANAN DR
VANDALIA, OH 45377
937-898-3750

CHIEF INSPECTOR
VANDALIA INSPECTION DEPT
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VANDALIA, OH 45377
937-898-3750

CITY MANAGER
VANDALIA CITY HALL
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VANDALIA, OH 45377
937-898-5891

TOWNSHIP ADMIN
WASHINGTON TWP ADM
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DAYTON, OH 45458
937-433-0152

ZONING ADMIN
WASHINGTON TWP ZONING
8190 MCEWEN RD
DAYTON, OH 45458
937-433-0796

FIRE CHIEF
WASHINGTON TWP FIRE DEPT
8320 MCEWEN RD
DAYTON, OH 45458
937-433-7644

CITY MANAGER
WEST CARROLLTON CITY MANAGER
300 E CENTRAL AVE
WEST CARROLLTON, OH 45449
937-859-5183

ENGINEER
WEST CARROLLTON ENGINEERING
300 E CENTRAL AVE
WEST CARROLLTON, OH 45449
937-859-5184

DIRECTOR
WEST CARROLLTON PLANNING & DEV
300 E CENTRAL AVE
MIAMISBURG, OH 45342
937-859-5783

FIRE CHIEF
WEST CARROLLTON FIRE
300 E CENTRAL AVE
WEST CARROLLTON, OH 45449
937-847-4645

POLICE CHIEF
WEST CARROLLTON POLICE
300 E CENTRAL AVE
WEST CARROLLTON, OH 45449
937-847-4668

ONSCENE COORDINATOR
OHIO ENVIRONMENTAL PROTECTION AGENCY
401 E 5TH ST
DAYTON, OH 45402
937-285-6357

Resolution Example

RESOLUTION #_____

A resolution to continue participation in a Multi-Jurisdictional Hazard Mitigation Plan in conjunction with the _____ County Emergency Management Agency.

WHEREAS, the currently exists between the City of _____, Ohio and the Board of Commissioners of _____ County, Ohio, an agreement that the County through its Emergency Management Agency shall provide emergency management for the City in conjunction with a countywide coordinated program, and

WHEREAS, through this countywide coordinated program, _____ County Emergency Management Agency has developed a Multi-Jurisdictional Hazard Mitigation Plan that includes all hazards to which _____ County and its municipalities are susceptible as per Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, and

WHEREAS, goals, objectives and strategies to mitigate against the hazards that have been identified in the County, including the City of _____, have been developed, and

WHEREAS, mitigation measures for the City and surrounding areas have been analyzed and prioritized, and

WHEREAS, _____ County stakeholders have reviewed the Multi-Jurisdictional Hazard Mitigation Plan.

NOW THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF _____, STATE OF OHIO:

That this Council hereby adopts and plans to implement the actions prescribed in the _____ County Multi-Jurisdictional Hazard Mitigation Plan which is on file in the Office of the Director, _____ County Emergency Management Agency. This Resolution shall take effect immediately.

PASSED _____ SIGNED _____
(Date) President of Council

ATTEST _____ APPROVED _____
Clerk of Council Mayor

APPROVED AS TO FORM: (Name)
Law Director
City of _____, Ohio

Letter Inviting Contiguous Counties to Participate in the Planning Process

OFFICE OF EMERGENCY MANAGEMENT

MONTGOMERY COUNTY
OFFICE OF EMERGENCY MANAGEMENT

117 S. Main St.
Suite 721
Dayton, Ohio 45422

937-224-8934 - phone
937-224-8881-fax
www.mcohio.org

COUNTY COMMISSIONERS
Judy Dodge
Dan Foley
Debbie Lieberman

COUNTY ADMINISTRATOR
Deborah A. Feldman

DIRECTOR
Jeffrey J. Jordan

January 27, 2012

The Montgomery County Office of Emergency Management is in the process of revising its Natural Hazard Mitigation Plan. The FEMA Local Mitigation Plan Review Guide recommends notification of adjoining counties as stakeholders in the planning process. We are notifying you of our plan revision to ensure an integrated and coordinated planning effort.

