

The Shelby County Emergency Management Agency is providing the following Natural Hazards Mitigation Plan draft for your review, if you so desire. Proposed additions, corrections, or other suggested modifications to this draft can be made by contacting Cheri Drinkwine, Shelby County EMA Director, either by e-mail at: shelbycountyema@gmail.com or by phone at (937) 726-1731.

The draft Plan is a modification of the County's Original Natural Hazards Mitigation Plan developed in 2005. The original Plan can be accessed through the County's website at: http://co.shelby.oh.us/wp-content/uploads/2016/05/7-2005_SC_MitigationPlan.pdf

Please also note that additional modifications to the draft will be occurring periodically over time. Once a reasonable amount of changes are made, an updated version will be placed on this site for your review. You will be notified of the change in draft Plan version available on the web for your continued opportunity to review and make comment on the draft Plan.

Should you have any questions regarding the review process, please utilize the contact information provided above.

Thank you for your interest in participating in this most important endeavor!

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LIST OF ACRONYMS

ARC	American Red Cross
BFE	Base Flood Elevation
BMPs	Best Management Practices
CNMP	Comprehensive Nutrient Management Plan
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
DMA2K	Disaster Mitigation Act of 2000
EAS	Emergency Alert System
EMA	Emergency Management Agency
EMS	Emergency Management Services
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
GIMS	Geographical Information Management Systems
gpd	gallons per day
gpm	gallons per minute
GPS	Global Positioning System
HMGP	Hazard Mitigation Grant Program
HUD	Housing and Urban Development
I/I	Inflow and Infiltration
LEADS	Law Enforcement Automated Data System
LEAP	Livestock Environmental Assurance Program
LLIA	Lake Loramie Improvement Association
LVA	Loramie Valley Alliance
MCD	Miami Conservancy District
mi ²	square miles
Mitigation Plan	Natural Hazards Mitigation Plan
MMI	Modified Mercalli Intensity
MNM	Manure Nutrient Management
mph	miles per hour
NAWAS	National Warning System
NCDC	National Climatic Data Center
NFIP	National Floodplain Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPPC	National Pork Producers Council
NRCS	Natural Resource Conservation Service
NWS	National Weather Service
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEMA	Ohio Emergency Management Agency
OPF	Official Plan Flood
OSHP	Ohio State Highway Patrol
PDM	Pre-Disaster Mitigation
PIO	Public Information Officer
PUCO	Public Utilities Commission of Ohio

SCARES	Shelby County Amateur Radio Emergency Services
SWCD	Soil and Water Conservation District
SWMP	Storm Water Management Plan
USDA	United States Department of Agriculture
USGS	United States Geographical Survey
WCT	Wind Chill Temperature
WMSC	Water Management and Sediment Control
WWTP	Wastewater Treatment Plant



EXECUTIVE SUMMARY

The Shelby County Emergency Management Agency spearheaded this effort to complete a comprehensive Countywide Mitigation Plan. Their dedication to this mitigation planning effort is seen in the results of having full participation from the County as well as the incorporated jurisdictions.

Shelby County is subject to natural hazards that threaten life and health as well as causing extensive property damage. To better understand these natural hazards and their impacts on people and property and to identify ways to reduce those impacts, the County's Emergency Management Agency (EMA) undertook this Countywide Mitigation Plan.

Most mitigation activities need funding. Under the Disaster Mitigation Act of 2000 (DMA2K, 42 USC 5165), a mitigation plan is a requirement for Federal mitigation funds. Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from the Department of Homeland Security's Federal Emergency Management Agency (FEMA). This Mitigation Plan meets the criteria as set forth by FEMA in the DMA2K and provides a community with a "comprehensive guide" for future mitigation efforts as they relate to the hazards that affect their community.

The initial Natural Hazards Mitigation Plan was developed in 2005 under the guidance of a Core Group of individuals from communities and agencies throughout Shelby County. That Plan can be accessed through the office of the Shelby County Emergency Management Agency and at:

http://co.shelby.oh.us/wp-content/uploads/2016/05/7-2005_SC_MitigationPlan.pdf

The update of the Mitigation Plan was developed under the guidance of a Mitigation Plan Update Committee. The Update Committee was comprised of the Shelby County Emergency Management Agency Director, the Mitigation Planning Contractor acquired by the Shelby County Emergency Management Agency Board, and representatives of relevant County departments, other government entities, as well as representatives from the private sector. Individuals involved as a part of the Update Committee are identified under Section 3.2 Plan Update Committee Development.

Shelby County has experienced many natural disasters in the past one hundred years. The Plan Update Committee evaluated these hazards and chose to address the following hazards based on their impact on human health and property damage: flooding, summer storms (thunderstorms, high winds, hail), winter storms (heavy snow, ice, and blizzard), tornadoes, droughts, and earthquakes.

With the hazards identified, a vulnerability assessment was completed for Shelby County. This assessment reviews how vulnerable the County is to property damage, threats to public health and safety, and adverse impact on the local economy. It also evaluates the location and likely damage to critical facilities and other structures from these five hazard types. As part of this assessment, multi-hazard maps of the jurisdictions were produced to illustrate some of the hazard areas and locations of structures and critical facilities with respect to these hazard areas. These multi-hazard maps can be found in Appendix G.

As with the 2005 Plan, the culmination of the Plan update was an Action Matrix for the communities to use to track progress on the implementation of their mitigation alternatives. The updated Plan incorporates any needed modifications of that Action Matrix. The completed Action Plan for the Plan Update can be found in Appendix I.

1.0 INTRODUCTION

A mitigation plan addresses natural disasters that could affect a local community, whether it is flooding, tornadoes, high winds, winter storms, or other type of natural disaster. A mitigation plan is an administrative document that is issued to establish activities that are designed to reduce or, when possible, eliminate long-term risk to human-life and property. The plan will also provide the community with a “comprehensive guide” for future mitigation efforts as they relate to the hazards that affect the County. By developing a mitigation plan, a community can identify their areas of risk, assess the magnitude of the risk, and develop strategies and priorities to identify projects for reducing risk. Regular updating of this Plan is paramount in maintaining a current view of County conditions and issues relating to natural disasters and how these specific conditions and issues may change over time.

The Shelby County Commissioners supported developing their Natural Hazards Mitigation Plan (Mitigation Plan), with funds received from Ohio Emergency Management Agency (OEMA) and the Federal Emergency Management Agency (FEMA). Although this planning effort was specifically designed to address the creation of a Pre-Disaster Mitigation (PDM) compliant plan, there has been an on-going effort in publicizing the County’s activities in relation to mitigation and how the public can continue to get involved and support the County’s mitigation efforts.

As part of the Disaster Mitigation Act (DMA2K, 42 USC 5165), communities that desire to remain eligible for Federal and State mitigation funds must have an approved mitigation plan in place.

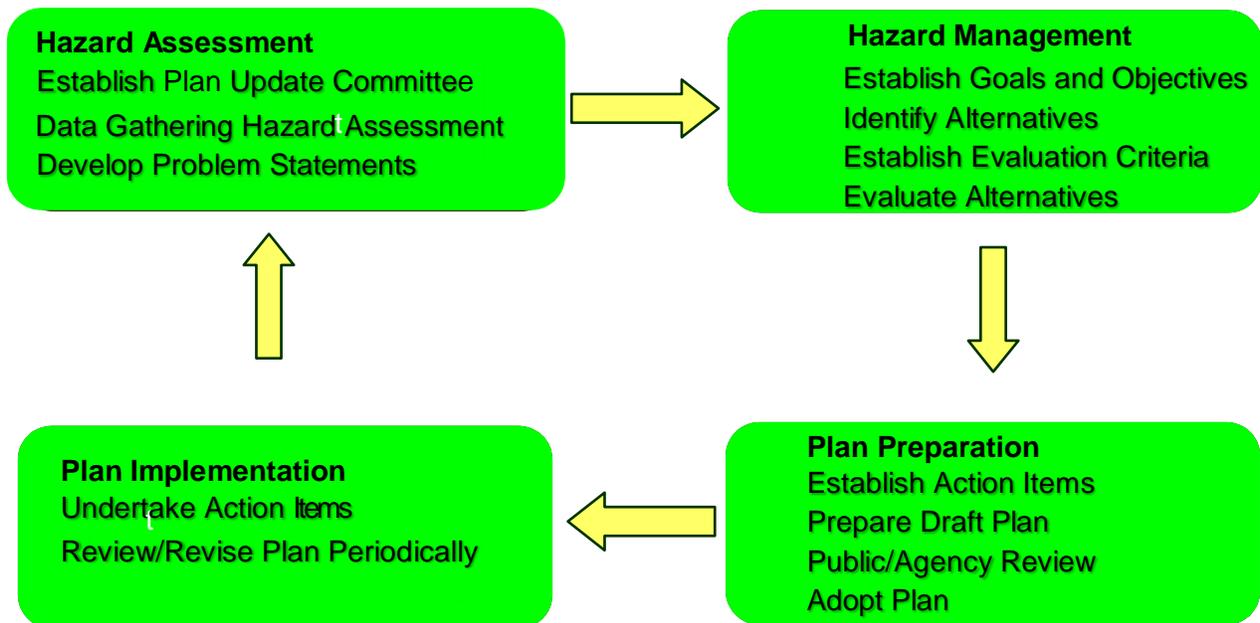
According to the DMA2K, incorporated jurisdictions within a county must participate as well as representatives from the unincorporated areas. Townships are not required to participate because the County Commissioners can represent them on mitigation projects. However, if a township would like to take an active role by submitting a hazard mitigation project, then their participation in the planning effort is crucial. Local participation is crucial to the successful implementation of these mitigation plans.

If a community chooses not to participate in the mitigation planning effort, the community becomes ineligible for any future federal or state mitigation money. This mitigation money usually comes in the form of a grant such as the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) or the PDM Grant Program, which is to be used to implement mitigation strategies and activities. Examples of eligible activities that could be supported by mitigation dollars include: relocation, acquisitions, elevation, dry-flood-proofing of historical residential homes or non-residential structures, safe room construction, soil stabilization, or other minor localized flood reduction projects.

The mitigation planning process that Shelby County followed was adapted from FEMA’s Local Mitigation Planning Handbook, March 2013. The planning process also involved evaluating several approved FEMA mitigation planning efforts from around the country that the Plan Update Committee approved for their content and set-up, which met the needs of Shelby County as well as satisfied the requirement of the reviewers, OEMA and FEMA.

The following flow diagram shows the typical Natural Hazard Mitigation Planning Process that was followed:

NATURAL HAZARD MITIGATION PLANNING PROCESS



In addition to the aforementioned process, the Update Committee members made sure that every community that participated in this planning effort was aware of their responsibilities as well as how they could represent their community the best. Suggestions that were incorporated into the initial invitation to participate in the natural hazard mitigation planning effort included:

- participation in scheduled planning meetings representing your community's interests
- supplying any historic information (background) on natural disasters for their respective community
- reviewing and commenting on the draft Mitigation Plan
- reviewing and selecting mitigation activities developed for their respective community to implement
- being an advocate for final adoption of the Mitigation Plan by their respective community

1.1 Mission Statement

At the beginning of the planning process for the 2005 Mitigation Plan, a mission statement was drafted by the Core Group developing this Plan. The Plan Update Committee reviewed and approved the following as its Mission Statement:

"The mission is to develop a document that meets the mandates of the Federal Disaster Mitigation Act of 2000. Through research, Shelby County will anticipate future natural hazard occurrences so as to implement appropriate mitigation techniques. The techniques identified in this document will have a positive impact on the residents, property and resources of Shelby County. Implementation of these techniques will: a) save lives, b) protect property; c) reduce the cost of recoveries through an efficient, coordinated rapid response; and, d) increase the educational awareness of frequency of natural hazard events."

1.2 Planning Approach

In an effort to continue to meet the mission of protecting lives, property, economic viability and quality of life for the people of Shelby County, the County Commissioners desired to create the Shelby County Mitigation Plan for their community and its residents. The initial *Shelby County Natural Hazards Mitigation Plan* was developed and completed in 2005. As mentioned previously, this initial Plan can be accessed through the office of the County's Emergency Management Agency and at the web site identified above.

The overall approach undertaken in the creation of the Mitigation Plan for Shelby County can be described as both comprehensive and collaborative. The comprehensive approach follows the interim final rule guidelines enacted under the DMA2K and FEMA suggested guidelines for the creation of a mitigation plan. Any additional items that Shelby County and the established Update Committee chose to address as part of the comprehensive analysis of their community were addressed as well.

The major components of this planning approach follow these elements:

- Establishing the Plan Update Committee, requesting participation from all community sectors.
- Providing both the 2005 Plan as well as the draft Plan update on the County's website for review and requested feedback from all community sectors.
- Meeting with Committee members, both formally and informally throughout the planning process which included discussions on: the overall review the original and updated Plan draft, the profiling and prioritizing of the natural hazards impacting the community, assessing vulnerabilities of those hazards to critical facilities and other vulnerable sectors of the community, setting goals and establishing an Action Plan for the mitigation of those hazards.
- Submitting requests for mitigation action items from all jurisdictions throughout the County, reviewing and prioritizing those currently in place as well as those new items received, and incorporating those accepted into the Action Matrix.
- Providing an Open House for the general public to make final recommendations prior to the submission of the final Plan to OEMA and FEMA.
- Submitting the finalized draft Plan, including a completed Plan crosswalk to the Ohio EMA for their review.
- Obtaining recommended changes to the draft Plan from OEMA and FEMA and incorporating those changes until final approval of the draft Plan is achieved.
- Submitting the finalized draft Plan to all required County jurisdictions for their individual approval by means of formal resolution.
- Submitting the finalized Plan and formal resolutions to the Ohio EMA and FEMA for their final approval.
- Distributing the finalized Plan, both in hard copy and digitized form, to all community sectors.
- Working with community leaders to incorporate mitigation activities within existing community plans whenever and wherever possible.
- Annually reviewing the finalized Plan, updating as necessary, and providing those changes to the community through the County's website.

2.0 COMMUNITY INFORMATION

As required by DMA2K, a community profile must be developed for the county and any jurisdictions participating in this effort. Because of the multiple jurisdictions involved in this plan, this section presents a demographical as well as historical description, if available, of each jurisdiction that will be adopting this plan. This brief profile of each jurisdiction gives some insight as to what types of communities exist in the County and provides a better understanding of the effect natural hazards, to be discussed in later sections, may have on this population. In numerous cases, the communities themselves provided the information that follows.

2.1 County Profile

Shelby County is located in western Ohio, approximately 40 miles north of Dayton. It is bordered by Auglaize County to the north, Logan and Champaign counties to the east, Miami County to the south and Darke and Mercer counties to the west. The County encompasses approximately 409.3 square miles of land, with a population of 49,423 according to the 2010 Census. The County consists of 14 townships including Clinton, Cynthian, Dinsmore, Franklin, Green, Jackson, Loramie, McClean, Orange, Perry, Salem, Turtle Creek, Van Buren, and Washington. Please refer to Appendix B for a map of the political boundaries.



The incorporated areas of Shelby County include Anna, Botkins, Fort Loramie, Jackson Center, Kettlersville, Lockington, Port Jefferson, Russia, and Sidney. According to the 2010 Census, the largest areas of population are the City of Sidney (21,229), the Village of Anna (1,567), the Village of Fort Loramie (1,478), and the Village of Jackson Center (1,462). Other Incorporated jurisdictions in the order of descending population include: Botkins, Russia, Port Jefferson, Lockington and Kettlersville.

The City of Sidney is the County Seat. The County has combined the Sidney-Shelby County Chamber of Commerce for the purpose to enhance the business climate in Shelby County in an effort to serve, support, and promote the Corporation and its Members. The Sidney-Shelby County Chamber of Commerce offers a significant resource within the community to promote growth and development. Manufacturing and agriculture are the leading industries in Shelby County.

2.2 County History

Shelby County was established in 1819. The county was named for General Isaac Shelby, an officer in the American Revolution who was noted for his bravery and honesty, and was elected Governor of Kentucky. Even though it was his namesake, it is believed that General Shelby did not ever visit this area. The people of the County chose the name Shelby because many of the settlers were from Kentucky and admired General Shelby. Additional information on Shelby County, Ohio can be found at the following website: www.shelbycountyhistory.org

2.3 Jurisdictions

Sidney

The City of Sidney is strategically located 40 miles north of Dayton, 85 miles west of Columbus, 100 miles south of Toledo, and 120 miles east of Indianapolis. According to the Census of 2010, there are 21,229 people, 8,344 households and 5,577 families residing in the City. The population density is 1,766 people per mi². There are 9,265 housing units at an average density of 772

people per mi². The median income for a household in Sidney is \$41,360 and the per capita income for the City is \$19,796. Please note that the financial data presented above and for those jurisdictions below are 2012 data. Additional information on the history of Sidney, Ohio can be found at: <http://www.sidneyoh.com/Visitors/history-sidney-ohio.asp>.

Anna

Anna is located forty-five miles north of Dayton, Ohio. According to the Census of 2010, there are 1,567 people, 551 households and 429 families residing in the Village. The population density is 1,521 people per mi². There are 589 housing units at an average density of 572 people per mi². The median income for a household in Anna is \$55,912 and the per capita income for the Village is \$19,984. Additional information on the history of Anna, Ohio can be found at: <http://villageofannaoh.com/about.htm>.

Botkins

According to the Census of 2010, there are 1,155 people, 480 households and 315 families residing in the Village. The population density is 932 people per mi². There are 507 housing units at an average density of 409 people per mi². The median income for a household in Botkins is \$46,121 and the per capita income for the Village is \$21,508. Additional information on the history of Botkins, Ohio can be found at: <http://www.botkinsohio.com/community/history.php>.

Fort Loramie

According to the Census of 2010, there are 1,478 people, 530 households and 396 families residing in the Village. The population density is 1,540 people per mi². There are 564 housing units at an average density of 588 people per mi². The median income for a household in Fort Loramie is \$66,959 and the per capita income for the Village is \$24,808. Additional information on the history of Fort Loramie, Ohio can be found at: <http://www.fortloramie.com/history>.

Jackson Center

According to the Census of 2010, there are 1,462 people, 576 households and 404 families residing in the Village. The population density is 870 people per mi². There are 644 housing units at an average density of 383 people per mi². The median income for a household in Jackson Center is \$47,892 and the per capita income for the Village is \$18,105. Additional information on the history of Jackson Center, Ohio can be found at: <http://www.jacksoncenter.com/community/history>.

Kettlersville

The Village of Kettlersville is located in the northwest section of Shelby County approximately five miles west of I-75. According to the Census of 2010, there are 179 people, 68 households and 48 families residing in the Village. The population density is 176 people per mi². The median income for a household in Kettlersville is \$45,800 and the per capita income for the Village is \$15,565. Additional information on Kettlersville, Ohio can be found at: https://en.wikipedia.org/wiki/Kettlersville,_Ohio.

Lockington

According to the Census of 2010, there are 141 people, 56 households and 42 families residing in the Village. The population density is 1,763 people per mi². There are 64 housing units at an average density of 800 people per mi². The median income for a household in Lockington is \$44,849 and the per capita income for the Village is \$14,508. Additional information on the history of Lockington, Ohio can be found at the following website: <http://www.shelbycountyhistory.org/schs/canal/lockington.htm>.

Port Jefferson

According to the Census of 2010, there are 371 people, 142 households and 97 families residing in the Village. The population density is 2,182 people per mi². There are 158 housing units at an average density of 929 people per mi². The median income for a household in Port Jefferson is \$30,899 and the per capita income for the Village is \$15,779. Additional information on the history of Port Jefferson, Ohio can be found at: http://en.wikipedia.org/wiki/Port_Jefferson,_Ohio.

Russia

The Village Russia is in the southwestern corner of Shelby County, and is bordered by the Conrail Railroad to the north. According to the Census of 2010, there are 640 people, 224 households, and 173 families residing in the village. The population density is 821 people per mi². There are 242 housing units at an average density of 310 people per mi². The median income for a household in Russia is \$43,375 and the per capita income for the Village is \$20,829. Additional information on the history of Russia can be found at http://en.wikipedia.org/wiki/Russia,_Ohio.

2.4 Census Information

2.4.1 County Population Projection

According to U.S. Census figures, the 2010 total population of Shelby County was 49,423. The area of highest population density is the City of Sidney. The largest village is the Village of Anna, with a population of 1,567. The largest unincorporated area is Cynthian Township with a population of 1,991.

The population of Shelby County has increased over the last 190 years. From 1820 to 1880, the population increased by over 19,000 people. From 1890 to 1970, there has been a gradual increase in population with the population growing by 13,041 people. From 1970 to 1980 the population increased by 5,341 people, which was the largest net change experienced by the County. Shelby County is expected to increase in population to 52,666 by 2030. Please refer to the Table 2-1 for more demographic information.

