

2019 Delaware County Multi-Hazard Mitigation Plan



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2019 Multi-Hazard Mitigation Plan for Delaware County/Executive Summary

This plan serves as the official Delaware County Multi-Hazard Mitigation Plan (MHMP) for Delaware County and all included jurisdictions. Mitigation planning efforts for Delaware County began in 2006 with the creation of the All Natural Hazard Mitigation Plan the first Federal Emergency Management Agency (FEMA) approved plan for Delaware County. The 2014 version was the first official update to that plan. The 2019 Plan represents the most recent version of the mitigation plan for Delaware County.

Delaware County is at risk of damage due to flooding, winter weather, tornadoes, HAZMAT incidents, and other natural and man-made hazards. This plan provides a long-term approach to reducing the likelihood that a natural hazard will result in severe damage.

The Delaware County Office of Homeland Security and Emergency Management (DCOHSEM) in coordination with the Delaware Hazard Mitigation Planning Group (DMPG) and involved Delaware County Stakeholders and citizens were responsible for the research and development of the 2019 Delaware County Multi-Hazard Mitigation Plan. Endorsed by FEMA as being in compliance with regulations based on the Disaster Mitigation Act of 2000, the plan will help the County to implement mitigation projects in order to keep Delaware County's residents and property safe from disaster.

The hazard mitigation planning process consisted of gathering and analyzing data available from various sources. The data shows the hazards most likely to result in costly damages are flooding, tornadoes, severe winter weather, and severe summer weather.

The plan recommends a number of public education efforts, continued support for flood mitigation buy-outs, and the examination and the potential modification of planning guidance and other best practices to ensure the risk of damage to new structures is minimized. Many of these recommendations are highlighted in the Mitigation Strategy section of the plan.

By adopting this plan, Delaware County government, as well as the cities, villages, and townships within commit to working with citizens and business owners to make Delaware County safer.

This project was made possible through a Federal Emergency Management Agency grant provided by DHS: FEMA.

The 2019 MHMP includes the following key updates:

- Historical hazards: Each natural and man-made hazard section within this plan documents current NCDC, WebEOC, and other citable sources reported hazards.
- County profile: Demographics, social, and economic data, as well as existing and future land use descriptions, are updated to reflect the current status of the county and its jurisdictions.
- Planning description: The new planning team and updated planning process are described and documented.
- Risk assessment: The Risk Assessment for Delaware County was updated again for the 2019 plan during the mitigation plan update process. Earthquakes and Cyber Attacks were added during the 2019 update process. Slight changes to the methodology for ranking systems and added descriptions.
- Mitigation: The mitigation section addresses the status of the previous plan's strategies in addition to new mitigation actions.



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Glossary

Ashley	Village of Ashley
Delaware	City of Delaware
DGHD	Delaware General Health District
DMPG	Delaware Mitigation Planning Group
FEMA	Federal Emergency Management Agency
Galena	Village of Galena
HIRA	Hazard Identification and Risk Assessment
LEPC	Local Emergency Planning Committee
NCDC	National Climactic Data Center
NFIP	National Flood Insurance Program
MHMP	Multi-Hazard Mitigation Plan
ODNR	Ohio Department of Natural Resources
ODPS	Ohio Department of Public Safety
OEMA	Ohio Emergency Management Agency
Ostrander	Village of Ostrander
Plan	Delaware County Multi-Hazard Mitigation Plan
Powell	City of Powell
PUCO	Public Utilities Commission of Ohio
SHELDUS	Spatial Hazard Events and Losses Database for the United States
STACC	Statewide Terrorism Analysis & Crime Center
Sunbury	Village of Sunbury
TWP	Township
WS	Water Supply



SECTION 1. INTRODUCTION

The consequences of both man-made and naturally caused hazards and disasters touch all places and people across the United States disrupting commerce, damaging property, and even costing lives. Delaware County, Ohio recognizes the effectiveness of proper mitigation planning to prepare for and ultimately minimize the social, environmental, and economic costs of such events. Delaware County officials, local jurisdiction representatives, and numerous other interested stakeholders dedicated their time and efforts to develop this Delaware County Multi-Hazard Mitigation Plan (the Plan) with invaluable help from the Ohio Department of Public Safety's (ODPS) Emergency Management Agency (OEMA) and the Federal Emergency Management Agency (FEMA).

Four sections compose this plan detailing the methods, analysis, and discussion surrounding the various hazards that threaten Delaware County and its encompassing jurisdictions. This section includes a discussion about the general purpose and goals which the DMPG wishes to achieve throughout the development and implementation of the Plan along with a basic description of the Plan's authority within the policy-making process. This section also includes a short description of Delaware County and of each of the participating jurisdictions including their population size, important sites, and other general information. Section 2 of this Plan details the process involved in the conception of this Plan including a description of who actively participated in the process, how community involvement was incorporated, and how the Plan was composed through deliberations, reviews, and evaluations. A summary of the proposed Plan adoption and maintenance is also included in this section.

Sections 3 and 4 contain the actual analysis of the potential natural and man-made hazards and the resulting mitigation strategy derived by the DMPG Hazard Identification and Risk Assessment (HIRA) process. Section 3 contains comprehensive list of the natural and man-made hazards that are considered in the Plan and a list of excluded hazards including the reason for their exclusion. Each hazard is subsequently profiled by discussing each hazards nature, historical impact on Delaware County and its vulnerability to the hazard. A risk assessment is then included at the conclusion of each profile with the number of vulnerable structures and their asset values including critical facilities and publicly owned structures. Section 4 then outlines the goals, objectives, and actions for each jurisdiction as part of the complete Delaware County Multi-Hazard Mitigation Strategy.

1.1 PLAN PURPOSE AND AUTHORITY

A Countywide agreement for Delaware County creating a countywide Emergency Management Agency was approved by the Board of County Commissioners and a majority of the Chief Executives of the political subdivisions within the county on July 18, 1977. It was amended in July of 1986, March of 2002, early 2010, early 2012, and 2017.

The initial All Natural Hazard Mitigation Plan was presented upon its completion to Delaware County and its political subdivisions on July 5, 2006, and was subsequently adopted by them in September and October of 2006. The 2014 Plan was officially implemented/adopted on May 22nd, 2014. This updated Multi-Hazard Mitigation Plan will again be submitted to the Delaware County EMA Executive Board as it provides representation for Delaware County and its political subdivisions (Cities of Dublin, Columbus, and Westerville excluded) for adoption after final approval from Ohio EMA or FEMA. The jurisdictions will then adopt the Plan following agency review and final approval.

This plan serves many purposes as a helpful tool for citizens, policymakers, local businesses, and many other interested stakeholders who all share a public interest in keeping Delaware County as safe as possible. These purposes include but are not limited to the following listed below:

Minimize injuries and loss of human life– to achieve the plan’s main goal of reducing the impact of natural and man-made hazards on the wellbeing of Delaware County’s citizens.

Enhance public awareness and education- to widen the public’s understanding of natural and manmade hazards and how they might affect public health and safety, the environment, the local economy, and basic day-to-day operations.

Coordinate inter-jurisdictional preparedness measures- to encourage and ensure multi-jurisdictional cooperation in countywide mitigation actions and programs so that they may be implemented efficiently and effectively.

Provide decision-making tool for interested stakeholders- to formulate a comprehensive, updated analysis of Delaware County’s vulnerability to hazards so that decision-makers can better prepare for natural and manmade disasters.

Achieve regulatory compliance- to ensure that the county and its political subdivisions meet state and federal mitigation planning requirements so that they may eligible to participate in grant programs, policies and regulations.

1.2 PARTICIPATING JURISDICTION PROFILES

This Plan covers Delaware County including the following jurisdictions: The City of Delaware, City of Powell, Village of Sunbury, Village of Ostrander, Village of Ashley, Village of Galena, Village of Shawnee Hills, and the unincorporated areas of Delaware County. This Plan does not include the City of Columbus, City of Westerville or the City of Dublin. These cities, including the portions within Delaware County’s boundary, participate in an agreement with Franklin County Emergency Management and Homeland Security. Following Federal approval, the participating jurisdictions intend to formally adopt this Plan, by way of passing a resolution, unless already bound by Delaware County’s regulations, which were already approved and adopted.



1.2.1 Delaware County

With a total population of over 200,400 residents within an area of approximately 459 square miles, Delaware has consistently been the fastest growing of Ohio's 88 counties in the past decade. It has also been named as one of the top 20 fastest growing, wealthiest and most educated areas in the nation. Delaware County is also the 14th largest county in Ohio. Situated directly north of Franklin County, which contains the city of Columbus, Ohio's capital city, Delaware County is diverse in community personalities and economic profiles.

Delaware County contains the cities of Delaware and Powell and portions of Columbus, Westerville and Dublin and the villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury. It is expected with the 2020 Census that the Village of Sunbury will attain City designation. There are 19 townships in Delaware County; however, Washington Township is not included in this Plan as they are included in Franklin County's Mitigation Plan. Of the participating 18 townships, 15 of the townships have enacted township zoning and 11 of those have completed comprehensive plans with 1 township having submitted a proposed comprehensive plan and 3 townships are under County Zoning.

All of the unincorporated areas in Delaware County are subject to the Delaware County Subdivision Regulations, which were first adopted in 1967 and revised in 1997 Section 711 of the Ohio Revised Code which enables the Delaware County Commissioners and the Delaware County Planning Commission to adopt regulations governing plans and subdivisions of land within their jurisdiction. These regulations were most recently revised in 2018 with minor modifications.

1.2.2 Local Jurisdictions

City of Delaware

With a population of 39,267, the City of Delaware is the largest city within Delaware County and contains the majority of the County's public offices, infrastructure, and operations. Some important sites include the Delaware County Fairgrounds and Ohio Wesleyan University. Historically occupied by the Delaware Indians, Delaware was platted on the west side of the bank in 1808 and has flourished with industrial and commercial development especially because of its proximity to Columbus.

Topographically the city is mostly flat, with a few hills throughout the residential areas of the city. The most important body of water in the city is the Olentangy River which runs along the Eastern Edge of U.S. Highway 23 until it gets to State Route 315, where it follows South all the way into Franklin County. It resides in the intersection of several crucial transportation networks including U.S. Highway 42, U.S. Highway 36, State Route 37, and U.S. Highway 23, also



known as Columbus Pike in the southern portion of the City. Two important railroads also dissect the City; one on the east and one west side of the city.

City of Powell

Recognized as a municipality in 1947 and registered as a city in 2000, Powell is the only other city, aside from Delaware included in this plan. Located in the southwest corner of Delaware County, Powell has celebrated phenomenal population growth with its current population reaching 13,204. Although a rural area lies to the north of the city, it is within very close proximity to Dublin, Ohio which is a densely populated area of Franklin County just south of Powell.

Like much of Delaware County, Powell resides on flat lands just to the west of the Del-Co Water reservoirs, and between the Olentangy and Scioto Rivers. Liberty Road/Route 9 and route 750 serve are the two most heavily traveled roads within the city and intersect in downtown Powell. The same CSX railroad that dissects the center of the City of Delaware also runs through the center of Powell.

Village of Sunbury

The Village of Sunbury lies just north of the Village of Galena, in the heavily rural eastern portion of Delaware County with a population of 5,389 residents. It is the home of the Ohio Fallen Heroes Memorial which memorializes all of the servicemen from Ohio who have lost their lives since September 11, 2001 in the Global War on Terrorism.

Its rapid development can be attributed to the intersection of routes 36/37 and State Route 3, which split off around the Village Square.

Village of Ashley

At the northeastern corner of Delaware County on the border of Morrow County resides the small Village of Ashley with a population of 1,537. Its historical development can be attributed to its notoriously fertile lands and its proximity to the railroad that connected Cleveland and Cincinnati, which also borders a small eastern portion of the City of Delaware. The aforementioned railroad cuts through the center of the village along with State Route 229 and U.S. Highway 42.

Village of Shawnee Hills

The Village of Shawnee Hills was originally founded as a resort fishing community near O'Shaughnessy Reservoir in southwestern Delaware County. Like other cities, villages, and areas in the southern part of Delaware County, Shawnee Hills has seen rapid growth and development, particularly within the last decade, with its current population estimated to be 787.



It is mostly residential, but not as densely populated as the city of Dublin, just south of Shawnee Hills. The only major roadway that passes through the village is State Route 745 which dissects the village in half. The village itself lies on the western bank of the O'Shaughnessy Reservoir.

Village of Ostrander

The Village of Ostrander and its modest population of 713 reside in the southwest corner of the county, within Scioto Township. Originally founded in 1852 due to its growth surrounding the CCC&I railroad that connected Springfield and Delaware.

The village is housed on U.S. Highway 36, also called Marysville Road, almost directly centered between the city of Delaware and the city of Marysville which is the largest city in Union County and lies on the western border of Delaware County. The closest body of water is Mill Creek which is a small branch of the Scioto River.

Village of Galena

The Village of Galena is the smallest village of Delaware County that lies on the southern border of the Village of Sunbury. It enjoyed historical development due to the presence of the Galena Shale Tile and Brick Company which operated from the 1890s to 1983. Its small population of 674 enjoys several of the amenities of Sunbury.

Galena is positioned at the confluence of Little Walnut Creek and Big Walnut Creek which are the headwaters of the Hoover Reservoir, just north of Columbus, Ohio. No major railroads exist within the community, but State Route 3 does form part of the border and dissects a small portion of the village.

Other Areas

There are several other smaller bergs that do not have governing bodies and are under County Authority. These are; Radnor, Olive Green, East Liberty, Center Village, Harlem, Condit, Condit Station, North Condit, Cheshire, Lewis Center, Hyatts, Bellpoint, Rathbone, Norton, Kilbourne, Leonardsburg, and Warrensburg.

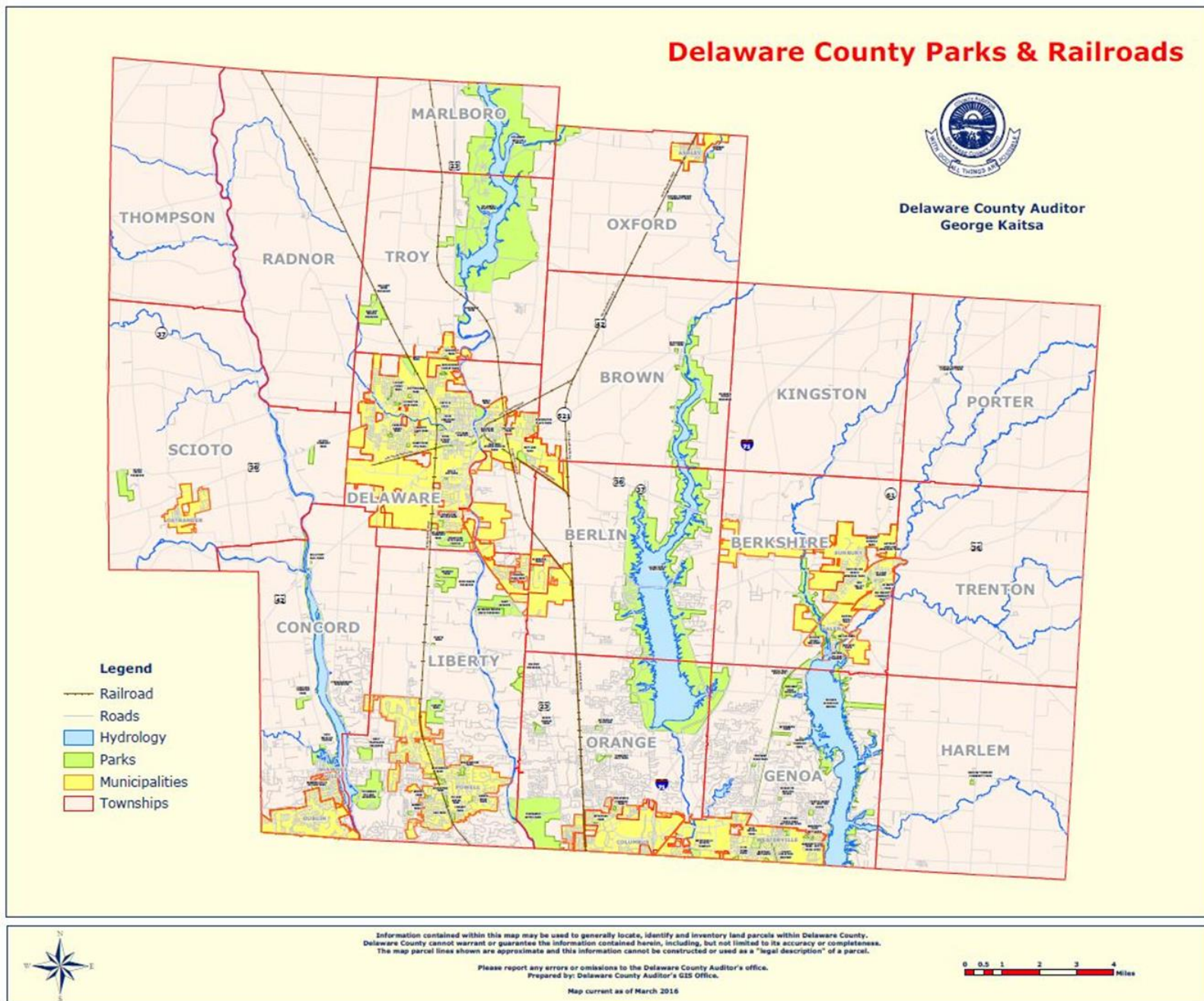


Figure 1: Delaware County Map. This map shows the hydrology locations, roads and railroads, parks, municipalities and townships in the county. Prepared by: Delaware County Auditor's GIS Office.

SECTION 2. PLANNING PROCESS

Prior to initiating the planning process, the Director of the Delaware County Office of Homeland Security of Emergency Management (DCOHSEM) consulted with the agency's governing body to determine the best and most resourceful way dedicate resources to update the current Delaware County Mitigation Plan. The Board and its Director hired a mitigation planning intern to assist with the composition and development of the plan. On behalf of the EMA Board, the intern contacted participants from the previous planning process, representatives from each jurisdiction covered by this Plan and other critical players to serve as the Delaware County Mitigation Planning Group (DMPG), the core group responsible for the planning process.

The DMPG then invited input from representatives of the jurisdictions covered within this Plan, critical leaders involved in the emergency management operations, interested stakeholders including local nonprofit organizations, universities, and employers in addition to the general public. The next section will identify and specify all participants within the planning process including the members of the DMPG and other participating stakeholders. Details on the general public's participation are outlined in a later section.

The Delaware County Auditor, by way of the Delaware County GIS Office, contributed a great deal to this plan through mapping and table creation.

2.1 PARTICIPANTS INVOLVED

The DMPG served as the base group in the planning process who converged at meetings and maintained frequent contact throughout the development of the updated plan. As mentioned above, the planning group included representatives from each of the jurisdictions covered by the Plan, participants from the previous mitigation process, and other critical stakeholders including environmental and GIS experts. The members of the DMPG are listed below with their jurisdiction/agency, name, and title.

Table 1: Delaware County Mitigation Planning Group Members. Shows contact name, their title, and the jurisdiction they are representing.

The Delaware County Mitigation Planning Group (DMPG) Members		
Jurisdiction	Contact Name	Title
City of Delaware	John Donahue	Fire Chief
City of Powell	Stephen Hrytzik	Police Deputy Chief
Village of Ashley	Jim Nelson	Mayor
Village of Galena	Thomas Hopper	Mayor
Village of Ostrander	Larry Crile	Mayor
Village of Sunbury	Alan Rothermel	Administrator
Village of Shawnee Hills	Russell Baron	Police Chief



Delaware County	Robert Parson	Auditor's Office, GIS Director
Delaware County	Barb Lewis - Unincorporated	Commissioner
Delaware County	Scott Stephens	Soil and Water Conservation District, District Administrator
Delaware County	Fred Fowler, Duane Matlack	Code Compliance, Department Supervisor
Delaware County	Scott Sanders	Regional Planning
Delaware County	Sean Miller	Director, Emergency Management
Delaware County	Jodi Elam	Mitigation Planning Intern, Emergency Management

The DMPG invited several interested stakeholders to participate and provide input on the planning process including top employers within Delaware County who served as business industry representatives, public safety officials, and critical nonprofit organizations relevant to emergency mitigation and management.

- Other Participating Stakeholders
- Kroger
- Townships
- Public Safety Entities
- American Red Cross
- PPG
- OWU: Public Safety
- United Way
- Army Corps of Engineers (Delaware and Alum Creek)
- EMA Directors of Surrounding Counties
- Delaware General Health District
- Other businesses & public

2.2 MITIGATION PLANNING TIMELINE

The mitigation planner worked closely with the Delaware County EMA Director, the EMA Board, and the remainder of the DMPG throughout the fall and winter of 2018 to reassess the former mitigation plan, reevaluate Delaware County's vulnerabilities to natural and manmade disasters, and determine the most appropriate actions to formulate a comprehensive plan that would best help to mitigate the effects of any identified hazards on the well-being of the County and its citizens. Below is the general timeline of the completion of the plan including details on when and how the public, the individual jurisdictions and the DMPG were involved in the planning process.

June 2018: Initial Formulation of the DMPG (Meeting 1)

The Delaware County EMA Executive Board and the Delaware County EMA Director determined the need to update the County's Mitigation Plan to meet the renewal deadline in May 2019. The board members determined the need to hire a mitigation planner to lead the efforts in the composition of the Plan. The planning group also participated in an initial questionnaire that was used to determine the perceived groups rating of hazards included and any need for new hazards to be included in the update.

September 2018: Initial Planning Stages, Assessment of Needs and Timeline Development

Following the hire of a mitigation planner, the planner convened with the EMA Director to determine the contacts within each jurisdiction included in this Plan and other relevant stakeholders who would be involved in the mitigation planning process. In addition, they outlined the general strategy and goals of the mitigation plan and reassessed the format and content of the previous Plan to determine the needs of the updated Plan that would satisfy and surpass Ohio EMA and FEMA requirements.

They also met to determine the general timeline of the completion of the Plan. In October of 2018, an advertisement was listed in the local newspaper, the Delaware Gazette, inviting the public to visit the Delaware County EMA website or selected libraries to access and review the previous mitigation plan and offer any suggestions and questions about what was going to be included in the updated plan. Advertisements were placed on the public library's bulletin boards, Delaware, Sunbury, Ostrander Branches, inviting the public to view copies of the plan at those libraries or online and provide any comments. Posts were also placed on the Delaware County EMA Facebook and Twitter advertising the availability of the plan for review. The review and comment period was a duration of 2 weeks from October 16, 2018 to October 30, 2018.

One public inquiry was received regarding the plan, but no other formal comments were received.

The mitigation plan will be reviewed every year by DCOHSEM personnel and placed on the Delaware County EMA website for Public review and feedback.

June – November: Hazard Identification and Prioritization and Action Deliberation

An electronic letter was extended to the determined DMPG members and other interested stakeholders (listed in the previous section) to invite them to participate in the planning process and offer their general concerns about which particular hazards most affected them, what they would like to see included in the updated plan and what actions would be the most appropriate for their jurisdiction. They were also invited to attend a mitigation planning meeting. All jurisdictions included within this Plan attended and actively participated in at least one of the planning meetings listed below or communicated individual, via email correspondence to report their feedback on the Plan (Appendix C & D).