We invite you to join in our planning process and welcome your participation. If you would like to participate please contact our office for further information. Thank you for your assistance with this project.

Sincerely,

Jeffrey Jordan, Director
Montgomery County Office of Emergency Management

The following contiguous county's EMA Directors that were contacted:

Butler County – Jeff Galloway

Clark County – Lisa D'Allessandris

Darke County – Rick Lee

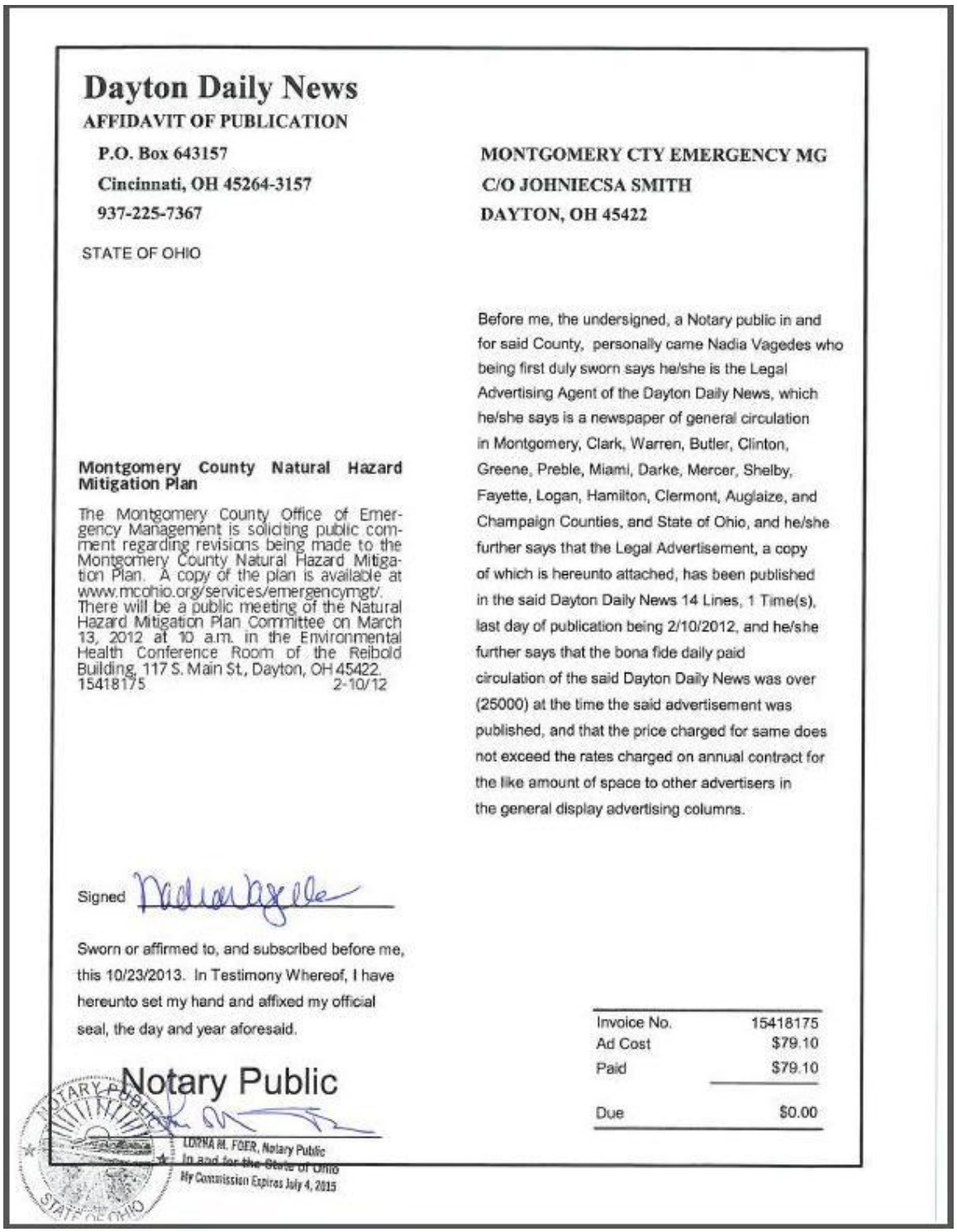
Greene County – Rosanne Anders

Miami County – Kenneth Artz

Preble County – Charlie Biggs

Warren County – Gully, Dave (Interim)

Press Release Informing the Public of Community Forum and Plan Presentation



Dayton Daily News

AFFIDAVIT OF PUBLICATION

P.O. Box 643157
Cincinnati, OH 45264-3157
937-225-7367

MONTGOMERY CTY EMERGENCY MG
C/O JOHNIECSA SMITH
DAYTON, OH 45422

STATE OF OHIO

Before me, the undersigned, a Notary public in and for said County, personally came Nadia Vagedes who being first duly sworn says he/she is the Legal Advertising Agent of the Dayton Daily News, which he/she says is a newspaper of general circulation in Montgomery, Clark, Warren, Butler, Clinton, Greene, Preble, Miami, Darke, Mercer, Shelby, Fayette, Logan, Hamilton, Clermont, Auglaize, and Champaign Counties, and State of Ohio, and he/she further says that the Legal Advertisement, a copy of which is hereunto attached, has been published in the said Dayton Daily News 14 Lines, 1 Time(s), last day of publication being 2/10/2012, and he/she further says that the bona fide daily paid circulation of the said Dayton Daily News was over (25000) at the time the said advertisement was published, and that the price charged for same does not exceed the rates charged on annual contract for the like amount of space to other advertisers in the general display advertising columns.

Montgomery County Natural Hazard Mitigation Plan