**Table 2-1
POPULATION TABLE**

Year	Total Population	Year	Total Population
1800	NA	1910	24,663
1810	NA	1920	25,923
1820	2,106	1930	24,924
1830	3,671	1940	26,071
1840	12,154	1950	28,488
1850	13,958	1960	33,586
1860	17,493	1970	37,748
1870	20,748	1980	43,089
1880	24,137	1990	44,915
1890	24,707	2000	47,910
1900	24,625	2010	49,423

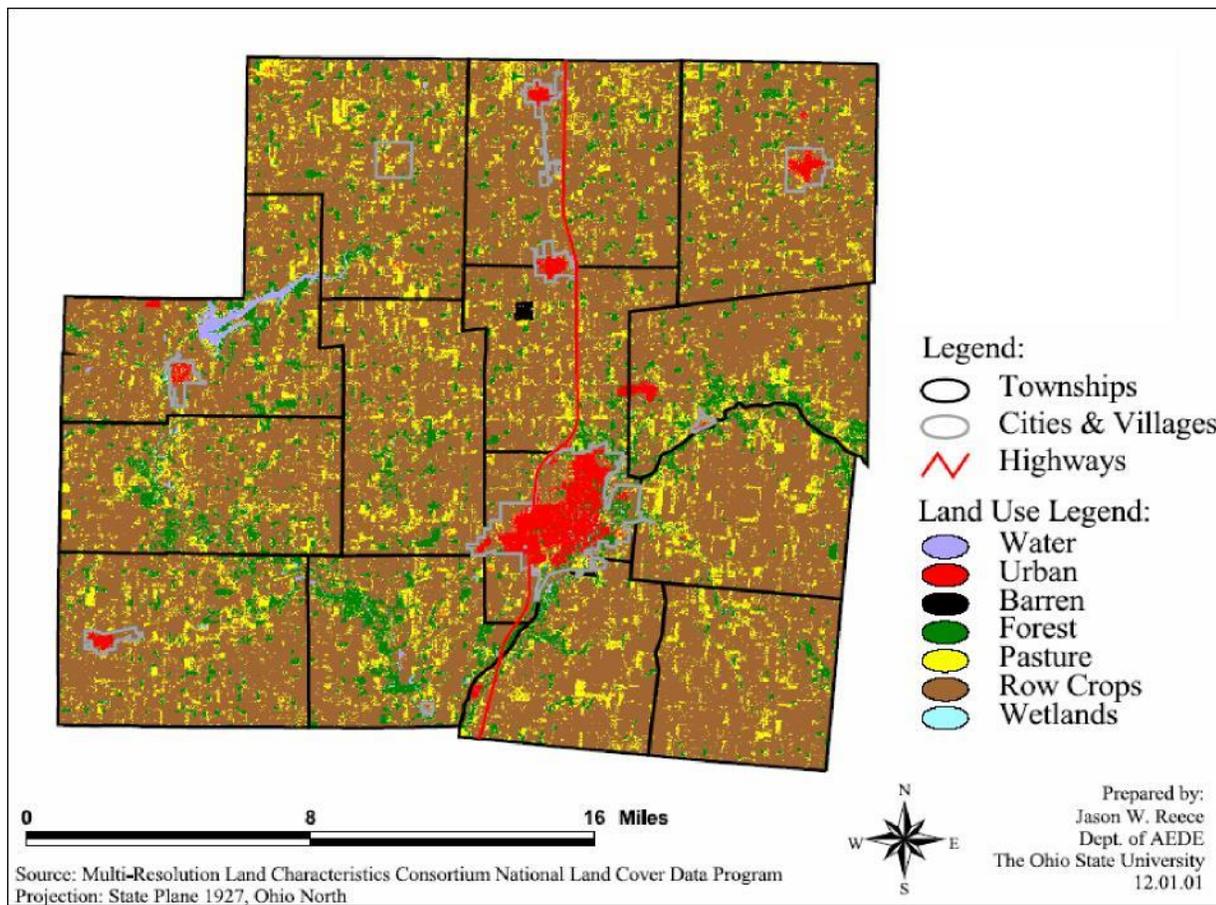
A Shelby County demographic profile is also available on the United States Census Bureau's website and provides more specific information for Shelby County and its political jurisdictions. The website can be accessed through the following link:
<http://quickfacts.census.gov/qfd/states/39/39149.html>.

2.5 County Land Use

According to the Comprehensive Plan for Shelby County, it has traditionally been a rural, agriculturally dominated County. Although it has a significant industrial base, interstate access, outstanding water resources, and stable communities, farming continues to be the dominate land use. Shelby County contains approximately 261,000 land acres, of which 81% is agriculture or open space. Approximately 3.4% of the County is classified as "urban," which contains all residential, commercial and industrial development, In addition, about 14.5% of the County contains woodlands. The balance of the County (1%) contains non-forested wetlands, shrub/scrub vegetation, open water, and barren land.

As estimated by the Soil Conservation Service, the County's water acreage consists of approximately 1,823 acres of lakes, including 1,655-acre Lake Loramie, as well as 18 private lakes and ponds of five to 18 acres in size, and numerous smaller ponds. Lake Loramie and several small lakes were originally developed as feeders for the old Miami-Erie Canal System and now are used primarily for recreation. According to the ODNR's Division of Water, approximately 245 linear miles of major streams and rivers, 120 miles of County maintained ditches, and nearly 400 miles of private maintained ditches are used for land drainage. This availability lends itself to many uses by both communities and individuals.

A description of Shelby County's future land use planning can be found in section 6.1.1.



The map above illustrates Shelby County's land use from the early 1990's.

2.5.1 Topography

The majority of the topographic landscape of Shelby County can be characterized as flat, with minimal rolling hills. While the northern portion of the county is relatively level, the southern area of the county is the most picturesque where moderate hills, and a ravine created by the Miami River is located. The minimal diversification of the landscape creates little difference in the County's highest and lowest topographical point suggested to be only a difference of approximately 280 feet. Elevations range from 1150 feet in the extreme southeast corner of the county to 870 feet just south of Lockington where the Great Miami River exits the county.

2.5.2 Watersheds

Approximately 95% of the County lies in the Upper Great Miami River basin, which flows south to the Ohio River. A small area in northwest Shelby County drains into tributaries of the St. Mary's River and the Auglaize River, which ultimately drain to Lake Erie.

Shelby County is located on a major watershed divide. A small portion of the northwest section of the County drains into small tributaries that are a part of the St. Mary's River system. The St. Mary's is part of the larger Lake Erie watershed. In addition, the Upper Auglaize River watershed encompasses a small section in Dinsmore, McClean and Van Buren townships which is also a part of the Lake Erie watershed. The remaining portions of the County are all part of the Great Miami River watershed. The Great Miami is part of the greater Ohio River watershed.

Loramie Creek Watershed

The Loramie Creek Watershed is located in West Central Ohio, and is comprised of portions of four counties, including Shelby, Darke, Mercer, and Auglaize. The watershed is at the headwaters of the Great Miami River, and once served as a heavily traveled portage route for Native Americans and colonial settlers. The majority of land use in this watershed is agricultural (87%). Several villages and towns exist in the watershed including Anna, Botkins, Fort Loramie, Kettlersville, Lockington, and Russia. Although the western edge of the City of Sidney drains to the Loramie Creek, most of Sidney lies outside the watershed and drains directly to the Great Miami River. The drainage area of this system draining into the Loramie Creek is 265 square miles. See Map C-1, Loramie Creek Watershed, Appendix C.

Great Miami River Watershed

The Great Miami River Watershed is located in the southwest portion of Ohio. This watershed contains 2,360 miles of rivers and streams, including the Great Miami, Stillwater, and Mad Rivers. The drainage area of these rivers in Ohio is 4,277 square miles. Total drainage area including that portion in Indiana is 5,702 square miles. The Great Miami River Watershed includes all or part of 15 counties with the headwaters in Hardin and Auglaize counties and the mouth in Hamilton County. The majority of land use in this watershed is agricultural (80.5%). See Map C-2, Great Miami River Watershed, in Appendix C.

Some of the most significant water resource features in the watershed are the Stillwater Scenic River, the Great Miami buried valley aquifer, the five major dams (dry) and flood protection system of Miami Conservancy District (MCD), and Indian Lake, a remnant of the Miami-Erie Canal system and one the largest lakes in Ohio.

Upper Auglaize River Watershed

The Upper Auglaize River basin is a sub-watershed of the Maumee River basin (Lake Erie drainage basin) located in portions of Auglaize, Allen, Putnam, Van Wert, Shelby, and Paulding counties. Agricultural, predominantly row crop, accounts for 89% of the land use in the Upper Auglaize River basin. Only 2.2% of the total land use is urban (residential and commercial/industrial combined). See Map C-3, Upper Auglaize River Watershed, Appendix C.

2.5.2.1 Aquifers

The carbonate aquifer, which is composed of layers of limestone and dolomite, is the principal source of groundwater in west central Ohio, including Shelby County. Limestone consists of fossilized sea shells, shell fragments, calcareous sands and consolidated limy mud. Its main mineral is calcium carbonate, CaCO_3 . Dolomite is similar to limestone, but has few recognizable fossils; its main mineral is calcium magnesium carbonate, $(\text{Ca, Mg})\text{CO}_3$. Both limestone and dolomite are commonly referred to as limestone or carbonate rocks. The limestone and dolomite formations, which underlie most of the western portion of Ohio, were deposited between about 400 and 500 million years ago. In most areas of this region, these formations are covered by a layer of glacial till, which is an unsorted mixture of clay, silt, sand, gravel and boulders deposited by glacial activity.

Limestone formations are usually good sources of groundwater because of their naturally formed solution channels, joints and fractures, which provide water storage capacity and pathways for water movement. The number of fractures and other openings in limestone varies greatly from one location to another and affects the amount of water that may be encountered when drilling a well. The position of such openings rarely can be determined from the land surface; therefore, there is always some uncertainty as to the production capability of a proposed well.

Groundwater also occurs in lenses (or pockets) of sand and gravel deposited by glacial activity. These deposits occur above the carbonate bedrock and may be imbedded in the glacial till or deposited in layers.

ODNR's Division of Water, maintains a statewide data base of more than 700,000 well logs. The Groundwater Resources Section of the Division manages this valuable data base, which includes some information collected by the U.S. Geological Survey (USGS) and the Ohio Environmental Protection Agency (Ohio EPA). Since 1948, well log information has been collected to increase the understanding of the groundwater resources in Ohio. Geologists and hydro geologists continue to study the state's groundwater resources, and as a result, Ohio is one of only a few states that have been completely mapped for groundwater availability (mapped by river basin, from 1959 to 1962).

Estimates of the size, shape, geologic make-up and yields of aquifers are being mapped county by county. Most of Ohio's counties have a completed map. The map presented in Appendix E (Map E-1), is a generalized representation of the water-bearing formations underlying Shelby County (adapted from map by Kostelnick, 1983). This illustration is based on a hydrogeologic interpretation of the well log data from Shelby County and surrounding areas, to be used only as a guide to understanding the groundwater resources in the County. The remainder of this section provides a brief description of the types of aquifers illustrated on the Map E-1.

AREA A: Permeable Sand and Gravel with High-Yield Potential

Area A illustrates the outwash sand and gravel deposits in the Loramie and Turtle Creek flood plains. These areas may yield large water supplies to properly screened wells. Well yields of up to 500 gpm generally can be obtained from depths of less than 75 feet.

AREA B: Ancestral Teays Valley filled with Glacial Till

This buried valley, illustrated as Area B, is a tributary to the ancestral Teays River valley. Commonly misunderstood to be an underground river, the Teays valley is a remnant of an ancient drainage system that cut a valley into the limestone before the area was glaciated. Later, with the coming of glaciers, the valleys were completely filled with glacial deposits. Intermittent deposits of sand and gravel can be found imbedded with thick layers of clay-rich glacial till.

Deep sand and gravel deposits in the ancestral Teays valley may yield small industrial and municipal supplies. The coarsest deposits generally occur between 100 and 300 feet below the surface. Yields of up to 500 gpm are possible from properly-constructed wells. Flowing wells have been noted near Salem and Perry townships. Test drilling may be necessary to locate the coarser deposits that have the potential for maximum yields. Deeper drilling into the impermeable shale in the valley floor is not advised.

AREA C: Thick Limestone beneath Glacial Till

The limestone aquifer illustrated as Area C is part of the regional carbonate aquifer which underlies much of west central Ohio. It is overlain by 15 to more than 200 feet of glacial till, consisting principally of clay with intermittent deposits of sand and gravel. Most wells are drilled into the limestone, and yields generally are adequate for domestic and farm water supplies. Where openings in the rock have been enlarged by solution, drilled wells may yield over 150 gpm.

AREA D: Limestone beneath Glacial Till

Area D is also part of the regional carbonate aquifer of west central Ohio. However, the water-bearing bedrock is thinner than in similar formations to the north. Yields of 25 to 100 gpm, considered adequate for industrial and municipal water supplies, may be developed from this aquifer at depths of less than 200 feet. Farm and domestic water supplies can usually be developed at depths of 60 to 120 feet.

AREA E: Shallow Permeable Sand and Gravel

Area E shows the thin outwash deposits in the Loramie Creek area. Shallow, irregular sand and gravel deposits within 75 feet of the surface may yield 25 to 100 gpm to properly screened wells.

AREA F: Carbonate Bedrock

Area F outlines the thin bedrock surface surrounding ancestral valleys. Well yields vary from 10 to 25 gpm from the thin limestone and shale present.

AREA G: Shallow Sand and Gravel with Low-Yield Potential

Thick clay, fine sand, and gravel over impermeable bedrock are found in these ancestral drainage channels, shown as Area G. Yields of 3 to 10 gpm may be developed for domestic supplies in the valley fill material. However, deeper drilling into the shale is not recommended, since dry holes do occur.

2.5.2.2 County Groundwater Resources

Shelby County's primary groundwater source is the carbonate aquifer composed of limestone and carbonate bedrock. In the northern half of the county, yields of greater than 150 gallons per minute (gpm) have been developed from wells penetrating fractured zones in the carbonate

bedrock. Farm and domestic supplies of greater than 10 gpm may be developed from shallow wells. Wells finished in the sand and gravel deposits in the northern part of the County also yield ample water supplies.

The limestone aquifer in the southern portion of the county generally yields 25 to 100 gpm. This water-bearing bedrock is thinner than formations to the north. Sand and gravel deposits may also yield 25 to 100 gpm within 75 feet of the surface from properly screened wells. Valley fill areas can provide up to 10 gpm, but deeper drilling into the shale bedrock below may produce dry holes.

Groundwater is a major water source for rural households in Shelby County. Approximately 41% of all households obtain their water from private wells. Based on an estimated usage of 75 gallons per person per day, 1,380,000 gallons per day (gpd) from private wells are used. Additional private water uses include industry (2,930,000 gpd), golf course and crop irrigation (190,000 gpd each in season) and livestock use (646,000 gpd), mostly from groundwater supplies. The remaining 59% use public water supplies, ground or surface water as the source.

2.5.2.3 Groundwater Levels

The water level in any well typically does not remain constant, but changes depending upon the proximity of adjacent wells and surface streams, and natural rainfall. Groundwater discharge and recharge greatly affect water levels in wells. The ODNR Division of Water monitors groundwater levels in one well in Shelby County. This well is located near Sidney and designated as SH-4 on

Map C-1. This well is one of a number of wells throughout west central Ohio used to monitor the natural seasonal fluctuation, or the effects of nearby pumping, on water levels in the carbonate aquifer.

Observation well SH-4 is 280 feet deep and the depth to limestone is approximately 136 feet. It is representative of many limestone wells in the region. Continuous water level measurements have been recorded at SH-4 since September 1979.

2.6 County Water Utilities

2.6.1 County Jurisdictions Water and Wastewater Systems

Shelby County

The County owns and operates two water treatment plants and four wastewater treatment plants within its limits. The County has one treatment plant at the Arrowhead Hills Subdivision, 75,000 gpd and another one at the Fair Haven County Home, 75,000 gpd. The four wastewater treatment plants are the Arrowhead Hills subdivision wastewater treatment plant (70,000 gpd), the Fair Haven County Home wastewater treatment plant (13,000 gpd), the Hickory Dell subdivision wastewater treatment plant (20,000 gpd) and the Lake Loramie wastewater treatment plant (400,000 gpd).

Sidney

Sidney operates the County's largest water and wastewater treatment plants. The Water Treatment Plant utilizes the Great Miami River, Tawawa Creek and five groundwater wells for its supply. The Water Treatment Plant (WTP) began construction in November 2015 on a new well field to reduce reliance on its surface water sources. The Water Treatment Plant (WTP's) plant's capacity is 10,000,000 gpd.

The Wastewater Treatment Plant (WWTP) began construction November 2015 for upgrading the treatment plant, adding additional process treatment and equipment to improve disinfection and bypass situations. The WWTP's plant capacity is 7,000,000 gpd.

Anna

Anna operates both a water treatment plant and wastewater treatment plant. The water treatment plant has a capacity of 350,000 gpd and services the Anna village limits. The capacity of the wastewater plant is 400,000 gpd.

Botkins

Botkins operates both a water treatment plant and wastewater treatment plant. Both the water treatment plant and the wastewater treatment plant have capacities of 500,000 (gpd) and services the Botkins village limits.

Fort Loramie

Fort Loramie operates a water treatment plant. The water treatment plant has a capacity of 576,000 gpd and services the Fort Loramie village limits. The wastewater is sent to the County wastewater treatment plant.

Jackson Center

Jackson Center operates both a water and wastewater treatment plant. The Village of Jackson Center receives its water from three wells and treats the water in its own facility. The water treatment plant's capacity is 500,000 gpd and the wastewater treatment plant's capacity is 1,800,000 gpd.

Kettlersville

Kettlersville has two water wells for the village and is on the County's sewer system.

Lockington

Lockington uses individual water wells and individual sewer systems.

Port Jefferson

Port Jefferson does not have a water treatment plant. The village uses individual water wells and has a connection to the City of Sidney's sewer system.

Russia

Russia operates both its own water plant and wastewater treatment plant. The capacity of the water plant is 100,000 gpd and the capacity for the wastewater treatment plant is 250,000 gpd.

3.0 INITIAL MITIGATION PLANNING PROCESS

3.1 Public Notification and Request for Community Participation

The incorporated jurisdictions of the County, as well as other agencies that work within the County, were notified by the Shelby County EMA Director of the County's plan to update the *Shelby County - All Natural Hazards Mitigation Plan* of 2005. This correspondence, found in Appendix A, was sent to determine their interest in formally participating in the mitigation planning process. The Shelby County EMA Office created a master list of jurisdictions they felt necessary to participate in this planning effort. The comprehensive list was reviewed to ensure that all the appropriate agencies as well as jurisdictions would be invited to participate in this effort. During the development of the Mitigation Plan Update, individuals representing a wide array of political subdivisions, other County governmental departments and agencies, private businesses, and community organizations were notified of the mitigation planning process and encouraged to participate in that process.

Prior to commencing the overall planning process, Shelby County also notified adjacent counties regarding the County's updating of the 2005 Mitigation Plan. The Shelby County EMA sent correspondence to these counties to determine if there was any interest in their formal assisting in the planning process. Although representatives of these counties were invited, only Logan County chose to directly participate. The remaining counties chose not to directly participate as most were conducting the same processes to update their mitigation plans. Shelby County also issued a press release regarding the updating of the 2005 Plan. This press release invited all County citizens to participate in this planning process. The Shelby County EMA Director was the contact source for all those agreeing to participate in this process. See Appendix A for copies of these correspondences.

Public participation is extremely important and valuable during any phase of mitigation planning, including during the Plan update phase. To assure the opportunity for citizens to review and comment on the draft Plan Update, the Update Committee placed a copy the proposed draft Plan Update on the Shelby County website as previously mentioned. A copy of the draft Plan Update was also available in the SCEMA office. Throughout the entirety of the planning process, citizens have had continual opportunity to review and comment upon the Mitigation Plan via this Shelby County website. Additional public participation activities are described in Section 9.1

Please note that descriptions of further public review as well as other major portions of the planning process are provided in the Plan update as they occurred.

3.2 Plan Update Committee Development

As an initial step in establishing the Plan Update Committee, participation in the overall planning process was directed toward the communities within Shelby County. This process was initiated by the Director of the Shelby County Emergency Management Agency who would assume chairmanship of the Update Committee established.

Shelby County has nine incorporated areas within its borders; the City of Sidney and the villages of Anna, Botkins, Fort Loramie, Jackson Center, Kettlersville, Lockington, Port Jefferson, and Russia. The County also has 14 townships: Clinton, Cynthian, Dinsmore, Franklin, Green, Jackson, Loramie, McLean, Orange, Perry, Salem, Turtle Creek, Van Buren, and Washington.

All nine incorporated communities were contacted for their participation and chose to participate in the update planning effort. Each township was also contacted during the update planning phase for participation in the overall planning process as well as their potential involvement in the selection of problem statements and mitigation alternatives. Those incorporated communities and townships, including their respective representatives, agreeing to participate in the planning process are identified below.

Participating Jurisdictions

COMMUNITY	REPRESENTATIVE	POSITION/TITLE
Shelby County	Julie Ehemann/Tony Bornhorst	County Commissioners
City of Sidney	Mike Barhorst	Mayor
Village of Anna	Robert Anderson	Mayor
Village of Botkins	Steven Woodruff	Mayor
Village of Fort Loramie	Philip Eilerman	Mayor
Village of Jackson Center	Scott Klopfenstein	Mayor
Village of Kettlersville	Eric Kaminsky	Mayor
Village of Lockington	Jerry Keener	Mayor
Village of Port Jefferson	David Clem	Mayor
Village of Russia	Terence Daugherty	Mayor
Perry Township	Mark Henman	Twp. Trustee

As stated previously, other community agencies, organizations, and groups were contacted for their participation in the planning process as well. The following list is provided of those entities contacted to determine their willingness to participate in the planning process.

Shelby County Governmental Organizations

Regional Planning Commission
 Floodplain Management
 BOCC
 Engineer’s Office
 Auditor
 Township Trustees
 Sheriff’s Office
 Sidney-Shelby County Health Department
 Sidney Economic Development
 Sidney Public Works
 Sidney Clerk of Council
 Village of Anna – Administrator
 Village of Botkins – Administrator
 Village of Fort Loramie – Administrator
 Village of Jackson Center – Administrator
 Village of Port Jefferson – Clerk/Treasurer
 Sidney GIS

Non-Profit Organizations

West Ohio Development Council
 Shelby County Historical Society
 American Red Cross
 Wilson Memorial Hospital
 Miami Conservancy District
 Loramie Valley Alliance – SS&WCD
 Logan County EMA
 Middle Great Miami Watershed Alliance

Shelby County Fire Departments

Sidney Fire and Rescue
 Fort Loramie Fire
 Anna Fire
 Houston Fire
 Jackson Center Fire
 Van Buren Township Fire
 Lockington Fire
 Maplewood Fire
 Port Jefferson Fire

Major Employers

Honda of America
 Freshway Foods
 American Trim
 Emerson Climate Technologies

Colleges and Universities

University of Dayton
 Ohio State University – Ext. Office

Other

Sidney-Shelby Co. Chamber of
 Commerce
 Upper Great Miami Watershed
 Project

As a component of the initial notification to the general population of the County’s involvement in updating the *Natural Hazards Mitigation Plan*, citizens were encouraged to participate in the planning process on an on-going basis. This was accomplished by several means. First of all, the

public was informed that they could, at any time, review on the County’s website, not only the 2005 Plan, but also the most current draft Plan update. As noted earlier, both the 2005 Plan and the draft Plan update can be accessed through the Shelby County website located at: http://co.shelby.oh.us/CommissionersOffice/pdf/files/2005_SC_MitigationPlan.pdf.