June 28, 2018: Planning Process and Hazard Discussion (Meeting 1)

The first two planning meetings involved discussing the hazards within the previous plan and determining a need to update the list of hazards identified as a threat to Delaware County. It was determined by consensus during the first of the three meetings that it was within the best interest of the county to include earthquakes and cyber-attacks to the existing list of hazards. The participants then ranked the threat of each hazard to life, property, the economy/businesses and the environment on a scale of one to ten (one being unthreatening and ten being highly threatening) during the first meeting. The agenda, questionnaire, and sign-in sheet from the first meeting can be viewed in Appendix C.

November 8, 2018: Hazard Identification and Action Discussion (Meeting 2)

The second planning meeting involved discussing the results of the questionnaire filled out during the first planning meeting. The planning group then talk over the rankings of all 13 hazards. The rankings were determined using questionnaire results and historic risk assessments for each hazard. It was decided to change certain aspects of the methodology to create a more concise understandable Plan. The agenda and sign-in sheet from the second meeting can be viewed in Appendix C.

January 9, 2019: Mitigation Plan Draft Review and Discussion (Meeting 3)

The planning group reviewed the draft mitigation plan for more than two weeks prior to the third meeting. During the meeting, the draft plan was reviewed with any updates made to the Plan since the second meeting and discussed the mitigation actions and priority ratings for the hazards. All comments about the draft plan were discussed and it was decided that after the final changes to the plan, it would be submitted to the state for review. The agenda, sign-in sheet, and any comments made from the third meeting can be viewed in Appendix C and D.

Advertisements were placed at public library's bulletin boards, Delaware, Sunbury, Ostrander Branches, inviting the public to view copies of the draft plan at those libraries or online and provide any comments (Appendix A). Posts were also placed on the Delaware County EMA Facebook and Twitter advertising the availability of the draft plan for review (Appendix A). The



review and comment period was a duration of 2 weeks from December 26, 2018 to January 9, 2019. During this time there were no public comments submitted.

August – October 2018: Compilation of Mitigation Actions and Plan Maintenance Schedule

Following the series of planning meetings, the actions in the previous mitigation plan were identified and assessed to determine their current status. These are all listed in Section 4.1 of this document. The actions were then prioritized to determine the most acceptable and beneficial mitigation actions for Delaware County and all jurisdictions included within this plan. A scale of the relative priority of facilities, assets, conditions, maintenance and other matters, which is determined by relative criticality. Purpose of prioritization was to rank action items in order from highest to lowest importance and to help facilitate decision-making.

Plan Approval and Adoption

Upon completing the necessary requirements of the plan, the DMPG submitted this Delaware County Multi-Hazard Mitigation Plan to the Ohio Emergency Management Agency and the Federal Emergency Management Agency for approval. Once approved, this plan will be adopted by each jurisdiction included within the plan. The Plan will be reviewed yearly by DCOHSEM personnel and placed on the Delaware County EMA website for Public review and feedback. The next Plan update will be due in May of 2024.

2.3 EXISTING PLANS AND RESOURCES REVIEWED

Several plans, studies, reports and other pieces of critical information were reviewed and utilized throughout the mitigation planning process to formulate the best and most up to date plan.

Plans Used

2014 Delaware County Multi-Hazard Mitigation Plan: This is otherwise referred to as the former mitigation plan throughout this document. The actions included within this plan were reviewed and included in the current plan as a method to determine their status and potential incorporation in the current plan. It was otherwise used as a general reference in the composition of the current plan.

State of Ohio Hazard Enhanced Mitigation Plan 2014: This plan included informative data on hazard occurrences within Delaware County and what hazards should be considered in the hazard ranking profiles. It was otherwise used as a general reference in the composition of the current plan.

Delaware County Hazard Specific Plans: Several such plans were consulted to obtain more detailed information about the analysis already composed regarding the hazards affecting Delaware County and all jurisdictions within this plan. They also provided data regarding the history of hazard occurrences. They were otherwise used as a general reference in the composition of the current plan.

County of San Diego Multi-jurisdictional Hazard Mitigation Plan 2010: This plan served as an example of an exemplary county mitigation plan and provided inspiration on the design and content of the plan.

Franklin County Natural Hazard Mitigation Plan 2018: This plan was used as an example of a well-organized and detailed mitigation plan.

Union County All Hazard Mitigation Plan 2018: This plan aided as an example of a nearby Ohio county and demonstrated relative information on the area and good inspiration on the outline.

Hamilton County Multi-Hazard Mitigation Plan 2018: This plan aided as an example of a well done and detailed Ohio county multi-hazard mitigation plan. Especially when developing the new hazard category of Earthquakes.

Data Sources and Other Resources

DALIS Census 2017: This Delaware County web-based source provided the population data for each of the jurisdictions within the county.

DALIS Parcel Data: Current Delaware County parcel data was used in GIS software to determine the potential property losses of each hazard in number and value.

NOAA National Climatic Data Center Storm Events Database: This web-based source provided data on the occurrences of various natural hazards events in Delaware County and was widely used in the hazard profiles within this plan.

Tornadohistoryproject.com: This web-based source provided specific information detailing tornado occurrences in Delaware County and the U.S. It was widely used in the tornado hazard profile in this plan.

Delaware County Regional Planning/Code Compliance Regulations: Provided statistics and a map available to determine development trends and how they relate to the hazards that threaten the jurisdictions covered within this plan.

WebEOC LEPC: This county database was used when reviewing HAZMAT hazard incidents in Delaware County. It was widely used in the HAZMAT hazard profile in this plan.

ODNR Geological Survey Earthquake Epicenters: Provided an interactive map of earthquakes epicenters and magnitudes for past earthquakes in Delaware Ohio. It was used for the earthquake hazard profile in this plan.

USGS Earthquake Hazards Program: Provided a second informative map of earthquakes that occurred in Ohio with detailed information. Used for the earthquake hazard profile in this plan.

County/City/Village Official Websites: The websites of each of the jurisdictions included within the plan were used to compose their profiles within the plan.



Delaware Gazette: Certain new articles were used for past man-made events that have occurred. Used for the Civil Disturbance and Terroristic hazard events.

Other data was obtained by public records requests.

When appropriate, local governments will integrate elements of this plan into other planning mechanisms (reference: Section 2.3) through planning group representatives, agencies and organizations responsible for those documents.

2.4 MITIGATION PLAN MAINTENANCE

To assure the current mitigation plan will uphold its relevance to Delaware County and the encompassing jurisdictions, it will be monitored, evaluated and updated as outlined below:

- 1.) To monitor the Plan, the Delaware County Emergency Management Agency will review the plan in its entirety at least once a year in accordance with the DCEMA annual operations maintenance schedule. It will be further consulted and physically marked as the status of mitigation actions included within the plan change. The Plan will be posted on our website and open for public viewing and welcome public feedback and suggestions for improvements to the current plan as described in section 2.2.
- 2.) To evaluate the Plan, the Delaware County Emergency Management Agency will assess continuously and mark notes and comments within the Plan that detail the status of the mitigation actions, their effectiveness, and any other details that will be helpful in achieving the overall mitigation goals. During its annual monitoring review of the plan, the DCEMA will also mark comments about the general effectiveness of the plan, any necessary changes, and anything that ought to be included in future revisions of the plan.
- 3.) To update the Plan, the Delaware County Emergency Management Agency Executive Committee will be kept apprised of any changes to the plan and will be sent the plan to stimulate comments and suggestions throughout the duration of the plan's existence. A copy of the revised plan will be posted on the DCEMA website for the public to review and make any recommendations for changes on a yearly basis.
- 4.) To update the Plan, Delaware County Emergency Management Agency Executive Committee will start the official update of the Plan within a 5-year cycle. The update and creation of the 2024 Multi-Hazard Mitigation Plan will be a year prior to the due date of May 2024, in order for appropriately review and update as necessary .



SECTION 3. HAZARD IDENTIFICATION AND RISK ASSESSMENT

3.1 OVERVIEW

Prior to creating a comprehensive and effective mitigation strategy, it is necessary to conduct a thorough analysis of the various hazards that might potentially affect Delaware County and its participating plan jurisdictions. In order to do so, each hazard is ultimately considered, evaluated and prioritized according to its level of concern for this Plan's jurisdictions. The hazards were then visually and statistically modeled using the locally updated GIS program, DALIS. These models were then used in concurrence with the County Auditor's data of property values to determine the potential asset loss and overall vulnerability of each individual jurisdiction and the County as a whole. These results are then discussed with the concern of current and future land use and development plans. This process involved in each section of the Hazard Identification and Risk Assessment (HIRA) process is detailed below.

HAZARD IDENTIFICATION

The first step in the HIRA process is hazard identification which involves evaluating all possible natural and man-made disasters that could potentially affect Delaware County and its inclusive jurisdictions. Various How-To guides and former plans were used to create a preliminary hazard list which was utilized to foster the discussion surrounding what hazards threatened Delaware County and its participating jurisdictions. A finalized list was then used for the Plan's HIRA analysis and mitigation strategy development. Any hazards not listed were omitted due to obvious reasons or to the fact that they will not occur in our jurisdiction, or the possibility of them occurring is highly unlikely. (Re: Volcano, Tsunami, Hurricane, Coastal Storm, see section 3.2.3 for complete list)

PROFILING HAZARDS

To best analyze and evaluate the potential damages and consequences incurred by the various natural and man-made hazards, it is first necessary to discuss the nature of the hazard and how it is most likely to behave in the participating jurisdictions. Each hazard profile contains a general description of the nature and behavior of the hazard followed by a summary of the most critical occurrences of the event in the County and jurisdictions' history. Finally, with the help of locally updated GIS data, the potential extent, magnitude and general probability of occurrence are discussed. The extent refers to the geographic areas which are most vulnerable within the county to the hazard. In comparison, magnitude quantifies the possible intensity as to which the hazard is most likely to hit the area and probability quantifies the likelihood that the hazard will hit the County.

RISK ASSESSMENT

The fourth step in the HIRA process involves assessing the vulnerability of people and assets within Delaware County as a whole and its individual jurisdictions which ultimately provides

insight to the potential losses, injuries, and damages that might result in the case of each hazard. Other direct and indirect consequences are also discussed in regards to various social, economic, and environmental consequences. This step in the HIRA analysis helps to better identify the most vulnerable areas when developing the mitigation strategy.

Each hazard's risk assessment begins with an identification of the most vulnerable populations and structures to that particular hazard. It then provides a table of the number of structures at risk for this hazard and the summation of their values or "damages in dollars". These numbers were found by overlaying at-risk areas over parcel data from the Delaware County auditor's office using GIS programs to determine vulnerable structures. The parcels were then categorized as either residential, non-residential critical or publicly owned using the parcel's land use code. (See table below for information about each category.)

Table 2: Codes for Vulnerable Structures for At-Risk Parcels

Codes Used to Classify Vulnerable Structures on At-Risk Parcels for Hazard Risk Assessment		
Category	Class Codes Used	Description
Residential	510-599	Family dwellings, residential, condominiums
Non-Residential	100-505	Agricultural, Industrial, manufacturing, retail, commercial, hotels, recreational, vacant, other
Critical	601-881 (excluding publicly owned codes)	schools, owned by parks, universities, churches, charities, utilities
Publicly Owned	600, 610, 620, 630, 640	Owned by USA, state, county, township, or municipality
Each Parcel Land Use Code can be found at : http://delaware-auditor-ohio.manatron.com/UseCodes.aspx		

Structures that were located in Delaware County, but within the municipality of Dublin, Columbus or Westerville were not included in the figures. Market improvement values were used in order to calculate the potential asset losses, and any structures with no improvement value were not included within the figures. If a hazard did not pose a structural threat, then a table was not included in the profile.

DMPG felt that it would be beneficial for mitigation and operational purposes to conduct a "threat analysis" for the applicable hazards. The analysis consists of a thorough analysis of a plausible hypothetical occurrence of catastrophic magnitude for each hazard. This would allow for better estimation and quantification of the social, structural, economic and environmental consequences of each hazard and provide general insight into the nature of the hazard within the County, despite the situation specific figures.



These **estimates are based on any of the potential hazards listed for total loss** on any at risk structure. Depending on path of hazard and how much of a given area is affected estimates could be lower.

Table 3: Total Structures in Delaware County and Local Jurisdictions.

TOTAL STRUCTURES IN DELAWARE COUNTY AND LOCAL JURISDICTIONS										
	Structures					Damage in Dollars				
JURISDICTION	Residential	Non-Residential	Critical	Publicly Owned	Total	Residential	Non-Residential	Critical	Publicly Owned	Total
Delaware	12,918	2,001	233	110	15,262	\$1,457,173,400	\$626,659,200	\$160,618,500	\$72,410,600	\$2,316,861,700
Powell	4,085	384	12	19	4,500	\$1,183,562,700	\$158,706,300	\$16,098,900	\$2,581,900	\$1,360,949,800
Galena	406	188	1	9	604	\$45,788,900	\$3,212,100	\$171,900	\$207,700	\$49,380,600
Shawnee Hills	377	147	2	1	527	\$58,708,000	\$10,285,000	\$180,100	\$7,300	\$69,180,400
Ashley	686	162	8	7	863	\$25,544,500	\$6,177,400	\$789,300	\$756,600	\$33,267,800
Ostrander	477	57	10	8	552	\$47,736,100	\$3,562,400	\$414,800	\$2,485,800	\$54,199,100
Sunbury	2,103	339	43	25	2,510	\$243,932,000	\$72,240,700	\$48,671,000	\$3,965,000	\$368,808,700
Other	52,870	8,869	443	319	62,501	\$9,587,655,270	\$1,365,529,800	\$361,745,700	\$135,590,100	\$11,450,520,870
TOTAL	73,922	12,147	752	498	87,319	\$12,650,100,870	\$2,246,372,900	\$588,690,200	\$218,005,000	\$15,703,168,970
Structures in Dublin, Westerville or Columbus that were also located within Delaware County were not included in these figures. Market improvement values of Delaware County parcels provided by the Delaware County Auditor’s office were utilized in the determination of damage in dollars. Structures determined from 2018 Building Outlines provided by the Delaware County Auditor’s GIS Office. Note: Building Outlines include outbuildings and accessory structures.										

DEVELOPMENT AND LAND USE ANALYSIS

The final step in the HIRA process utilizes the assessment and analysis conducting in regards to potential injuries and losses that might occur in the Delaware County's current state of development. Following the adoption of the plan, it is necessary to also consider the trend of land use and development within the County and its participating jurisdictions, particularly within highly vulnerable areas so that the mitigation strategy is truly comprehensive and time-sensitive.

3.2 HAZARD IDENTIFICATION

3.2.1 Identification Process and Sources

As mentioned above, hazard identification is the process in which the DMPG can best identify what hazards are most likely to affect the Delaware County area and its participating jurisdictions. FEMA's all-inclusive hazard list on Worksheet #1 of the How-To guide provided a structure in which to identify the hazards. First, the natural disasters included on FEMA's worksheet were discussed and graded as seen in table followed by the disasters listed in the State of Ohio's Mitigation plan not included in the previous list, concluding with any other hazards presented by the DMPG. The previous Plan, various public officials, and data from geological and climatic sources were used to determine if there were a significant number of previous occurrences and/or a credible concern that there will be future occurrences of the hazard. If so, they were included in this plan's final hazard list. If not, then the reasons are accounted for in section 3.2.3 of this Plan.

3.2.2 Hazard List

It was decided by the DMPG that there were several potential natural and man-made disasters that could affect Delaware County and its participating jurisdictions. Those that were excluded are listed in section 3.2.3. Although hailstorms were deemed a potential hazard, they were included within the Severe Summer weather category as most instances of hailstorms within the county have been in correlation with such storms and can be included in the considerations and analysis of the severe summer weather hazard analysis and risk assessment. Several man-made hazards were identified as serious potential threats that required mitigation planning by the DMPG in addition to the natural hazards. The finalized list of hazards is divided between natural and man-made hazards and listed alphabetically as seen below (Table 4).



Table 4: Natural and Man-made Hazards that are included in the plan. Lists each hazards sources uses to collect data and the specific remarks for what's included in that hazard.

NATURAL HAZARDS		
Hazard	Sources	Remarks
Dam Failure	ODNR Division of Water Resources: Dam Safety Program and other Experts	Database Report for “dam failure”, “incident”, or “breach”. Data from ODNR Division of Water jurisdiction and expert view from Army Corps. Dams. Data started in 1980 (39 years).
Drought	NOAA	“Drought”. Data started in 1950 (68 years).
Earthquake	ODNR	“Earthquakes”. Data started in 1870 (148 years).
Flooding	NOAA	“Flash Flood”, “Flood”. Data started in 1995 (23 years).
Severe Summer Weather / Extreme Heat	NOAA	Includes events between April-October. “Excessive Heat”, “Hail”, “Heat”, “High Wind”, “Lightning”, “Strong Wind”, “Thunderstorm Wind”. Data started in 1962 (68 years).
Severe Winter Weather	NOAA	Includes events between Nov-March. “Blizzard”, “Cold Wind/Chill”, “Extreme Cold/Wind Chill”, “Frost Freeze”, “Heavy Snow”, “Ice Storm”, “Winter Storm”, “Winter Weather”. Data started in 1990 (28 years).
Tornado	NOAA and Tornadohistoryproject.com	“Tornado”. Data started in 1960 (58 years), with one outlier that is included in the map and history list but not into the Hazard Ranking Assessment.
MAN-MADE HAZARDS		
Hazard	Sources	Remarks
Civil Disturbance	FEMA, Center for Homeland Defense and Security NPS (School shooting database) and News articles, Experts (Law enforcement), Sheriff’s Office Intelligence Center, OH SAIC: Fusion Center	Includes shootings, small bombs, and riots. Data started in 1990 (28 years).
Cyber-Attack	OH SAIC: Fusion Center, IT department, Law	Includes events of “Ransomware”, “Phishing”, and “Spear-Phishing”. Data started in 2010 (9 years).



	enforcement, and News articles	
HAZMAT	Web EOC, LEPC Report Dataset	Events included: <ul style="list-style-type: none"> • 500+ gallons spilled • Full HAZMAT Response Team activation • Extremely hazardous materials • Caused direct injury Data started in 1990 (29 years).
Pandemic	DGHD: Emergency Preparedness Specialist and News articles	Events included in Risk Assessment were those that affected 7% of Delaware County's population (14,000+ people). Events described were those that affected 100+ people or close calls.
Large Utility Failure	PUCO database of Delaware County,	Events included (Code 4401): <ul style="list-style-type: none"> • 2,500+ customers for 4 hrs. affected • 100+ customers for 24 hrs. affected • Any police, fire, hospital or count wide 911 systems out for 4+ hrs. Data started in 2000 (19 years).
Terrorism	News articles, Experts (Law enforcement), and OH SAIC: Fusion Center, Delaware County Sheriff's Intelligence Center	Events with a deliberate act of violence used for political gain in a public place. Data started in 2000, (19 years).

3.2.3 Omitted Hazards

The DMPG felt it necessary to omit a number of hazard's from FEMA's list of potentially threatening hazards as they were deemed either a minor or non-existent threat to Delaware County as a whole and to all of its jurisdictions profiled within this Plan. Those excluded hazards are listed below with the grounds for their omission from this Plan.

Avalanche- No history of occurrence and unlikelihood of future occurrence as Delaware County's terrain is mostly flat.

Coastal Erosion- No oceanic or large coastal area within Delaware County.

Coastal Storm- No oceanic or large coastal area within Delaware County.

Expansive Soils- No history of this being an issue within the County

Hurricane- County not located within an area in which hurricanes are a threat



Land Subsidence- No history of this being an issue within the County

Landslide- No history of this being an issue within the County

Tsunami- County not located in an area in which tsunamis are a threat

Volcano- There are no volcanoes located in Delaware County.

Wildfire- ODNR ranks the entirety of Delaware County as having the lowest risk possible of wildfires

Windstorm- Considered as a part of Severe Summer Storm.

3.2.4 Hazard Prioritization

In order to determine what the most threatening natural and man-made hazards for Delaware County the DMPG underwent a thorough two-part ranking system. The group determined that there were eight factors to consider in ranking the hazards. They included the following shown and described in Table 6 on the following pages.

The first method in determining the ranking of Delaware County's most threatening hazards involved the use of historical records and sources to determine the probability of an event, the probability of a severe event, the most likely onset time and the population size at risk. Numbers from the NOAA database were used to estimate the life safety impact and the impact on property by using historical occurrence. For hazards that did not have a previous occurrence within the county, figures from that hazard's individual threat analysis were used for categorization purposes.

In order to determine the probability of a severe natural hazard, the number of historical severe events were divided by the length of the data collection period (since 1950 or 68 years) in order to determine the probability percentage. An event was deemed significant if it was within the Ohio EMA's State of Ohio Disaster History document of presidential disaster declarations or if it was listed in the NOAA disaster database as causing any injuries, death or property damages of over \$5,000.

Table 5: Past Presidential Declarations Disasters located in Delaware County.

Past Presidential Declarations of Major Disaster in Delaware County			
Disaster Number	Disaster Type	Declared Date	Public Assistance
DR-90-OH	Floods	January 23, 1959	\$1,434,684



DR-167-OH	Flooding, Severe Summer Storm	March, 24, 1964	\$571,482
DR-191-OH	Tornadoes, High Wind, Severe Storms	April 14, 1965	\$275,248
DR-421-OH	Tornadoes, High Wind	April 4, 1974	\$12,196,287
DR-3055-OH	Winter Storms, Severe Blizzard	January 26, 1978	\$3,546,669
DR-1453-OH	Severe Winter Storm, Ice/Snow Storm	March 14, 2003	\$61,143,244
DR-1519-OH	Severe Summer Storm, Flooding	June 3, 2004	\$47,353,657
DR-3198-OH	Winter Storm, Snow Removal and Response	January 11, 2005	\$11,116,398
DR-1580-OH	Severe Winter Storms, Ice and Mudslides, Flooding	February 15, 2005	\$146,794,339
DR-3250-OH	Hurricane Katrina Emergency Shelter Operation	September 13, 2005	\$2,499,103
DR-3286-OH	Winter Storm	April 24, 2008	\$6,800,000
DR-1805-OH	Severe Wind Storms associated with Tropical Depression IKE	October 24, 2008	\$54,624,981
EM-3346-OH	Severe Storms	June 30, 2012	Unknown, not available

Due to the varying nature of the hazards and the conditions in which they occur, ad hoc estimation based on personal experience and review of the threat analyses in this plan was used to score the onset time and potential population sizes affected under each hazard.

Participants in the Delaware County Mitigation Planning Meeting engaged in the ranking process utilizing their own intuition to quantify their perception of Delaware County's vulnerability to each individual hazard. They were instructed to provide a number between 1 and 10 (1 being no threat and 10 being a detrimental threat) for the categories of life safety impact, impact on property, impact on business/economy, and impact on the environment.

All scores were combined and weighted according to the table on the next page. The following tables includes the definitions for the categories used to determine the ranking and how they were used (Table 6 & 7). Table 8 includes the results of the scores and lists the hazards from its highest weighted score, or those which threaten Delaware County the most to the lowest weighted score or hazards which threaten Delaware County the least. The percentages listed in the table under the "probability of occurrence and "probability of severe occurrence" are the estimated likelihood of an event each year based on historical occurrences.