The Montgomery County Office of Emergency Management is soliciting public comment regarding revisions being made to the Montgomery County Natural Hazard Mitigation Plan. A copy of the plan is available at www.mcohio.org/services/emergencymgt/. There will be a public meeting of the Natural Hazard Mitigation Plan Committee on March 13, 2012 at 10 a.m. in the Environmental Health Conference Room of the Reibold Building, 117 S. Main St., Dayton, OH 45422.
15418175 2-10/12

Signed Nadia Vagedes

Sworn or affirmed to, and subscribed before me, this 10/23/2013. In Testimony Whereof, I have hereunto set my hand and affixed my official seal, the day and year aforesaid.

Notary Public

LORNA M. FOER, Notary Public
In and for the State of Ohio
My Commission Expires July 4, 2015

Invoice No.	15418175
Ad Cost	$79.10
Paid	$79.10
Due	$0.00

- Figure A-1: Image of Dayton Daily News Affidavit of Publication

February 8, 2012
For Immediate Release
Contact: Ryan McEwan (937) 224-8940

Montgomery County Natural Hazard Mitigation Plan

The Montgomery County Office of Emergency Management is soliciting public comment regarding revisions being made to the Montgomery County Natural Hazard Mitigation Plan. A copy of the plan is available at www.mcohio.org/services/emergencymgt/. There will be a public meeting of the Natural Hazard Mitigation Plan Committee on March 13, 2012 at 10 a.m. in the Environmental Health Conference Room of the Reibold Building, 117 S. Main St., Dayton, OH 45422.

Montgomery County Natural Hazard Mitigation Plan

The Montgomery County Natural Hazard Mitigation Plan is a stand-alone plan that identifies priorities and projects designed to reduce the impact of disasters on communities. By maintaining a current hazard mitigation plan the county and local jurisdictions are eligible for federal mitigation funds as they become available. In order to complete this process we are asking the public to provide comment on the revision of the plan. For your comparison, the links below will take you to the current version and the proposed revised version of the plan.