When the initial planning group was established for the 2005 Plan, the following entities were considered as formal participants. Those 2005 members listed below did not formally participate in the Plan update but were included as participants under the representation of the Township Trustees and the County Commissioners.

Franklin Township
 Dinsmore Township
 Salem Township
 Clinton Township
 Loramie Township

Cynthian Township
 McLean Township
 Jackson Township
 Turtle Creek Township

It was determined that the issues associated with the townships could best be served through the representation of the Board of County Commissioners on the Update Committee.

Once responses to the request for participation in the planning process had been received, a finalized update planning group was created. The individuals identified below, along with their respective associations, are those who, in some way, participated in the formal development of the updated Shelby County Mitigation Plan.

PARTICIPATING ORGANIZATION	REPRESENTATIVE
Shelby Co. Regional Planning Commission	Diana Reisinger
Shelby County BOCC	Julie Ehemann/Tony Bornhorst
Sidney-Shelby Co Chamber of Commerce	Jeff Raible
Sidney Economic Development	Barbara Dulworth
Shelby Co Auditor	Jean Watercutter
Village of Anna - Administrator	Nancy Benroth
Village of Botkins - Administrator	Ryan Piche
Village of Ft. Loramie - Mayor	Philip Eilerman
Village of Jackson Center - Administrator	Bruce Metz
Village of Lockington - Mayor	Jerry Keener
Sidney Fire & Rescue Fire Chief	Brad Jones
Ft Loramie Fire Chief (Emerson Climate Tech)	Brad Schulze
Van Buren Twp. Fire Chief	Chuck Axe
American Red Cross	Randy Earl
Wilson Memorial Hospital	Kristie Branson
Miami Conservancy District - Gen Mgr.	Janet Bly
Loramie Valley Alliance - SS&WCD	Jason Bruns
Sidney-Shelby County Health Dept.	LouAnn Albers
Logan Co EMA	Helen Norris
American Trim	Cliff Falls
OSU Extension Office	Deb Brown
Sidney GIS	Ginger Gehret
EMA Board	Rick Simon
City of Sidney - Mayor	Mike Barhorst
Village of Ft. Loramie – Administrator	Tony Schmitmeyer

3.3 Update Committee Meetings and Setting Committee Planning Activities

Following the finalization of the Plan Update Committee membership, both formal and informal meetings were held to discuss issues relating to developing a workable natural hazards mitigation plan for the citizens of Shelby County. All correspondence relating to these meetings can be found in Appendix A.

The initial meeting of the Plan Update Committee was held on September 30, 2014. The citizens of Shelby County were informed of that meeting via news media sources and were welcomed to attend. This meeting focused on identifying the overall planning process, solidifying understanding of group member responsibilities as planning participants, and developing a congenial relationship among Group members.

Discussions at this initial meeting also focused on the planning process itself and what specific planning activities need to be implemented in order to successfully complete a workable mitigation plan, resulting in that Plan being approved by both the Ohio and Federal Emergency Management Agencies.

Actual face-to-face meetings of the Update Committee will be described in this Section, understanding the informal discussions within the Update Committee were also an important part of the overall planning process. These informal discussions were conducted via telephone and e-mail. Descriptions of these informal discussions are also included in this Section.

During the development of the draft Plan, the Update Committee reviewed and analyzed each section and appendix of the Plan. Changes in each portion of the Plan draft were initially made as indicated by a blue typescript to facilitate review and comment by the Update Committee. Where no changes were made, the Committee decided that the information remained valid and current. This process was implemented to make the Plan update review easier for those of the Planning Committee and other planning participants.

Also, as a part of the planning process, the Committee sent out requests for the submission of mitigation projects that could be implemented to benefit the County as well as individual communities. This information was sent to the County Commissioners, City and village mayors, as well as to the trustees of each township. A specific project form was sent to each of these entities in conjunction with the aforementioned correspondence (see Appendix A). A total of fifteen new project proposals were received including 13 potential projects identified by the County Resilience Group (See Section 4.5.6). These additional projects were included as a part of the Action Matrix (see Appendix H) and evaluated by the Plan Update Committee. There were also two project proposals from the Village of Anna and one from Perry Township. These three projects were incorporated within the "Multiple Hazard" mitigation actions identified within the new Action Matrix.

A second formal meeting of the Plan Update Committee was held on April 5, 2016. The primary purpose of the meeting was to review, discuss, and prioritize not only the existing mitigation actions identified in the Action Matrix from the 2005 Plan, but also those mitigation actions received from jurisdictions within the County as requested by the Update Planning Committee. A more detailed description of this activity is found in Section 8.0.

In addition, the Committee also discussed the Open House required to be arranged to provide the general public with the opportunity to comment upon the draft Plan that would be submitted to OEMA/FEMA for their review. It was decided that the Open House would be scheduled for Wednesday, November 16 from 4-6 pm at the office of the Shelby County Emergency Management Agency, 800 Fair Road in Sidney.

Prior to that date, the final proposed Plan draft was placed on the County's website. This would allow the citizens of Shelby County the opportunity to review and comment upon the draft before the Open House. News releases regarding the placement of the draft on the website as well as information regarding the Open House can be found in Appendix A of the draft Plan.

Open House details

Additional meeting information and planning activities to be added as completed.

The following sections provide the main components of the planning process. They appear and are described in the order of their activity. These activities are covered in detail and include but are not limited to: hazard identification and risk assessment, mitigation strategies, and Plan approval, evaluation and implementation.

4.0 HAZARD PROFILE

One of the initial tasks in developing a natural disaster mitigation plan, as well as any updates, is to determine a hazard profile for the County. Shelby County has experienced many natural disasters in the past one hundred years. These disasters have ranged from tornadoes and blizzards, to flooding and droughts. With regard to mitigation planning, the first step in developing a workable plan is to focus upon natural disasters that have historically impacted Shelby County. The purpose of this section is to identify those natural disasters most relevant to Shelby County, to describe their occurrences, and to determine the relative probability of their reoccurrence. The following components of this section describe the process of assessing and determining those specific hazards that would be focused upon by the planning group, identifying the historical hazard events that have occurred in Shelby County, as well as providing general background information on each of those hazards.

Also, according to the Ohio EMA, between March 21, 1997 and August 20, 2012, there have been 18 federally declared disasters that have impacted Shelby County. In three of those declared disasters, Shelby County received Federal Public Assistance Grant funds. These three grants provided over \$575,500 of funding to the County.

4.1 Initial Hazard Assessment

In order to properly evaluate the natural hazards to which Shelby County may be susceptible, a three-step process was utilized. This three-step process was completed in order to consolidate the hazards for which Shelby County should prepare, and potentially mitigate, in the future. The three steps are described in the following paragraphs.

Step 1 - The initial consideration of those natural disasters most likely to impact Shelby County centered on common knowledge of governmental agency officials, local professionals, and others having an understanding of those hazards that have occurred in the past and considering the likelihood of reoccurrence.

Step 2 - The NCDRC database was consulted for those historic natural disasters specifically identified for Shelby County. The NCDRC website provides data for natural disasters occurring from 1950 – 2015. Search parameters focused on the natural disasters considered to be most relevant to Shelby County. Those disasters included drought, flood, severe summer and winter storms, and tornado.

Because NCDRC information did not address hazards such as earthquakes and dam/levee failure, other sources were contacted for this data. The information pertaining to earthquake susceptibility was attained the Ohio Seismic Network website. Dam/levee failure information was obtained from the ODNR – Dam Safety Program website.

Step 3 - The ODPS Ohio Emergency Management Agency Hazard Identification/Risk Analysis (HIRA) website information, updated in 2011, was researched. The HIRA information was obtained for Shelby County. OEMA HIRA ratings for Shelby County hazard risks are as follows:

Dam/Levee Failure – Low
Drought – Medium
Earthquake – Low
Flood – Excessive
Land Subsidence – None

Severe Summer Storms - Excessive
Tornado – Low
Wildfire – None
Windstorm – Medium
Winter Storms – Excessive

4.2 Risk Assessment Ranking

The Plan Update Committee began the process of risk assessment ranking by collecting historical data as previously mentioned. Once obtained, these data were reviewed and discussed by the Plan Update Committee. Also taking into consideration the hazard priorities of the initial Core Group, the Plan Update Committee agreed with their prioritization, culminating in the following prioritized list:

Flooding (including dam/levee failure)
Winter Storms – Snow, Ice, and Extreme Cold
Summer Storms – Thunderstorms, high winds, hail, and lightning
Tornadoes
Droughts and Extreme Heat
Earthquakes

4.3 Flooding (including Flash Floods, Riverine Floods, and Dam/Levee Failure)

Floods are a naturally recurring event for a river or stream, and are caused by weather phenomena and events that deliver more precipitation to a drainage basin that can be readily absorbed or stored within the basin. Flooding is a localized hazard that is a result of heavy or continuous rainfall exceeding the absorptive capacity of soil and the flow capacity of rivers and streams. Floods can be generally considered in two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and riverine floods, caused by precipitation over a longer time period and over a given river basin.



Port Jefferson Flood of 2003

Flash Floods

Flash floods occur within a few minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Flash floods can destroy buildings and bridges, uproot trees, and scour out new drainage channels. Heavy rains that produce flash floods can also trigger mudslides. Most flash flooding is caused by slow-moving thunderstorms, repeated thunderstorms in a local area, or by heavy rains from hurricanes and tropical storms. Although flash flooding occurs often in higher elevation areas, it is also common in urban areas where much of the ground is covered by impervious surfaces. Roads and buildings generate greater amounts of runoff than typical forested land. Fixed drainage channels in urban areas may be unable to contain the runoff that is generated by relatively small, but intense, rainfall events.

Riverine Floods

Riverine flooding refers to periodic flooding of lands adjacent to non-tidal rivers and streams. It is a natural and inevitable occurrence. When stream flow exceeds the capacity of the normal watercourse, some of the above-normal stream flow spills over onto adjacent lands within the floodplain. Riverine flooding is a function of precipitation levels and water runoff volumes within the watershed of the stream or river. The recurrence interval of a flood is defined as the average time interval, in years, expected to take place between the occurrence of a flood of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Flooding is an important issue for the residents and business owners of Lake Loramie. Whether it was flash floods or riverine flooding events that have occurred in the past, damage has been extensive. Areas that are prone to flooding in Shelby County are along the banks of Lake Loramie and the watersheds of the Great Miami River and Loramie Creek.

Reservoirs and Dams

Reservoirs and dams impound water to reduce the amount of water that reaches an area at one time. A reservoir holds high flows behind a dam or in a storage basin. Water is released at a controlled rate. Reservoirs and dams are generally perpendicular to a stream or river.

There are two Class I dams in Shelby County, which are classified by the ODNR's Division of Dam Safety – Lake Loramie Dam and Lockington Dam. Data relating to these dams can be found at: <https://gis.ohiodnr.gov/MapView/?config=ohiodams> (select Shelby County under “County Bookmark”).

Lake Loramie Dam

According to ODNR's Division of Engineering, Lake Loramie Dam is part of Lake Loramie State Park located in Shelby County and was built in 1844 to impound a feeder lake to the Miami & Erie Canal. The dam has a maximum height of 23.3 feet that carries a portion of State Route 362.

The dam has a 220-foot-long concrete spillway that discharges water from the lake into Loramie Creek. As a Class I high-hazard potential structure, a sudden failure of Lake Loramie Dam likely would result in the structural collapse of at least one residence or one commercial or industrial business and probable loss of human life. (Hazard ratings refer to the consequences of dam failure, not the dam's condition.)

Investigations of the dam structure reveal the concrete spillway is deteriorated and has a very low safety level. Due to complex issues and a potentially time consuming process to address all the deficiencies, ODNR has proceeded with an incremental approach by preparing a final design to replace the existing spillway, reduce seepage and increase embankment stability. The new spillway will have similar height and flow characteristics as the existing spillway. Construction is expected to begin in 2016 and take approximately one year to complete. An emergency action plan will be shared with emergency management officials once it is completed.

Lockington Dam

As described by ODNR's Division of Engineering, Lockington Dam is an earthen embankment located across the Loramie Creek in southern Shelby County near the Village of Lockington. The road across the top of the dam is a maintenance road closed to the public. Construction of the dam began in February of 1918 and was completed in October of 1921.

The dam has two concrete conduits through the base of the embankment near the center of the valley. The conduits are sized to discharge floodwaters at a rate that can be handled by the flood protection levees and channels downstream. The remainder of the floodwaters are temporarily stored behind the dam and released over time. An emergency spillway is located directly above the conduits in the same structure.

Levees and Floodwalls

Levees and floodwalls restrain the flow of the stream or river. During a flood, the stream or river flow is not reduced; only confined. Levees and floodwalls are generally parallel to the flow of the stream. Currently, Shelby County has no floodwalls within the County.

According to ODNR's Division of Dam Safety, Shelby County does have a designated levee (also considered a Class II dam). This earthen levee is located along the west side of the Great Miami River, starting south of Route 47 to Children's Home Road. Road and is 5,100 feet long and 10.2 feet high. Additional information regarding this levee can be found at the website listed above in Section 4.3 under Reservoirs and Dams.

4.3.1 Special Flood Zone (100-year Floodplain)

Flood Insurance Rate Maps (FIRM) show areas delineated to be special flood hazards. The Base Flood Elevation (BFE) refers to the elevation associated with a special flood zone, or a flood with a 1% chance of occurring in any given year. Areas within a special flood zone area, also known as the 100-year floodplain, have an elevation lower than the BFE and are categorized into zones. Zone "A" is the flood insurance rate zone that corresponds to a special flood zone area that is determined in the Federal Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone. Zone "AE" is the flood insurance rate zone that corresponds to a special flood zone area that is determined in the Federal Flood Insurance Study by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Shelby County has special flood zones identified within the County. All of unincorporated Shelby County is in compliance with state floodplain management standards and participates in the National Flood Insurance Program (NFIP). The County has been involved since September 02, 1982.

4.3.2 Repetitive Loss

In most counties there are areas that periodically suffer damages from floods. They are known as "repetitive loss" properties. Repetitive loss properties are defined as properties with structures that have had two or more insurance claims within a 10 year period. According to FEMA, there are eight properties that have suffered from repeated flooding occurrences in Shelby County. Considerations for these properties are addressed as a part of the Action Matrix found in Appendix I.

4.3.3 Significant Historic Flooding Events

July 7-9, 2003

Several clusters of heavy thunderstorms moved across western Ohio during the early morning and afternoon on July 7 bringing 2"-4" of rain to an already saturated area. Flooded roads and creeks and small streams rising out of their banks occurred throughout the region. Some of the worst flooding was in Shelby and Logan counties, where evacuations were executed near the swollen Great Miami River, as well as Jackson Center. On July 8, Lake Loramie State Park was evacuated as the lake came out of its banks. Numerous roads were flooded across the northern half of the county. County Road 25A and nearby parkland were underwater in Sidney. One hundred homes near Lake Loramie were flooded. Evacuations occurred near Fort Loramie, Jackson Center, and Port Jefferson. Thunderstorms continued on July 9 as heavy rain moved across portions of western Ohio during the early morning. Another two to three inches fell on many areas that had seen 6 to 12 inches over the past week. This additional rainfall caused many road closures due to high water, and small streams to rise out of their banks again. The most serious flooding occurred from northern Darke County through Shelby and Logan counties. Communities along the swollen Great Miami River from Indian Lake downstream through Lakeview, DeGraff, Port Jefferson and Sidney dealt with flooded homes and businesses. Sandbagging occurred in Port Jefferson in an effort to keep water out of homes.



Sidney – Big 4 Bridge



Port Jefferson

May 21, 2004

An intense line of thunderstorms moved across west central and central Ohio during the afternoon and evening. Torrential rainfall accompanied the storms, with two to four inches falling over much of the region. Numerous roads were flooded and closed due to the heavy rain in Sidney.

January 13, 2005

As weary electric utility crews completed repairs to ice storm-damaged power lines from the December storm another concern was on the rise, Sidney and Shelby County communities turned anxiously to a rising Great Miami River and new threat of flooded roadways. The river went from an elevation of 8.5 feet to 13.5 feet but was expected to crest short of 14 feet. This flooding incident was caused by a winter storm in December of 2004 as described in Section 4.5.4.



Shelby County January 2005

December 21-22, 2013

On December 21-22, 2013, Shelby County experienced riverine flooding and county-wide flooding due to extended heavy rainfall and snow melt. The Great Miami River rose to 15.42 feet prompting the activation of the City of Sidney’s River Flood Action Plan and opening of the EOC. Residents along the river were notified of possible evacuations and sandbags were set in place. Due to flooding across the county, many roads were closed. There was some wind damage due to the severe thunderstorms. The City of Sidney received \$31,747 for damages from the Ohio State Disaster Relief Fund.

4.3.4 Frequency/Probability of Future Occurrence

According to the NCDC, there were 40 flood events recorded in Shelby County from January 1950 thru December 2015. These events caused almost \$700,000 in property damage. No deaths or injuries were recorded.

Past floods are indications of what can happen in the future, but mitigation plans are based on the risk of future flooding. Flood studies interpret historical records to determine the statistical potential that storms and floods of certain magnitude will recur. Such events are measured by their recurrence interval.

Recurrence interval, or frequency of occurrence, is defined as the average number of years between storms of a given intensity. Recurrence intervals commonly used in technical studies and design are 25, 50 and 100 years. Recurrence interval addresses how often a flood of a specific depth will be expected to occur. Structures located within areas considered at higher risk are prioritized at a higher level as it relates to mitigation. Since most of Shelby County is rural in nature, estimated losses were based on just a few higher populous areas, where significant property damage was likely to occur. NCDC listings of flood events can be found in Appendix F

4.4 Summer Storms – Thunderstorms, High Winds, Hail and Lightning

Hazards that fit into the severe storm category include thunderstorms, high winds, hail and lightning. One of the biggest problems associated with severe weather is the lack of public education and awareness. Severe storms can do damage, but are often the precursor for much more severe weather to follow. One example is the direct association of tornadoes with thunderstorms.

4.4.1 Thunderstorms

A severe thunderstorm watch is issued by the National Weather Service (NWS) when the weather conditions are such that damaging winds of 58 mph or more, or hail 3/4 of an inch in diameter or greater, are likely to develop. Citizens should locate a safe place in the home and tell family members to watch the sky and listen to the radio or television for more information. A severe thunderstorm warning is issued when a severe thunderstorm has been sighted or indicated by weather radar. At this point, danger is imminent and citizens should move to a safe place and turn on a battery-operated radio or television and listen for weather updates.

Severe storms are also associated with other hazards such as tornadoes and severe flooding. Since tornadoes and flash flooding are spawned by thunderstorms, people should review what action to take under a tornado warning or a flash flood warning when a "severe thunderstorm warning" is issued. When thunderstorms are forecasted to bring heavy rains (which can cause flash flooding), strong winds, hail, lightning and tornadoes, people should get inside a sturdy building and stay tuned to a battery-operated radio for weather information. People should also be aware that lightning and high winds are also major threats during thunderstorms.

4.4.2 High Winds

Straight-line winds are often responsible for most of the wind damage associated with a thunderstorm. These winds are often confused with tornadoes because of similar damage and wind speeds. However, the strong and gusty winds associated with straight-line winds blow roughly in a straight line unlike the rotating winds of a tornado.

Property damage and loss of life from windstorms are increasing due to a variety of factors. According to the Ohio Manufactured Housing Association, the use of manufactured housing is on an upward trend, and this type of structure provides less resistance to wind than conventional construction. Uniform building codes for wind resistant construction are not adopted by all states, and population trends show rapid growth in the highly exposed areas.

According to NCDC, a total of 118 thunderstorm and high wind events were recorded in Shelby County and the region from January of 1950 thru December of 2015. Within this time period, the monetary damage totaled \$6.7 million in property damage and \$5,000 in crop damage.

4.4.3 Hail

Hail is a type of precipitation composed of balls or irregular lumps of ice. It occurs when super-cooled water droplets (remaining in a liquid state despite being below the freezing point, 0 °C/32 °F) in a storm cloud collide with some solid object, such as a dust particle or an already-forming hailstone.

Hail often forms in strong thunderstorms, often along a cold front, where the layer of air on top is much colder than that on the bottom. The smaller hailstones can bounce up and down between the warm and cold layers due to updrafts and gravity. The longer the stones bounce around, the larger they grow. These strong, severe, or even supercell thunderstorms can also produce hail in the summer months, even without a cold front.

Hailstones, while most commonly only a few millimeters in diameter, can sometimes grow to several inches or occasionally even bigger. Such large hailstones can do serious damage, notably to automobiles, skylights, and glass-roofed structures. Pea or golf ball-size hailstones are not uncommon in severe storms. Rarely, massive hailstones have been known to cause concussions or to kill people by causing head trauma.

Forty-six hail events were recorded from January of 1950 through December of 2015 by the NCDC for Shelby County. Hail size ranged from 3/4 inch to two inches. Of those, seven events caused a total of \$30,000 in property damage.

4.4.4 Lightning

Lightning kills 75 to 100 people a year. It is the second largest killer of natural hazard events, exceeded only by floods. Lightning strikes can happen anywhere and affect anyone. Only 10% of lightning strikes result in death, leaving the rest with various degrees of disability, most being central nervous system issues.

Four lightning events were recorded from January of 1950 thru December of 2015 for Shelby County by the NCDC. One injury was reported in Anna. Property damage associated with these events totaled over \$170,000.

4.4.5 Significant Historic Summer Storm Events

August 9, 2000

Numerous trees were downed in Ft. Loramie, Newport and Sidney, and a barn was damaged near Hardin. In Sidney, some trees fell on houses, some falling trees ripped up sidewalks, and a roof was blown from a shed. Two clusters of thunderstorms caused significant damage on the August 9. During the morning hours, a large bow echo raced across the area causing widespread wind damage. During the afternoon and evening hours, a large cluster of storms formed causing widespread wind damage and hail along with some flooding.