Table 6: Hazard Prioritization Categories used for Ranking Hazards. Each ranking category included the definition, the weighted percent that is used to calculate the score and a detailed explanation for how the score for each category is determined.

HAZARD PRIORITIZATION CATEGORIES			
Ranking Category	Definition	% of Score	How it was determined
Probability	The probability that the county would experience the event to a degree that would be recorded in the NOAA storm events database.	15	Varies according to each hazard. Most natural hazards found using the NOAA storm events database or citable publications and personal accounts. Looks at the probability of an event per year that it has been recorded since to determine a percentage. The percentage was then valued on a 1-5 scale to regulate the score.
Probability of Severe Occurrence	That probability that the county would experience the event to a degree that it would warrant a presidential disaster declaration or \$5000+ dollars of property or crop damage, or any injuries and/or loss of life.	15	Varies according to each hazard, Most natural hazards found using the NOAA storm events database, and FEMA's presidential declaration database. Counts all events of the hazard that is included on the presidential declaration list for the county and any events that directly caused \$5000.00 or more dollars of damage or any injuries recorded. The total was then valued on a 1-5 scale to regulate the score.
Onset Time	The amount of time the event takes to materialize	5	Categorized according to Delaware County EMA stakeholders' experience and past history of hazard characteristics. Assumed onset time was used to determine the 1-5 scale to regulate the score.
Population Size	The geographic extent to which a populated area could be potentially affected by this hazard	20	Categorized according to Delaware County EMA stakeholders' experience and past history of hazard characteristics. The county was broken down by its 18 townships and used to determine how many could be



			on average affected by an individual hazard event. That total was then valued on a 1-5 scale to regulate the score.
Life Safety Impact	The likelihood that there will be injuries and/or loss of life	20	Determined using DMPG's questionnaire rankings of all hazards. Ranking answers were averaged.
Impact on Property	The likelihood that there will be damage and/or destruction of structures within the community including residential, non-residential, public, and critical structures.	10	Determined using DMPG's questionnaire rankings of all hazards. Ranking answers were averaged.
Impact on Business/Economy	The likelihood that there would be short-term and/or long term consequences on the local economy and businesses.	10	Determined using DMPG's questionnaire rankings of all hazards. Ranking answers were averaged.
Impact on Environment	The likelihood that there would be short-term and/or long term damage to the environment and local ecosystems.	5	Determined using DMPG's questionnaire rankings of all hazards. Ranking answers were averaged.



Table 7: Hazard Ranking Category Scale. Shows the scale break down for the four categories that use past hazard occurrences to determine a score.

Hazard Ranking Category Scale							
Probability		Probability of Severe Occurrence		Onset Time		Population Size (TWP)	
1	<1-2%	1	None	1	More than a week	1	Localized: 1
2	2-10%	2	1-2	2	More than 24 hours	2	Limited: 2-5
3	10-50%	3	3-5	3	12-24 hours	3	Critical: 5-10
4	50-100%	4	6-8	4	6-12 hours	4	Excessive: 10-15
5	>100+%	5	9+	5	<6 hours, Minimal or no warning	5	Catastrophic: 15+

Probability: The probability that the county would experience the event to a degree that would be recorded in the NOAA storm events database. The average occurrence of each hazard per year was found and was turned into a percentage to determine what rating would be assigned on a 1-5 scale.

Severe Occurrence: That probability that the county would experience the event to a degree that it would warrant a presidential disaster declaration or any amount of property or crop damage, or injuries and/or loss of life. Events of an individual hazard were counted if they were listed on the presidential disaster declaration, caused \$5000 or more dollars in damage, or directly caused any injury or death. The events were totaled for each hazard and then classified to determine its 1-5 scale rating.

Onset Time: The amount of time the event takes to materialize. Categorized according to Delaware County EMA stakeholders' experience and past history of hazard characteristics. Assumed onset time was used to determine the 1-5 scale to regulate the score.

Population Size: The geographic extent to which a populated area could be potentially affected by this hazard. Categorized according to Delaware County EMA stakeholders' experience and past history of hazard characteristics. The county was broken down by its 18 townships and used to determine how to what extent an individual hazard event would affect. That total was then valued on a 1-5 scale to regulate the score.



Table 8: Hazard Ranking Total Score based of Ranking Category Results.

Delaware County Hazard Identification List and Ratings

Hazard	Probability of Occurrence	Probability of Severe Occurrence	Onset Time	Population Size	Life Safety Impact	Impact on Property	Impact on Business / Economy	Impact on Environment	Rating / Weighted Score
Tornado	3 (15%)	4 (6-8)	5 (<6 hrs.)	2 (Limited: 2-5)	6.78	7.78	6.56	4.44	1: 4.71
Severe Winter	5 (380%)	5 (9+)	4 (6-12 hrs.)	5 (Catastrophic: 15+)	5.00	3.33	4.33	3.22	2: 4.63
Flood	5 (230%)	5 (9+)	4 (6-12 hrs.)	2 (Limited: 2-5)	4.11	5.89	6.22	6.56	3: 4.46
Pandemic	1 (0%)	3 (3-5)	2 (> 24 hrs.)	3 (Critical: 5-10)	8.22	3.00	7.11	4.33	4: 4.17
Severe Summer	5 (460%)	5 (9+)	4 (6-12 hrs.)	3 (Critical: 5-10)	4.22	3.33	3.22	3.56	5: 3.98
Dam Failure	1 (1.5%)	1 (None)	5 (<6 hrs.)	1 (Localized:1)	6.89	7.00	6.33	6.56	6: 3.79
HAZMAT	3 (34%)	1 (None)	5 (<6 hrs.)	1 (Localized:1)	6.00	6.11	5.78	6.56	7: 3.77



Hazard	Probability of Occurrence	Probability of Severe Occurrence	Onset Time	Population Size	Life Safety Impact	Impact on Property	Impact on Business / Economy	Impact on Environment	Rating / Weighted Score
Terrorism	1 (0%)	1 (None)	5 (<6 hrs.)	1 (Localized:1)	7.56	5.78	5.89	4.22	8: 3.64
Utility	3 (47%)	2 (1-2)	5 (<6 hrs.)	3 (12-24 hrs.)	4.56	4.44	4.67	3.00	9: 3.57
Earthquake	1 (1%)	1 (None)	5 (<6 hrs.)	1 (Localized:1)	5.22	6.67	6.00	4.44	10: 3.28
Civil Disturbance	3 (14%)	2 (1-2)	5 (<6 hrs.)	1 (Localized:1)	3.89	5.00	5.67	3.44	11: 3.22
Drought	2 (3%)	1 (None)	2 (>24 hrs.)	5 (Catastrophic: 15+)	3.22	2.89	4.44	4.67	12: 3.16
Cyber	3 (11%)	1 (None)	5 (<6 hrs.)	1 (Localized:1)	3.22	4.44	6.89	2.67	13: 2.96

All eight category scores are shown below as well as the total weighted score. Hazards were put in order from 1-13, most impactful to least for Delaware County. Half of the categories are taken from the planning groups questionnaire results and the other half is based off of datasets and research that was categorized into a 1-5 ranking system, each with different explanations.

3.3 HAZARD PROFILES

3.3.1 Dam Failure

Dam failure is a significant concern for Delaware County as there are thirty-nine dams and reservoirs located within the county that could result in significant losses if they were to fail or become inundated. Some of the significant dams located in the county are Delaware, Alum Creek, O'Shaughnessy, Westerville, Whispering Pines, seven dams owned by Del-Co Water, Lexington Glen, Columbus Upground Reservoir in NW Delaware County (Thompson Township), and two Sunbury Reservoirs. The Hoover Dam structure is located within Blendon Township in Franklin County, but a significant portion of its reservoir exists within Delaware County and should be considered a potential hazard to Delaware County residents (see flood section). The Dams located within Delaware County are regulated by the U.S. Army Corp of Engineers (USACE), Ohio Department of Natural Resources (Division of Water) (ODNR) and Federal Energy Regulatory Commission (FERC). This hazard was ranked 6th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

Dam failure or excessive release of its contained water could occur in Delaware County as a result of numerous reasons including, but not limited to neglect, storm damage, flash flooding upstream, or a catastrophic event (man-made or natural). This would most likely cause personal injury, death or significant high water damage to property downstream in Delaware County and Franklin County. It could also close several roads, destroy bridges, and even extend to other ponds and reservoirs in its path. This hazard is unique because failure or excessive release of water could be the result of either natural occurrences such heavy rainfall or a man-made disaster such as an act of terrorism that would compromise the dam and cause inundation.

There are three main types of dam failures that behave differently, but can often be interrelated depending on the causes and conditions of the dam failure (See the Figure 2 below for an illustration of a typical dam):

- 1.) Overtopping: this sort of failure results from water eroding the embankment due to uncontrolled water flow over, around, and adjacent to the dam. Earth embankments are not designed to be overtopped and there are particularly susceptible to erosion which is almost impossible to stop once it has begun in the overtopping process.
- 2.) Seepage: internal movement of water that may take place through the dam, the foundation or the abutments. Although all earthen dams have seepage slowly permeating through the dam and its foundation, if uncontrolled, it can progressively erode soil from the embankment or its foundation. Erosion of the soil begins at the downstream side of the dam, progressively works towards the reservoir, eventually developing a direct connection otherwise known as “piping”. Once fully developed piping exists, complete dam failure is practically inevitable.

3.) Structural: such a failure can occur in either the embankment or the appurtenances, typically indicated by cracking, settlement and slides. Such failure can sometimes be prevented if the dam is properly monitored and lowered at the first signs of structural compromise.

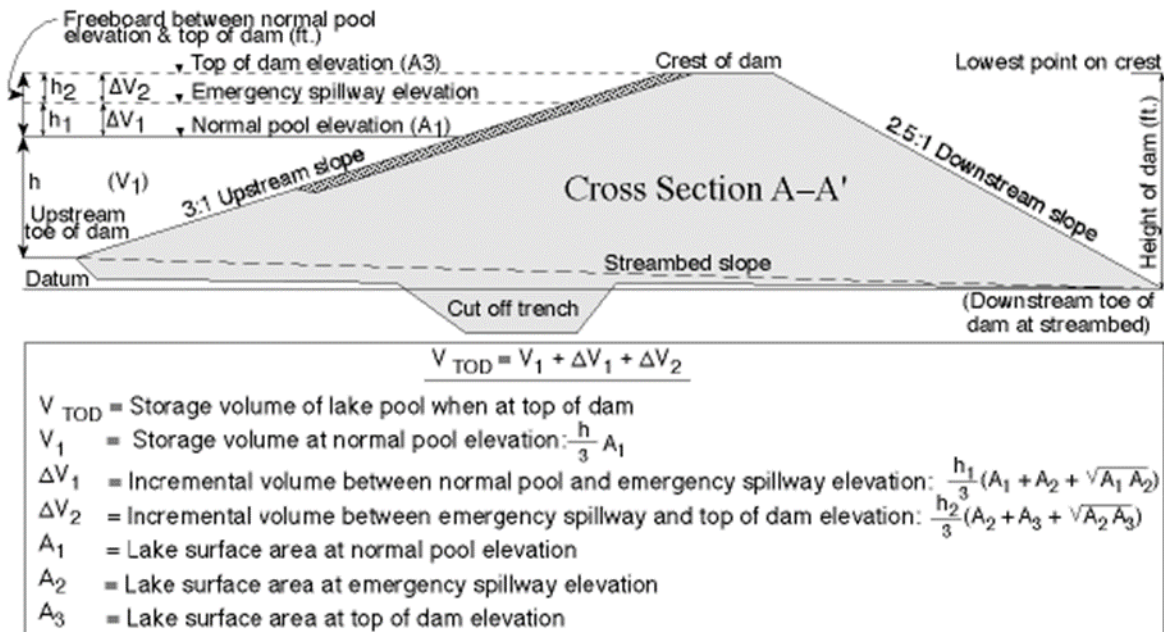


Figure 2: Dam System Diagram. Shows a typical dam structure. Diagram better shows how storage volume of dams is calculated which is used for determining potential downstream hazards. ODNR

Dam Classification for dams under ODNR Division of Water jurisdiction can be found in the OAC Section 1501:21-13-01. The three criteria for dam classification are the height of the dam, the volume of storage, and potential downstream hazard. The table below illustrates how each criterion is divided into different classes (Table 9). Figure 3 and Table 10 shows the number of dams and their classes located in Delaware County. Dams are classified based on the highest criterion that is met. For example, if a dam is taller than 60 feet, but has a storage volume of 550 acre-feet and rated health and property hazard for potential downstream hazard, it would still be classified as a class I dam.



Table 9: Dam Classes. Shows dam classes and their qualifications.

DAM CLASSES			
Class	Height of Dam	Storage Volume	Potential Hazard
Class I	Greater than 60 ft.	Greater than 5000 acre-feet	Probable loss of life
Class II	Greater than 40 ft.	Greater than 500 acre-feet	Health hazard, flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, downstream dams, only access to residential areas.
Class III	Greater than 25 ft.	Greater than 50 acre-feet	Low value non-residential structures, local roads, agricultural crops and livestock
Class IV	Less than or equal to 25 ft.	Less than or equal to 50 acre-feet	Losses restricted mainly to the dam

HAZARD HISTORY

There has never been a complete dam failure or inundation of any of the dams within Delaware County, but there have been a few historic occurrences where there was a concern for failure.

1987- According to the Ohio Mitigation Plan, Lexington Glen Dam near State Route 37, in Delaware, Ohio failed in 1987 due to erosion on the emergency spillway and four erosion rills in the downstream slope.

1960's- According to the Ohio Mitigation Plan, the Above Ground Reservoir No. 1 located in Sunbury, Ohio overtopped in the 1960s; however, no downstream damage was recorded.

2005- In January of 2005, a set of severe winter storms with average 5-8 inches of rainfall throughout Central Indiana and Ohio caused Delaware Lake, in northern Delaware County, to

flood. The water line rose from its typical height of about 905 feet above sea level to approximately 945 feet above sea level reaching between 1 and 5 feet of the top of the Delaware Dam. Thankfully the dam was not overtopped and the floodgates were not opened, but it was the closest to inundation the Delaware Dam had ever experienced since its construction in 1948. Alum Creek Dam, in South Central Delaware County, also saw record levels reaching 17 feet above its average height. Currently, the Village of Sunbury is in the process of creating a dam Emergency Action Plan (EAP).

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

All of Delaware County's 39 resident dams are relatively dispersed throughout the county as can be seen in Figure 3.

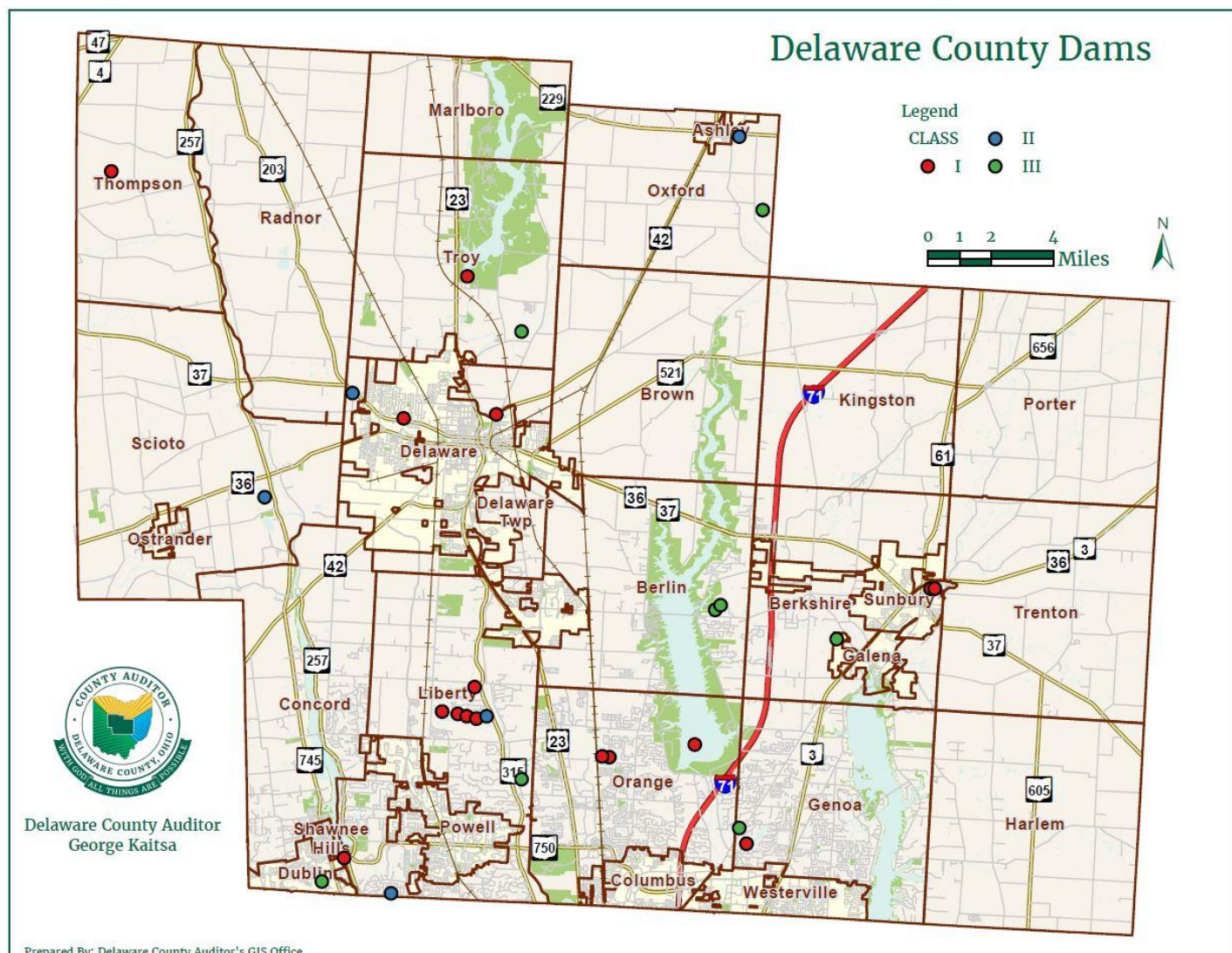


Figure 3: Dams County Dams. This map shows the location and class of all dams located in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.



Fifteen Class I dams threaten Delaware County due to their larger capacities and capabilities to incur losses. If the Delaware Reservoir should breach or experience an excessive release, it could inundate a wide variety of infrastructure. A failure or excessive release at the Alum Creek Reservoir would inundate a wide variety of infrastructure, could cause issues with the Westerville Reservoir and proceed down Alum Creek through Westerville and into Franklin County. The failure of either of these dams would have the most serious impacts on Delaware and Franklin Counties. O'Shaughnessy Dam, located on the Scioto River, is owned and operated by the City of Columbus and regulated by the Federal Energy Regulatory Commission (FERC). A breach would affect extreme southern Delaware County and Franklin County, especially because it produces electrical power for the City of Columbus.

Table 10: Number of Dams in Delaware County by Class

Dams in Delaware County by Class				
Dam Class	Dam Name	Jurisdiction (TSP)	GIS Lat.	GIS Long.
Class I	Alum Creek Lake Dam	Orange	40.193	-82.964
	Alum Creek Upground Reservoir	Orange	40.189	-83.003
	Alum Creek Upground Reservoir No. 2	Orange	40.189	-83.007
	Camp Greenwood Lake Dam	Delaware	40.310	-83.056
	Delaware Reservoir Dam	Troy	40.358	-83.069
	Del-Co Upland Storage Reservoir No. 2	Liberty	40.204	-83.073
	Del-Co Upland Storage Reservoir No. 3	Liberty	40.203	-83.069
	Del-Co Upland Storage Reservoir No. 4	Liberty	40.203	-83.065
	Del-Co Upland Storage Reservoir No. 5	Liberty	40.205	-83.081
	John R. Doult Upground Reservoir	Thompson	40.395	-83.233
	Lexington Glen Dam	Delaware	40.308	-83.098
	O'Shaughnessy Reservoir Dam	Concord	40.153	-83.126
	Sunbury Upground Reservoir No. 1	Berkshire	40.248	-82.855
	Sunbury Upground Reservoir No. 2	Berkshire	40.248	-82.853
	Timber Lake Liberty Dam	Liberty	40.214	-83.066
	Westerville Reservoir Dam	Genoa	40.158	-82.940
Class I Total				16
Class II	Ashley Waterworks Reservoir	Oxford	40.408	-82.943
	Campden Lakes North Dam	Liberty	40.141	-83.104
	Homestead Neighbors Lake Dam	Delaware	40.317	-83.122
	Lake Hill Lodge Dam	Scioto	40.281	-83.163
	Libertyvale Lake Dam	Liberty	40.203	-83.060
Class II Total				5



Class III	Berkshire Lake Dam	Berkshire	40.231	-82.898
	Gleasonkamp Pond Dam	Troy	40.339	-83.044
	Golden Bear Reservoir Dam	Concord	40.145	-83.136
	Havens Lake Dam	Liberty	40.181	-83.044
	Lake Crum Dam	Oxford	40.382	-82.933
	Pomeroy Pond No. 1 Dam	Berlin	40.243	-82.952
	Pomeroy Pond No. 2 Dam	Berlin	40.241	-82.954
	The Lake Club Dam	Delaware	40.164	-82.943
Class III Total				8
Total Number of Dams				29

The reservoirs owned by Del-Co Water are small in comparison to the Delaware and Alum Creek Reservoirs and would cause a relatively small amount of damage. These Del-Co reservoirs are partitioned and are close to each other. Five are located north of Home Rd. and west of Old 315. The other two are located on the southwestern edge of Alum Creek Reservoir, referred to as the McNamara Reservoir. The Lexington Glen Dam is located just north of State Route 37 and just north of East and West Chatham Drive. In the event of dam failure, these homes would be affected as they are downhill of Lexington Glen Dam. There are currently no inundation maps for Whispering Pines, Westerville, Sunbury Dams, Columbus Upground, and Ashley Reservoirs. See the maps below the potential areas affected by inundation throughout the County (Figure 4, 5, & 6).