Current Montgomery County Natural Hazard Mitigation Plan

Proposed Montgomery County Natural Hazard Mitigation Plan Revisions

Please direct all comments regarding the plan revisions to mcoem@mcohio.org.

NOAA Weather Radio

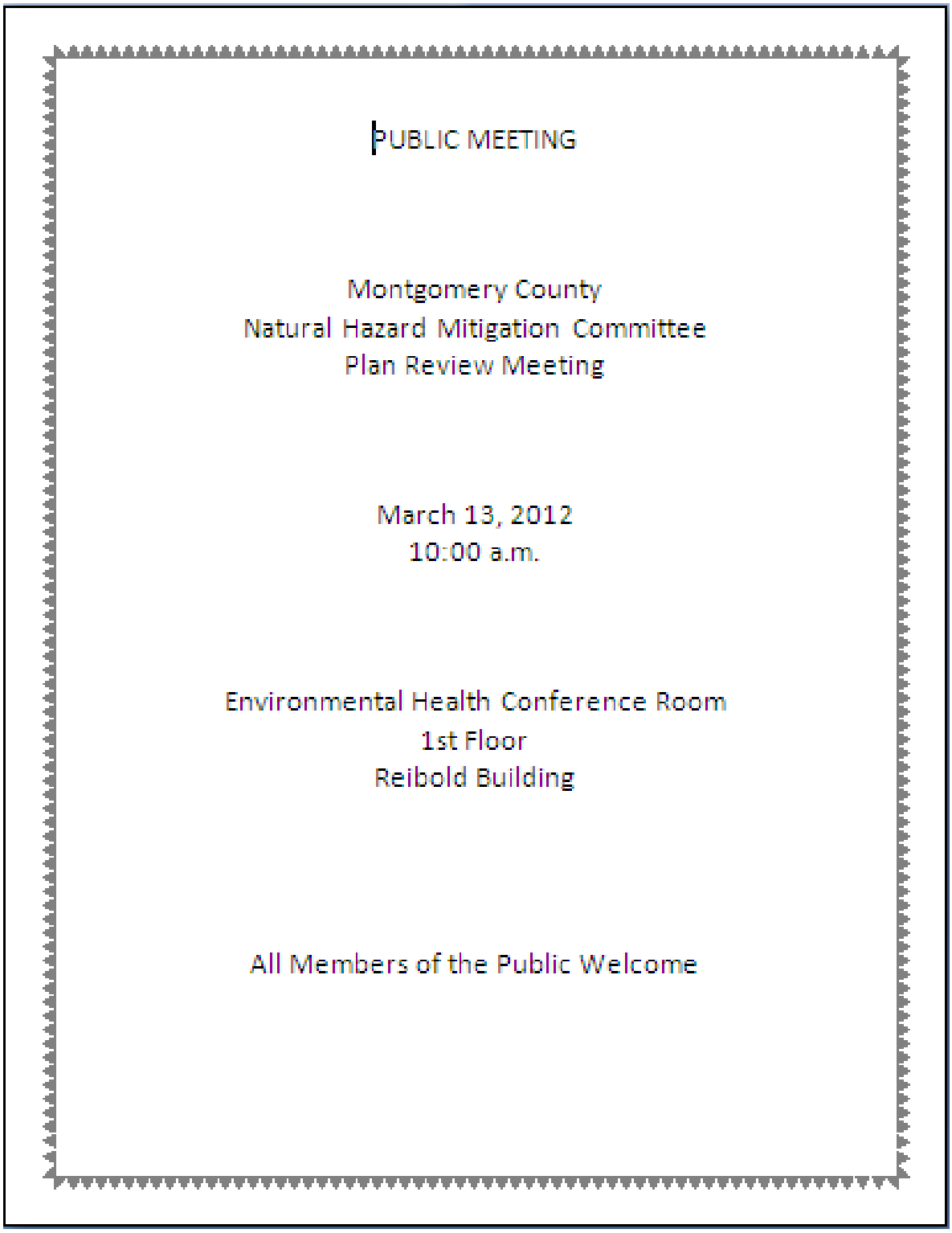
National Oceanic and Atmospheric Administration (NOAA) Weather Radios are one of the most effective means for you to receive timely warnings of severe weather events. For full details of this program check out the Wilmington National Weather Service Office site. The local NOAA broadcast frequency is 162.475 MHz (WXJ-46).