September 26, 2003

A strong microburst caused damage to homes across the eastern part of the County near Port Jefferson. One house was torn from of its foundation, and several others sustained major damage. Numerous trees were downed across the area. Maximum wind speeds were estimated between 100 and 120 mph.

November 12, 2003 Several power outages occurred countywide. Trees were reported down on Ohio 66, Fair and Kuther Roads 3 miles southwest of Sidney, Kirkwood-Miami River Road four miles south southwest of Sidney, and Miami-Shelby East Road. Power poles were reported either leaning or downed in the village of Anna. Several counties in west central and portions of central

Ohio experienced damage to trees and power lines due to synoptic wind. A cold front associated with low pressure over the Great Lakes region produced strong winds behind it, averaging 25 to 35 mph with higher gusts.

September 14, 2008

The remnants of Hurricane Ike produced strong winds of 40 to 50 miles per hour. A gust of 73 mph was recorded in Anna. Widespread damage occurred across the region, from trees being blown down on powerlines, to significant crop losses and structural damage amounting to \$5.7M. This event resulted in Shelby County receiving over \$100,000 in Federal public assistance.

August 19, 2009

A series of severe storms brought damaging winds and hail to the area during the evening hours of August 19th. One tornado was also reported. Thunderstorm winds caused damage to trees, a roof on a mobile home, and windows in Sidney. Nickel to quarter size hail was also reported. Property damage losses were estimated at \$23,000.

August 7, 2011

A cluster of storms in Indiana organized into a bow echo during the afternoon and then moved into Ohio. This produced severe weather across the central parts of Ohio. The main threat from these storms was damaging thunderstorm winds. Two power poles and a silo were blown over in an area between Botkins and Jackson Center. One tree was reported down and another was broken. These occurrences were due to damaging thunderstorm winds, causing an estimated \$35,000 in property damage.

June 29, 2012

On June 29, 2012, late in the afternoon, a line of fast moving severe thunderstorms with powerful winds swept across the state from west to east. The Derecho storm left widespread damage and downed power lines and poles, leaving thousands without power. NWS reported 80 mph winds during the event. Extreme heat along with the power outage was a great cause for concern for many of the residents in Shelby County. A Red Cross shelter and cooling center were activated, with the focus on those residents who were dependent on medical electronic equipment.

4.4.6 Frequency/Probability of Future Occurrence

According to the NCDC, there were 168 thunderstorm, high wind, hail, and lightning events recorded from January of 1950 thru December of 2015 in Shelby County. These events have caused \$6.9 million in property damage, six injuries, and no deaths. Severe storms in Shelby County have caused the most cumulative property damage of any of natural hazard and quantitatively have the highest likelihood of occurring on a yearly basis. Based on historical information, Shelby County can expect to endure at least three severe storms in any given year. All jurisdictions within the County are at risk for summer storms. Current populations and structures within the County, as well as those identified in future projections, are at risk for being negatively impacted by summer storms.

4.5 Winter Storms

A winter storm encompasses several types of storm systems that develop during the late fall to early spring. It deposits any of the following types of precipitation: snow, freezing rain, or ice. Blizzards and ice storms are subcategories of winter storms. A winter storm watch indicates that severe winter weather may affect an area. A winter storm warning indicates that severe winter weather conditions are definitely on the way.

4.5.1 Blizzards

A blizzard warning signifies that large amounts of falling or blowing snow, and sustained winds of at least 35 mph, are expected for several hours. In order to be classified as a blizzard, as opposed to merely a winter storm, the weather must meet several conditions. The storm must decrease visibility to a quarter of a mile for three consecutive hours, include snow or ice as precipitation, and have wind speeds of at least 35 mph. A blizzard is also characterized by low temperatures.

4.5.2 Ice Storms

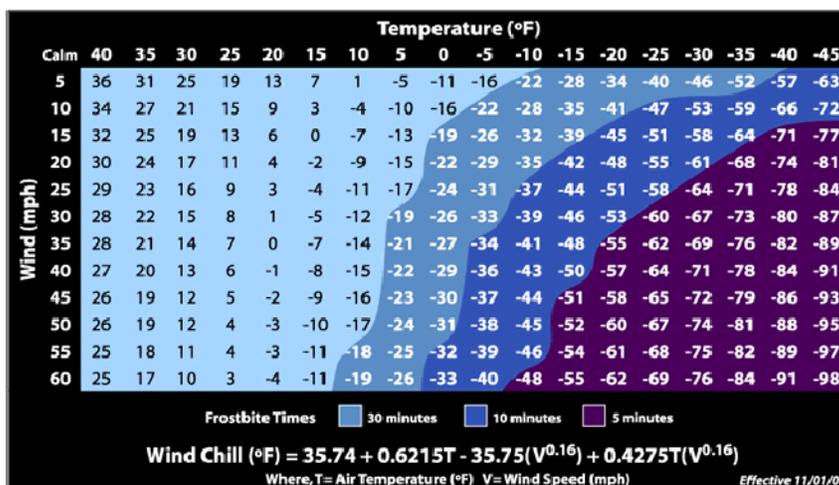
An ice storm is defined as a weather event containing liquid rain that falls upon cold objects creating 1/4 inch thick or more accumulation of ice buildup. This ice accumulation creates serious damage such as downed trees and power lines, leaving people without power and communication. It also makes for extremely treacherous road conditions.

Occasionally, snow will fall after an ice storm has occurred. With the ice covered, it is nearly impossible to determine which travel areas to avoid. When traveling by car, this snow covered ice causes accidents and when walking it causes people to fall, possibly sustaining injuries.

4.5.3 Extreme Cold

Extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with extreme cold with a wind chill. The impacts include frostbite and hypothermia. The wind chill temperature is how cold people and animals feel when outside. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Therefore, the wind makes it feel much colder. If the temperature is 0 degrees Fahrenheit and the wind is blowing at 15 mph, the wind chill is -19 degrees Fahrenheit. At this wind chill temperature, exposed skin can freeze in 30 minutes. The following chart lists wind chill values associated with degrees in Fahrenheit and wind in mph. For information on the Wind Chill Temperature (WCT) index, please visit <http://www.nws.noaa.gov/om/winter/windchill.shtml>



Frostbite is a severe reaction to cold exposure that can permanently damage its victims. A loss of feeling and a white or pale appearance in fingers, toes, or nose and ear lobes are symptoms of frostbite.

Hypothermia is a condition brought on when the body temperature drops to less than 90 degrees Fahrenheit. Symptoms of hypothermia include uncontrollable shivering, slow speech, memory lapses, frequent stumbling, drowsiness and exhaustion.

4.5.4 Significant Historic Winter Storm Events

January 25 - 27, 1978

The Great Blizzard of '78, termed a "severe blizzard" by the NWS, struck the Ohio Valley and Great Lakes paralyzing the region as transportation, schools, and businesses were shut down for days. The near hurricane force winds heaped snow into enormous drifts covering cars and reaching rooftops and left thousands without power or heat. All air, rail, and highway transportation was at a complete standstill for over 24 hours. I-75 was closed for 3 days. The National Guard was activated to help with snow removal, emergency rescues, food and medicine deliveries.

December 13, 1995

A warm front moving north through Ohio produced mixed precipitation. By mid-morning the freezing precipitation had spread north to Shelby County, causing many accidents, especially on major roads. Numerous power outages also occurred as the ice accumulated to as much as 1/8 inch thick.

December 19, 1995

The first major snowstorm of the season developed over central and west Central Ohio 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. Across West Central areas the precipitation fell mainly as snow, and blizzard conditions were experienced. Total snow accumulations for Shelby County ranged between eight and 14 inches. Farther south, Dayton received around five inches of snow, and Columbus received near four inches. Over 60,000 customers were without power at times near and north of Dayton and Columbus. For parts of West Central Ohio this storm was the worst storm since the Blizzard of 1978.

January 2, 1996

Low pressure strengthening in the Tennessee valley passed into southeast of Ohio. The heaviest snow fell near and north of interstate 70, across Shelby County where there was up to one foot of snowfall and blizzard conditions. Wind gusts up to 40 mph were common in this area, with snow drifts between three and five feet. Roads oriented east to west were quite hazardous as strong north winds produced large snow drifts shortly after these roads were plowed. Temperatures during much of this event were in the upper teens and 20s.

December 22-23, 2004

Beginning on December 22, 2004, a winter storm producing heavy snowfall, freezing rain, sleet, and bitterly cold temperatures affected a large swath of Ohio including Shelby County. Snowfall averaged between 14"-20" in the county causing power outages, disrupting transportation and essential services. A state of emergency was declared for Shelby and the surrounding counties. This event caused extreme flooding in January of 2005 as described in Section 4.3.3. These two events resulted in a Federally-declared disaster whereby Shelby County received almost \$356,000 in public assistance funding.

January 5, 2005

On January 5, 2005, a destructive and historic ice storm swept through Shelby County causing severe flooding and heavy ice accumulations. The effects of high water and weight of the ice caused road closures and numerous evacuations. Downed trees, power lines and poles triggered the loss of utilities and electrical power. A shelter was opened at the Sidney High School.

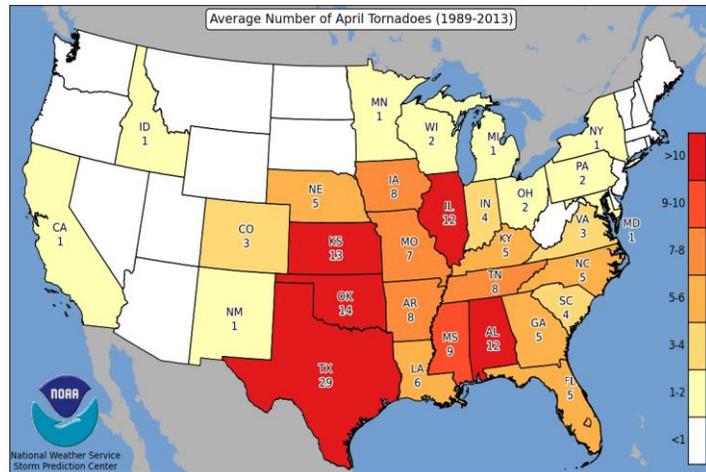
4.5.5 Frequency/Probability of Future Occurrence

According to the most recent version of NCDC, there were 73 recorded winter storm, blizzard, snow, ice, and extreme cold/wind chill events in Shelby County from January 1950 thru December of 2015. There were no records of loss of life or injuries associated with the incidents specific to Shelby County. There were however, eight deaths and nine injuries within the region associated with winter storms. Four events during this time period caused a total of \$60,000 in property damage with \$540,000 losses due to crop damage specifically associated with Shelby County.

Shelby County can expect to endure at least two winter storm or ice storm events in any given year. All jurisdictions within the County are at risk for winter storms. Current populations and structures within the County, as well as those identified in future projections, are at risk for being negatively impacted by winter storms.

4.6 Tornadoes

Tornadoes are produced from the energy released during a thunderstorm, but account for only a tiny fraction of the overall energy generated. What makes them particularly dangerous is that the energy is concentrated in a small area, perhaps only 100 yards across. Not all tornadoes are the same and science does not yet completely understand how a portion of a thunderstorm's energy becomes focused into something as small as a tornado.



Tornadoes occur mostly in the central plains of North America, east of the Rocky Mountains and west of the Appalachian Mountains. They occur primarily during the spring and summer – the tornado season comes early in the south and later in the north according to the seasonal changes in relation to latitude – usually during the late afternoon and early evening. They have been known to occur in every state in the United States and every continent on the earth, any day of the year, and at any hour.

According to the NWS, the development of Doppler radar has made it possible, under certain circumstances, to detect tornadic winds with radar. However, spotters remain an important part of the system to detect tornadoes, because not all tornadoes occur in situations where the radar can "see" them. Citizen volunteers comprise what is called the SKYWARN (www.skywarn.org) network of storm spotters, who work with their local communities to watch out for approaching tornadoes to ensure that appropriate action is taken during tornado events. Spotter information is relayed to the NWS, who operates the Doppler radars and issues warnings, usually relayed to the public by radio and TV, for communities ahead of the storms.

The NWS utilizes all the information they can obtain from weather maps, modern weather radars, storm spotters, monitoring power line breaks, as well as additional sources for issuing tornado warnings.

Although the process by which tornadoes form is not completely understood, scientific research has revealed that tornadoes usually form under certain types of atmospheric conditions. Those conditions can be predicted, but it is not yet possible to predict in advance exactly when and

where they will develop, how strong they will be, or precisely what path they will follow. According to the NWS, there are some "surprises" every year, when tornadoes form in situations that do not look like the right conditions in advance, but these are becoming less frequent. Once a tornado is formed and has been detected, warnings can be issued based on the path of the storm producing the tornado, but even these cannot be perfectly precise regarding who will, or will not, be struck.

Table 4-2 shows that although the State of Ohio may not have the most tornadoes, those that do hit Ohio are significant in damage and have other indication factors of a large scale tornado.

**Table 4-2
State Tornado Ranking**

Rank	Total Number of Tornadoes	Deaths per 10,000 sq. miles	Number of Killer Tornadoes	Total Tornado Path Length per 10,000 sq. miles	Killer Tornadoes as a % of all Tornadoes	Annual Tornadoes per 10,000 sq. miles
1	Texas	Massachusetts	Texas	Mississippi	Tennessee	Florida
2	Oklahoma	Mississippi	Oklahoma	Alabama	Kentucky	Oklahoma
3	Florida	Indiana	Arkansas	Oklahoma	Arkansas	Indiana
4	Kansas	Alabama	Alabama	Iowa	Ohio	Iowa
5	Nebraska	Ohio	Mississippi	Illinois	Alabama	Kansas
6	Iowa	Michigan	Illinois	Louisiana	Mississippi	Delaware
7	Missouri	Arkansas	Missouri	Kansas	North Carolina	Louisiana
8	Illinois	Illinois	Indiana	Indiana	Michigan	Mississippi
9	S Dakota	Oklahoma	Louisiana	Nebraska	New York	Nebraska
10	Louisiana	Kentucky	Tennessee	Wisconsin	Massachusetts	Texas

Although the number of tornadoes in Ohio does not rank high compared to other states in the United States, the State does average around 14 tornadoes a year. Ohio's peak tornado season runs from April through July, with most tornadoes occurring between 2 p.m. and 10 p.m. Even though June has been the month with the most tornado occurrences, many of the State's major tornado outbreaks have taken place in April and May. However, history has shown that tornadoes have occurred with some frequency during autumn months but can occur during any month of the year and at any time of the day or night.

Tornadoes are considered the most violent atmospheric phenomenon on the face of the earth with their strength being measured by the Enhanced Fujita Scale as described in Table 4-3. This scale is the mechanism used to determine the potential type of tornado that may have affected a particular community. It is based on velocity of wind and the type of damage the tornado caused. Many EF0 and EF1 tornadoes have touched down in Ohio, but Ohio has also been struck by some of the most destructive (EF5) tornadoes ever, including the April 3, 1974 tornado which devastated Xenia, killing over 30 people and destroying 2,000 buildings.

Enhanced Fujita Scale for Tornadoes

Scale	Wind Speed	Typical Damage
EF-0 Weak	40-72 miles per hour (mph)	Light Damage: Some chimneys damaged, twigs and branches broken off trees, shallow-rooted trees pushed over, signboards damages, some windows broken.
EF-1 Weak	73-112 mph	Moderate Damage: Surface of roofs peeled off, mobile homes pushed off foundations or overturned, outbuildings demolished, moving autos pushed off the roads, trees snapped or broken; beginning of hurricane speed winds.
EF-2 Strong	113-157 mph	Considerable Damage: Roofs torn off frame houses, mobile homes demolished, frame houses with weak foundations lifted and moved, large trees snapped or uprooted, light-object missiles generated.
EF-3 Strong	158-206 mph	Severe Damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted, heavy cars lifted off the ground and thrown, weak pavement blown off the roads.
EF-4 Violent	207-260 mph	Devastating Damage: Well-constructed houses leveled, structures with weak foundations blown off the distance, cars thrown and disintegrated, trees in forest uprooted and carried some distance away.
EF-5 Violent	261-318 mph	Incredible Damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate, automobile-sized missiles fly through the air in excess of 300 feet, trees debarked, incredible phenomena will occur.

4.6.1 Significant Historic Tornado Events

April 11, 1965

The Palm Sunday tornado cut a devastating path though the County, wrecking farmsteads and injuring several residents. This tornado was rated an EF4 on the Enhanced Fujita Scale. This tornado alone caused \$2.5 million in property damages, 50 injuries and three deaths.

4.6.2 Frequency/Probability of Future Occurrence

Shelby County has had six tornadoes from January of 1950 to December of 2015 according to the NCDC. One tornado that occurred in 1965 was rated an EF4 on the Enhanced Fujita Scale. This tornado alone caused \$2.5 million in property damages, 50 injuries and three deaths. The other tornadoes caused over \$500,000 worth of property damage, 24 injuries and no deaths. Based on historical information, Shelby County can expect to endure one tornado every eight to nine years. All jurisdictions within the County are at risk for tornadoes. Current populations and structures within the County, as well as those identified in future projections, are at risk for being negatively impacted by tornadoes.

4.7 Droughts and Extreme Heat

A drought is a period of abnormally dry weather that persists long enough to produce a serious hydrologic imbalance (i.e., crop damage, water supply shortage, etc.) The severity of the drought depends upon the degree of moisture deficiency, the duration and the size of the affected area.

The worst drought in 50 years affected 35 states, including Ohio, during the long, hot summer of 1988, when some areas had been suffering from lack of rainfall since 1984. Rainfall totals in 1988 throughout the mid-west, Northern Plains and the Rockies were 50% to 85% below normal.

4.7.1 Significant Historic Drought Events

July 1- August 1999

Dry conditions that began in the spring and early summer continued into July. Excessive heat contributed to substantial crop loss across much of the Buckeye state. Rainfall was widely scattered and did little to help farmers. Drought conditions continued across the Ohio Valley through August with most areas receiving well below normal rainfall for the month. In some areas around 50% of crops were considered total losses. Most counties in southwest Ohio were declared Federal Disaster Areas by the US Department of Agriculture. At the time of this writing, no monetary estimates were available concerning the crop loss.

4.7.2 Frequency/Probability of Future Occurrence

In Shelby County, there were two droughts and no extreme heat events recorded from 1950 thru 2015 according to the NCDC. There was no property damage, crop damage, or injuries recorded for any of these events. The County suffers varying amounts of crop damage during severe heat and dry conditions that may not be categorized as a drought.

During the development of the Plan update, the Update Committee concluded that this damage is not always recorded but still has a detrimental effect on the County. The Update Committee also concluded that, unlike other hazards such as flooding or tornadoes, there is little mitigation that can be preplanned to reduce the amount of agricultural damage caused by a drought. All jurisdictions within the County are at risk for droughts to occur. Current populations and structures within the County, as well as those identified in future projections, are at risk for being negatively impacted by drought conditions.

4.8 Earthquakes

4.8.1 Earthquakes in Ohio

The problem with earthquakes is that major earthquakes are a low probability, high consequence event. It is because of the potential high consequences that geologists, emergency planners and other government officials have taken a greater interest in understanding the potential for earthquakes in some of the areas of the eastern United States and educating the population as to the risk in their areas. Although there have been great strides in increased earthquake awareness in the eastern United States, the low probability of such events makes it difficult to convince most people that they should be prepared.

Although the New Madrid Line is in close proximity to the State of Ohio, there has not been an earthquake of any significance since 1875 caused by this fault line. An earthquake on June 18, 1875 caused damage in western Ohio, and affected a total area estimated at over 40,000 square miles. Walls were cracked and chimneys thrown down in Sidney and Urbana. The shock was felt sharply at Jeffersonville, Indiana. The affected area included parts of Illinois, Indiana, Kentucky and Missouri. Northeastern Ohio, east of Cleveland, is the second most active area of the state. At least 20 earthquakes have been recorded in the area since 1836, including a 5.0 magnitude event in 1986 that caused moderate damage. A broad area of southern Ohio has experienced more than 30 earthquakes

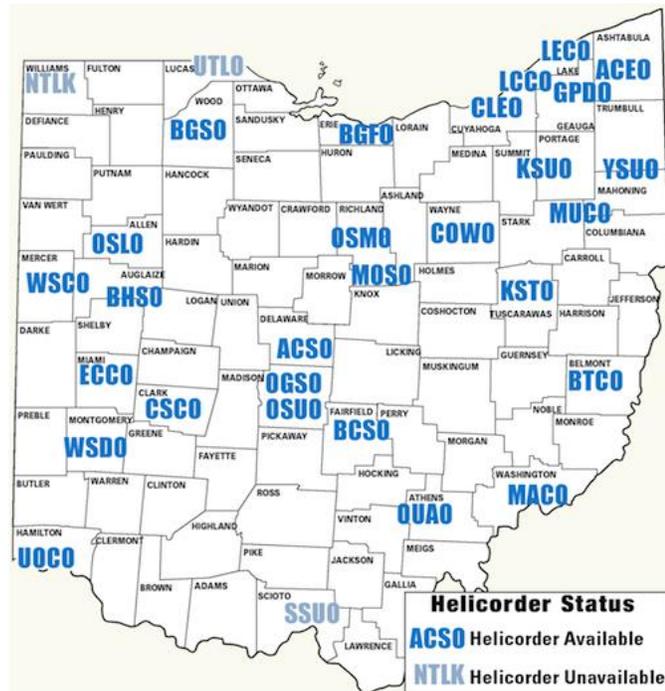
According to OhioSeis, there have been 22 earthquakes in Shelby County since 1925 exceeding a magnitude of 2.0 on the Richter Scale and above an intensity of II on the Mercalli Scale. The largest historic earthquake in Ohio was centered in Shelby County in 1937. This event, estimated

to have had a magnitude of 5.4 on the Richter scale and VIII on the Mercalli Scale, caused considerable damage in Anna and several other western Ohio communities, where at least 40 earthquakes have been felt since 1875.