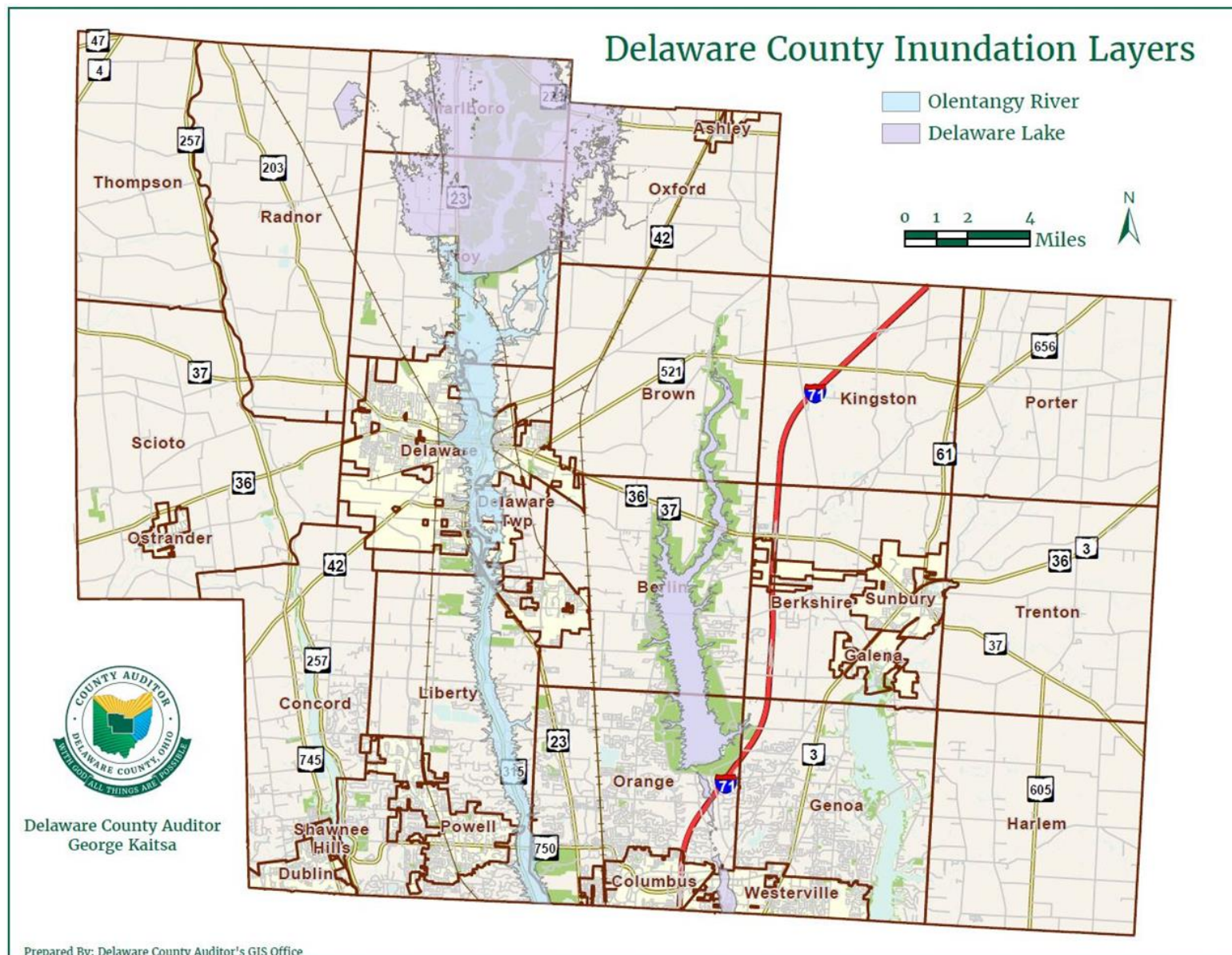


Figure 4: Delaware County Inundation. This map shows the inundation layers for both Olentangy River and Delaware Lake located in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

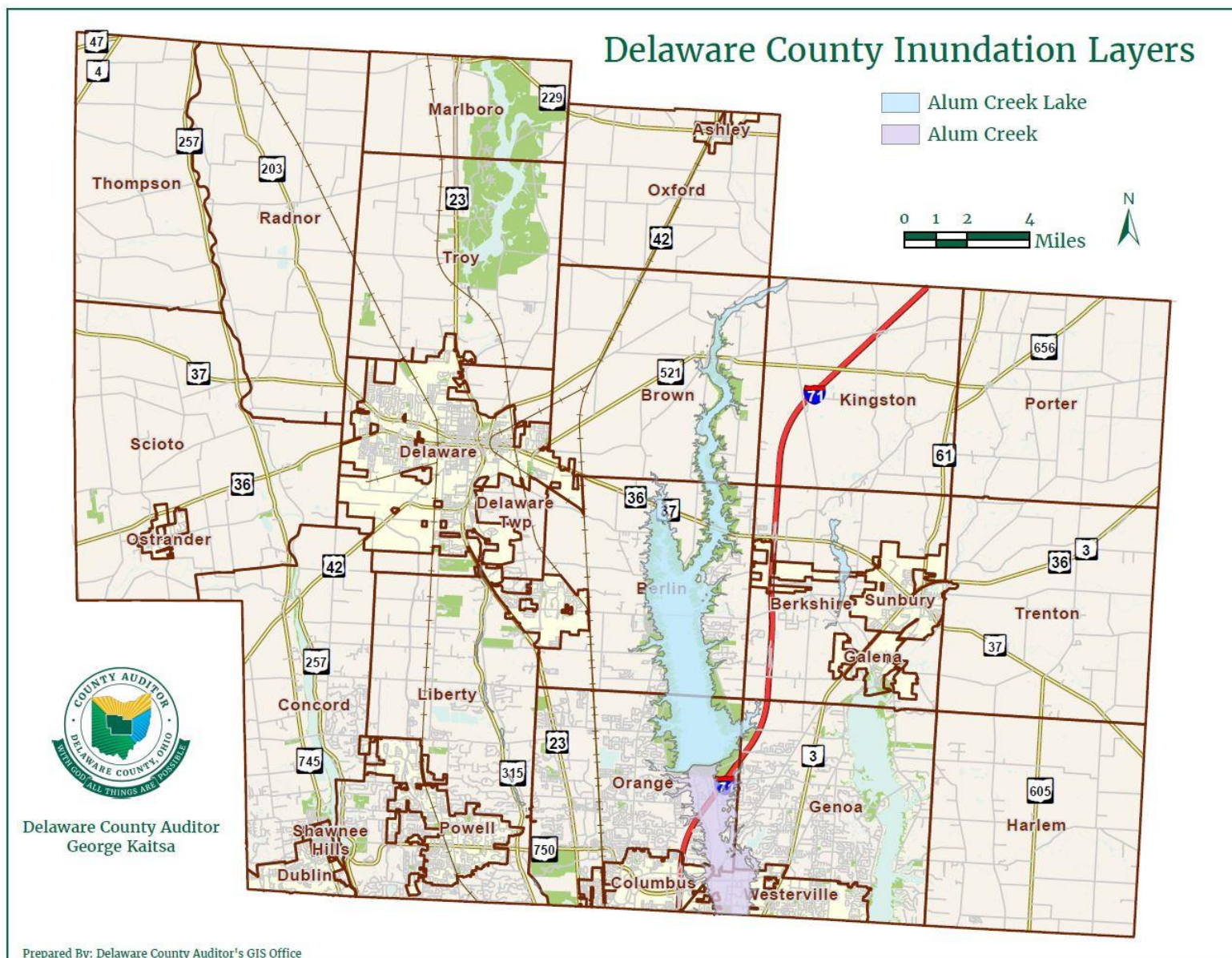


Figure 5: Delaware County Inundation. This map shows the inundation layers for both Alum Creek Lake and Alum Creek located in Delaware County.
Prepared by: Delaware County Auditor's GIS Office. 2018.

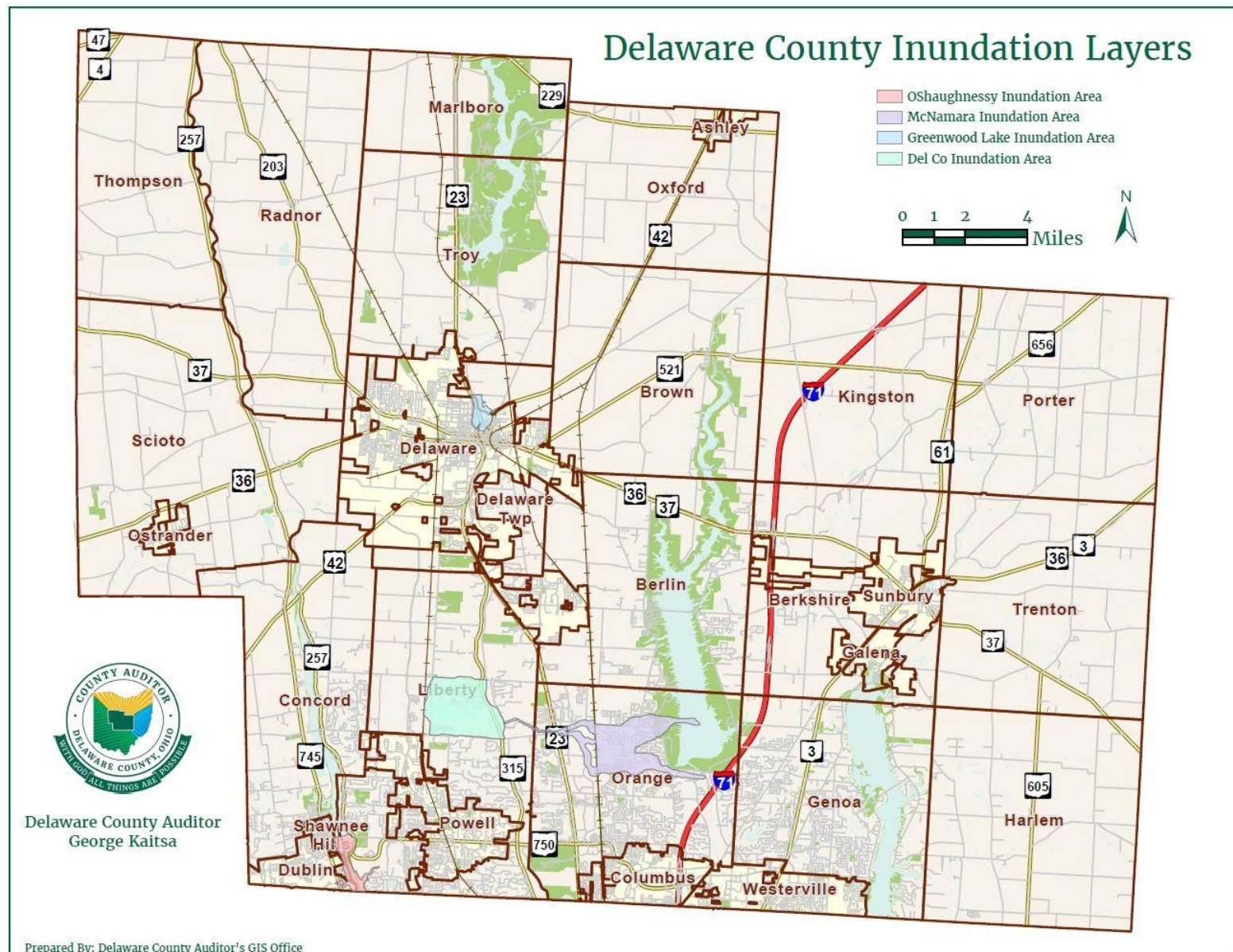


Figure 6: Delaware County Inundation. This map shows the inundation layers for OShaughnessy, McNamara, Greenwood Lake and Del Co. located in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

As there has never been an incident of complete dam failure in the history of Delaware County's dams and an excellent dam safety program is in place to monitor and prevent such an event, it is difficult to assess the probability of a future occurrence of this hazard. The ODNR and US Army Corps also implement excellent Dam Safety Programs that reduces the risk of dam failure through education and monitoring activities, lessening the probability of failure. Thus, the historical occurrences of potential failure and the age of the dams were used to estimate a probability of future occurrence. The average age of the three largest dams (Delaware, Alum Creek, and O'Shaughnessy Reservoir) was about 69 years old at the composition of this plan and there has only been natural or man-made event (the 2005 flood) in which there was extremely high possibility of dam inundation; therefore, the DMPG estimates a 1.5% (or 1/65) annual chance of dam failure each year. Additionally, the previous actual occurrences at the much smaller dams we feel justifies the 1.5%.

RISK ASSESSMENT

Like flooding, it is easy to identify the populations and structures most vulnerable to dam failure as the flow of the water is determined by the topography of the land. Structures within a close vicinity of each dam are at the greatest risk of injury, loss of life, and structural damage as they will experience the greatest amount of water at its greatest velocity should any of the dams fail. This is particularly true for the Del-Co, McNamara and Sunbury reservoirs as their failure would most likely result in water surrounding the dam rather than feeding into a river. In contrast, populations and structures within the 100-yr and 500-yr floodplains of Alum Creek and the Scioto and Olentangy rivers are highly vulnerable if the Alum Creek Dam, the O'Shaughnessy Reservoir or the Delaware Dam were to fail as they flow into each river respectively and would most likely cause severe flooding.

Local GIS inundation maps for all of the dams except for the Whispering Pine, Westerville, Sunbury Dams, Columbus Upground, and Ashley Reservoirs were used to overlay onto the auditor's parcel data and determine the number of structures at-risk within each jurisdiction. Delaware, Powell, Shawnee Hills are the only cities or villages that contain at-risk populations or structures due to their proximity to crucial rivers and reservoirs. Delaware City contains a staggering 2,429 vulnerable structures valued at over \$400 million because the densely populated city lies directly south of the dam in the direct pathway of the water's direction. In addition, there are over 5,000 vulnerable structures that lie outside of the county's municipalities, particularly since the majority of the dams and reservoirs are a sizeable distance from them.

Table 11: Dam Inundation Figures by Jurisdiction. Shows the structures and economic damages of at risk structures by dam inundation in specific jurisdictions in Delaware County.

DAM INUNDATION FIGURES BY JURISDICTION										
	Structures at Risk					Damage in Dollars				
JURISDICTION	Residential	Non-Residential	Critical	Publicly Owned	Total	Residential	Non-Residential	Critical	Publicly Owned	Total
Delaware	1,673	622	94	40	2,429	\$135,085,300	\$12,273,200	\$119,307,900	\$55,195,500	\$429,861,900
Powell	7	N/A	N/A	N/A	7	\$2,625,800	N/A	N/A	N/A	\$2,625,800
Galena	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	\$0
Shawnee Hills	19	6	N/A	N/A	25	\$3,447,700	\$0	N/A	N/A	\$3,447,700
Ashley	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	\$0
Ostrander	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	\$0
Sunbury	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	\$0
Other	4,394	1,071	29	111	5,605	\$911,262,950	\$114,334,100	\$26,387,700	\$37,235,500	\$1,089,220,250
TOTAL	6,093	1,699	123	151	8,066	\$1,052,421,750	\$234,607,300	\$145,695,600	\$92,431,000	\$1,515,155,650
Structures in Dublin, Westerville or Columbus that were also located within Delaware County were not included in these figures. Market improvement values of Delaware County parcels provided by the Delaware County Auditor’s office were utilized in the determination of damage in dollars. Structures determined from 2018 Building Outlines provided by the Delaware County Auditor’s GIS Office. Note: Building Outlines include outbuildings and accessory structures.										

THREAT ANALYSIS

Each dam exists under different conditions and would affect its surrounding residents and environment differently should they fail. Alum Creek, Delaware Lake, and O'Shaughnessy Reservoir are by far the largest dams within Delaware County and are capable of inducing the greatest amount of harm and damages should any of them fail. Alum Creek Reservoir, located in the central and southern portion of the county is connected to an outlet that flows through the densely populated area in the county and eventually flows directly through the City of Westerville located in Franklin County. Similarly, O'Shaughnessy Reservoir is one of a number of reservoirs that control the flow of the Scioto and is located in a densely populated area of the county near the Village of Shawnee Hills. Both GIS analysis and DMPG consensus determined that the most dangerous dam in Delaware County is the Delaware Dam which feeds into the Olentangy River, the waterway that dissects the City of Delaware and runs into the neighboring Franklin County. There will be more information that will be included in the next Plan update regarding the City of Columbus Upground Reservoir in Thompson Township.

Thus, it was determined that the most probable worst case scenario would be the complete inundation and overtopping or failure of the Delaware Dam, overflowing into the Olentangy River as it might have in 2005. The most disconcerting consequence would be the highly probable loss of human life due to the rapid onset time of dam failure, the large magnitude of the hazard from massive amounts of water moving at high velocities, and the proximity of the river to densely populated areas.

The Delaware Lake serves as a reservoir and a means of flood control for the Olentangy River which dissects Delaware City in a heavily populated area. Although it is difficult to estimate the number of lives that would be lost, it is likely that there will be limited casualties, especially if proper evacuation measures are taken. According to the Association of Dam Safety Officials, most dam failures that have occurred since 1980 resulted in zero or 12 casualties with only Hurricane Katrina's levee failures resulting in hundreds of casualties. Assuming all non-residential structures are evacuated, there are 3,956 residential structures within the inundation areas of the Olentangy River/Delaware Dam containing people at risk (see the Figure 7 below for the extent of the inundation and Table 12 for dam inundation figures). Since the average household within Delaware County is 2.8 people, an estimated 11,076 people (or $2.8 \times 3,956$) are at risk of dam failure, meaning that if even 95% of the at-risk population is evacuated properly there are still nearly 533 people that face severe injury or death.

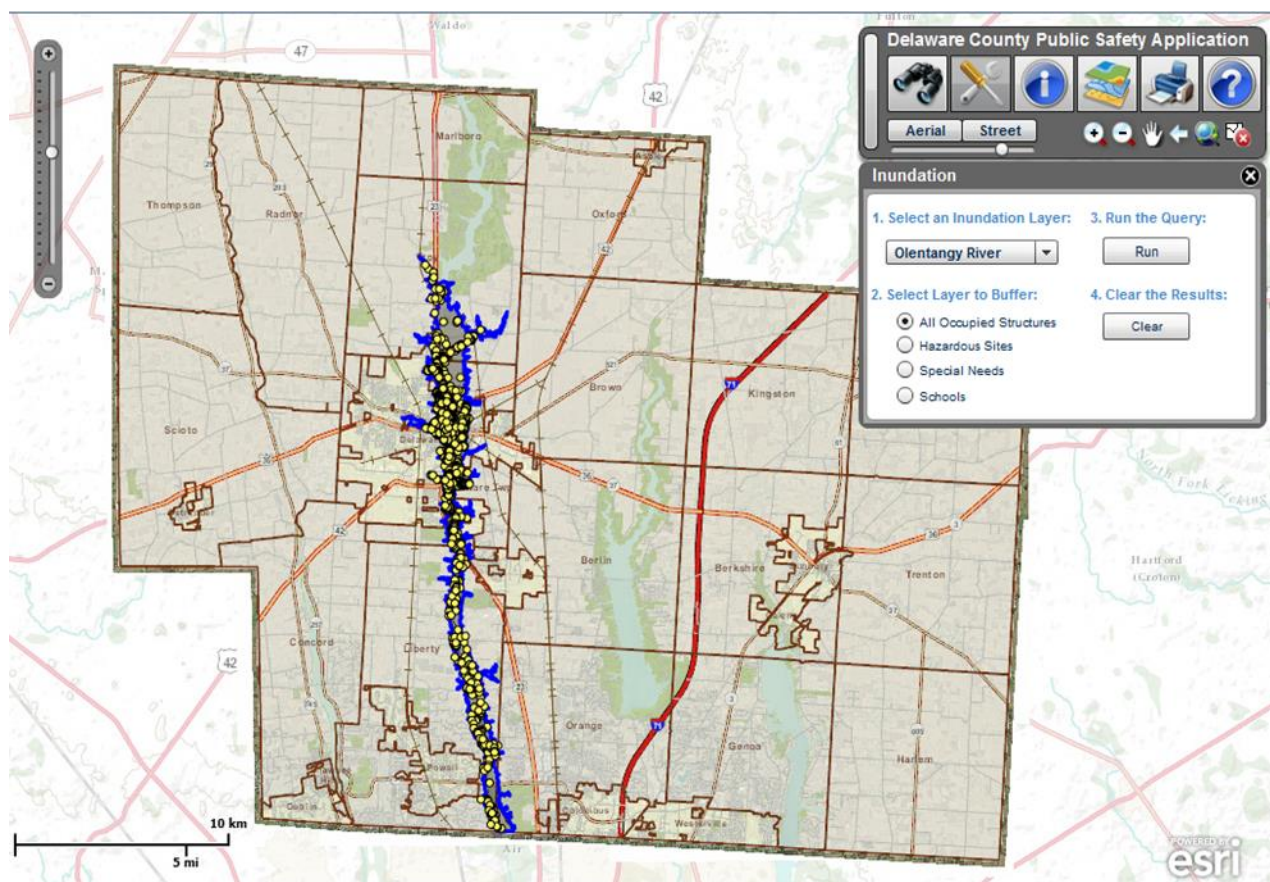


Figure 7: Olentangy River Inundation Example. This map shows the occupied structures located in the Olentangy River Inundation that would be impacted. Source: Delaware County Public Safety Application. 2014.

In addition to the number of lives that may be lost from an inundation of the Delaware Dam, the county would experience severe structural losses. Should the Delaware dam fail a number of parks, businesses and homes would be immediately threatened in Delaware County and in Franklin County as well. See the table below for a breakdown of the at-risk structures according to each inundation map including the Delaware Dam's failure into the Olentangy River (Table 12).

Should the Delaware Dam fail, the county could see damage of over 3,900 structures destroyed and restoration costs of over \$709 million. Since the inundation area contains much of downtown Delaware, these figures include several publicly owned buildings. Such an occurrence would have absolutely detrimental direct and indirect consequences. Aside from the structural losses mentioned above, the surrounding environment would greatly suffer. Dam failures would disperse sediment from the erosion in an unnatural way, altering the landscape and the surrounding ecosystem in Delaware State Park and along the Olentangy River. Flooding from the inundation into residences could also release hazardous materials into the environment.



Table 12: Dam Inundation Figures by Dams in Delaware County.

DAM INUNDATION FIGURES BY DAM		
Dams	Structures at Risk	Damage in Dollars
Alum Creek Lake	205	\$107,962,400
Alum Creek Dam	1,462	\$262,520,400
Delaware Lake	824	\$59,570,500
Delaware Dam / Olentangy River	3,956	\$709,558,050
Del Co	350	\$105,312,900
Greenwood	298	\$23,420,100
McNamara	1,494	\$373,400,000
O'Shaughnessy	199	\$81,480,100
Structures in Dublin, Westerville or Columbus that were also located within Delaware County were not included in these figures. Market improvement values of Delaware County parcels provided by the Delaware County Auditor's office were utilized in the determination of damage in dollars. Structures determined from 2018 Building Outlines provided by the Delaware County Auditor's GIS Office. Note: Building Outlines include outbuildings and accessory structures.		

3.3.2 Drought

Drought is a regional natural meteorological hazard that exists in many different climates. It is caused by a deficiency of precipitation and can be aggravated by other factors such as high temperatures, high winds, and relatively low humidity. Its onset and conclusion are particularly difficult to identify and predict since its effects accumulate slowly over time. Drought is equally likely to occur throughout the County and its encompassing jurisdictions. Although it is not considered a highly dangerous hazard for the County, the DMPG felt it necessary to establish a mitigation strategy as there are large agricultural areas of the county that would feel the effects of a drought should it hit the region. This hazard was ranked 12th highest in regards to its potential impact to Delaware County.

HAZARD PROFILE

A drought is a period of abnormally dry weather, which persists long enough to produce a serious hydrologic imbalance (for example 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.