If you have a radio capable of Specific Area Message Encoding (SAME), the SAME code for Montgomery County is 039113. Click here for more information on the SAME system.

Upcoming Events

Learn about Flood Safety, how to find out if your home is at risk, and Flood. Insurance at the National Weather Service's Flood Safety web site.

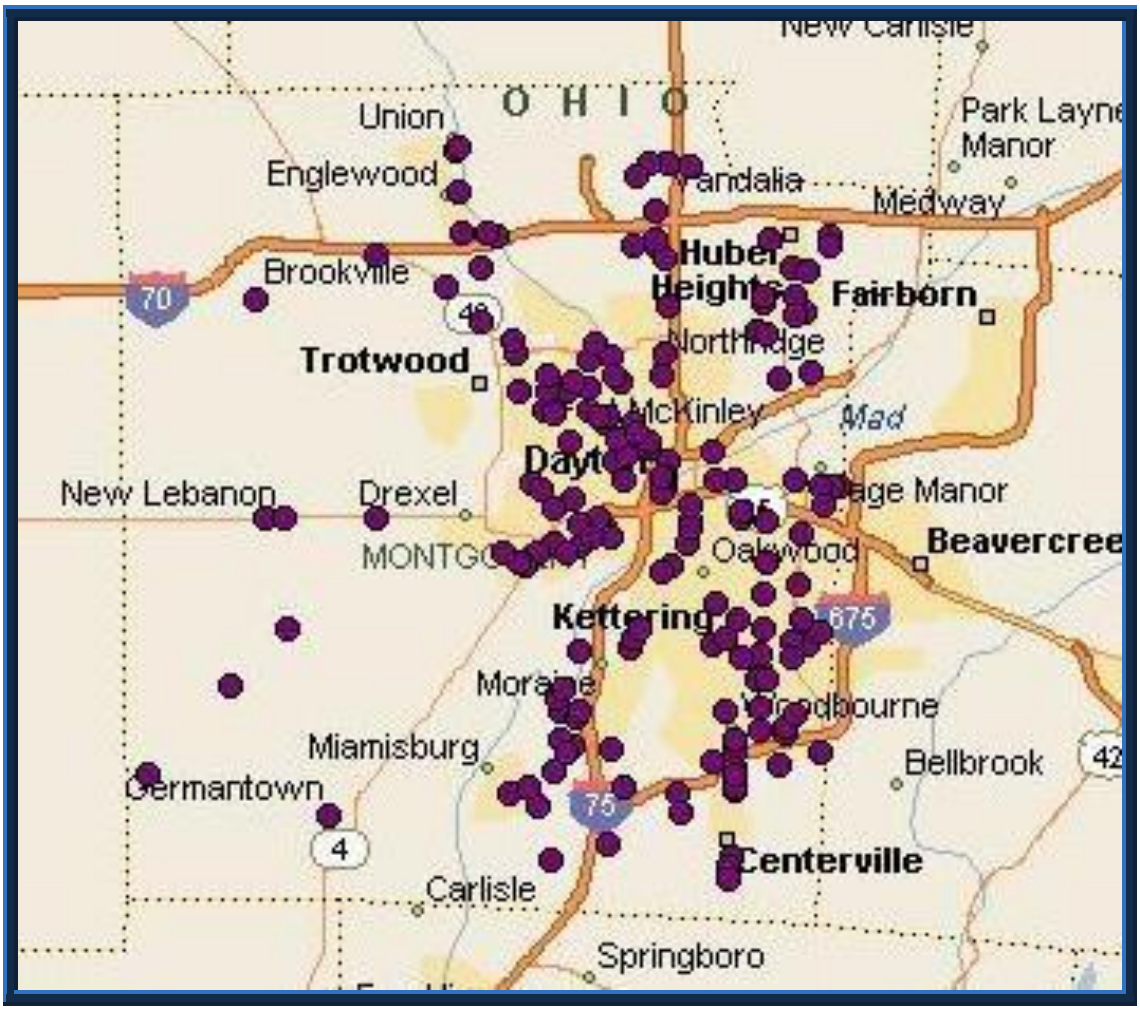
- Figure A-2: Image of Link to Mitigation Plan on http://www.mcohio.org/services/emergencymgt/index.html