4.8.2 Monitoring of Earthquakes

The ODNR Division of Geological Survey has established a 29-station cooperative network of seismograph stations throughout the State in order to continuously record earthquake activity. The network, which went on line in January 1999, ended a five-year gap during which there was only one operating station in Ohio. The State was dependent on seismographs in Kentucky and Michigan to record Ohio earthquakes.

The 29 stations of the new seismograph network, which is called OhioSeis, are distributed across the State, but are concentrated in the most seismically active areas or in areas that provide optimal conditions for detecting and locating very small earthquakes that are below the threshold of human notice. These small micro earthquakes are important because they occur more frequently and help to identify the location of faults that may periodically produce larger, potentially damaging earthquakes.



The OhioSeis seismograph stations are located at colleges, universities and other institutions, employing new technology that not only makes them very accurate, but also relatively inexpensive and easy to operate and maintain. In contrast to the old technology, in which a pen made a squiggly line on a paper drum, the new system is entirely digital and uses a desktop computer to continuously record and display data. Two other innovations have made the system unique. An inexpensive Global Positioning System (GPS) receiver is used to keep very precise time on the continuously recorded seismogram, and each station's computer is connected to the Internet for rapid data transfer.

Each OhioSeis station is a cooperative effort. Seismometers, the instrument that detects Earth motions and other seismic components were purchased by the Division of Geological Survey with funds provided by FEMA through the OEMA, as part of the National Earthquake Hazards Reduction Program. The computers and Internet connection were purchased and provided by the cooperating institutions.

4.8.3 Measuring Earthquakes

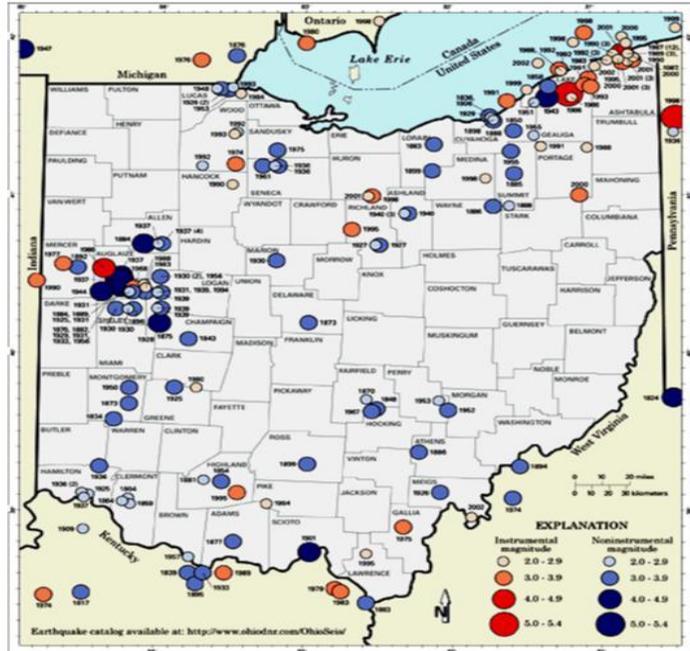
The current measurements of earthquakes have been utilized since the early 1930s using both the Mercalli Scale and the Richter Scale. The Mercalli Scale was developed in 1931 and measures earthquake intensity using a Roman numeric scale to designate increasing levels of intensity. The Richter Scale was developed in 1935, measuring earthquake magnitude using a numerical logarithmic scale. Detailed explanations of each scale can be found at: http://en.wikipedia.org/wiki/Mercalli_intensity_scale and http://en.wikipedia.org/wiki/Richter_magnitude_scale.

A comparison of these two scales is as follows:

Magnitude (Richter Scale)	Description	Mercalli intensity	Average earthquake effects	Average frequency of occurrence (estimated)
Less than 2.0	Micro	I	Micro-earthquakes, not felt, or felt rarely by sensitive people. Recorded by seismographs	Continual/several million per year
2.0–2.9	Minor	I to II	Felt slightly by some people. No damage to buildings.	Over one million per year
3.0–3.9		II to IV	Often felt by people, but very rarely causes damage. Shaking of indoor objects can be noticeable.	Over 100,000 per year
4.0–4.9	Light	IV to VI	Noticeable shaking of indoor objects and rattling noises. Felt by most people in the affected area. Slightly felt outside. Generally causes none to minimal damage. Moderate to significant damage very unlikely. Some objects may fall off shelves or be knocked over.	10,000 to 15,000 per year
5.0–5.9	Moderate	VI to VIII	Can cause damage of varying severity to poorly constructed buildings. At most, none to slight damage to all other buildings. Felt by everyone. Casualties range from none to a few.	1,000 to 1,500 per year
6.0–6.9	Strong	VII to X	Damage to a moderate number of well-built structures in populated areas. Earthquake-resistant structures survive with slight to moderate damage. Poorly designed structures receive moderate to severe damage. Felt in wider areas; up to hundreds of miles/kilometers from the epicenter. Strong to violent shaking in epicentral area. Death toll ranges from none to 25,000.	100 to 150 per year
7.0–7.9	Major	VIII or greater	Causes damage to most buildings, some to partially or completely collapse or receive severe damage. Well-designed structures are likely to receive damage. Felt across great distances with major damage mostly limited to 250 km from epicenter. Significant death toll.	10 to 20 per year
8.0–8.9	Great		Major damage to buildings, structures likely to be destroyed. Will cause moderate to heavy damage to sturdy or earthquake-resistant buildings. Damaging in large areas. Felt in extremely large regions. Death toll in the thousands.	One per year
9.0 and greater			Near or at total destruction - severe damage or collapse to all buildings. Heavy damage and shaking extends to distant locations. Permanent changes in ground topography. Death toll can surpass 10,000.	One per 10 to 50 years

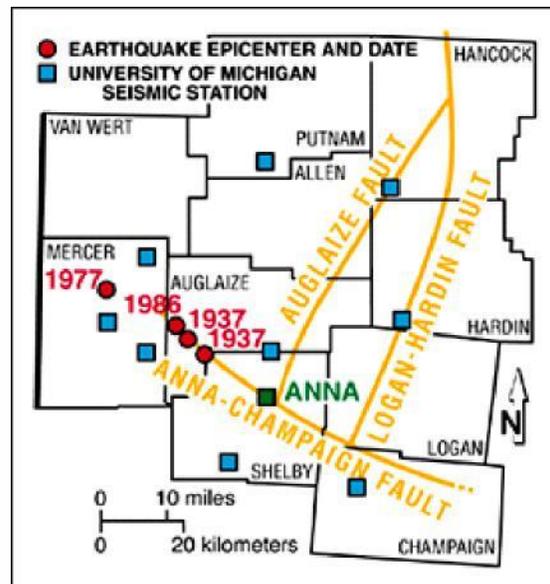
The Division of Geological Survey is coordinating the seismic network and has established the Ohio Earthquake Information Center at the Horace R. Collins Laboratory at Alum Creek State Park, north of Columbus. This facility functions as a repository and laboratory for rock core and well cuttings, but has a specially constructed room for earthquake recording. The seismograph system allows for very rapid location of the epicenter and calculation of the magnitude of any earthquake in the State. The earthquake records, or seismograms, from at least three seismograph stations are needed to determine earthquake locations (epicenters). These records can be downloaded from the internet at any station on the network, and location and magnitude can be determined. Small earthquakes were in many cases not even detected by distant, out-of-date seismograph stations.

The OhioSeis network provides a whole new dimension of understanding about the pulse of the Earth beneath Ohio. Although the new seismograph network will not predict earthquakes or provide an alert prior to an event, it will provide insight into earthquake risk in the State so that intelligent decisions about building and facility design and construction, insurance coverage and other planning decisions can be made by individuals, business and industry, and governmental agencies.



Epicenters of past earthquakes in Ohio

There has been speculation that Anna received the brunt of damages from the 1937 earthquakes because the community is located directly above the sediment-filled valley of the pre-glacial Teays River. This ancient river apparently followed the trace of the Anna-Champaign fault until it was obliterated by an early Pleistocene glacier and its valley was filled with nearly 500 feet of glacial sediment. The speculation is that ground motion is amplified by these unconsolidated sediments in the Teays River valley and that Anna, located over the buried valley, receives a greater degree of shaking than nearby communities located on shallow bedrock.



Faults in Shelby County

Although the Anna area is the seismically most active region of the state, geologists currently have only minimal understanding of the geology of basement rocks in the region. There is some speculation that the Anna-Champaign fault is associated with a proposed failed rift zone in western Ohio. However, until additional data is derived from future earthquakes, deep drilling, and other investigations of basement geology in western Ohio, the cause of earthquakes in this area will remain speculative.

4.8.4 Significant Historic Earthquake Events

June 18, 1875

This earthquake was felt throughout an area of at least 40,000 square miles and was most intense at Sidney and Urbana (Champaign County), where masonry walls were cracked and chimneys toppled. It has been interpreted to have had a Modified Mercalli Intensity (MMI) of VIII, which equates to a 4.1-5.4 magnitude on the Richter scale.

September 30, 1930

This earthquake cracked plaster and toppled a chimney in Anna. An epi-central MMI of VII and a magnitude of 4.2 have been assigned to this event.

March 2 and 9, 1937

These two earthquakes are the most damaging to have struck Ohio. Maximum intensities were experienced at Anna; where a MMI of VII was associated with the March 2 event and an MMI of VIII was associated with the March 9 event. In Anna, chimneys were toppled, organ pipes were twisted in the Lutheran Church, the masonry school building was so badly cracked that it was razed, water wells were disturbed and cemetery monuments were rotated. Both earthquakes were felt throughout a multi-state area. Analysis of seismograms from these earthquakes by the USGS assigned magnitudes of 4.7 and 4.9, respectively, to these events.

1981-1983

In 1980 and 1981, six small earthquakes occurred in eastern Shelby County. In 1983, four earthquakes occurred in the same location; two on November 4. The 1983 quakes, along with the earlier ones, all measured about 2.0 or less on the Richter scale—too small to be felt locally. The significance of this cluster of micro earthquakes is uncertain, but this general area has been the source of at least 35 earthquakes that were felt by local residents, including two damaging events in March 1937.

July 12, 1986

Minor damage, consisting primarily of cracked windows and plaster and fallen bricks from chimneys, was reported when an earthquake with a MMI of VI occurred, centered northwest of Anna, near St. Mary's, in Auglaize County. It had a magnitude of 4.5. Significant events pertaining to Shelby County were identified by utilizing the procedures stated above. Descriptions of past significant events are found in Appendix G with the NCDC listings of specific historical events found in Appendix H. Included in this Appendix is a listing of earthquakes in Shelby County since 1925 exceeding a magnitude of 2.0 on the Richter Scale and above an intensity of II on the Mercalli Scale.

4.8.5 Frequency/Probability of Future Occurrence

As stated previously, Shelby County is one of the most active sites in Ohio for earthquake occurrence. Notwithstanding, even though the entire County may be at risk for the occurrence of earthquakes, the probability of a major earthquake occurring the County remains low. However, current populations and structures within the County, as well as those identified in future projections, are at risk for being negatively impacted by earthquakes.

5.0 VULNERABILITY ASSESSMENT

Shelby County is susceptible to many different kinds of natural hazards as reviewed in the previous section of this plan. If a hazard event struck vacant land, there would not be much cause for concern. However, since Shelby County has close to 50,000 residents and thousands of homes, businesses and critical facilities, the potential for damage and injury could be high, especially in higher populous areas such as Sidney, Jackson Center and Fort Loramie.

This section reviews how vulnerable Shelby County is to property damage and threats to public health and safety. This section also reviews how hazards may have an adverse impact on the economy. The potential for property damage is measured in dollars based on historical events of the past and damage incurred from those events.

As previously mentioned, from March of 1997 through August of 2012, Shelby County has been a part of 18 federally declared disasters. During that period, Shelby County received three Federal Public Assistance Grants for various natural disasters, primarily for floods, and both summer and winter storms. The three grants were received for the federally declared natural disasters on 2/15/2005, 11/1/2005 and 10/24/2008, totaling more than \$575,500. A detailed description of these federally declared natural disasters can be found at OEMA's SHARPP website.

A four-step process was followed to estimate the cost to Shelby County of the hazards reviewed in the Hazard Profile section (Section 4.0) of this report. This process was documented on a per hazard basis. The steps that were used are as follows:

- Step 1: Inventory critical facilities and structures susceptible to property damage.
- Step 2: Determine potential dollars lost based on various levels of damage on different categories of structures.
- Step 3: Evaluate the impact on infrastructure and general population.
- Step 4: Evaluate deaths, injuries and property/crop economic losses.

With the exception of flooding, all identified natural hazards impacting the County have the potential of affecting all jurisdictions. Jurisdictions within the County potentially affected by 100-year flooding are described in Section 5.4.1.7 as well as in Appendix G.

5.1 Critical Facilities

During this planning phase, members of the Update Committee discussed the types and locations of the critical facilities within Shelby County. All the critical facilities within Shelby County (water and wastewater treatment plants, medical facilities, fire and EMS, schools with shelters, and law enforcement facilities) are shown on the map entitled 'Shelby County Multi-Hazard Map in Appendix G. Table 5-1 below provides a summary of critical facilities by facility type. Multi-Hazard Maps of Shelby County are provided in Appendix G.

**Table 5-1
Critical Facilities in Planning Area**

Critical Facility	Total
WTP/WWTP	8/9
Medical Facilities/Nursing Homes	1/5
Fire/EMS	11/6
Schools/Schools with shelters	18/10
Law Enforcement	6
Total Critical Facilities	64

5.2 Potential Dollars Lost

The second step of the vulnerability assessment was to calculate the impact of the given hazards in terms of property damage and loss of property use. Structural values and typical structural loss situations were used for various categories of facilities. This approach did not predict which facilities will be hit by which hazard, but it instead provided a general estimate of the level of damage that would be expected based upon available data.

First, the value of the property being damaged was determined based on the total values of structures within that category. Total values of the structures were obtained from the County's Auditor's Office.

Contents value was calculated as a percentage of the structure's value. Table 5-2 shows the relative value of the typical contents to the typical structure type. These ratios were taken from FEMA guidance documents and continue to be valid considerations as concurred by the Plan Update Committee.

Table 5-2
Contents Value as a Percentage of Structure Value

Occupancy Class	Value (%)
Residential	50%
Commercial	100%
Industrial	150%
Medical Facilities	150%
General Government	100%
Schools/Libraries	100%
Religion/Non-profit	100%

Second, three levels of physical damage were evaluated for each category of structure. These levels have a percentage of damage associated with each. The dollars lost for each level, however, may be underestimated since there may be downtime associated with closing a business for an extended period of time.

Minor damage: Many structures exposed to a storm or other hazard will suffer only minor to moderate damage. For example, a tornado may just damage the roof and windows of some structures. For this calculation, 5% of the structure's value was used. Because the structure stays substantially intact, no contents losses were considered.

Moderate damage: This category represents more serious damage, such as a collapsed wall or floodwater over the first floor of a building. Moderate damage is calculated as 40% of the structure's value plus 40% of the content's value.

Major damage: This category is used when a building is demolished or heavily damaged. An example of the former is a house leveled by a tornado. An example of the latter is floodwater more than 1.5 feet over the lowest floor (i.e., over the electrical outlets). The average dollar figure for this category is 75% of the structure's value and 75% of the contents' value.

Table 5-3 shows the calculated dollar losses for each level of damage per facility type. The type of facility as listed was limited to that information available from the County Auditor's Office.

**Table 5-3
Physical Potential Dollar Losses (2015 calculations)**

Property	Total Value	Minor Damage	Moderate Damage	Major Damage
Residential	\$1,414,176,920	\$70,708,846	\$848,406,152	\$1,590,949,035
Commercial	\$185,964,050	\$9,248,203	\$104,139,868	\$278,946,075
Industrial	\$223,694,300	\$11,184,715	\$125,268,808	\$419,426,813
Agricultural	\$216,416,410	\$10,820,821	\$121,193,189	\$324,624,615
Religious	\$35,877,300	\$1,793,865	\$23,091,288	\$53,815,950
Government	\$71,380,180	\$3,569,009	\$39,972,900	\$107,070,270
Education	\$72,685,200	\$3,634,260	\$40,703,712	\$109,027,800
Medical	\$28,220,390	\$1,411,020	\$15,804,418	\$52,913,230

5.3 Vulnerability Data Collection

Prior to assessing the community's vulnerability to hazards as a part of the 2005 plan, local sources of information were researched including comprehensive plans, land use plans, land development regulations and flood regulations, to determine if the county previously addressed its vulnerability to any particular hazard. In most cases, local plans and regulations did not yet exist or were very minimal in addressing natural hazard situations and building parameters.

Therefore, other state and national sources were researched for detailed information. One of these resources was the NCDC. The NCDC is the world's largest active archive of weather data. The NCDC produces numerous climate publications and responds to data requests from all over the world. The NCDC supports a three-tier national climate services support program that includes partners such as the NCDC, Regional Climate Centers, and State Climatologists. The NCDC has long served as a national resource for climate information. The NCDC's data are used to address issues that span the breadth of this nation's interests

Another source of hazard information that was explored was the Ohio Seismic Network as described in previous sections of this report. The Division of Geological Survey of the ODNR coordinates a 29-station cooperative network of seismograph stations throughout the state in order to continuously record earthquake activity. OEMA's Ohio Earthquake Program Manager was also contacted to discuss the risks associated with each county to determine if the type of geology lends itself to increased damage. The data obtained from the Ohio Seismic Network as provided above contain both the Richter Scale of magnitude as well as the Mercalli Scale of intensity.

Because the state and national agencies are not always privy to the local knowledge, some information extracted from their libraries may not be comprehensive or complete. Therefore, the Plan Update Committee utilized the resources described above as well as their experience and knowledge with verification from the local EMA directors to prioritize the hazards determined to affect the county the most and assess them according to local concerns.

5.4 Vulnerability Assessment by Hazard

5.4.1 Flooding

Flooding is a site-specific hazard. Therefore, floodplains are an important planning consideration. A floodplain is any land area susceptible to inundation by floodwaters from any source. Floodplains are measured in terms of the amount of storm water that it takes to cover a given area of land. These storm events are measured in frequency of occurrence, such as 25-year, 100-year and 500-year, with the standard measurement being the 100-year storm or floodplain. The 100-year floodplain is the land area having a 1 in 100 chance of flooding in any given year, but the statistics can be misleading. In reality, the 100-year storm or flood could occur two, three, or more years in a row (unlikely, but possible), because the 100-year flood is a statistical probability and not a predictable recurrence. Statistically, the 100-year flood has a 25% chance of occurring during the typical 30-year lifespan of a home mortgage.

Any future development within floodplains can impact the direction, flow and level of the watercourse during periods of high water or flooding. In other words, if fill material is placed or a house constructed in a floodplain, it will alter the boundaries of the floodplain downstream of that area. This alteration happens because structures or fill utilize valuable space that would otherwise act as a natural retaining area for floodwaters to spread and slow. Not only does development in the floodplain increase dangers downstream, developments within the floodplain are at higher risk of damage due to flooding. This damage includes fill material and debris from destroyed structures upstream colliding with structures in the floodplain downstream of an affected area. Bridges may also be washed out in floods because river borne debris clog their free-flow area.

The County has in place floodplain requirements for future construction. These requirements, as discussed in Section 6.0, restrict additional construction unless certain parameters are met. Any future construction within the floodplain would be considered at risk for flooding.

5.4.1.1. Infrastructure Impact

According to Shelby County's GIS data, there are a total of 2,698 structures in Shelby County considered to be at-risk due to 100-year flooding. All the at-risk areas are located on the maps in Appendix G. Structures located within these 100-year floodplains are therefore susceptible to damage during a flood. This issue is addressed as a part of the Action Matrix found in Appendix I.

5.4.1.2 Population Impact

Based on the NCDC data from 1950, Shelby County's citizens have had to endure multiple flooding situations, including flash floods and river floods. See Appendix F for tables extracted from the NCDC that show the number of reported events since 1950. Flash floods affect a specific area over a short period of time and a smaller population than river floods. On occasion, a life may be lost because of water rising very quickly in this short time.

Unlike flash flooding, the 100-year river flood has a less likelihood of occurring but will impact a larger population. There is a 1% chance each year that the rivers and streams within Shelby County will flood to the delineated 100-year flood zone (special flood zone). This flood will affect the populations occupying at-risk structures located in the floodplain area shown on the Multi-hazard Map in Appendix G.

5.4.1.3 Property Damage

Based on information retrieved from the NCDC, flooding in Shelby County has accounted for over \$750,000 in property damage from 1950 thru 2015. Most flood damage in Shelby County is caused by riverine flooding. From January 1950 through December 2015, the County suffered \$390,000 in property damage from riverine flooding as compared to \$294,000 in damage from flash flooding. There have been no incidents of breaches of Shelby County's two Class I dams or the levee located in the city of Sidney.

5.4.1.4 Injuries/Loss of Life

Even though the NCDC has no recorded injuries or deaths due to flooding from 1950 thru 2015, the potential for injury and death is ever present, especially in flash flood events. During flash floods, water rises very quickly and may catch citizens by surprise. Homeowner's may not be prepared for the rising waters and the need to seek safety quickly. Motorists often think that they can drive through ponded water and risk getting stuck in the flooded area. Due to the extent of flooding in Shelby County, the risk to human life is moderate but can be reduced by increasing public awareness.

5.4.1.5 Economic Losses

The economic losses a community suffers during a flood event can be high. Productivity decreases as residents miss work to tend to the damage incurred at their homes. Some inventory within a business itself may be lost if the owner is not prepared and the facility not flood proofed prior to a flood event. Small businesses may suffer so much damage that they are unable to reopen. Contractors and clean up companies may reap the benefits of the damage but not enough to offset the overall losses to the economy.

The County's infrastructure will also suffer damage that will need to be repaired. Some roads and bridges may wash out. Shelby County has several areas that suffer repeated flooding. These areas are mapped on the Multi-Hazard Map in Appendix G.