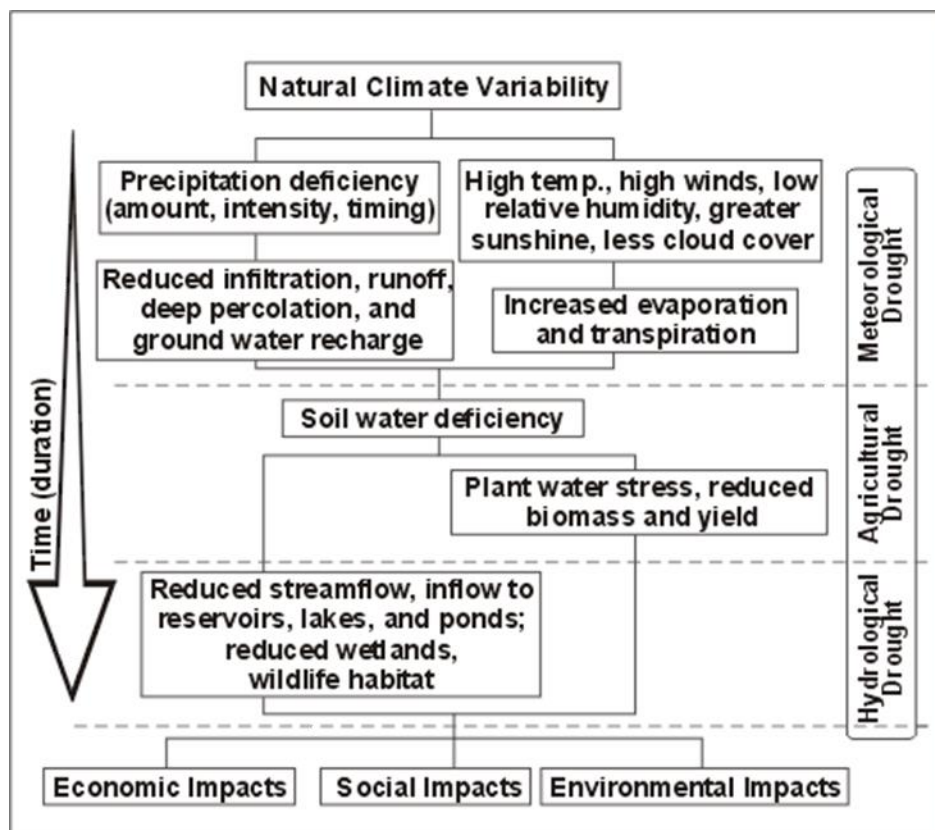


Figure 8: Natural Climate Variability Diagram. Diagram describes the different impacts that droughts can cause and the time duration that they can take to occur. Source: National Weather Service, Public Factsheet. 2006

There are four different types of drought as defined below:

Meteorological – a measure of departure of precipitation from normal. Due to climatic differences, what is considered a drought in one location may not be a drought in another.

Agricultural – refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.

Hydrological – occurs when surface and subsurface water supplies are below normal.

Socioeconomic – refers to the situation that occurs when physical water shortage begins to affect people.

According to the State of Ohio's mitigation plan, Ohio is most often affected by agricultural and hydrological droughts and is typically affected by both simultaneously. Although droughts are hard to predict, meteorologists can best do so by monitoring meteorological and hydrological variables such as precipitation patterns, soil moisture, and stream flow.

HAZARD HISTORY

According to the Geological Society of America's "Managing Drought" Factsheet, there have been multiple severe droughts since 1996 that have had a substantial economic, social and environmental impact on several regions within the country. The Dust Bowl days of the 1930s affected 50,000,000 acres of land, rendering the farmers helpless. In the 1950s, the Great Plains suffered a severe water shortage when several years went by with rainfall well below normal. Crop yields failed and the water supply fell.

The worst drought in 50 years affected at least 35 states during a long hot summer of 1988, when some areas had been suffering a lack of rainfall since 1984. In 1988, rainfall totals over the mid-west, Northern Plains and the Rockies were 50% to 85% below normal. Crops and livestock died, and some areas became a desert. Forest fires began over the Northwest and by the fall had resulted in 4,100,000 acres of destroyed forest.

There have only been two recorded droughts listed for Delaware County listed on NOAA.

1999 – In July of 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. Crop damage amounts were not available at the time of this writing.

1999 – In August of 1999 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.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

The magnitude of a drought not only depends on its duration and intensity, but also on the regional water supply demands made by human activity and vegetation. Since droughts are regional events, they can be considered a county-wide hazard with equal vulnerability across Delaware County. As mentioned above, Delaware County and the State of Ohio, as a whole, are most likely to be affected by agricultural and hydrological droughts.

According to several historical maps in the NCDC archive, the State of Ohio is not within a region that is frequently or intensely affected by droughts and dry weather; however, the most recent NCDC seasonal map assessing the magnitude of drought across the United States includes Delaware County in a region where drought is expected to persist or intensify.

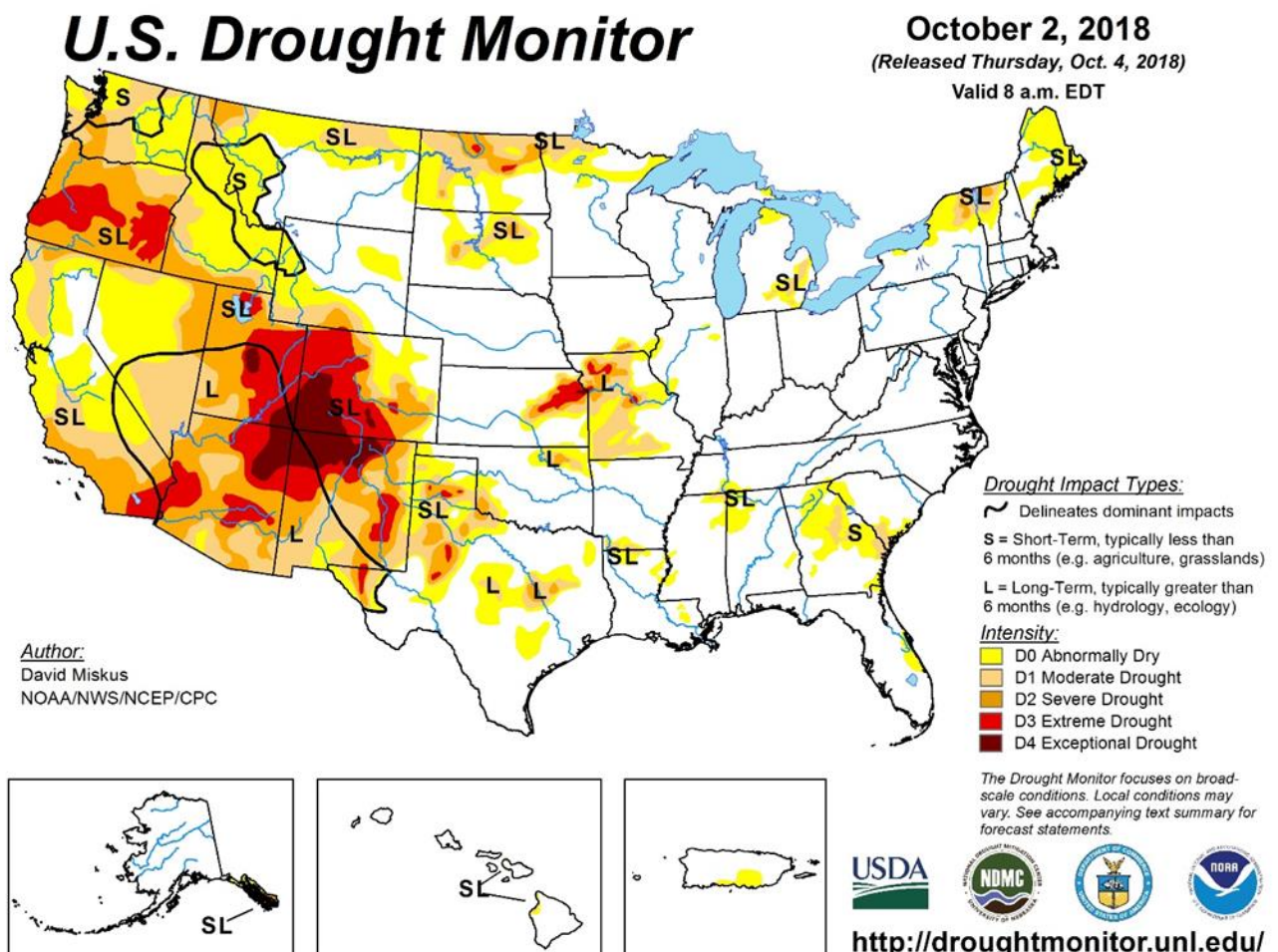


Figure 9: U.S. Drought Monitor Map. Map shows the drought intensity, impacts and time span occurring across the United States. Source: NOAA/NWS/NCEP/CPC. 2018.

U.S. Drought Monitor Ohio



October 2, 2018

(Released Thursday, Oct. 4, 2018)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week 09-25-2018	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago 07-03-2018	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-02-2018	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-25-2018	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 10-03-2017	45.23	54.77	14.22	0.00	0.00	0.00

Intensity:

D0 Abnormally Dry

D1 Moderate Drought

D2 Severe Drought

D3 Extreme Drought

D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

David Miskus

NOAA/NWS/NCEP/CPC



<http://droughtmonitor.unl.edu/>

Figure 10: U.S. Drought Monitor Map for Ohio. Map shows the drought intensity occurring across Ohio and over the last year.
Source: NOAA/NWS/NCEP/CPC. 2018.

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for September 20 - December 31, 2018
Released September 20, 2018

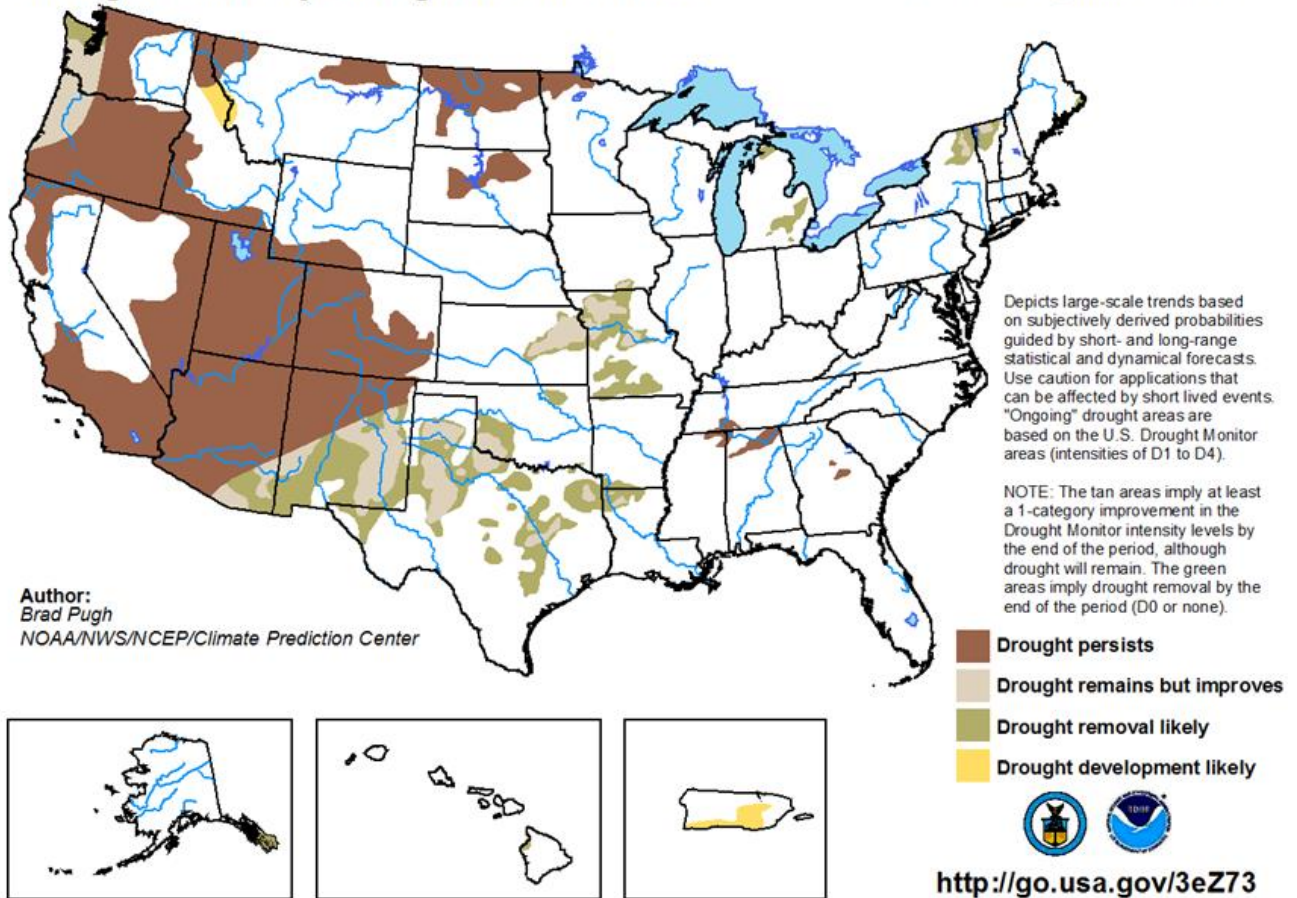


Figure 11: U.S. Seasonal Drought Outlook. This map shows large-scale drought trends across the United States during the valid period. Source: NOAA/NWS/NCEP/Climate Prediction Center. 2018.

As there have been two droughts recorded within Delaware County in the past 68 years, there is a 3% (or 2/68) chance each year that Delaware County will be affected by drought; however, the Geological Society of America suggests that global climate change is expected to increase the probability, frequency, intensity, and duration of droughts throughout the United States especially because lower reservoir levels, higher temperatures and greater variability in precipitation have been observed. Thus, this percentage probability may increase as time passes.

RISK ASSESSMENT

If a drought were to impinge on Delaware County, it would most likely affect agricultural areas and populations whose livelihood depend on the agricultural sector because of drought's negative effect on stored soil water which can be reduced and/or depleted during a drought. Drought, however, does not pose a threat towards residential structures, public structures or critical facilities. Thus, it was not necessary to include a risk assessment jurisdiction table for



this hazard. Its effects are felt more by residents, economic sectors, and the environment depending on agricultural and drinking water demands.

THREAT ANALYSIS

During the last update of this plan in 2013, Delaware County and much of the Midwest region of the country experienced a moderate drought due to high temperatures and low levels of precipitation from a La Nina event in the tropical Pacific Ocean. According to the National Drought Monitor, it has been the most extensive drought in over a half of century, covering the widest area since 1956.

No lives within the county were threatened by the 2013 drought and it is highly unlikely they will be in the future because of Delaware County's extensive water supply. The past drought and any future drought will most likely result in greater economic consequences than any social ones from loss of life or injury. The past event required vegetable growers to irrigate their crops for much of the season, putting those without irrigation systems at risk of low crop yields. Corn and soybeans are the most vulnerable crops. It was expected that much of the region would see large losses, especially since farmers planted record numbers of crops, expecting as agriculture is a significant economic sector within the county.

The effect of a drought on citizens and the various sectors of an area depend on several factors such as meteorological and hydrological conditions, demographic characteristics, regional land use, soil type, water demand, and local preparedness measures. It has been reported by the Climate Prediction Center that drought cost the United States \$39 billion (unadjusted) in 1988 alone. Droughts are a natural occurrence within the environment suggesting that although the hydrological systems and ecosystems might be changed or negatively impacted by a drought, they would most likely be minor consequences that are difficult to prevent. In addition to all the aforementioned factors, crop prices could be expected to also be impacted due to the severity of drought.

3.3.3 Earthquake

Earthquakes are a natural geological hazard that exists in many different locations around the world, some being more of a threat than others. Although Delaware County hasn't experienced an earthquake since 1873, the magnitude from surrounding events, whether from other Ohio counties or from the surrounding states, has the ability to affect any part of Delaware County. Earthquakes are a natural consequence of the slow movement of the earth's crustal plates. They occur along faults, which are zones of weakness in the upper crust. The closest major fault line in Delaware County is the New Madrid Fault in Missouri. The risk of earthquakes could be on the rise according to ODNR, with the increased number of fracking wells located in the state. This hazard was ranked 10th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

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

Earthquakes are the consequence of the slow movement of the earth's crustal plates. At the sites where these plates collide, earthquakes are a regular phenomenon. More than 100,000 earthquakes with magnitudes of 3 or greater occur worldwide each year. It is estimated that there are 500,000 detectable earthquakes in the world each year. 100,000 of those can be felt, and 100 of them cause damage according to the USGS.

Below you can view areas of highest to lowest concern for earthquake potential in the United States (Figure 12). While the West Coast does have greater seismic activity and higher hazard potential, there are still concerning areas of the Midwest. The New Madrid Fault line area of impact and its potential effects can be viewed.

Hot zones for potential earthquakes in the U.S.

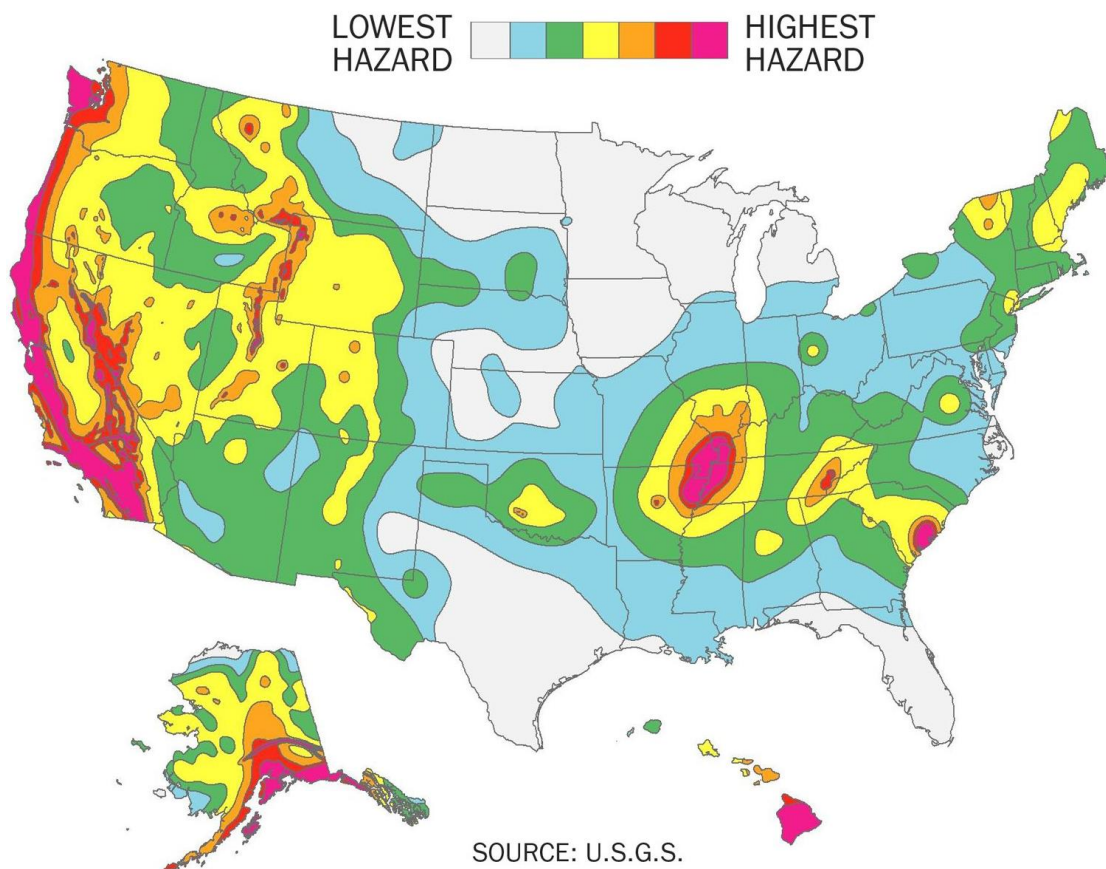


Figure 12: Potential Earthquake Zones in the U.S. The ANSS backbone is based on the core of the original US National Seismic Network. In partnership with the National Science Foundation, the USGS worked with the Earthscope program (through the U.S. Array project and IRIS) in 2004-2006 to upgrade and install new backbone stations. This effort was completed in September 2006, with 15 new stations installed and 20 existing stations upgraded. Today, the ANSS Backbone consists of nearly 100 stations in the United States, many of them contributed by partner networks and organizations. Source: USGS.

Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active area in the Midwest is referred to as the New Madrid Seismic Zone. However, this zone is not of particular concern to Ohio, but many seismologists and emergency planners consider the New Madrid, Missouri seismic zone to pose the greatest threat to Ohio, particularly to southwestern Ohio.

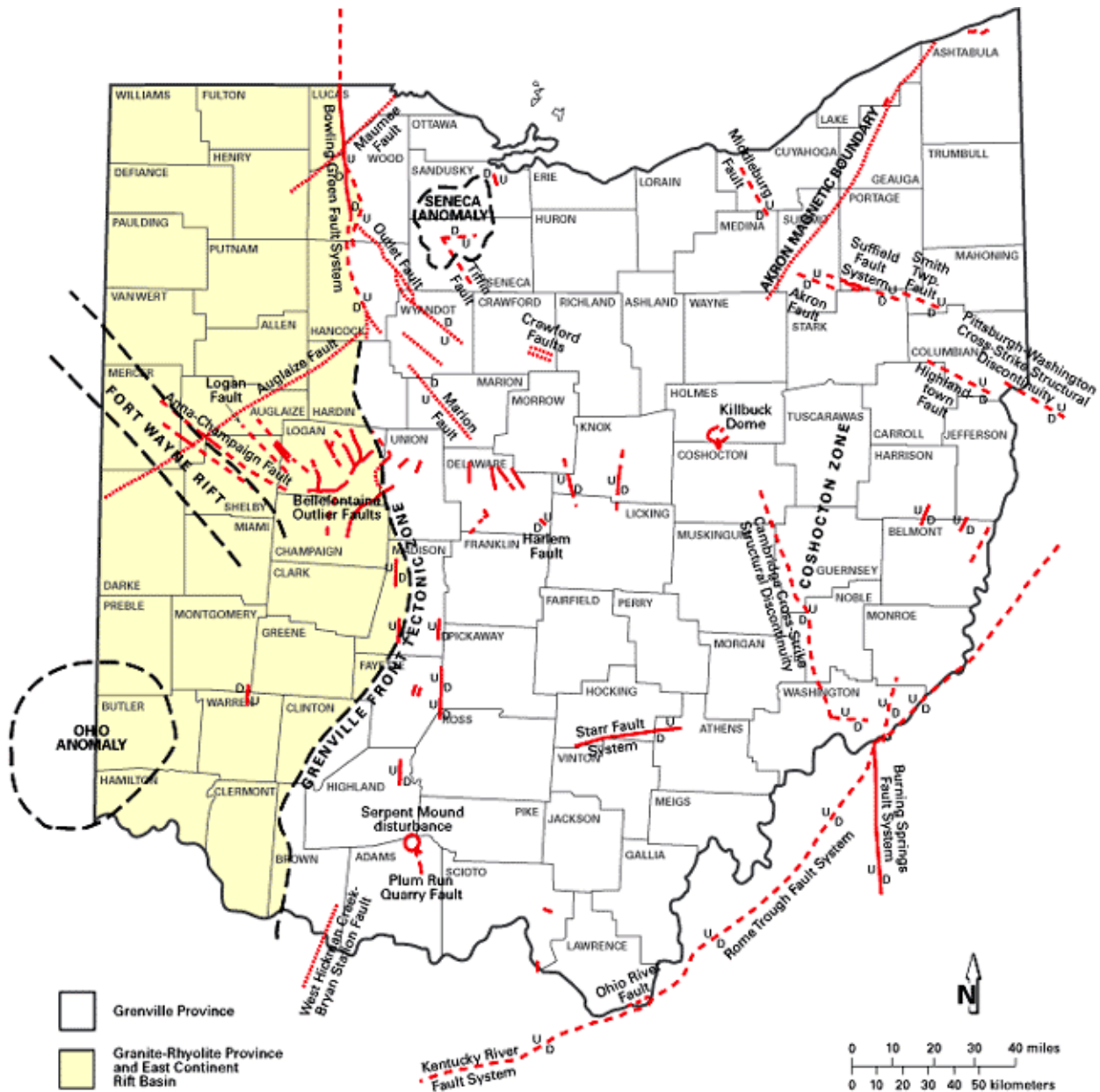


Figure 13: Ohio Fault Lines. Note: This map portrays a number of deep faults and other structures that have been identified by a variety of geological studies. Some faults are well known, whereas others are speculative. Very few of them are visible at the surface. The Fort Wayne (Anna) rift in western Ohio is the site of numerous historic earthquakes. Source: NSGS Modified from Division of Geological Survey Digital Chart and Map Series No. 7. 1991.