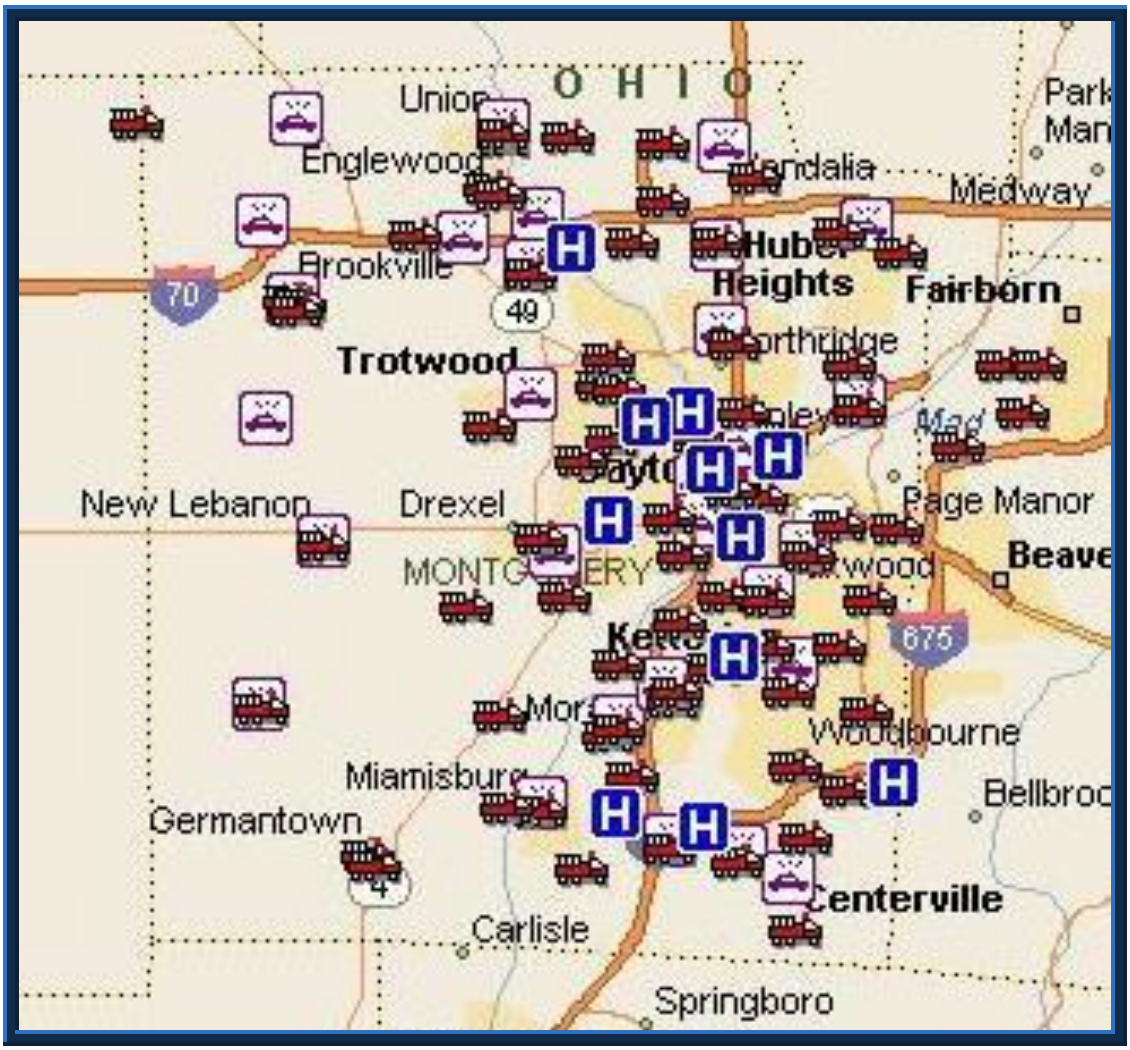
- Figure A-3: Image of Sign Placed outside the Reibold Building Inviting Public to Participate in Mitigation Plan Review