Residents often cannot rely on Federal assistance for the damages incurred. Since January 1, 1964, Shelby County has been declared a federal disaster area on 11 occasions due to damage suffered by severe storms and associated flooding. If a Presidential Disaster Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the clean-up process.

5.4.1.6 HAZUS Calculations for Flood Losses

During the Plan update process, HAZUS models were run to establish potential structural and associated monetary losses from both a 25-year flood as well as a 100-year flood. HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS).

The geographical size of the region is 409 square miles and contains 1,714 census blocks. The region contains over 18 thousand households and has a total population of 49,423 people (2010 Census Bureau data).

There are an estimated 21,358 buildings in the region with a total building replacement value (excluding contents) of 4,448 million dollars (2014 dollars). Approximately 90.71% of the buildings (and 66.56% of the building value) are associated with residential housing. The specific HAZUS information and data can be found in Appendix D.

5.4.1.7 Community Profile

For the purposes of this hazard profile, projections of affected parcels with structures and associated monetary losses are based on the impacts resulting from a 100-year flood. Projections made for this Plan component relate to data obtained from currently available FIRM (Flood Insurance Rate Maps). The digitized FIRM data were utilized with GIS to quantify the parcel information given below. Analysis is provided on the numbers and types of property parcels with structures and their respective values found within the County. These figures are compared with those parcels with structures determined to be within the hazard area. A percentage of those numbers and values are also given. Community profiles are addressed individually for the two watersheds determined to be of most concern (Loramie Creek and Great Miami River. Data for creeks having a less significant impact on individual communities are also provided.

The data below are provided for the entire floodplain as indicated, as well as for the individual incorporated areas impacted by the particular floodplain. The data for the individual incorporated areas reflect only the total number of parcels with structures affected and their respective losses. These data are valuable in the eventual consideration of mitigation initiatives developed by individual incorporated political subdivisions. Current data provided below are based on 2015 calculations.

Community Profile – Loramie Creek

Type of Structure	Number of Structures			Value of Structures		
	# in County	# in Hazard Area	% in Hazard Area	\$ in County	\$ in Hazard Area	% in Hazard Area
Residential	15,980	41	0	\$1,414,176,920	\$5,042,610	0
Commercial	1,080	20	2	\$214,184,440	\$2,650,260	1
Industrial	303	1	0	\$223,694,300	\$84,260	0
Religious	120	2	2	\$35,877,300	\$584,090	2
Government	189	1	1	\$71,380,180	\$1,300,000	2
Education	35	1	3	\$72,685,200	\$5,099,840	7
Total	17,707	66	0%	\$2,031,998,340	\$14,741,060	1%

Community Profile – Loramie Creek (Incorporated Areas)

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Botkins	902	7	Negligible	\$56,746,560	\$1,855,100	3
Fort Loramie	979	59	6	\$103,417,130	\$12,885,960	12

Community Profile – Great Miami River

Type of Structure	Number of Structures			Value of Structures		
	# in County	# in Hazard Area	% in Hazard Area	\$ in County	\$ in Hazard Area	% in Hazard Area
Residential	15,980	571	4	\$1,414,176,920	\$26,086,520	2
Commercial	1,080	69	6	\$214,184,440	\$7,050,040	3
Industrial	303	6	2	\$223,694,300	\$1,078,410	Negligible
Agricultural	2,342	4	0	\$216,416,410	\$536,030	0
Religious	120	7	6	\$35,877,300	\$1,200,800	3
Government	189	22	12	\$71,380,180	\$18,026,620	25
Education	35	3	9	\$72,685,200	\$1,908,700	3
Total	20,049	682	3	\$2,248,414,750	\$55,887,120	2

Community Profile – Great Miami River (Incorporated Areas)

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Sidney	7804	610	8	\$868,571,680	\$52,951,990	0
Port Jefferson	175	72	41	\$8,228,400	\$2,935,130	36

Community Profile – Plum Creek

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Sidney	10,762	34	Negligible	\$868,571,680	\$6,017,720	1

Community Profile – Mill Creek

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Sidney	10,762	1	0	\$868,571,680	\$35,710	0

Community Profile – Tawawa/Mosquito Creek

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Sidney	10,762	1	0	\$868,571,680	\$46,200	0

Community Profile – Jackson Center Creek

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Jackson Center	1,072	6	1	\$62,014,330	\$2,680,290	4

Community Profile – Ninemile Creek

Affected Incorporated Area	Number of Structures			Value of Structures		
	# in Community	# in Hazard Area	% in Hazard Area	\$ in Community	\$ in Hazard Area	% in Hazard Area
Russia	264	35	13	\$42,480,680	\$4,758,390	11

5.4.2 Summer Storms

Shelby County is highly susceptible to severe summer storms, which encompasses thunderstorms, high winds, hail and lightning. See Appendix F for tables extracted from the NCDC that show the number of reported events from 1950 thru 2015. Again, current populations and structures within the County, as well as those identified in future projections of infrastructure, buildings, critical facilities, and populations, would be at risk for being negatively impacted by summer storms.

5.4.2.1 Infrastructure Impact

Since severe storms are random in nature, the impact on Shelby County’s infrastructure is not limited to a certain area as with river flooding. Homes and businesses all throughout the County are susceptible to high winds, hail and lightning. Shingles are blown from rooftops and hail may dent siding or break windows. Lightning strikes may be more damaging to structures that are not grounded with lightning rods. Trees may become uprooted and limbs detached and blown into structures. High winds may also cause severe damage to mobile home parks if units are not properly tied down to permanent concrete pads or structures. On occasion, a structure may be destroyed completely but a high frequency of this extent of damage will not be expected.

Utilities and municipal plants may also be damaged during severe storms. Debris, such as tree limbs, blown into utility lines may cause downed power lines.

5.4.2.2 Population Impact

Because severe storms are random in nature, the entire County population is susceptible and should be prepared. All citizens should become familiar with locations of shelters in which they can seek safety in the event of severe weather. Citizens are informed of shelter locations open during a natural disaster.

5.4.2.3 Property Damage

According to the NCDC, there have been 168 severe summer storms (including thunderstorm/high winds), hail, and lightning events in Shelby County reported from 1950 thru 2015, with total property losses of over \$6.7 million. A single high wind event in September of 2008 caused a total of \$5.7M.

This information shows that severe summer storms, namely thunderstorms, high winds and lightning are extremely costly to the County.

5.4.2.4 Injuries/Loss of Life

Since 1950, there have been six recorded injuries due to severe storms, high winds, hail and lightning. Four of these injuries were associated with a high wind event in July of 1995.

Because the number of severe summer storms affecting Shelby County is large, the potential for injury and death is high. As the population of the County continues to grow, as forecasted by the 2010 Census, there is more potential for injury and/or loss of life. Risks associated with summer storms are injuries from flying debris, medical issues because of loss of power, lightning strikes, and hazardous driving conditions.

5.4.2.5 Economic Losses

The economic losses a community suffers during a severe summer storm event can be high. In communities with hazard trees, these trees have the potential to destroy homes and businesses if uprooted. Fallen branches may also cause severe damage. Residents and business owners then turn their efforts from work and running a business to clean up efforts.

With many older homes within the county, damage costs from severe summer storms begin to accumulate quickly due primarily to the age of the house and its susceptibility to damage. Residents often cannot rely on federal assistance for the total damages incurred. Since March of 1997, the President of the United States has declared Shelby County a disaster area on 12 occasions due to damage suffered by severe summer storms. If a Presidential Disaster Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the clean-up process.

5.4.3 Winter Storms

Shelby County is located in the west central portion of the state and is susceptible to winter storms, which encompass snow, ice and extremely cold temperatures. See Appendix F for tables extracted from the NCDC that show the number of reported events from 1950 thru 2015. Current populations and structures within the County, as well as those identified in future projections of infrastructure, buildings, critical facilities, and populations, would be at risk for being negatively impacted by winter storms.

5.4.3.1 Infrastructure Impacts

Because the area receives a moderate amount of snowfall and can be stricken by ice storms, all of the structures erected in the County are susceptible to damage if not designed to the proper snow loading parameters.

5.4.3.2 Population Impacts

Because snow, ice and extreme cold storms occur countywide, the entire county population is susceptible and should be prepared. Motorists should be aware of declared snow emergencies and seek safety before becoming stranded. Motorists should also be educated on the presence of black ice on roadways and bridges. Functional needs populations will be the most susceptible to snow, ice, and extreme cold conditions, such as hypothermia, and should prepare for such events prior to the winter months.

5.4.3.3 Property Damage

According to the NCDC, there have been 73 winter storm events in Shelby County reported since 1950, with total property losses of \$60,000.

5.4.3.4 Injuries/Loss of Life

According to NCDC data as well as personal accounts there were no reports of injuries or deaths in Shelby County from 01/01/50 thru 12/31/15 due to winter storm events. Overall, the number of winter events affecting Shelby County is moderate, as well as the potential for excessive damage. The potential for injury and death is low - moderate. As the population of the county continues to grow there is greater potential for injury and/or loss of life. Risks associated with severe winter weather are hazardous driving conditions, medical conditions such as hypothermia and frostbite, and increased risk of dehydration.

5.4.3.5 Economic Losses

The economic losses a community suffers during a winter storm event, which can leave behind snow and thick layers of ice, can be high. In communities with hazard trees, these trees have the potential to destroy homes and businesses if uprooted. Fallen branches may also cause severe damage. If power lines become burdened with snow and snap, prolonged power outages may cause some businesses to close for an extended period of time leading to loss of revenue.

With many older homes within the county, damage costs from snow and ice begin to accumulate quickly due primarily to the age of the house and its susceptibility to damage. Residents often cannot rely on federal assistance for the total damages incurred. Since January 1, 1964, the President of the United States has declared Shelby County a federal disaster area on four occasions due to damage suffered by winter storms. If a Presidential Disaster Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the clean-up process.

5.4.4 Tornadoes

As seen in the hazard profile and as determined by the Plan Update Committee, Shelby County has a relatively low risk of incurring damage from tornadoes. See Appendix F for tables extracted from the NCDC that show the number of reported events between 1950 and 2015.

As mentioned previously, current populations and structures within the County, as well as those identified in future projections of infrastructure, buildings, critical facilities, and populations, would be at risk for being negatively impacted by tornadoes.

5.4.4.1 Infrastructure Impact

Because tornadoes are random in nature, no one area of the County is more susceptible to infrastructure damage than another area. Since the occurrence of tornadoes is low, the effect on the infrastructure will also be low with only a few houses or businesses needing repairs. Trees may become uprooted, limbs detached and blown into structures. On occasion, a structure may be destroyed completely but a high frequency of this extent of damage is not expected.

Please see the Shelby County Multi-Hazard Map in Appendix G for tornado paths recorded in the County.

5.4.4.2 Population Impact

Since tornadoes typically present localized hazards, the overall population impact within the County is low - moderate. Several homes may need repair, but typically homeowners will have insurance to cover these expenses and will not suffer any long term financial hardship. The populations located in mobile home parks and campgrounds should take particular care to seek adequate permanent shelter with approaching severe weather.

5.4.4.3 Property Damage

According to the NCDC, there have been six tornadoes in Shelby County reported since 1961 with magnitudes ranging from EF0 to EF4. These tornadoes caused property losses of \$3.0 million. One recorded EF4 tornado in 1965 caused \$2.5 million in damage, which also was the most damage in one event that has been recorded. The average loss for the other five recorded events was \$100,000 in property damage.

With the exception of the 1965 tornado, the County has not suffered significant property damage due to tornadoes. Therefore, there is a moderate impact relative to property damage.

5.4.4.4 Injuries/Loss of Life

Since 1961, there have been 74 recorded injuries and three recorded deaths due to tornadoes. In addition, 50 injuries and three deaths were associated with one particular EF4 tornado that struck the County in 1965. Because the number of tornadoes that have affected Shelby County is small, the potential for injury and death is low. As the population of the County continues to grow, as illustrated by the 2010 Census, there is more potential for injury and/or loss of life. However, the frequency of tornadoes in the County is such that even with a growing population, the potential for injury or death will still be relatively low.

5.4.4.5 Economic Losses

Due to the infrequency of tornado events in Shelby County, the overall impact on the economy is very low. If a tornado were to touch down, the economic losses would be local versus county-wide. Residents often cannot rely on federal assistance for damages incurred. Since January 1, 1964, Shelby County has been declared a federal disaster area on three occasions due to damage suffered by tornadoes. If a Presidential Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the clean-up process.

5.4.5 Droughts and Extreme Heat

As seen in the hazard profile and as determined by the Plan Update Committee, Shelby County has a low risk of incurring damage from droughts and extreme heat. Due to the non-site specific nature of this hazard, the best way to deal with preparing for future events is to consider historical occurrences. This information was obtained from the NCDC shown in Appendix F. Current structures and critical facilities within the County, as well as those projected for the future, would be at minimal risk from the effects of droughts.

5.4.5.1 Infrastructure Impact

Because droughts and extreme heat are non-site specific hazards, the effects of a drought should be evaluated countywide. There are no documented critical facilities that are considered at-risk as it relates to droughts. By itself, a drought does not damage developed property. However, over a long period of time, certain soils can expand and contract resulting in some structural damage to buildings. A small percentage of buildings in areas with such soils suffer minor damage during their "useful lives." Therefore, the overall impact on the County's infrastructure will be very low.

5.4.5.2 Population Impact

Since drought and extreme heat events are non-site specific, the entire County population could be affected by hot, dry conditions. The overall impact that droughts and extreme heat have on the Shelby County population is low based on the number of events recorded by the NCDC since 1950. However, the County's residents, especially the sensitive populations, should still be aware of the dangers of extreme heat, such as heat exhaustion and heat stroke.

5.4.5.3 Property Damage

According to the NCDC, there have been two drought events and no extreme heat events in Shelby County. All events were recorded in 1999. However, no recorded property or crop damage was associated with these events.

5.4.5.4 Injuries/Loss of Life

Since 1950, there have been no recorded injuries and no deaths due to drought and extreme heat conditions. Because of this statistic, the County's overall potential for injury and death is low.

Continual public awareness and information is valuable in reducing the risks associated with droughts.

5.4.5.5 Economic Losses

Due to the minimal amount of damage recorded for drought and extreme heat events in Shelby County, the overall impact on the economy is low. However, when droughts do occur, the economic losses will be countywide affecting the farming community the most. It is very unlikely that a Presidential Disaster Declaration would occur, therefore all mitigation costs would have to be funded locally.

5.4.6 Earthquakes

As seen in the hazard profile and as determined by the Plan Update Committee, Shelby County has a moderate risk of incurring damage from earthquakes. The County has had over 40 epicenters within its boundaries. Please refer to Section 4.8.3 for additional information on Shelby County's epicenters. Current populations and structures within the County, as well as those identified in future projections of infrastructure, buildings, critical facilities, and populations, would be at risk for being negatively impacted by earthquakes.

5.4.6.1 Infrastructure Impact

Shelby County and surrounding counties in western Ohio have experienced more earthquakes than any other area of the state. At least 22 earthquakes have occurred in this area since 1925. Although most of these events have caused little or no damage, earthquakes in 1930, 1931 and 1937 caused minor to moderate damage. Two earthquakes that occurred in 1937, on March 2 and March 9, caused significant damage in the Shelby County community of Anna. The damage included toppled chimneys, cracked plaster, broken windows and structural damage to buildings. The community school, of brick construction, was razed because of structural damage. Therefore, the overall impact on infrastructure in this area is moderate to high.

5.4.6.2 Population Impact

Since the threat of an earthquake is moderate based on the frequency of occurrences in this area, the overall impact on the County's population will also be moderate. All citizens within the County need to be aware of the threat of potential earthquakes since the County is located on two fault lines.

5.4.6.3 Property Damage

The level of damage possible from an earthquake in Shelby County is light to moderate based on a 4.0-5.4 magnitude quake as registered on the Richter scale or VII-VIII on the Mercalli Scale. Quakes of this magnitude would be felt by all, even people driving automobiles. Damage to buildings would vary depending on the quality of construction. Walls, monuments and chimneys may fall. Water wells and aquifers can be affected. Some heavy furniture may move. The 1937 earthquake that shook Anna destroyed the school, which was then razed. Because of the magnitude of an expected event, the level of property damage in the County could be moderately high.

5.4.6.4 Injuries/Loss of Life

The level of an expected earthquake in Shelby County is to be considered life threatening. Some injuries may result from falling objects. Because the likelihood of an earthquake occurring is moderate, the potential for injury or death is also moderate.

5.4.6.5 Economic Losses

Based on the property damage expected from a 4.0-5.4 magnitude earthquake, the impact on the local economy and local government expenditures is considered to be moderate.

6.0 HAZARD MITIGATION PRACTICES

As required by the DMA2K, this Mitigation Plan summarizes policies, plans, regulations, programs and projects that Shelby County has implemented or is planning to implement in the future that affect growth and how the County can achieve and maintain sustainability as well as minimize the impact of natural disasters on new and existing structures within the County. These administrative controls and activities are separated into four categories as determined by FEMA which are referred to as hazard mitigation activities. The following sections describe these general categories, as well as plans and activities that the communities are implementing now or plan to implement in the future.

It should be noted that, whenever and wherever possible, these policies, plans, regulations, programs and projects incorporate language that specifically relate to the mitigation of natural hazards that may impact County communities.

6.1 Local Planning, Zoning and Regulations

6.1.1 Comprehensive Planning – Future Land Use

Shelby County

The *Shelby County Comprehensive Land Use Plan* is based upon the organization of future land use at two levels: countywide and local (village, sewer service areas, and townships).

The countywide level addresses such regional items as sewer service areas (existing and proposed), priority farm areas, areas suitable for residential development, major industrial and commercial concentrations, corridors and greenways, and major community facilities. This categorization serves as the general development background for the Plan.

The local level addresses the future development pattern around villages and other areas with utilities, such as Anna or Lake Loramie, as well as proposed future sanitary service areas. This local level is a more detailed level of development and is comprised of three layers:

- Allocate funds for future expansion of a village via utilities;
- Support transition zone for single-family development with onsite systems would be supported
- Support rural area where farming should be dominant.

The *Shelby County Comprehensive Land Use Plan* represents an organized way of addressing future development in response to the goals and development principles of the County's overall Comprehensive Plan. To an extent, it builds upon the existing land use practices in the County. Mitigation considerations have been incorporated within the *Land Use Plan*. Mitigation activities, such as floodplain management, will continue to be an important environmental component of this *Land Use Plan* as they relate to population increases and newly built structures. The *Comprehensive Land Use Plan* was developed by the Shelby County Regional Planning Commission and is available through that County department.

City of Sidney Comprehensive Plan

The City of Sidney officials, with assistance from the Comprehensive Plan Steering Committee, have begun the process of updating the city's comprehensive plan. Sidney's last comprehensive plan, titled "Imagine Sidney 2025," was completed in 2009. This Plan can be found on the City's website at: http://www.sidneyoh.com/pdf/Comm_Srv/final-comp-plan%204-26-2010.pdf.

The plan will help guide community officials for the next five or more years in areas such as neighborhoods, land use and development, parks and recreation, infrastructure, community services and facilities, and transportation.

6.1.2 Zoning Ordinance and Building Codes

A zoning ordinance regulates development by dividing the community into zones or districts and establishing the type of development allowed within each district. The floodplain can be designated as one or more separate zoning districts in which development is prohibited or allowed only if it is not susceptible to flood damage. Some districts that are appropriate for floodplains are those designated for public use, conservation or agriculture. Zoning works best in conjunction with a comprehensive plan or “road map” for future development and building codes.

Building codes provide some of the best methods of addressing all the hazards in this plan. They are the prime measure to protect new property from damage by high winds, tornadoes, earthquakes, hail and winter storms. When properly designed and constructed according to code, the average building can withstand the impact of most of these forces.

The incorporated jurisdictions of Shelby County are required to have their own building codes and zoning regulations. All nine incorporated areas adopted an ordinance revising the zoning regulations and establishing a zoning code. Furthermore, all 14 townships have adopted zoning regulations.

6.1.3 Subdivision Regulations

Subdivision Regulations govern how land will be divided into individual lots. These regulations set construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers, storm water retention or detention basins, and drainage ways.

All of the unincorporated areas in Shelby County are subject to the Shelby County Unincorporated Area Subdivision Regulations, other than land within 1.5 miles of the City of Sidney as provided in Section 711.09 of the Ohio Revised Code. Section 711 of the Ohio Revised Code enables the Shelby County Commissioners and the Shelby Regional Planning Commission to adopt regulations governing plats and subdivisions of land within their jurisdiction.

The subdivision regulations consist of nine articles, including preliminary design plan, final plan, subdivision design standards and requirements for construction of improvements, revisions and enforcement.

In addition, the City of Sidney adopted an ordinance on August 24, 1998 for subdivision regulations. These regulations have jurisdiction over any division, subdivision, re-subdivision and/or re-plat, dedication plat or vacation plat of land located within the City. City Engineering Department requirements, standards and regulations apply to all subdivisions and associated public improvements proposed and/or required for areas within the Sidney Corporation limits. The subdivision regulations consist of 10 articles, including general provisions, definitions, minor subdivisions, preliminary plats, final plats, surety requirements, waiver procedure, enforcement and violations, fees and penalty.

The other eight incorporated villages have also adopted subdivision regulations. These subdivision regulations are all similar and consist of eight sections, including general provisions, definitions, minor subdivisions, preliminary plat, final plat, assurance for completion and maintenance of improvements, requirements for construction improvements and design, and miscellaneous provisions.

6.1.4 Floodplain Regulations

Communities that adopt and enforce a floodplain management ordinance, to regulate new and exciting development within the floodplains can significantly reduce the effects of flood damage. Communities typically adopt minimum standards that are recommended by FEMA. The objective of these regulations is to ensure that development will not aggravate existing flooding conditions and that new buildings will be protected from flood damage. Zoning and open space preservation work to keep damage-prone development out of hazardous or sensitive areas while floodplain development regulations impose construction standards on what is allowed to be built in the floodplain.