Earthquakes can cause strong ground shaking that can lead to the collapse of buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers or homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Magnitude, which is determined from measurements on seismographs, measures the energy released at the source of the earthquake. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined through effects on people, human structures, and the natural environment. Table 13 below defines earthquake magnitudes and their corresponding intensities.

Table 13: Earthquake Magnitudes and Corresponding Intensities. Uses the Richer Scale and the Modified Mercalli Intensity.

Richter Scale	Typical Maximum Modified Mercalli Intensity	
1.0 – 3.0	I – Instrumental	Not felt; detected only by sensitive instruments.
3.0 – 3.9	II – Weak	Felt by only a few people, especially on the upper floors of tall buildings.
	III – Slight	Felt quite noticeably by people indoors, especially on the upper floors of buildings. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck.
4.0 – 4.9	IV – Moderate	Felt indoors by many people, by few outdoors. Standing motor cars rock noticeably. Dishes and windows rattle alarmingly. Sensation like heavy truck striking building.
	V – Rather Strong	Generally felt by most. Dishes and windows may break and large bells will ring. Vibrations like large train passing close to house.
5.0 – 5.9	VI – Strong	Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight.
	VII – Very Strong	Slight to moderate damage in ordinary structures.
6.0 – 6.9	VIII – Destructive	Considerable damage in ordinary structures; chimneys and monuments fall.
	IX – Violent	Considerable damage in all structures; ground cracks; underground pipes break.
7.0+	X – Intense	Most structures destroyed; rail bend; landslides occur.
	XI – Extreme	Few structures left standing; bridges destroyed; broad fissures in the ground underground pipes break.
	XII – Catastrophic	Total destruction; objects thrown into the air; ground moves in waves or ripples; river routes may change direction.

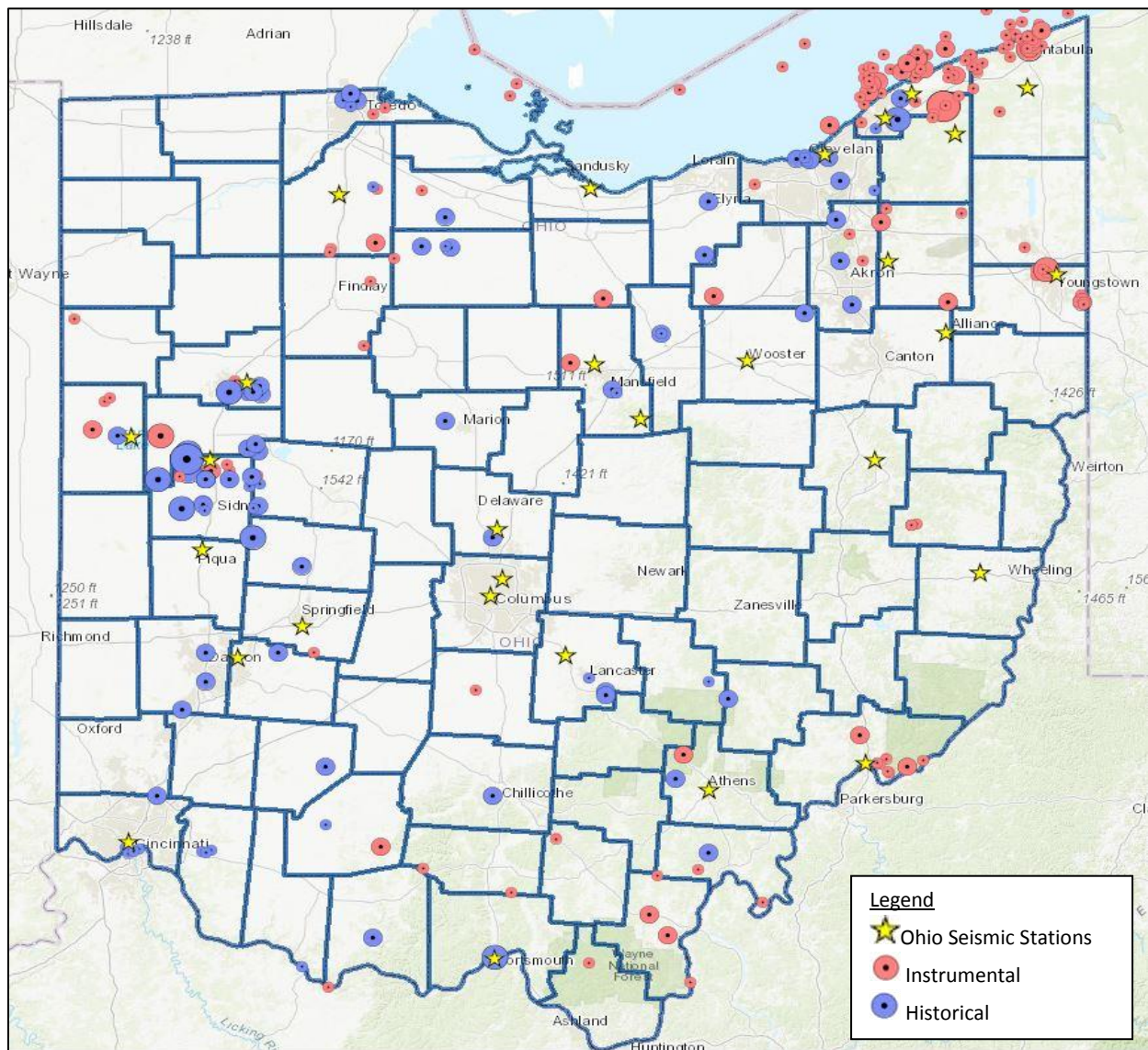


Figure 14: Ohio Earthquake Epicenters and Seismic Station Map. This map displays the locations and scale of earthquakes that have occurred in Ohio. These earthquakes are categorized by instrumental and historical based recordings. Locations of Ohio's Seismic Stations are also represented on the map, including the one located in Delaware County. Source: ODNR, Division of Geological Survey, Office of Information Technology – GIS Services Section. 2018.

Delaware County Earthquakes:

1873- On January 4th the only earthquake historically recorded in Delaware County occurred in Orange Township with a magnitude of 3.8.

Other Ohio Earthquake Events:

1811-1812- There were a series of earthquakes in New Madrid, Missouri which were the largest earthquakes in historic times in the continental United States. Half the town of New Madrid was destroyed. Large areas sank into the earth and new lakes were formed. The Mississippi River changed its course, creating numerous geographic exclaves, including Kentucky Bend. Some sections of the Mississippi River appeared to run backward for a short time. Church bells were reported to ring as far as Boston and sidewalks were reported cracked and broken in Washington, DC. The New Madrid Fault System is still a major concern according to USGS. Publications on this fault are available at usgs.gov.

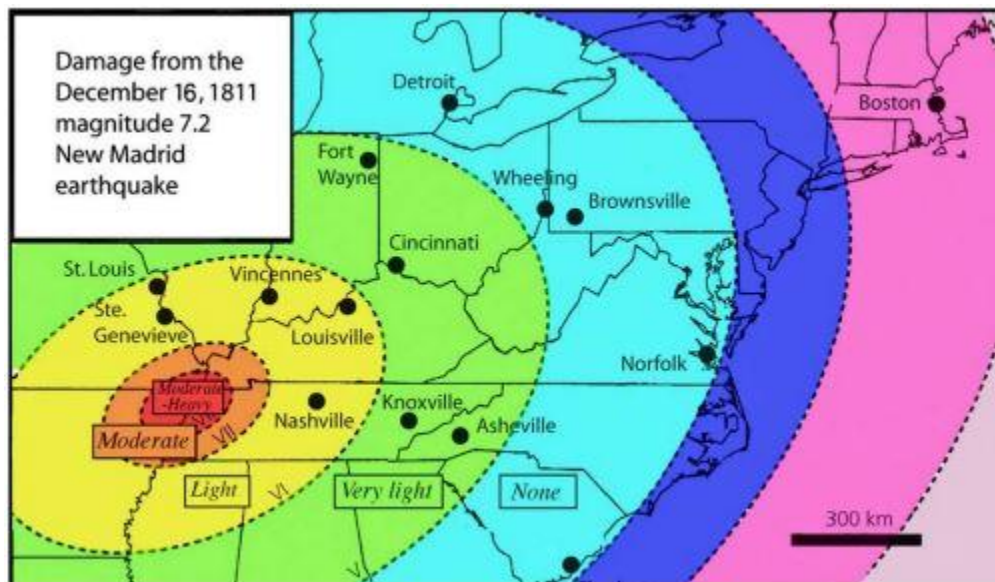


Figure 15: Largest Earthquakes during the New Madrid Series Earthquakes in 1811-1812. Shows the general area that was affected by the 1811-1812 earthquakes that occurred at the New Madrid Fault and the areas that felt and experienced damage. Source: Purdue. 2009.

1937- On March 8th, 1937 the most damaging earthquake was recorded in western Ohio near the town of Anna and measured 5.4 in magnitude. In Anna, which most of the damage occurred, 69 chimneys toppled, foundations and plaster cracked, water wells were disturbed, and cemetery monuments were rotated. The earthquake caused building damage as far away as Fort Wayne, Indiana and was reportedly felt in Indiana, Illinois, Kentucky, Michigan, Missouri, West Virginia, Pennsylvania, and Southern Canada.

1986- On January 31st, an earthquake strongly shook Ohio and was felt in 10 other states and southern Canada. This event was a 5.0 magnitude earthquake and caused moderate damage in the epicenter area of Lake and Geauga counties.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Delaware County has a very low earthquake risk, with a total of 0 earthquakes since 1931. The USGS database shows that there is a 0.61% chance of a major earthquake within 50km of Delaware County, OH within the next 50 years. However, there is still a chance Delaware County including all jurisdictions could experience the effects of an earthquake either from one originating within or outside of County.

The extent of an earthquake is countywide. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. Soils along rivers and other bodies of water have higher water tables and higher sand content. As a result, these areas are more susceptible to liquefaction and land shaking. Liquefaction is a phenomenon in which the strength and stiffness of soil is reduced by earthquake shaking as a result of water filling the space between individual soil particles. This can cause buildings to tilt or sink into the ground, slope failures, lateral spreading, surface subsidence, ground cracking, and sand blows.

RISK ASSESSMENT

An Earthquake has the possibility to hit and affect all areas of the county equally. At any given location it would be expected to have similar effects on the land, infrastructure, and health in Delaware County. It is well documented that earthquakes can have significant effects on water wells. The shaking associated with an earthquake may cause sand to plug a well screen, therefore reducing the volume of water that can be pumped. Conversely, the shaking can dislodge sand plugging a well screen and cause an increase in the volume of water that can be pumped from the well. Both of these phenomena have been widely reported from the epicenter areas of Ohio's larger earthquakes, including the 1937 Anna earthquakes and the 1986 Chardon earthquake. In some cases, the well returns to its normal state, but in others, the well needs to be serviced to restore former production volume. Production spikes from oil and gas wells have been reported following a local earthquake. Very large earthquakes at great distances can also cause the water table to temporarily rise and fall when the long-period surface waves pass through the state. The 7.9-magnitude Denali, Alaska earthquake on November 3, 2002, caused water-level changes in some Ohio wells.

All future structures will also have the potential to experience an earthquake. However, given that new structures must meet current building codes and given the expected magnitude of earthquakes in Delaware County, structure loss is expected to be low. Older buildings or dilapidated structures might experience more damage, especially brick buildings and those with chimneys. Historical downtown buildings might be the most at risk.

THREAT ANALYSIS

The largest earthquake in Ohio occurred in 1937, in western Ohio in the Shelby and Auglaize Counties area. This earthquake followed a smaller one and is estimated to have had a magnitude of 5.4. Considerable damage occurred in Anna and surrounding communities. This damage included nearly every chimney in Anna being damaged, cracks and wall separation in the school, rotation of cemetery monuments, and changes in water wells, and other minor to moderate damage. The Anna school had to be condemned and torn down.

However unlikely, if an earthquake of this magnitude did occur in Delaware County there would be significant damage to older historical buildings especially those made of brick. Houses with chimneys could also see significant damage. Structural codes and upgrades to buildings construction allow newer structures the possibility to face less damage. It is estimated that such an earthquake could result in high economic costs in property damages. It is also likely that a major earthquake would be detrimental to the local economy and local government facilities as they would be forced to designate their time and resources to recovery efforts. Other critical facilities might be hindered depending on the level of damage that their buildings faced. In regards to the environment, a severe earthquake can have an effect on water quality. When the intense shaking of an earthquake occurs, an influx of sediments from the surrounding area can impact water quality for surface and groundwater systems.

3.3.4 Flood

Flooding has been and will continue to be a major natural meteorological hazard priority in Delaware County's mitigation planning due to its frequency in occurrence, its probability of future occurrence, and its ability to incur large costs. Although much of Delaware County's flooding problems have been mitigated through the use and maintenance of reservoirs, there are still instances of flooding that threaten Delaware County's citizens, property and environment. Flash flooding, in particular, can incite problems including disruptions in transportation networks, utility service, business activities and damages to homes, businesses and infrastructure, loss of crops and loss of life. This hazard was ranked 3rd highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

A flood is an overflowing of large amounts of water beyond its normal confines. Most often floods are a result of heavy rainfall that raises the water level of existing bodies of water over their flood barrier. Flood events can be very serious and very costly, depending on how high the water crests. Floodwaters may outright destroy homes, businesses and other structures. If not destroyed, it can take a considerable amount of time, money and effort to restore a structure to its pre-flood condition. One effect of flooding is mold, which can pose a health hazard. In addition, floodwaters can be contaminated with substances like raw sewage or hazardous materials. Many of the flood-related deaths (about half) occur in automobiles, especially since just two feet of quickly moving water can cause cars to float or move off the road and only six inches of fast moving water can sweep an adult off their feet.

There are many different types of flooding that affect Delaware County including riverine and flash flooding. Riverine flooding is generally characterized by a gradual rise in waters from both large water basins and small tributaries. Such flooding is typically gradual, can last for long periods of time. In contrast, flash flooding happens when large amounts of water rise rapidly with little warning or time to evacuate. One of the greatest flood problems is the obstruction of floodways by inadequate waterway openings, abandoned dams, encroachments, fills, bends in the stream, heavy brush or trees within the channel and on its banks, highways, railroads and private crossings, to name a few.

HAZARD HISTORY

Obtaining updated information regarding significant costly occurrences of flooding in Delaware County involved compiling data from several sources including newspapers, internet websites and the NCDC database. Some of the most significant flooding events in Delaware County and its participating jurisdictions are profiled below along with recent flooding events that have occurred since the adoption of the previous Mitigation plan for the County.

1898 – The 1898 flood was one of the worst the County had experienced due to such heavy rains in a short period of time. Damage estimates range from \$50,000 to \$60,000 throughout the

county. It was reported that the County briefly lost electricity and many bridges were washed out.

1913 – The Delaware Gazette reported on March 25th, 1913 that the Olentangy River rose to 32 feet, 23 feet above flood stage and 11 feet higher than the previous record. This also caused routes between the East and West side of Delaware County to be cut off since the Winter Street, Central Avenue, And William Street Bridges and the Big Four Railroad Bridge were washed away. It is estimated that the flood resulted in \$1.5 million in damages and 18 lives lost.

1929 – The Delaware Daily Gazette reports that on February 26th, 1929 there was approximately 2 inches of rainfall that caused the waters of the Olentangy River to rise 3 ½ feet above flood stage. There were many residents that reported cellar flooding and the State Highway Department lost more than 40 pieces of equipment due to high waters.

1937 – Heavy rainfall began on January 14th and continued for nearly two weeks causing flood waters to rise and recede several times. Although no major damage was reported in Delaware County, the widespread rain affected 10 other States, displaced over 500,000 people and resulted in 120 deaths.

1959 – This flood has historically been compared to the flood of 1913 as one of the worst in Delaware County's history. The Delaware Reservoir was reported to be at 18 feet above flood stage and waters rose within 4 feet at the top of the Delaware Dam. All schools in Delaware County were closed due to flooding and/or impassable roadways.

1975 – Heavy rains accumulated over 3 inches of rain in a 2 day period in late February. Many roadways were closed and basements were flooded countywide.

1990 – Heavy rains added to the already saturated ground causing a portion of State Route 315 to be closed for several hours.

2004- As much as five inches of rain caused severe flooding in and around Delaware County on June 15th, 2004. There were 154 homes damaged, many in subdivisions along State Route 257 northwest of Powell and 34 mobile homes in the Shroyer's Mobile Home Park just north of Delaware sustained damage when the Olentangy River rose out of its banks. Numerous roads and bridges were damaged by high water and culvert washouts.

2005- A widespread area of showers and thunderstorms ahead of a warm front affected much of central and western Ohio on January 11th, 2015. One to three inches of rain fell across the region, exacerbating existing flooding from previous rains and snowmelt. The heaviest rainfall occurred from west central Ohio southeast through the Columbus area. Numerous roads and low lying areas were flooded, and a number of creeks and streams rose out of their banks. A few days later an area of showers with embedded thunderstorms ahead of a cold front produced nearly an inch of rain across central Ohio during the evening. The rain fell on already saturated

soils, and several roads were flooded and closed across the area. The Interstate 270/US Route 23 interchange on the south side of Columbus was closed because of high water.

2007- On March 1st, 2007 a cold front produced heavy rainfall which caused flooding of several roads in Scioto Township. Blues Creek rose out of its banks. There were about \$3000 in property damage from the event.

2011- A weak shortwave combined with bulk shear and instability to produce thunderstorms during the early morning of July 24th, 2011. One of these storms briefly became severe. The persistence of these storms along a convergence boundary also produced flash flooding in the area. The main threats from these storms were flash flooding due to heavy rainfall and damaging thunderstorm winds. Roads were closed due to high water caused by heavy rain. Some driveways were washed out.

2015- On June 17th, 2015 Ohio Route 257 was closed at Hoskins Road due to high water. Thunderstorms developed along a stalled frontal boundary. The storms trained across portions of the region and produced very heavy rain and flooding.

2016- A mesoscale convective system developed across Illinois and worked east then southeast across the region during the early morning hours of June 23rd, 2016. Three to four inches of fast flowing water was reported on Cypress Drive in Delaware County.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

The areas of concern within Delaware County that could lead to significant flooding are the two major rivers in Delaware County (the Olentangy River and the Scioto River) and the two major creeks in Delaware County (Alum Creek and Big Walnut Creek). All of these moving bodies of water are controlled by dams forming the O'Shaughnessy Reservoir, Delaware Reservoir, Alum Creek Reservoir, and Hoover Reservoir. All have floodgates to control water flow except for the O'Shaughnessy Reservoir which has a spillway.

FEMA FIRM data was utilized to in order to determine the 100-year flood zones which are typically referred to as vulnerable flood risk areas as it is considered that there is a probability of 1% or 1/100 chance of flooding in the area every year. The map below displays the geographic extent of these high-risk areas within Delaware County along with the outlined jurisdictions incorporated within this plan (Figure 16). Yet, the NCDC database illustrates that floods occur more than once every hundred years within Delaware County. Recent figures show 53 floods have occurred within the county between January of 1996 to June of 2018 and out of those 20 have caused significant damages. This suggests that there is an 86.9% probability (or 20 events/23 years) that a flood will occur each year within the county. None of the recently recorded floods caused any injuries or deaths with an average of \$8,500 in property damages per event, so it is likely that most future flooding events will be minor to moderate in magnitude with minor property damages; however, severe flooding is always a possibility despite its infrequency of occurrence.

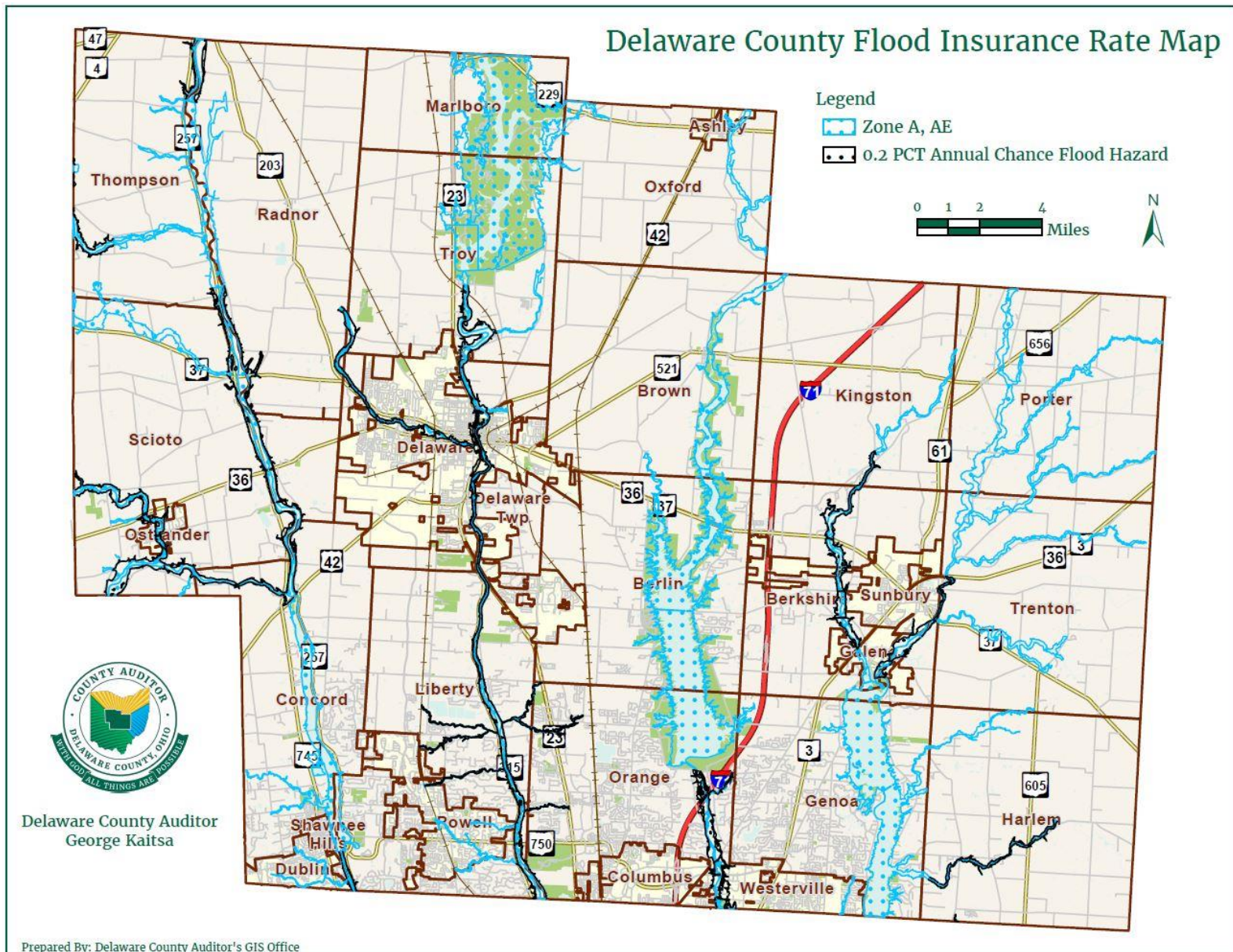


Figure 16: Delaware County Flood Insurance Rate Map (FIRM). Shows the flood insure rate zones in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

RISK ASSESSMENT

Delaware County is filled with a number of rivers, creeks and other waterways making a number of people and structures vulnerable to flooding. As the nature of a flood is based mainly on the composition of the floodplain, it is significantly easier to predict what structures are most vulnerable to flooding in comparison to other natural hazards. People with riverfront properties and those who reside in floodplain areas are the most vulnerable populations.