Appendix

B Critical Facilities



- Figure B-1: Child Care Facilities



- Figure B-2: Emergency and Safety Critical Facilities

- Figure B-3: Government Facilities

- Figure B-4: Offeror or Transporter of Hazardous Materials

- Figure B-5: Educational Facilities

- Figure B-6: Senior Care Facilities

Appendix C

Acronyms and Definitions

Acronyms

FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GCEMA	Greene County Emergency Management Agency
MCOEM	Montgomery County Office of Emergency Management
MVEOP	Miami Valley Emergency Operations Plan
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmosphere Administration
NPS	National Park Service
OBES	Ohio Bureau of Employment Services
ODNR	Ohio Department of Natural Resources
ODPS	Ohio Department f Public Safety
OEMA	Ohio Emergency Management Agency
PmPT	Pre-mitigation Planning Team
SFHA	Special Flood Hazard Area
USGS	United State Geological Survey

Definitions

Aquifer: An underground geological formation able to store and yield water.

Acquisition Program: A means of purchasing property in the floodplain to demolish or relocate the structure and to convert the land to be forever maintained as open space.

Base Flood: The flood having a one percent chance of being equaled or exceeded in any given year.

Berm: A mound or wall of earth.

Buffer: A natural or vegetated area through which storm water runoff flows in a scatter manner so that the runoff does not become channelized. A buffer provides for infiltration of the runoff and filtering of pollutants.

Buyout Program: See Acquisition Program

Conservation Easement: Voluntary legal agreement between a landowner and conservation organization (government agency or land trust) that permanently limits some of the land's uses (primarily development rights).

Community Rating System: A program managed by the National Flood Insurance Program to provide incentives for those communities that go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding.

Dam: A barrier constructed across a waterway to control the flow or raise the level of water.

Drainage Basin: The area of land that drains to a given point on a body of water.

Drought: An extended period with little or no precipitation; often affects crop production and availability of water supplies.

Erosion: A natural process of breaking away and moving soil or rock fragments by the action of water, wind, ice, or gravity.

Federal Emergency Management Agency (FEMA): An independent agency reporting to the President and tasked with responding to, planning for, recovering from and mitigating against disaster.

Flash Flood: Sudden flooding cause by an intense storm dropping large amounts of rain within a brief period. A flash flood occurs with little or no warning within six hours of a rain event and can reach full peak in only a few minutes.

Flood: A large flow of water over normally dry land, especially one that causes loss or damage. The National Flood Insurance Program defines a "flood" as a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) the overflow of inland or tidal waters; and,

(2) the unusual and rapid accumulation of runoff of surface waters from any source.

Flood Elevation Certificate: A form used to certify building elevations to ensure compliance with community floodplain management regulations, determine proper insurance premium rates and support requests for a Letter of Map Amendment (LOMA) or Revision (LOMR-F).

Flood Fringe: The land area located between the limits of the floodway and the maximum elevation subject to inundation by a100-year flood.

Flood Insurance: Federally-backed policies available to homeowners, renters and business owners that, unlike standard homeowner's insurance, covers flood damage and loss.