On March 14, 2013, Shelby County adopted Flood Damage Prevention Regulations pursuant to authorization contained in Section 307.37 and 307.85 of the Ohio Revised Code. These regulations apply to all areas of special flood hazard within the jurisdiction of Shelby County. The purpose of the implementation of these flood regulations is to protect human life and health, minimize public money expenditure for flood control projects, minimize need for rescue and relief efforts associated with flooding, minimize prolonged business interruptions, minimize damage to public facilities and utilities, maintain a stable tax base by providing for the proper development in flood prone areas to minimize future flood height areas, and to ensure that those who occupy flood hazard areas assume responsibility for their actions. The regulations consist of five sections that outline definitions, general provisions, administration and provisions for flood hazard reduction. In addition to meeting the minimum standards for the State of Ohio, the regulations require construction of buildings or structures to be two feet above the highest adjacent grade elevation.

Incorporated areas are also required to have floodplain regulations pursuant to authorization contained in Section 307 of the Ohio Revised Code. These regulations are the same as the Flood Damage Prevention Regulations described previously. The following incorporated areas of Shelby County have adopted these regulations and are Botkins, Port Jefferson, Russia and Sidney.

6.1.5 Drainage Regulations

In order to protect a county's natural resources a community can implement regulations such as County Water Management and Sediment Control Regulations. The purposes of these regulations are to protect the county's water resources by ensuring that the proper storm water and erosion and sediment control measures are in place. Erosion and sediment control measures are called Best Management Practices (BMPs), and when installed and maintained correctly, they help prevent soil from leaving the site. Storm water control measures ensure that the volume of storm water runoff remains the same as before development occurs.

Some examples of what can go into a County Water Management and Sediment Control Ordinance are as follows:

- Submit a Water Management and Sediment Control (WMSC) Plan for proposed commercial, industrial, or residential development sites on parcels greater than five acres.
- Submit an abbreviated plan for sites on parcels less than five acres and part of a larger plan of development.

- Submit a plan for residential dwellings only if a village, township, or city zoning requires them to do so. They must check with the appropriate community for this information.
- Comply with the regulations whether or not a plan is required. All county residents are responsible for being familiar and complying with the regulations.

A designated agency should inspect sites to ensure that the regulations are being followed correctly. The designated agency should also work diligently to review plans and perform site inspections to ensure that these erosion and sediment control measures are in place.

Shelby County has storm water regulations, which govern unincorporated areas. They however, do not regulate lots smaller than five acres. This lot size limitation effectively leaves residential development unregulated. Sidney and the villages of Anna, Fort Loramie, Jackson Center, and Russia have enacted storm water regulations, which generally require retention basins for commercial, industrial, and major residential subdivisions. Botkins is also evaluating similar regulation to adopt in the future.

6.1.6 National Flood Insurance Program (NFIP)

Political subdivisions within the County have also established individual floodplain management programs as a part of the National Flood Insurance Program (NFIP). These jurisdictional requirements for construction and other development within identified floodplain areas stand alone and are not identical to provisions outlined in the *Comprehensive Land Use Plan* adopted June of 2005 by the Board of County Commissioners. The County, as a whole, is covered under the NFIP. The latest floodplain studies conducted within the County occurred in November of 2013.

Floodplain Identification and Mapping

The map modernization program for Shelby County was initiated in 2008 with the initial scoping meeting held in June of 2008. The map modernization project for the County has been completed and became effective on April 2, 2015.

Each participating community in the NFIP program formally adopts effective flood maps by resolution or ordinance. Other activities include community programs for the awareness of flood hazards and actuarial rating for new construction for flood insurance.

Floodplain Management

Each participating community in the NFIP program has a Designated Floodplain Administrator (DFPA) that serves as the jurisdiction's Floodplain Administrator per resolution or ordinance. Each Floodplain Administrator is generally the person actively administering the floodplain management program in the community, although there may be others to assist.

The participating NFIP communities have current floodplain standards and regulations included in zoning and subdivision regulations. If necessary, special purpose regulations are adopted by formal resolution or ordinance. These codes and regulations are enforced by each jurisdiction's Floodplain Administrator who also conducts floodplain monitoring. Mitigation efforts on new and improved structures are controlled through building permits and other applications submitted to each political jurisdiction having authority over new and improved building construction covered under their individual floodplain standards and regulations. Each of these jurisdictional regulations/ordinances meets the current NFIP requirements. According to the Ohio Department of Natural Resources, none of these jurisdictions are a part of the Community Rating System (CRS).

Shelby County Communities Participating in the National Flood Insurance Program

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Reg-Emer Date
390503	Shelby County	12/20/74	09/02/82	04/02/15	09/02/82
390507	City of Sidney	05/24/74	11/17/82	04/02/15	11/17/82
391007	Village of Anna			04/02/15	
390504	Village of Botkins	05/31/74		04/02/15	09/29/78
390830	Village of Fort Loramie			04/02/15	
390505	Village of Jackson Center	05/31/74	04/01/09	04/02/15	04/01/09
395376	Village of Lockington			04/02/15	
390506	Village of Port Jefferson	08/09/74	09/02/88	04/02/15	09/02/88
390880	Village of Russia		09/30/88	04/02/15	09/30/88

The Village of Kettlersville has not had a special flood hazard identified within its jurisdiction and therefore is not participating in the National Flood Insurance Program (NFIP).

6.1.7 Flood Control

Flood control projects have traditionally been used by communities to control or manage floodwaters. They are also known as “structural” projects that keep flood waters away from an area as opposed to “non-structural” projects, like retrofitting, that do not rely on structures to control flows.

In 1997, \$200,000 was budgeted to the Loramie Valley Alliance (LVA) from the Ohio General Revenue Fund to implement flood control and water quality improvements in the Loramie Creek Watershed. According to the coordinator for the LVA, there is a huge interest in reducing flooding in the Loramie Watershed. To date, all funds used have been geared toward the removal of log jam obstructions on the Loramie Creek and its tributaries. The removal of these obstructions has alleviated flooding pressure caused by the back-up of the jams.

6.1.8 Flood Control Measures

The most common type of measures that keep flood waters away from an area are reservoirs and dams, diversion channels, levees and floodwalls. As previously described in Section 4.3, Shelby County has two Class I dams, a diversion channel on Lake Loramie, and one levee located in the City of Sidney. Measures to minimize infiltration of water from these structures are directed toward periodic inspection and the implementation of repairs or replacement whenever needed. Shelby County has no formal floodwalls.

The City of Sidney also has a Flood Abatement Program that was established to address residential properties that were succumbing to sewer backups and basement flooding during precipitation events. The original program provided monetary relief to the property owner to address flood control measures on private property. These measures included the removal of foundation drains, roof drains and/or the installation of backflow prevention devices on the sanitary lateral.

The Flood Abatement Program was modified to incorporate residential or private property problems discovered during the City's Inflow and Infiltration Reduction (I/I) Program. This program is an ongoing and active program whereby City staff members investigate sources of I/I into the City's sanitary sewer system. The I/I Reduction Program utilizes numerous tools such as sewer televising, smoke testing, flow monitoring and dye testing to identify those contributors of clean water into the sanitary sewers.

Reduction of I/I into the sanitary sewer system has become the City Sewer Department's primary objective. Clean water intrusion into the sanitary sewer system creates potential sewer flooding problems and increases the City's operational costs at the Wastewater Treatment Plant.

The majority of I/I discovered comes from private property sources, such as, downspout connections to sanitary laterals, missing or defective cleanout caps, foundation drain connections to the sanitary laterals and/or defective sanitary lateral pipes. It has become necessary to modify the Flood Abatement Program to provide monetary assistance to residential property owners that have been identified and targeted for repairs or removal of their contributing I/I.

6.1.9 FEMA's Risk Mapping, Assessment, and Planning Program

On March 6, 2013 a Flood Risk Review (FRR) Meeting was held for Shelby County as well as a Flood Risk Information Open House held on July 25, 2013. These meetings were held to review the newest floodplain maps. as part of the Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program. The meetings were conducted by FEMA, the Ohio Department of Natural Resources (ODNR), and STARR, a joint venture mapping partner to FEMA. These interactive meetings allowed an opportunity for the technical staff of the County to view the community's spatial flood risk data and ask questions about the data development methods. It was an opportunity to learn about how the County could use these data to communicate risk to County residents. Local education about flood risk and risks from other hazards is an essential part of building community resilience through mitigation action.

As a follow-up to those meetings, the County was presented changes since the last Flood Insurance Rate Maps (CSLF) dataset and the Flood Depth Grid dataset were obtained. The CSLF dataset provides information regarding changes made to the mapped floodplain and floodway boundaries during the course of an updated study of flood hazards for Shelby County and any impacted jurisdictions. The Flood Depth Grid dataset identifies the depth of flooding at multiple flood recurrence intervals where data were available. The CSLF and Flood Depth Grid data will be include in a Flood Risk Report and Flood Risk Map that will be delivered to you in the future. In addition, we have enclosed *User Guidance for Flood Risk Datasets and Products* to explain how these products are intended to be used to help you plan and communicate about risk in your community.

6.1.10 FEMA's MAP Program and Shelby County Resilience Group Meeting

In the spring of 2015, Shelby County was invited to participate in FEMA's Risk Mapping, Assessment, and Planning (MAP) program. The focus of the program is to reduce risk by increasing public awareness and identify ways FEMA can support the County's risk reduction efforts. County officials met with representatives from FEMA Region 5 and the Stantec consulting group several times throughout the summer, fall, and winter months. During the meetings, the County's hazard mitigation interests, needs and goals were discussed and actions to reduce risk were identified. Technical assistance was given to use depth grids showing impact on parcels and roadways within the identified floodplain along Lake Loramie and Loramie Creek.

On January 12, 2016, a meeting was held of the Shelby County Resilience Group. The community resilience meeting is one of the multiple interactions FEMA, ODNR and Ohio EMA have with communities during the Shelby County Flood Insurance Rate Map (FIRM) update process. This meeting included representatives from the Village of Botkins, Village of Fort Loramie, Village of Jackson Center, City of Sidney, Shelby County, FEMA, Ohio DNR, Ohio EMA and Stantec. The intent of this meeting was to provide general information on actions that Shelby County could take to enhance their sustainability, discuss possible areas of mitigation interest and to identify mitigation technical support to help communities advance mitigation projects. The desired result of this meeting was to provide technical support that could be used by Shelby County to reduce risk.

During the meeting, a variety of mitigation actions were discussed that could potentially mitigate a number of flooding issues throughout the County. Following a review of these potential mitigation actions, the Mitigation Committee agreed to initially incorporate them into the proposed Action Matrix as “new” projects. All proposed mitigation activities would then be discussed and finalized by the Committee at a subsequent meeting.

6.1.11 Drainage Maintenance Measures

Man-made Ditches and Storm Sewers

Man-made ditches and storm sewers help drain areas where the surface drainage system is inadequate, or where underground drainage-ways may be safer or more practical. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer improvements are designed to carry the runoff from smaller, more frequent storms. There are three types of drainage improvements that are usually pursued to reduce storm water flooding: putting drainage-ways in underground pipes, channelization, and removing obstructions caused by stream crossings, such as culverts and bridges with small openings. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water. To reduce the cumulative downstream flood impacts of numerous small drainage projects, additional detention or run-off reduction practices should be provided in conjunction with the drainage system improvements.

Adequate field drainage remains a very important issue for the majority of landowners in the Lake Loramie Watershed. The Shelby SWCD currently employs two individuals to handle the workload generated from requests related to field drainage. The Shelby County Engineer’s Office also manages a significant workload relative to ditch maintenance.

Several miles of Loramie Creek, from Lake Loramie to Loramie-Washington Rd., and one of its primary tributaries, Mile Creek, are maintained as open ditches. These stream segments were petitioned in 1981 for spot clean out, sandbar removal and brush clearing. The Mile Creek section also included bank reconstruction. The permanent maintenance program for these drainage projects includes periodic brush, log jam and sandbar removal. A 15-foot wide strip is kept clear of trees along the length of these stream segments to accommodate maintenance access. The access strips are recorded as easements on the adjacent property.

Diversion Channels

A diversion is a new channel or overflow weir that sends floodwater to a different location, thereby reducing flooding along a watercourse. During normal flows, the water stays in the old channel. During flood flows, the stream spills over to the diversion channel.

The Lake Loramie diversion channel functions to a very limited extent for flood control. However, Lake Loramie is impounded by a 3,260 foot earth embankment, stretching northwest to southeast, with a maximum height of 23 feet. Sluice gates atop the concrete weir spillway determine the lake level.

Two separate outlet gate structures are located in the northern portion of the dike. The southward outlet is utilized to draw down the lake. The northern gate structure, once linked to the feeder canal, is now permanently sealed.

6.2 Structure and Infrastructure Projects

These types of projects involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. Many of these types of actions are projects that may be eligible for funding through the FEMA Mitigation Assistance Program.

Such protective measures are usually undertaken by property owners on a building-by-building or parcel basis. They help reduce a building's susceptibility to flood damage.

6.2.1 Acquisition

Acquisition of a property and removing any structures eliminates the potential for harm to residents and businesses. After any structures are removed, the land is usually converted to public use, such as a park, or allowed to revert to natural conditions.

6.2.2 Relocation

Relocation is moving a building to higher ground, either within the same property boundary or to a separate property. The building should always be moved to an area not susceptible to flooding.

6.2.3 Retrofitting

Retrofitting a flood-prone structure entails installing flood protective measures on a specific structure or group of structures. Some of the more common examples of retrofitting and flood-proofing are elevating a flood-prone building above the flood level, creating barriers around a flood-prone structure, dry flood-proofing a structure to make it water-tight and wet flood-proofing to intentionally allow flood waters to enter and yet reduce water pressure on the structure.

Retrofitting structures for other hazards is also possible. Structures affected by high winds can possibly be mitigated by securing a roof structure with adequate fasteners or tie downs to mitigate damage that may occur. Other retrofits are to strengthen garage doors, windows and other large openings. For tornadoes, constructing underground shelters or safe rooms can save lives. Burying power lines is a retrofit measure that addresses the winds from tornadoes, thunderstorms and ice that accompany winter storms.

6.2.4 Safe Rooms

Safe rooms provide protection for citizens during periods of severe weather such as straight-line winds and, most particularly, tornadoes. Safe rooms can be installed during initial construction or as an addition to existing structures. Safe rooms can be installed within a structure or externally.

The Shelby County Mitigation Committee has included, within its Mitigation Plan update, a provision of its Action Plan that encourages the construction of safe rooms for new and existing structures. Construction of these rooms is completely under the control of the property owner.

6.3 Natural Systems Protection

6.3.1 Riparian Buffer/Wetland Protection

Riparian area refers to the vegetated area next to a watercourse often thought of as the floodplain and its connected uplands. Riparian buffers can protect water resources from non-point source pollution and provide bank stabilization, flood storage and aquatic wildlife habitat. They can be a natural resource management tool used to limit disturbance within a certain distance of a water course to maintain streamside vegetation. Some communities in the State of Ohio have proceeded to adopt riparian buffer overlays and zoning ordinances to reap the benefits of such protection.

Currently, neither Shelby County nor any of its villages or townships have codes for the development and protection of wetlands. The Shelby Soil and Water Conservation District (SWCD) uses the State and Federal programs as they become available for issues associated with wetlands protection.

6.3.2 Open Space Preservation

Open space preservation is a technique that can be used to not only preserve floodplains but to preserve lands that may be crucial to controlling runoff that adds to flood problems. Existing undeveloped areas can be preserved as open space through zoning ordinances. Lands that ought to be set aside as open space but are already being put to other uses can be converted to public ownership (acquisition) or to public use (easement). Once the land is owned by the county, municipality, or state, buildings and other development that are subject to flood damage can be removed or prohibited. Open space lands and easements do not always have to be purchased outright. Developers can be required to dedicate land to the public for a park and/or to provide easements for flood flow, drainage or maintenance.

Shelby County Park District operates three park facilities which include Bornhorst Woods, Hardin Park, and a portion of Lockington Reserve. The Miami Conservancy District owns Lockington Reserve. The total acreage for outdoor recreation is 6,286 acres. In addition, the County contains several outstanding recreation resources, including the North County National Scenic Trail, Buckeye Trail, Lake Loramie State Park, Lockington Locks State Memorial, and the Miami and Erie Canal. Outdoor educational areas such as Lake Loramie, Gross Woods State Nature Preserve and Lockington Reserve provide for wildlife observation, bird watching, fishing, hiking and outdoor learning.

6.3.3 Watershed Planning Efforts

Approximately 95% of the County lies in the Upper Great Miami River basin, which flows south to the Ohio River. A small area in northwest Shelby County drains into tributaries of the Auglaize River, which ultimately drains to Lake Erie.

6.3.4 Habitat Restoration

In urbanized watersheds, some stream and/or rivers suffer the effects of increased erosion and water quality problems because of the amount of development that is occurring in a given area. Bioengineering techniques can help prevent further degradation and also provide water quality and habitat benefits.

Biotechnical practices use vegetative or other natural materials to achieve stream management objectives, usually erosion control. One of the chief advantages of biotechnical practices is that they help restore natural stream features, like in-stream habitat and stream-bank vegetation. The

materials used for biotechnical practices are generally less expensive than for more traditional approaches, but installation is more labor intensive and they may require more frequent maintenance.

The ODNR has published a *Stream Management Guide #10*. This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. It maps and briefly describes some of the many projects that have been constructed in Ohio using biotechnical practices, including the installation date.

Loramie Watershed Association

A local network of landowners banded together in order to voice concerns relative to area flooding and formed the Loramie Watershed Association. When the Loramie Watershed Association began working toward solving drainage problems, it became clear that in order to achieve its goals, the concerns of other groups must be recognized and appreciated.

Great Miami River Watershed Network

The Great Miami River Watershed Network is a voluntary group that meets quarterly to discuss items of mutual concern related to water resources. The Miami Conservancy District and the Miami Valley Regional Planning Commission cosponsor the group and facilitate the quarterly meetings. The network provides a forum where watershed-related organizations in the Great Miami River Watershed can maximize their resources and work together.

Middle Great Miami Watershed Alliance

The Middle Great Miami Watershed Alliance developed from a request from multiple parties to address water issues in the central and northeast portions of Miami County. The Alliance works to promote the wisest use of the land and water resources for the present and future generations. Although the Alliance was originally developed for Miami County, the Middle Great Miami Watershed Alliance encompasses portions of the Great Miami River and tributaries on both the east and west sides of the river, from downstream of Plum Creek to upstream of Honey Creek. The watershed also includes the drainage area of Lost, Spring, Peters, Tawawa, Leatherwood, and Mosquito creeks, and includes areas in Miami, Shelby and Champaign counties.

6.3.5 Conservation Reserve Program (CRP)

The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The CRP is administered by the Farm Service Agency, with the National Resource Conservation Service (NRCS) providing technical land eligibility determinations, conservation planning and practice implementation.

The CRP reduces soil erosion, protects the ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers.

Filter strips are implemented as part of the CRP program. Filter strips are buffer strips placed along creeks and ditches that “filter” or mitigate the movement of sediment, nutrients and pesticides within farm fields and from farm fields. Filter strips can be 15 to 100 feet wide and may be grassed areas or trees.

Grassed waterways control erosion in a cultivated field. When a crop field is experiencing gully erosion, constructing a grassed watercourse helps to stop the erosion and make the area more crossable with tillage equipment. If eligible, landowners receive maximum 90% cost-share assistance from the Farm Service Agency for the excavation of a grassed waterway, tile installation (up to six feet) for the distance of the waterway, and any necessary structures, through the CRP. In addition, the CRP program provides a rental payment for the land in grassed waterways for 10 years.

6.4 Education and Awareness Programs

The Shelby County Mitigation Planning Committee views educational and awareness programs as paramount in mitigating natural disasters that impact the County. This consideration is demonstrated by the goals and objectives established by the Committee and are reflected in the prioritization of educational materials as a main component of the Mitigation Plan’s Action Matrix.

The distribution of these educational materials and their availability to citizens as a part of the County’s website improves citizen knowledge of what to do, both individually and collectively, to protect them from the effects of natural disasters on their communities.

Within the County there are additional educational and awareness programs that are directed toward various natural disaster mitigation activities. Some of these programs are as follows.

6.4.1 Public Information Programs

A successful hazard mitigation program involves both the public and private sectors. Public information activities advise property owners, renters and businesses about hazards and ways to protect people and property from these hazards. These activities can motivate people to take the steps necessary to protect themselves and others. Information can initiate voluntary mitigation activities at little or no cost to the government. Property owners mitigated their flooding problems long before there was government funding programs.

6.4.2 Environmental Education

The Shelby County SWCD considers the education program to be preventive medicine for the environment. Programs, such as Envirothon and Conservation Day Camp, are offered for preschoolers through adults. They are offered in schools, clubs, Boy and Girl Scout groups, civic organizations, churches, and any other interested organizations. Topics offered include water quality, soils, agriculture, wetlands, wildlife, trees or numerous other natural resources issues.

6.4.3 Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program (CREP) program is a Federal/State conservation partnership program recently approved for Ohio’s Western Lake Erie Watershed. A portion of Dinsmore, Mclean and Van Buren townships in Shelby County, drain into the Auglaize River which eventually drains into the waters of Lake Erie.

The intent of the Ohio CREP is to reduce stream sedimentation, filter surface water runoff prior to entering streams or open ditches and enhance wildlife habitat. Numerous federal and state agencies, as well as conservation organizations, are partners in the CREP effort.

The CREP is a voluntary program that uses financial incentives to encourage farmers to enroll in the CRP by committing to protect land for either 15, 20, or 30 years, depending upon the enrolled practice. In addition to reducing runoff of soil sediment, nutrients, and pesticides, watercourse buffers also help lower water temperatures, increase dissolved oxygen and provide additional habitat for fish and wild life. Other eligible practices for this program include hardwood tree plantings, filter strips, wetland restoration, field, (farmstead) windbreaks and wildlife habitat incentive.

6.4.4 Urban Conservation

The Shelby County SWCD offers urban conservation services to urban homeowners, including soils advice, tree sales, yard waste composting, drainage assistance and backyard conservation. The SWCD is also involved in assisting the Shelby County Health Department with evaluations of development sites. The SWCD evaluates the drainage aspects of a site and makes recommendations to the Health Department.