In order to determine the number of structures that are vulnerable to floods, FEMA floodplain data for the 100-year flood zone and the 500-year flood zone were each overlaid on parcel data from the Delaware County auditor's office using GIS. Two separate tables illustrate the number of structures at risk for a 100-yr flood and a 500-yr flood (Table 14 & 15).

THREAT ANALYSIS

Flooding is a serious concern within Delaware County due to the large number of waterways within the county, the frequency of precipitation within the region and the potential property damage that flooding can incur. Improved warning systems and local preparedness have greatly reduced the risk of injury and death to county citizens; however, flooding is still highly dangerous for pedestrians and drivers, particularly if there is a flash flood. Flooding typically causes minor damages.

NFIP Participation:

Table 16: Status of Jurisdiction Flood Insurance Rate Maps (FIRM)

Status of Jurisdiction FIRMS				
	Initial Flood Hazard Boundary Map (FHBM) identified	Initial Flood Insurance Rate Map (FIRM) identified	Current Effective Map date	Reg-emer. Date
Ashley	12/21/73	04/21/99	04/16/09	01/03/85
Delaware City	05/17/74	11/02/83	04/16/09 & 2/17/16	11/02/83
Delaware County	12/16/77	10/18/83	04/16/09	10/18/83
Galena	02/15/74	09/04/87	04/16/09	09/04/87
Ostrander	N/A	09/19/90	04/16/09	05/03/91
Powell	10/18/74	03/04/85	04/16/09	03/04/85
Shawnee Hills	02/08/74	04/21/99	04/16/09	09/29/78
Sunbury	05/31/74	09/01/87	04/16/09	09/01/87

Table 17: Repetitive and Severe Repetitive Loss Properties in Delaware County

Repetitive and Severe Repetitive Loss Properties in Delaware County											
	Jurisdiction	City	Mitigated	Comm. Number	Occupancy	Zone	Total Building Payments	Total Contents Payments	Total Paid	Average Payment	Losses
Severe Repetitive Loss	Scioto Twp.	Delaware (Unincorp.)	Yes	390146	SINGLE FMLY	AE	\$117,170.51	\$3,358.62	\$120,529.13	\$24,105.83	5
	Scioto Twp.	Delaware (Unincorp.)	Yes	390146	SINGLE FMLY	AE	\$56,902.21	\$4,995.43	\$61,897.64	\$12,379.53	5
Repetitive Loss	Scioto Twp.	Delaware (Unincorp.)	No	390146	SINGLE FMLY	A	\$35,510.44	-	\$35,510.44	\$8,877.61	4
	Liberty Twp.	Powell (Unincorp.)	No	390146	SINGLE FMLY	A12	\$3,066.41	\$3,634.24	\$6,700.65	\$3,350.33	2
	Liberty Twp.	Powell (Unincorp.)	No	390146	SINGLE FMLY	X	\$29,247.54	\$32,602.62	\$61,850.16	\$10,308.36	6
	Liberty Twp.	Powell (Unincorp.)	No	390146	SINGLE FMLY	B	\$63,087.00	\$3,073.47	\$66,160.47	\$22,053.49	3
	Troy Twp.	Delaware (Unincorp.)	No	390146	SINGLE FMLY	X	\$26,006.50	-	\$26,006.50	\$13,003.25	2
	City of Powell	City of Powell	No	390626	SINGLE FMLY	A08	\$23,220.49	\$1,881.00	\$25,101.49	\$12,550.75	2
Total							\$354,211.10	\$49,545.38	\$403,756.48	\$106,629.15	29

Repetitive Loss Properties to floods: EMA assisted Scioto Township in a flood mitigation project. This project pertained to two properties, which Scioto Township obtained through the Repetitive Flood Claims (RFC) grant. There was the potential to acquire a third house, but it was up to the homeowner to participate. The idea behind this project was to alleviate the burden of flood claims on the publicly-funded National Flood Insurance Program (NFIP). The two properties in the project have been demolished, graded and seeded. The third homeowner did not wish to participate. These properties are deed restricted to open space in perpetuity, so if the area floods in the future, there will be no structures present. No one will be in harm's way on these properties and the fire department will not have to perform rescues. The total grant award was for \$701,099.99 and was through the fiscal year 2011 Repetitive Flood Claim. The project was officially completed in 2013.



Figure 17 & 18: Before and After Mitigation Project. Shows a before mitigation (left photo) and after mitigation project (right photo) for a parcel of land located in Delaware County that was able to go through the National Flood Insurance Program (NFIP). Source: Delaware County EMA. 2014



SCIOTO TOWNSHIP/DELAWARE COUNTY ACQUISITION PROJECT / RFC FY 2011
NFIP Community ID #390146

ACQUISITIONS COMPLETED						
Project Number	Property Owner	Address	Parcel Number(s)	URA Y/N	Activity Status	Monitor Date/Closeout/Site Visit
ST1	*Rep Loss [REDACTED]	1763 SR 257 S Delaware, OH 43015	50022001006000	No	AC	5-15-13
ST2	*Rep Loss [REDACTED]	1803 SR 257 S Delaware, OH 43015	50022001007000	No	AC	5-15-13

TOTAL ACQUIRED: 2

TOTAL DECLINES: 1

***AW-501 FORMS MAILED TO NFIP REPETITIVE LOSS UPDATES ON MAY 24, 2013 FOR ST1 AND ST2**

A = Acquisition

C = Offer Accepted/File Completed

D = Declined to Participate

Figure 18: Scioto Township/Delaware County Acquisition Project. Source: Delaware County EMA. 2011.

FLOODPLAIN REGULATIONS

Delaware County Code Compliance, a department of the Environmental Services Division, developed a floodplain regulations plan called “Flood Damage Prevention Regulations”. This plan was adopted on April 16, 2009, by the Board of County Commissioners of Delaware County. In these regulations, the Floodplain Administrator’s duties and responsibilities are outlined in Section 3.2 which includes enforcing the floodplain regulations. The Floodplain Administrator also conducts monitoring activities on a regular basis and provides community assistance such as educating owners on development regulations for floodplains, development permit requirements, why regulations are required for floodplains, the importance of flood insurance and requirements of the National Flood Insurance Program (NFIP).

3.3.5 Severe Summer Weather and Extreme Heat

Ohio is located in a region of the United States that experiences extreme cold during the winter months and extreme heat during the summer months. According to the Ohio EMA, the state has seen a reduced average of annual precipitation events over the past 50 years, but an increasing average of heavy and/or severe precipitation events. This could lead to longer dry spells and more disastrous and threatening episodes of severe summer weather. The DMPG felt compelled to prepare for the consequences of ever-increasing severe summer weather as it threatens property, crops and even human life. This hazard was ranked 5th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

Severe summer weather can vary in its inclusion of thunderstorms, high wind, lightning, hailstorms, and extreme heat. All of these are generally localized in a small geographic region (with the exception of extreme heat which spans across a larger region) although they are typically large enough to affect half or more of the county. Events included are between April-September months.

According to the National Weather Service, a thunderstorm is classified as severe if the wind gusts are greater than 50 knots or 58 mph, if there is hail with a ¾ inch or greater diameter, or if the storm produces a tornado. A typical thunderstorm is 15 miles in diameter, lasts for approximately 20-30 minutes and usually occurs at the forefront of an incoming cold front. Strong straight-line winds can cause severe damage to property, especially if winds are strong enough to topple trees and power lines.

A key component of thunderstorms is lightning which is a rapid atmospheric discharge of electricity. It tends to strike tall, conductible objects such as trees, utility lines, buildings, and even humans. Lightning strikes are among the most dangerous weather conditions as they cause more deaths each year than tornadoes or hurricanes.

Extreme or excessive heat is classified as uncharacteristically high temperatures within a region and can come in the form of a “heat wave” which is an extended period of time under these conditions. It is a particularly threatening hazard because evaporation is slowed and the human body requires more effort to maintain a normal body temperature. Dangerous levels are measured and categorized using the NOAA’s National Weather Service Heat Index which can be seen in the NOAA chart below (Figure 19). Stagnant air conditions, poor air quality and high humidity often exacerbate the effects of extreme heat on the local population and the environment.

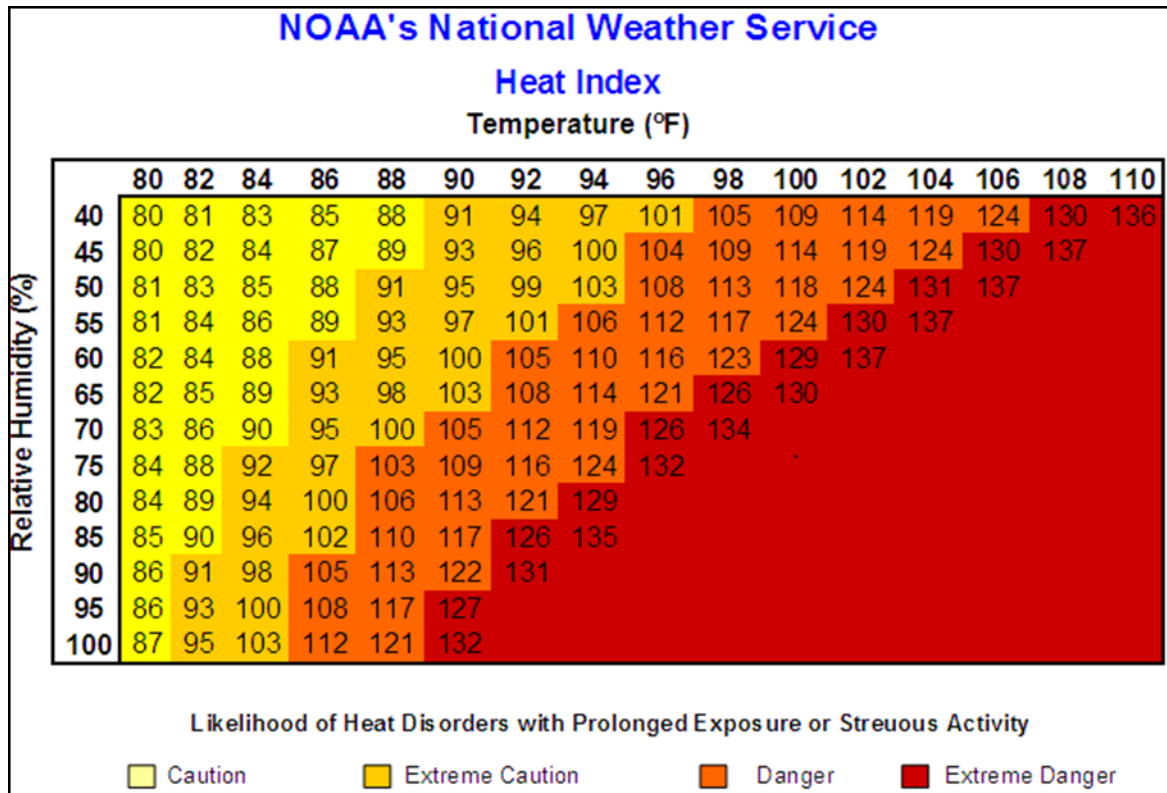


Figure 19: NOAA's National Weather Service Heat Index. Chart shows the likelihood of a heat disorder occurring with prolonged exposure. The Heat Index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. Source: NOAA/NWS. 2014.

HAZARD HISTORY

Historical events of severe summer weather in Delaware County were found by compiling data from the NCDC Storm Events Database and various local officials. Events that included excessive heat, lightning, wind, thunderstorm, hail, and heat were found between January 1st, 1960 and August 31st, 2018. Those that occurred April 1st through September 30th in any given year were included in the final count as they could be considered summer events. 256 incidents of severe summer weather and 0 periods of excessive heat were found during the aforementioned data period. Due to the large number of occurrences, only the most severe and recent incidents are described below:

2008- In September of 2008, the remnants of Hurricane Ike reached Ohio and the deep inland of the United States as winds reached 78 mph uprooting trees, damaging homes, and bringing down several power lines and poles. About 2.6 million customers across Ohio lost power.

2010- On September 16th, 2010 a scattered line of storms developed in an area of strong deep shear, damaging trees and roofs by thunderstorm winds. One woman was injured from a tree falling on her home by Alum Creek Reservoir (Orange Township). There was an estimated \$40,000 dollars lost in property damages.

2011- On June 4th, 2011 thunderstorms developed on a lake breeze pushing ahead of a cold front, resulted in damaging winds and hail. Trees were torn down, a barn roof was blown off and wood was driven into the siding of a house. The storm resulted in approximately \$15,000 dollars in property damages.

2012- On Jun 29th, 2012 Delaware County and most of Central Ohio experienced a derecho, or a widespread, long-lived windstorm, that produced highly damaging straight-line winds. Over 300,000 people in the area lost power and some went without it for almost 10 days. Additionally, the Concord Township Fire Station sustained severe damage to its roof.

2014- On April 29th, 2014 a thunderstorm developed along and south of a warm front. Some of the storms during this time had the potential to become severe. The main threats from these storms were damaging winds and sub-severe hail. Property damages from the storm resulted in approximately \$25,000 dollars.

2017- On April 5th, 2017 showers and thunderstorms developed ahead of a strengthening surface low which moved from the Middle Mississippi Valley into Northwest Ohio. The damage included a piece of aluminum siding being pulled from a house façade, a boat on a trailer was pushed across the yard damaging a couple of cars, and numerous trees were reported knocked down. The property damages from the storm resulted in approximately \$10,000 dollars.

2017- On July 22nd, 2017 thunderstorms associated with an upper-level disturbance moved across the Delaware County area during the morning hours. The storms produced damaging winds and localized flash flooding. The storms resulted in approximately \$18,000 dollars in property damages, several trees, and power poles being downed, and 3 people injured. A camper trailer was overturned at Delaware State Park and three people were injured when a tree fell onto a tent of campers. A semi-truck trailer was also blown over on US Route 23 South of State Route 229 due to the wind severity.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

To determine the probability of future occurrences of severe summer weather within Delaware County, historical events and updated NCDC climate maps were used. Thunderstorms, heavy precipitation and winds, and extreme heat are all county-wide events that tend to span across a broad region. In comparison to other areas of the United States, Delaware County and the Central Ohio region sees an annual mean total precipitation of 30-40 inches per year with an average annual number of days of measurable precipitation ranging from 105.5-120.4 days, with both measurements located in the medium to medium-high spectrum of national figures. See the maps below illustrating these numbers respectively.

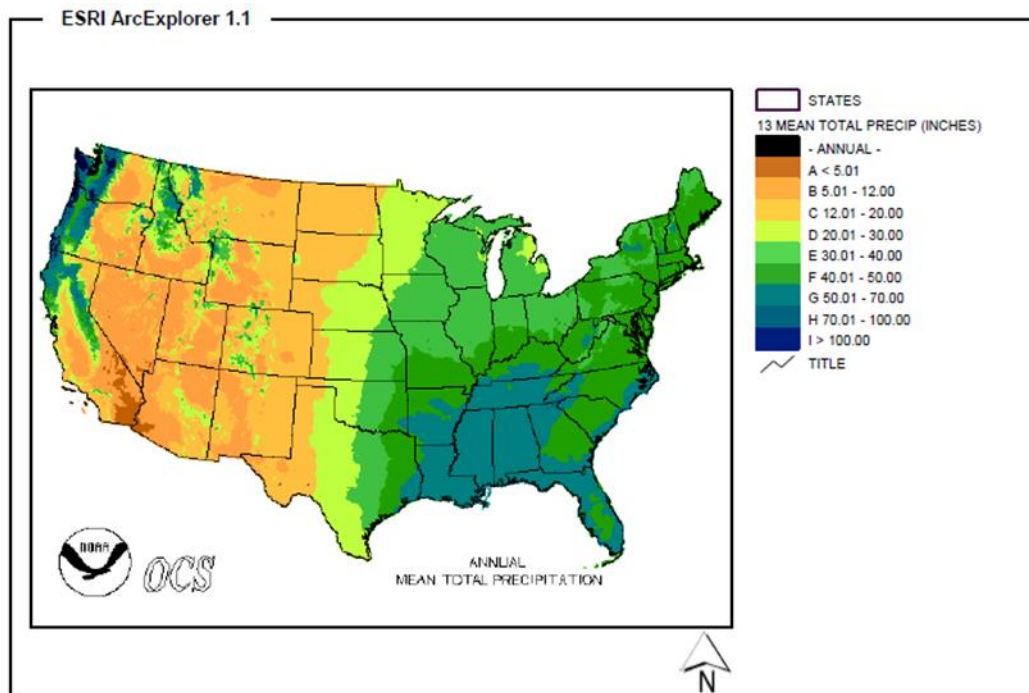


Figure 20: Annual Mean Total Precipitation. Shows annual total precipitation in inches across the contiguous United States. Source: NOAA, 2014.

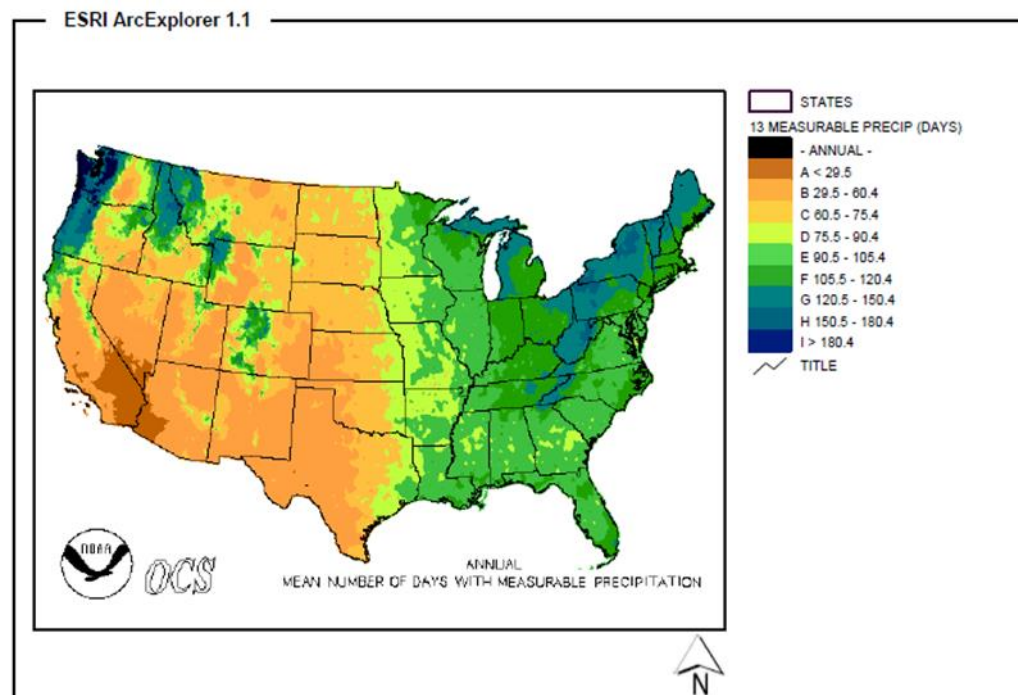


Figure 21: Annual Mean Number of Days with Measureable Precipitation. Shows the number of days that a location received measurable precipitation across the contiguous United States. Source: NOAA, 2014.

Temperature and humidity are the two most important factors in the level of danger that extreme heat threatens Delaware County. The County experiences medium to medium-high levels of annual mean extreme maximum temperature between 91.1 and 100.0 degrees as can be seen in figure below (Figure 22). Delaware also sees a medium-high level of average relative humidity between 66% and 75% as can be seen in the figure below (Figure 23).

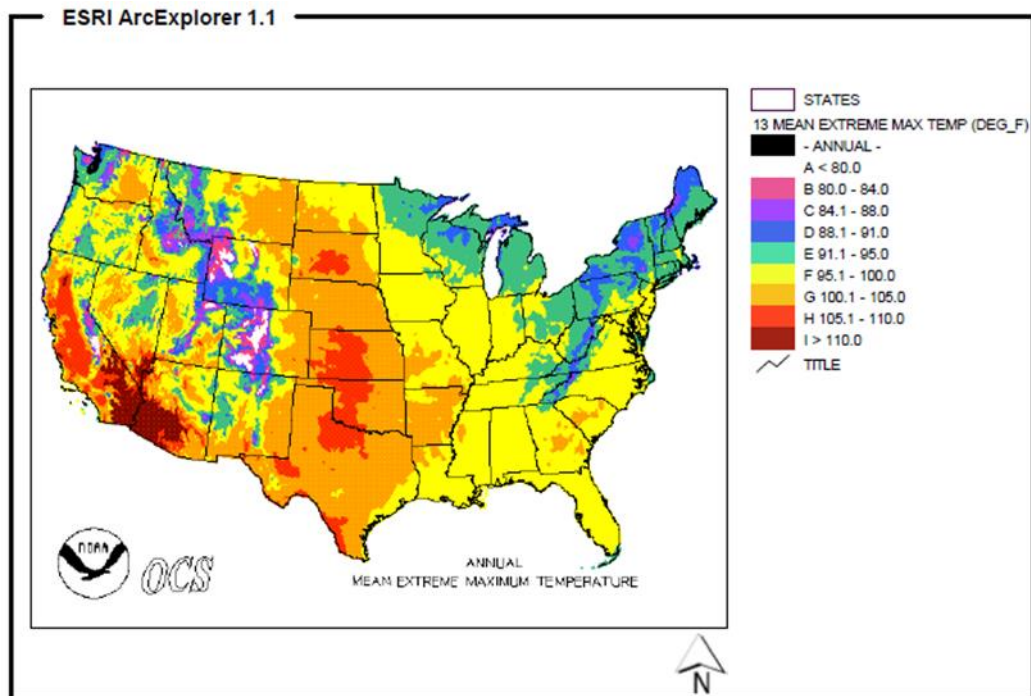


Figure 22: Annual Mean Extreme Max. Temperature. Shows annual extreme heat temperatures in degrees across the contiguous United States. Source: NOAA. 2014.