Flood Insurance Rate Map (FIRM): The official map of a community that marks both the special hazard areas and the risk premium zones applicable to the community. It is the map used by the Federal Emergency Management Agency to determine flood insurance rates.

Flood Watch: High flow or overflow of water from a river is possible in the given time period. It can also apply to heavy runoff or drainage of water into low-lying areas. These watches are generally issued for flooding that is expecting to occur at least six hours after heavy rains have ended.

Floodplain: The low land area adjacent to streams susceptible to being inundated by floodwaters and has a history of flooding during big storms.

Floodplain Management: The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to, floodplain regulations, emergency preparedness plans and flood control works.

Flood-proofing: Any combination of structural and nonstructural additions, changes, or adjustments to structures, which reduce or eliminate risk of flood damage to real estate or improved real property, water and sanitation facilities, or structures with their contents.

Floodwall: A wall made of masonry block, reinforced concrete or similar impermeable materials designed to provide protection from temporary flooding.

Floodway: The portion of the channel and floodplain of a stream or other watercourse designated to provide passage for floodwaters. The high hazard portion of the floodplain.

Floodway encroachment: Lateral limits of a floodway district along streams or other bodies of water that preserve the flood-carrying capacity of the floodway.

Freeboard: An additional amount of height above the Base Flood Elevation used as a safety factor in determining the level at which a structure's lowest floor must be elevated or flood-proofed to be in accordance with floodplain regulations.

Greenway: A linear corridor of natural floodplain that generally contain multi-use recreational trails.

Groundwater: Water found in between soil particles and cracks in rocks underground. Groundwater is a natural resource used for drinking, recreation, industry, and growing crops.

Impervious area: The amount of hard surfaces like rooftops, parking lots, and roads.

Levee: A man-made structure, usually an earthen dikes, designed to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

Mitigation: To minimize; lessen the severity.

National Flood Insurance Program (NFIP): The program of flood insurance coverage and floodplain management created by the Federal Emergency Management Agency in 1969 as a means to have floodplain property owners build up a policy base of funds out of which future claims would be paid instead of relying on the federal government to pay for flood losses. It is administered under the Title 44 of the Code of Federal Regulations, Subchapter B.

100-year flood: More accurately referred to as a "one percent chance flood," a flood of a magnitude that statistically has one chance in 100 of occurring in any given year.

100-year floodplain: The land adjacent to a river, lake, creek or stream that has a 1 percent chance within any given year of being inundated by water during a flood.

Outfall: The place where a sewer, drain or stream discharges.

Precipitation: The part of the hydrologic cycle when water falls, in a liquid or solid state, from the atmosphere to Earth (rain, snow, sleet).

Public water: Water derived from public streets and carried into the drainage systems

Riparian: Typically, lush vegetation along a stream or river.

Runoff: Rainwater, snowmelt and other water that is not absorbed into the ground but instead flows across land picking up pollutants and eventually runs into streams and rivers.

Sediment: Loose particles of soil and sand washed from land into waterways.

Storm drain: Constructed opening in a road system through which runoff from the road surface flows into an underground system

Stream: A general term for a body of flowing water. A natural watercourse containing water at least part of the year.

Tributary: A smaller stream that flows into a larger river, creek or stream.

Vapor: The state of water in the hydrologic cycle in which individual molecules are highly energized and move about freely; also known as gas/gaseous.

Variance: A grant of relief by a participating community from the terms of its floodplain management regulations.

Watershed: Also called a drainage basin. The entire land area that drains water to a particular stream, channel, river or lake. Watersheds are nature's way of dividing up the landscape as every lake, pond, wetland, river, creek and stream has its own watershed (geographic area).

Waterway: A natural or man-made place for water to run through, such as a river, stream, creek or channel.

Wetland: An area of land that is regularly wet and where water saturation is the dominant factor in determining the nature of soil development and the types of plant and animal communities. Ponds and marshes are among the common names for wetlands.