6.4.5 Outreach Projects

Outreach projects are the first step in the process of orienting property owners to the hazards they face and the concept of property protection. They are designed to encourage people to seek out more information in order to take steps to protect themselves and their properties.

Research has proven that outreach projects work. However, awareness of the hazard is not enough; people need to be told what they can do about the hazard, so projects should include information on safety, health and property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

6.4.6 Real Estate Disclosure

Many times after a natural disaster, people say they would have taken steps to protect themselves if only they had known they had purchased a property that was exposed to a natural hazard. By reaching out to residents in a community, they become informed as to what hazards are a potential in the community. The community has provided them with information that they did not have previously. This knowledge allows them to make an informed decision on purchasing insurance to cover their potential losses.

6.4.7 Federal law

Federally regulated lending institutions must advise applicants of a mortgage or other type of available loan if the property is in a floodplain as shown on the most current Flood Insurance Rate Maps. If so, flood insurance is required for buildings located within the floodplain if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

6.4.8 State law

The State of Ohio's Department of Commerce has a Residential Property Disclosure Form pursuant to section 5302.30 of the Revised Code and rule 1301:5-6-10 of the Administrative Code. It is to be completed by the owners who want to sell their property. Under a good faith stipulation, they are to note any areas of the house that may be dangerous which include being in a floodplain or Lake Erie Coastal Erosion Area, whether there are drainage/erosion problems, or if there are zoning/code violations.

Shelby County and surrounding areas' multiple listing services do not include a listing of whether a property is in a flood zone or wetland. Disclosure practices are left up to the individual real estate broker or agent.

6.4.9 Websites, Social Media and Libraries

The County maintains a website of general county information such as departments and engineer's information (www.co.shelby.oh.us). The Shelby County Emergency Management Agency (www.co.shelby.oh.us/emergency-management) website is a resource for disseminating educational materials concerning the natural hazards that affect communities. Other community websites include:

www.sidneydailynews.com Sidney Daily News - Sidney, OH
<http://www.1055tamfm.com/> WMVR 1080 AM / 105.5 FM - Sidney, OH

The Shelby County EMA, along with the City of Sidney and county villages use social media platforms such as Facebook and Twitter to disseminate preparedness and emergency information to the public.

In addition, the Shelby County SWCD operates a lending library for environmental and agricultural books, pamphlets, leaflets and videos. These materials are made available for public use.

7.0 PROBLEM STATEMENTS, GOALS AND OBJECTIVES

Problem statements, goals and objectives are needed for any planning effort to guide the assessment of the possible mitigation measures. The recommended actions of this plan are consistent with what is appropriate for Shelby County. Mitigation goals and objectives reflected community priorities and should be consistent with other plans for the County.

After the determination of the ~~draft~~ problem statements identified below, the Plan Update Committee developed ~~the following~~ goals and objectives in the order of the prioritized hazards.

7.1 Flooding

Flooding - Problem Statements

Numerous roads, culverts and bridges within the County are being washed out during flood events.

There is a lack of awareness and education of the dangers of flooding in the county.

The County does not have any regulations for above ground propane tanks located outside of the 100-year floodplain.

Some citizens are apathetic to the dangers associated with driving through high flood water.

The majority of Shelby County relies on wells for water. These wells have the potential to become contaminated when inundated with flood water.

The County lacks a river/stream maintenance program, which includes addressing debris and log jams.

Flooding - Goals and Objectives

Overall Goal: To save lives and protect property by reducing the impact of flooding to the communities and residents of Shelby County.

Objective 1: To reduce damage, and expedite the recovery process.

Objective 2: To establish administrative controls for construction.

Objective 3: To educate citizens to increase their awareness of and preparedness for the hazards associated with flooding.

7.2 Summer Storms (Thunderstorms, High Winds, Hail and Lightning)

Summer Storms - Problem Statements

Prolonged power outages have adverse effects on the communities and residents including the Functional Needs population within the County.

Many communities have large, older trees that are susceptible to losing limbs or being knocked down by high winds. Uprooted trees and limbs cause damage to power lines.

Hail can cause extensive roof damage to new and older structures.

Some ditches and culverts throughout the county lack the capacity to carry flow from heavy rain events.

Shelby County lacks adequate numbers of sirens and NOAA weather radios to afford all the opportunity to receive early warning of approaching severe weather.

Some critical facilities, those facilities that need to maintain power at all times, are not equipped with back-up generators in the event of a power outage.

There is a lack of education on the dangers and hazards associated with severe storm events as well as how to prepare for them.

Summer Storms – Goals and Objectives

Overall Goal: To save lives and protect property by reducing the impact of summer storms – thunderstorms, hail, and lightning, to the communities and residents of Shelby County.

Objective 1: To educate citizens to increase their awareness of and preparedness for severe storm events.

Objective 2: To maintain operations of critical facilities and emergency services.

Objective 3: To improve the warning system throughout the County.

7.3 Winter Storms (Snow, Ice and Extreme Cold)

Winter Storms – Problem Statements

Some critical facilities, those facilities that need to maintain power at all times, are not equipped with back-up generators in the event of a power outage.

There is a lack of education on the dangers and hazards associated with winter storm events as well as how to prepare for them.

The County does not have an accurate account of the number of Functional Needs population or where they are located within the County.

Prolonged power outages have adverse effects on the communities and residents including the Functional Needs population within the County.

The citizens within Shelby County are unaware of designated shelter locations where they can seek safety in the event of a winter storm.

Some of the older homes existing in the County may be unable to withstand the weight of a heavy snowstorm because they were built prior to the County establishing building codes which address snow loads.

Blocked roadways and transportation may interrupt service and make it difficult for citizens to receive help and seek safety.

Winter Storms – Goals and Objectives

Overall Goal: To save lives and protect property by reducing the impact of winter storms – snow, ice, and extreme cold, to the communities and residents of Shelby County

Objective 1: To educate citizens to increase their awareness of and preparedness for winter storm.

Objective 2: To maintain operations of critical facilities and emergency services.

Objective 3: To reduce property damage caused by severe weather.

7.4 Tornadoes

Tornado – Problem Statements

Shelby County lacks adequate numbers of sirens and NOAA weather radios to afford all the opportunity to receive early warning of approaching severe weather.

There are no regulations that require safe rooms to be included in new construction.

There are no tornado shelters or permanent structures near mobile home communities or campgrounds.

The County may be unable to keep up with debris removal after an event due to lack of manpower and equipment.

Some critical facilities, those facilities that need to maintain power at all times, are not equipped with back-up generators in the event of a power outage.

Tornado – Goals and Objectives

Overall Goal: To save lives and protect property by reducing the impact of tornadoes to the communities and residents of Shelby County.

Objective 1: To build the warning system throughout the county.

Objective 2: To identify safe locations for all citizens during tornado events.

Objective 3: To increase citizen's awareness of and preparedness for the hazards of tornadoes, and where to seek safety during tornado events.

7.5 Droughts and Extreme Heat

Drought and Extreme Heat – Problem Statements

There is a lack of public awareness concerning open burning issues during times of drought.

During droughts, the County's wells may be susceptible to running dry, which would deplete the communities' water supplies.

Due to the extremely dry conditions, the risk of grass fires increases. Grass fires may grow uncontrollable and quickly spread endangering lives and property.

Individual communities do not have contingency plans for an alternate water supply in case wells begin to dry up.

Water treatment plants within the county may not have the capacity to treat raw water that is needed during drought conditions.

Drought and Extreme Heat – Goals and Objectives

Overall Goal: To save lives and protect property by reducing the impact of drought **and** extreme heat to the communities and residents of Shelby County.

Objective 1: To educate citizens including the functional needs population to increase their awareness of and preparedness for drought and extreme heat.

Objective 2: To develop a drought emergency plan to include contingency plans for alternate water sources.

Objective 3: ~~To reduce potential damage through preplanning.~~ To establish and promote accessible heating and cooling centers in the communities.

7.6 Earthquakes

Earthquake – Problem Statements

There is a lack of public awareness in the County concerning how to react safely in the workplace and at home in the case of an earthquake.

Some critical facilities, those facilities that need to maintain power at all times, are not equipped with back-up generators in the event of a power outage.

Water wells can be affected when earthquakes take place.

Wells may be damaged and water service disrupted to communities as a result of a quake.

Transportation service may be interrupted due to road and infrastructure damage.

Older buildings existing in Shelby County have not been built or upgraded to current seismic codes and may suffer significant damage from an earthquake.

Mobile homes may not have adequate foundation/anchoring and may suffer significant damage.

Earthquake – Goals and Objectives

Overall Goal: To save lives and protect property by reducing the impact of earthquakes to the communities and residents of Shelby County.

Objective 1: To educate citizens to increase awareness of and preparedness for the hazards of an earthquake event.

Objective 2: To protect and reduce damage to critical facilities and infrastructure.

8.0 ACTION MATRIX

8.1 Action Matrix Development

A major component of the Mitigation Plan is the development of an overall action matrix for the County. A first step in that development is determining mitigation actions for each of the identified hazards.

During the 2005 planning activities, the Core Group chose a total of 50 potential mitigation activities. Of those 50 activities, 17 were labeled as “prioritized” activities. The results of the Core Group activities comprise the initial Action Matrix. These results can be found on the County’s website: http://co.shelby.oh.us/CommissionersOffice/pdffiles/2005_SC_MitigationPlan.pdf found in Section 8.0. The finalized 2005 Action Plan can be found in Appendix N of that Plan. The Plan Update Committee used the 2005 prioritized Action Matrix as a foundation for the Action Matrix of the updated Plan.

A modified version of the 2005 Action Matrix was developed and submitted to the Update Committee for their review and assessment. This modified version contained several changes. One modification included the numerical “priority” breakdown from the 2005 Matrix. Another change was the consolidation of duplicate “mitigation actions” that spanned multiple “hazard” types. A final modification included a “Status” column. The Committee was charged with determining whether each of the 2005 mitigation actions would be considered as “on-going,” “completed,” or was to be “deleted” from the newly developed matrix.

In conjunction with this activity, the Committee was also sent two additional documents for their consideration. The first, expanded the proposed Action Matrix to include the 16 new mitigation actions, as mentioned in Section 3.3. A separate form was also created for the Committee to numerically evaluate both the old and the new mitigation actions. These actions were evaluated and prioritized for inclusion within the final Action Matrix. The items submitted to the Committee for their initial review and assessment can be found in Appendix H.

8.2 Evaluating and Prioritizing Mitigation Actions

Once the initial status determination was completed, the Committee utilized a similar method of assessment used in the 2005 Plan to prioritize the final list of mitigation actions that would be identified within the new Action Matrix. This assessment process used a scoring methodology to rate each proposed mitigation action on the basis of the following criteria topics: Technically Feasible, Frequency of Hazard Risk, Activities Reduce Risk, and Funding Available. Committee members used values from 1 to 5 (with 5 being highest) to rate each mitigation action.

This assessment form, as mentioned previously, including instructions, was sent to all Committee members as an e-mail attachment (See Appendix H). Once the forms were completed, Committee members returned them via e-mail to the Shelby County EMA Director for totaling and averaging. The numerical results for each mitigation action, as well as their projected priority status, were then sent back to the Committee members for their review in preparation for discussion and finalization at the next scheduled meeting.

8.3 Matrix Results

The Action Matrix lists all of the mitigation actions from the 2005 Plan as well as the new projects submitted for this phase of the planning process. Each mitigation action was categorized by the hazard type(s) associated with it. Many of the mitigation actions within the Matrix addressed multiple hazards and were broken down as such within the table. Each of the mitigation actions were assessed and prioritized according to the process described above. Mitigation actions that spanned multiple hazards were prioritized collectively as a single priority.

Once this task was completed, for each mitigation action, the Committee identified: the projected start and end dates, the lead agencies that would be associated with the activity; the resources that would be used to fund the activity; and the activity's current status. Any remarks regarding the action were also included as a part of the Matrix.

The finalized Action Matrix, found in Appendix I, will be updated as a part of the annual Plan review as described below.

9.0 Plan Finalization and Maintenance

9.1 Draft Plan Finalization

After developing the Action Matrix, the Plan Update Committee proceeded to finalize the draft Plan. With the proposed changes in the Plan discussed and accepted by the Plan Update Committee, the Plan was properly formatted to reflect the modifications and additions made to the Plan throughout the entirety of the planning process. Once this activity was completed, the updated Plan was reviewed by the Committee to affirm that no additional changes to the draft needed to be made at this point. The final proposed Plan draft was then placed on the County's website for public review as previously described.

9.2 Formal Public Review and Open House

Once the finalized draft was placed on the County's website, the public was informed via news release of that fact and encouraged to review the draft prior to an upcoming formal Open House. The public was given a sufficient period of time to review the draft Plan on the County's website. This additional time for public review would give citizens the opportunity to develop questions or comments before attending the Open House. This formal Open House would be used to afford the citizens of Shelby County the opportunity to discuss and comment upon any additional modifications to the draft that may need to be made prior to its submission to OEMA and FEMA. The correspondence associated with these events can be found in Appendix A.

The Open House was scheduled and took place on November 16, from 4-6 pm in the conference room of the Shelby County EMA. At the Open House there were ? citizens in attendance. ...

9.3 Draft Plan Submission

Following the final additions and corrections made to the draft Plan, the draft was submitted to the OEMA and FEMA for their review. In conjunction with this submission, a planning crosswalk was completed and submitted along with the draft. The crosswalk provided the location of information within the Plan draft that addressed topics and issues of planning that are required by FEMA.

Once the Plan update receives final approval from FEMA, it will become a part of the Shelby County website. Any subsequent modifications to the Plan will be incorporated on the website so that citizens will have access to the most updated version of the Plan.

9.4 Plan Finalization

Following receipt of any recommendations for correction by OEMA and FEMA to the draft Plan, those necessary modifications will be incorporated within the draft. The modified draft will then be resubmitted to FEMA for final approval in conjunction with approved resolutions from the County Commissioners, the incorporated jurisdictions within the County as described below.

The Final Mitigation Plan was then prepared and provided in digital format to the jurisdictions within Shelby County for their review. Any township choosing to formally adopt this Mitigation Plan as a separate entity from the County also received a digital copy of the plan.

The County Commissioners and each incorporated jurisdiction within the County have the responsibility for adopting and administering the Mitigation Plan. Those not selecting to formally adopt the Plan will not be eligible to receive mitigation monies to support any mitigation efforts throughout the five-year mitigation plan cycle.

9.5 Plan Adoption

During the course of these mitigation planning efforts, each political subdivision was given the opportunity to participate in all phases of Plan development as described above. Plan adoption completes this portion of their commitment to mitigate natural disasters within their communities.

Formal adoption of the Shelby County Mitigation Plan follows the completion of the final Plan and the necessary approvals from OEMA and FEMA. Formal adoption primarily comes in the form of a resolution, depending upon the requirements of the political subdivision in question.

The governing bodies of all political subdivisions identified as a part of the Plan were provided a copy of the final Plan update for their review. Representing the political subdivisions affected were the Shelby County Commissioners, the City of Sidney, and village councils within the County.

Representatives of the Mitigation Plan Update Committee solicited the support and full adoption of the Plan by direct contact with the Shelby County Commissioners and the mayors of the City of Sidney and the incorporated villages within the County. This contact served to solidify understanding of their responsibilities under the mitigation planning process.

To assist in the timely Plan approvals by the affected political subdivisions, the Update Committee requested that formal consideration of initial Plan approval be placed on the meeting agendas of the relevant political subdivisions. Subsequent distribution of the Plan among members of these political bodies would allow for their timely review before formal consideration of the Plan and the development of the final adoption resolution.

Copies of all resolutions passed by these entities will be submitted to the Mitigation Planning Committee and maintained as a part of the Mitigation Plan within Appendix K. Copies of the resolutions will also be forwarded to the Ohio Emergency Management Agency for their files.

9.6 Plan Distribution

Once the Plan receives formal approval from FEMA, it will be distributed via several formats. A digitized copy of the Plan will be placed on the County's webpage for continual public review. Future modifications to the Plan will be incorporated within the Plan website. Digitized copies of the Plan will also be distributed to all incorporated jurisdictions within the County as well as the Office of the County Board of Commissioners. Replacement versions will be provided to these entities as modifications are made. Hardcopy versions of the Plan and future modifications will be made available in the office of the County Emergency Management Agency as well as public libraries throughout the County.

9.7 Plan Review and Maintenance

The Plan Update Committee decided that the Plan would be reviewed annually. The primary review would focus upon the Action Matrix items found in Appendix H. Any updates to that portion of the Plan would be made at that time. Actions that had changed in status such as those completed and recent occurrences of natural disasters would be modified accordingly and placed directly on the County's website as previously described. It was also decided that the main body of the Plan containing population data, financial losses, and similar data would be made following the five-year anniversary of the Plan. These changes would be incorporated as a part of the next five-year Plan update.

Citizens of Shelby County will have the continued opportunity to review and comment on the finalized Plan as they did throughout the planning process. As stated previously, the draft Plan, as well as the finalized Plan will continue to be a part of the Shelby County website. Once the Plan is finalized and placed on the website, residents will be informed of this action. Citizens will also be informed of when the Planning Committee will hold its annual review of the Plan. This will provide them with an additional opportunity to comment on any updates to the Plan.

9.8 Plan Integration

As indicated previously, hazard mitigation processes and activities outlined in the Shelby County Mitigation Plan have been, and will continue to be, components of other County plans as well as local ordinances. These additional documents, described in Section 6.1, include the County's *Comprehensive Land Use Plan*, the *Shelby County Emergency Operations Plan*, and other local ordinances, primarily relating to floodplain management. Each jurisdiction's officials and representatives follow the same practices as the County when incorporating mitigation actions into local codes, regulations, and ordinances.

The *Shelby County Comprehensive Land Use Plan* utilizes incorporated mitigation procedures to help address the current and future status of the entire County. This document, as a part of the Environmental Task Force Report, includes specific goals and recommendations that relate to its coordination with the County *Emergency Operations Plan*.

In conjunction with both the *Comprehensive Land Use Plan* and the *Natural Hazards Mitigation Plan*, local ordinances incorporate mitigation activities that relate to their specific communities. These ordinances are primarily associated with floodplain management issues in limiting building within areas of the 100-year floodplain.

The County *Emergency Operations Plan* does not include the *Natural Hazards Mitigation Plan* as a formal component. However, natural disaster mitigation activities described in the *Mitigation Plan* can be used to help limit the adverse effects of natural disasters during necessary response actions described in the *Emergency Operations Plan*. Mitigation activities such as communications, in place for public warning, are indeed applicable to emergency responders during any type of emergency.

The incorporation of mitigation considerations within other County plans is crucial in minimizing the impacts of natural disasters on all areas within the County. Mutual coordination among all County agencies, departments, and political subdivisions is an important mechanism to mitigate the natural disasters that will occur. As an important component of the overall planning process, the Update Committee will continue to encourage the incorporation of mitigation activities within existing County plans as described in Section 6.1.

9.9 Resolution of Adoption

RESOLUTION NO.

ADOPTION OF THE UPDATED SHELBY COUNTY COUNTYWIDE NATURAL HAZARDS MITIGATION PLAN AND ESTABLISHMENT OF A SHELBY COUNTY NATURAL HAZARDS MITIGATION PLAN UPDATE COMMITTEE

WHEREAS, on _____, the Shelby County Commissioners passed Resolution No. _____ adopting the SHELBY COUNTY NATURAL HAZARDS MITIGATION PLAN (the Mitigation Plan) pursuant to _____ which established goals to minimize and reduce storm water damages to existing structures and land use in order to maximize the protection of public health, safety, and welfare, and identify and develop revenue sources to complete the goals and objectives; and

WHEREAS, the mission of the Shelby County Natural Hazards Mitigation Plan Update Committee is: "To develop a working document that fulfills the mandates of the Federal Disaster Mitigation Act of 2000, and satisfies the requirements of FEMA and the Ohio EMA, as well as meets the needs of all of Shelby County. Further, by researching and planning for future natural hazards and implementing appropriate mitigation techniques, all of Shelby County can save lives and protect property, reduce the cost of disasters and provide for a rapid and efficient recovery by coordinating response efforts, and increasing the educational awareness of natural hazard events and their effects on the people, property, and resources of all Shelby County; and

WHEREAS, on April 12, 2012 the Shelby County Emergency Management Agency Director approved the development of a Mitigation Plan Update on behalf of the Shelby County Board of County Commissioners; and

WHEREAS, a Mitigation Plan for Shelby County will be required beginning following FEMA approval of the Mitigation Plan Update to receive any state or federal mitigation funding such as flood prone property improvement or buyout funds; and

WHEREAS, the County of Shelby County is subject to flooding, tornadoes, winter storms, and other natural hazards that can damage property, close businesses, disrupt traffic, and present a public health and safety hazard; and

WHEREAS the Mitigation Planning Update Committee, represented by the Director of the Shelby County Emergency Management Agency and the Mitigation Planning Contractor and assisted by representatives from the County, municipalities and stakeholder organizations, has prepared a recommended Mitigation Plan that reviews the options to protect people and reduce damage from these natural hazards; and

WHEREAS, the recommended Mitigation Plan has been widely circulated for review by the County's residents and federal, state, local, and regional agencies and has been supported by those reviewers.

NOW, THEREFORE BE IT RESOLVED by the Shelby County Commissioners that:

1. SHELBY COUNTY NATURAL HAZARDS MITIGATION PLAN is hereby adopted as an official plan of Shelby County.
2. The Mitigation Planning Update Committee is hereby established as an advisory body. It shall be composed of the Director of the Shelby County Emergency Management Agency and the Mitigation Planning Contractor

3. The Plan Update Committee shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the Mitigation Plan
4. The Shelby County Mitigation Plan shall be a part of the Shelby County Emergency Management Agency web site for continual use and review by the public
5. Comments and suggestions for updating the Plan can be made to the Director of the Shelby County Emergency Management Agency

Passed by the Shelby County Board of Commissioners on

Vote:

Yes _____

No _____