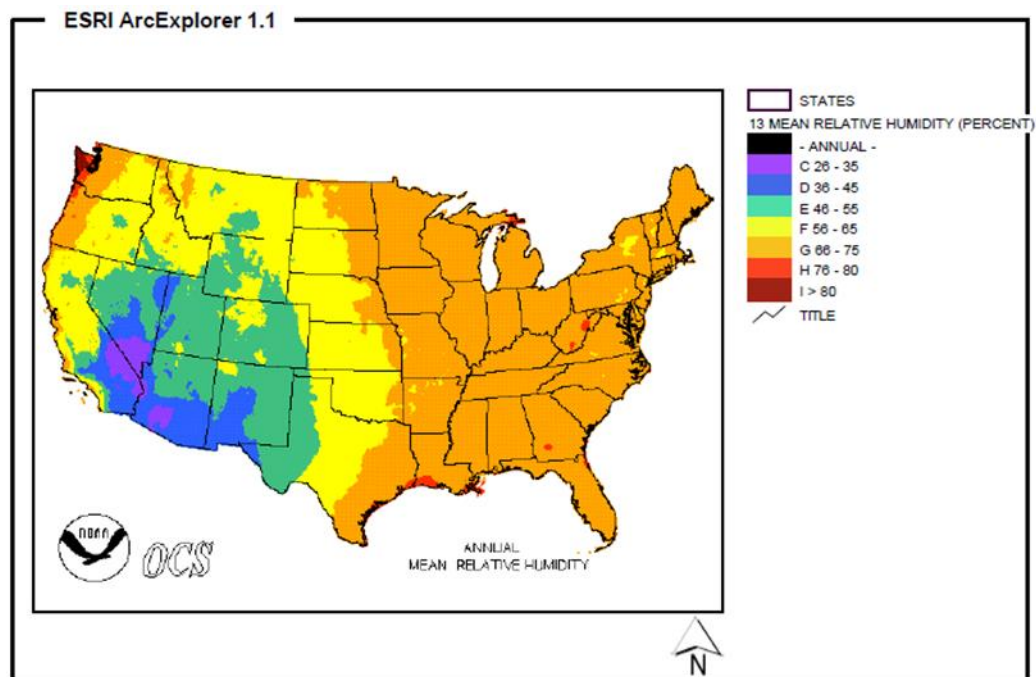


Figure 23: Annual Mean Relative Humidity. Shows the annual relative humidity in percent experienced in the contiguous United States. Source: NOAA. 2014.

According to data collected from the NCDC storm events database, since 1963, there have been 256 counts of severe summer weather that included one or more of the following: excessive heat, summer storm, thunderstorm wind, high wind, lightning, or hail. Although the annual number of severe summer weather events has fluctuated since the start of data collection in 1963, an estimated probability of annual occurrence of a severe summer weather event can be deduced by averaging the number of occurrences with the data collection period. Thus, it was determined that there is an average of 4.6 severe summer storms per year (or 256 / 56 years).

RISK ASSESSMENT

Although other state and local mitigation plans have attempted to identify determining factors that might make certain structures more vulnerable than others, the DMPG decided that because severe summer weather can be a county-wide event and the variances in structures are not significant enough to constitute different vulnerabilities. Thus, all structures within the county were deemed equally vulnerable, including critical facilities and those that are publicly owned.

THREAT ANALYSIS

Severe summer weather can consist of excessive heat, high winds, heavy rain, lightning, thunderstorms, or hail and it is likely that Delaware County will continue to experience any combination of these conditions in the future. According to the NCDC storm events database which contains storm data since January 1, 1950, thunderstorm winds are the greatest threat to life and property in Delaware County. Between September of 1963 and May of 2018, Delaware County experienced 256 severe summer weather events over a total of 178 days incurring a total of over \$85,313,000 in property damages. The average amount of damages based off all past events is around \$333,000 (85,313,000 / 256), but it is important to note that the majority of events result in \$0 dollars of property damage and the most common amount of property damage for those events that cause severe damage is \$5000. We can expect to see an average of 4.6 severe summer weather events occurring per year based on past event frequency.

As such events can be anywhere from minor to catastrophic in regards to public safety and property damage, it is difficult to predict the precise consequences and geographic extent of the next highly severe summer weather event, but the tropical storm Hurricane Ike in 2008 and the “derecho” incident that occurred during the composition of the previous plan suggests that a highly severe summer weather event could potentially produce millions of dollars of property damage. In contrast, extreme heat poses little to no substantive threat to property; however extreme heat combined with low levels of participation can contribute to drought conditions and potentially cause an indeterminate amount of crop damages.

As a naturally occurring hazard, there is little concern for significant environmental damages as a result of severe summer weather. Yet, there are potential economic consequences should a severe summer weather result in a power outage as it did during the “derecho” in which some residences and businesses were left without power for 10 days. It is likely that the impact on



businesses and the economy would only last for a short period during and immediately after the event and would probably not incur long-term consequences to individual entities or the economy as a whole.

3.3.6 Severe Winter Weather

Unlike some areas of the country, Ohio residents and local governments are quite accustomed to and prepared for instances of severe winter weather as it is common within the County and across the state during winter months. Yet, occasional blizzard and extreme winter events can make conditions dangerous and disruptive. Ice is especially dangerous to motorists and pedestrians when it accumulates on bridges, roads, and walkways. It can also affect poles, lines, electrical wires and communication towers which can affect power and telecommunications for days. This hazard was ranked 2nd highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

Severe winter weather can be characterized by blizzards, cold wind/chill, extreme cold/wind, frost freeze, heavy snow, ice storms, winter storms and winter weather with freezing temperatures and heavy precipitation that can occur across a large region. A blizzard is categorized as sustained wind or frequent gusts of 35 mph or greater and considerable falling and/or blowing of snow reducing visibility to less than ¼ mile over a period of 3 hours or longer. Freezing rain or drizzle is a form of precipitation that falls as a liquid but freezes into glaze or rime upon contact with the cold ground or surface structures. Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops.

Wind chill is another dangerous aspect of winter storms as it accelerates heat loss from exposed skin contributing to frostbite. Although there are no specific rules to determine when the wind chill is dangerous, it is generally accepted that -20 degrees and below is highly likely to be dangerous. See the chart below for the NOAA's National Weather Service wind chill chart that illustrates the most dangerous times.

Winter storms are one of the most challenging forms of emergencies as they may include blizzards, communications system failures, electrical storms, hail, high winds, ice, power outages, road closures, sleet, snow, and transportation accidents that pose risks to buildings, collections, and people. On average the United States has roughly four catastrophic winter storms annually with storms occurring most commonly in the northeastern United States. Over the last century or so as many as nine major winter storms have occurred during a single bad year. Recent studies indicate that total winter storm losses during the last fifty years or so have totaled over \$35.2 billion with an average death rate of 35 annually due to winter storms.

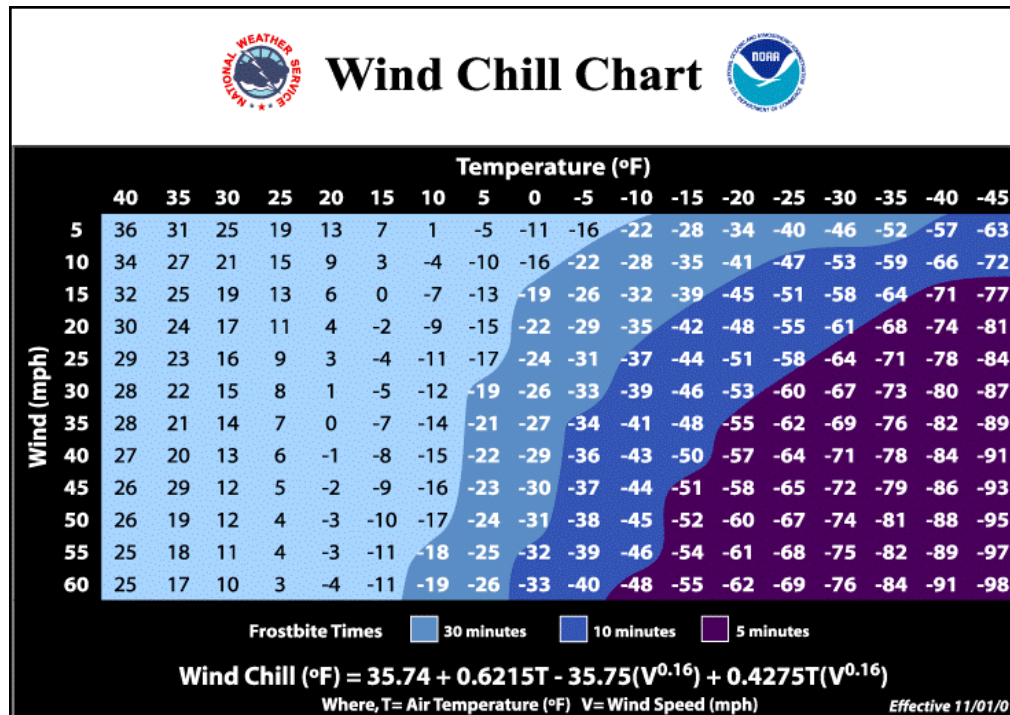


Figure 24: NOAA's National Weather Service Wind Chill Chart. The NWS Wind Chill Temperature (WCT) index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures. Source: NOAA/NWS. 2001.

HAZARD HISTORY

According to the NCDC Storm events database which contains data about climactic events occurring since 1950, Delaware County did not experience any blizzards or instances of extreme cold/wind chill, but there were winter storms, winter weather, cold/wind chill, ice storms, frost/freeze, hail, high wind and instances of heavy snow. Those events that occurred November 1st through March 30th in any given year were included in the final count as they could be considered winter events. Due to the large number of occurrences, only the most severe incidents are described below:

2007- On February 13th, 2007 the county experienced blizzard snow and ice along with a mixture of other winter weather conditions. Eight inches of snow was reported at the county garage while ice pellets cut higher snowfall totals. Power outages resulted and icing brought down several trees and power-lines.

2007- On December 5th, 2007 the county experienced heavy snow reaching 3.5 to 4 inches in southern parts of county.

2007- On December 15th-16, the county experienced heavy snow with 6 inches of snow as it spread across western Ohio at a rate of nearly an inch per hour.

2008- On March 7th-8th, the county experienced 30 to 40 mph winds and blizzard-like conditions with a total of 13.5 inches in snow measured in Delaware County.

2009- On January 10th, 2009 the county experienced an ice storm with a prolonged period of freezing rain occurring across the I-70 corridor. A quarter of an inch of ice was measured in Sunbury.

2009- On January 14th, 2009 the county experienced heavy snow of about 4.5 inches.

2009- On January 28th, 2009 the county experienced significant snowfall with rates reaching two inches per hour along the I-71 corridor. A quarter inch of ice was measured in Delaware County along with 3 inches of snow and sleet.

2010- On February 5th-6th, 2010 the county experienced a wintry mix that transitioned to all snow resulting in 8 inches measured by a county spotter.

2010- On February 15th-16th the county saw heavy snow across the region, especially along the I-71 corridor. There was 5.5 to 7 inches of snow measured throughout the county.

2011- On February 1st, 2011 the county experienced an ice storm with snow and sleet which transitioned into freezing rain. Three-quarters of an inch of ice was measured in Delaware along with several inches of sleet accumulation. This resulted in approximately a quarter million power outages and 4 indirect injuries including two people who were taken to hospital for carbon monoxide poisoning.

2012- On December 26th, 2012 the county reported 6 inches of snow on the west side of Delaware. Heavy snow and strong winds combined to create near blizzard conditions over portions of Ohio beginning Christmas night and continuing into Wednesday the 26th.

2013- On March 5th, 2013 the Powell area had around 7.5 inches of snowfall. Low pressure tracked throughout Kentucky towards southeast Ohio and brought a round of winter weather to much of the region.

2014- On February 4th, 2014 Delaware County received 4 to 5 inches of snow, with an estimated six inches along the southern border with Franklin County. A fast-moving winter storm moved across the Ohio Valley. Locations across northern Kentucky and southern Ohio started with heavy snow and transitioned to sleet and freezing rain. Significant ice accumulations caused tree damage and power outages to 5-10,000 people. Further north, snow mixed briefly with sleet, before changing to freezing rain as precipitation tapered off. The resulting 5 to 10 inches of snow and sleet accumulation in west-central and central Ohio. This storm brought widespread travel impacts with many schools and businesses being closed on Wednesday, February 5th.

2015- On February 21st, 2015 Sunbury experienced 7 inches of snowfall. A spotter east of Westerville measured 5.3 inches. Southerly flow behind a departing arctic front pulled a significant amount of moisture over the Ohio Valley Friday night, February 20th into Saturday the 21st. As the low-level jet encountered a mid-level disturbance, snowfall rates of 1 to 2 inches per hour were noted over much of the region.

2016- On January 13th, 2016 the county experienced around 2 inches in Delaware. A mesoscale band of snow brought 5 inches of snow or more which fell in a very narrow band though Ohio.

2018- On January 12th, 2018 the county experienced 5.5 inches of snow 3 miles northwest of Dublin. Another 5 miles west of Hartford 3.9 inches of snow was measured, while an observer near Galena measured 3.8 inches. The ODOT county garage in Delaware measured 3 inches of snow.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Since winter weather is typically a regional occurrence, it is most often determined that the County experiences the same level of vulnerability to severe winter weather. Within a broader scope, though, Ohio and Delaware County exist within a region of the United States that experiences an annual mean total snowfall between 12.1 and 36.0 inches each year, which are medium-high values on the national spectrum as can be seen in the map below (Figure 25).

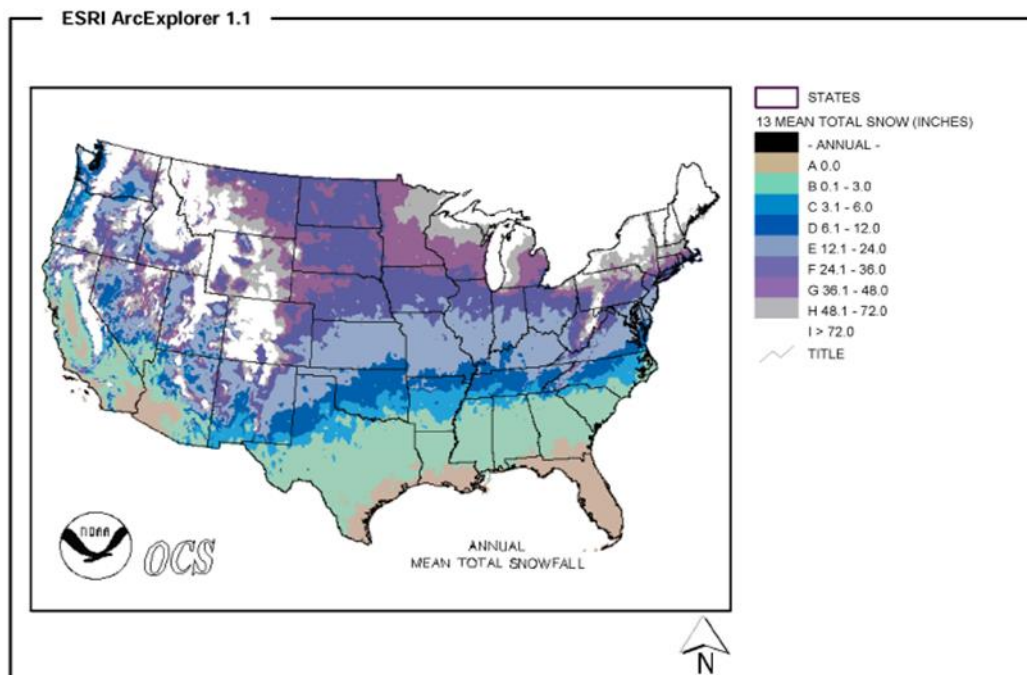


Figure 25: Annual Mean Total Snowfall. Shows annual total snowfall in inches across the contiguous United States. Source: NOAA. 2014.

The NOAA map below illustrates that Ohio as a whole as a 95%+ probability of experiencing measurable snowfall each year (Figure 26). By looking at the hazard history in the previous section, it can be estimated that there is a high likelihood that severe winter weather it will affect the Delaware County area. Every winter season has a probably average rate of approximately 1.5 severe winter events and 3.8 winter events occurring per year.

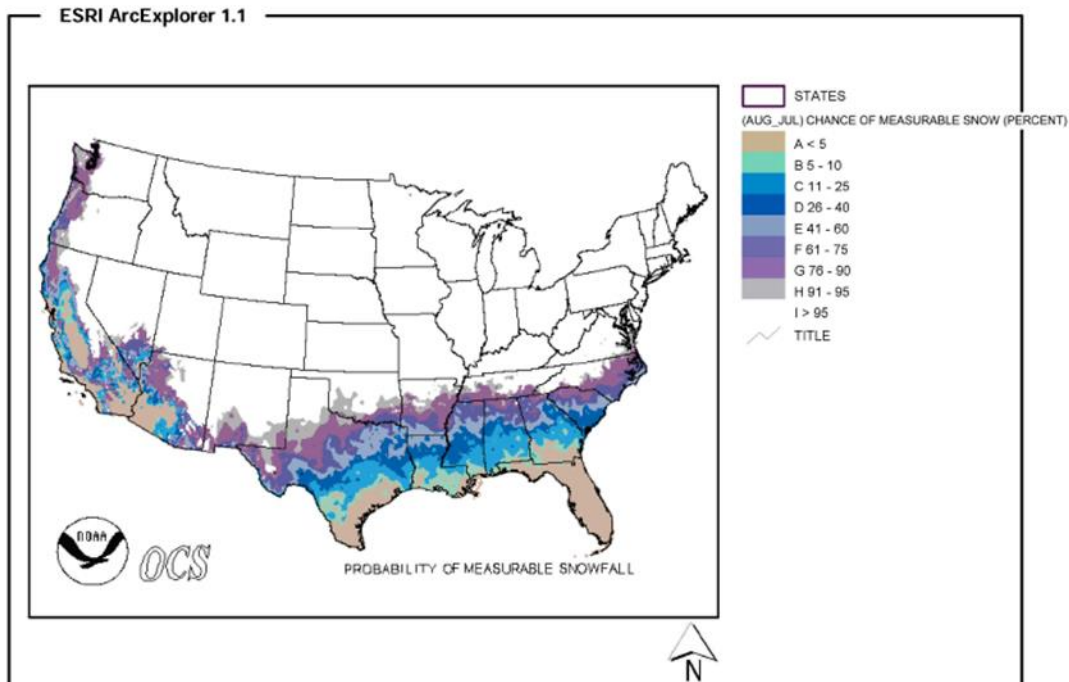


Figure 26: Probability of Measureable Snowfall. Shows chance of measurable snowfall occurring in percent across the contiguous United States. Source: NOAA. 2014.

RISK ASSESSMENT

Winter weather occasionally incurs property damage and crop damage but appears to affect humans more than the structural environment. There have been 8 recorded winter weather events that have caused property damage and 1 event that caused crop damage according to the NOAA Storm Events Database between 1991 and present-day; totaling 606,000 dollars of damage. There have not been any recent property or crop damages recorded since the last update of this plan. Although other state and local mitigation plans have attempted to identify determining factors that might make certain structures more vulnerable than others, the DMPG decided that because severe winter weather is a countywide event and the variances in structures are not significant enough to constitute different vulnerabilities, then all structures within the county are equally vulnerable, including critical facilities and those that are publicly owned.

THREAT ANALYSIS

Like severe summer weather, severe winter weather can occur as any combination of several different conditions and it can occur at a mild to catastrophic magnitude. The two most threatening situations that have occurred in the county and will most likely happen again in the future are a severe ice storm or heavy snow conditions. Both are dangerous to people, property and the economy, although Delaware County is more accustomed to and prepared for winter weather than other regions of the country.

Should the county encounter a severe ice storm as it did in 2007 and 2011, there is an elevated risk of injury or death from slippery road conditions. It is also not uncommon that property can



be damaged from heavily iced tree limbs or power lines; although it is likely that such damage would be limited to a few thousand dollars. Such storms can also cause power outages which disrupt law enforcement, public safety, and business operations and can be unfavorable to the local economy throughout the duration of the icy conditions. Blizzard conditions can also lead to such consequences as heavy snow and resulting snow alerts can keep people in their homes harming local business and potentially causing injuries and death. As severe winter weather is a naturally occurring hazard, there is little concern over the effect in the environment.

3.3.7 Tornado

Tornadoes have the ability to incur large amounts of property damage, injuries and/or deaths. They are difficult and unpredictable in their pathways and occurrences. Tornadoes can occur at any time and during any month of the year. The unpredictability of tornadoes makes them one of Ohio's most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum expected velocity at about 318 miles per hour. A wind velocity of 200 miles per hour will result in a wind pressure of 102.4 pounds per square foot of surface area—a load that exceeds the tolerance limits of most buildings. The U.S. topography drives collisions of dry wind from the Rockies and warm low-level, moist air from the Gulf of Mexico to create much of the tornadoes in the Midwest, often referred to as Tornado Alley. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are nature's most violent windstorms – even weak ones can cause significant damage and fatalities. A tornado is defined as a rotating column of air, in contact with the surface, pendant from a cumuliform cloud, and often visible as a funnel cloud and/or circulating debris/dust at the ground. According to the National Climatic Data Center, 11 tornadic events were reported in Delaware County from 1929 through 2017, all of which were rated F2 (or EF2) and under. This hazard was ranked No. 1 out of 13 for most plausible impactful hazards to occur in Delaware County.

HAZARD PROFILE

Tornadoes are produced from energy released during a thunderstorm, but account for only a tiny fraction of the overall energy generated by a thunderstorm. What makes them particularly dangerous is that the energy is concentrated in a small area, perhaps only a hundred yards across. Not all tornadoes are the same, of course, 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 whenever and wherever conditions are right, but they are most common 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 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.

The damaging strong winds generated from tornadoes can reach above 300 miles per hour in the most violent tornadoes, causing automobiles to become airborne, rip ordinary homes to shreds, and turn broken glass and other debris into lethal missiles. The biggest threat to living creatures (including humans) during tornadoes is flying debris and the risk of being tossed about in the wind.



Tornadoes are classified according to the Enhanced Fujita tornado intensity scale. The Enhanced Fujita Scale ranges from low-intensity EF0 with effective wind speeds of 65 to 85 miles per hour, to EF5 tornadoes with effective wind speeds of over 200 miles per hour. The Enhanced Fujita intensity scale is included in table below.

Table 18: Enhanced Fujita Scale. Shows the ratings of tornadoes and the details associated with their damages. Source: NOAA

Enhanced Fujita Scale			
Rating	Description	Wind Speed	Damages to Expect
EF0	Gale tornado	65-85 mph	Light Damage: Some damage to chimneys; break branches off trees; push over shallow rooted trees; damage to signboards
EF1	Moderate tornado	86-110 mph	Moderate Damage: Surface peeled off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads
EF2	Significant tornado	111-135 mph	Considerable Damage: Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe tornado	136-165 mph	Severe Damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown
EF4	Devastating tornado	166-200 mph	Devastating Damage: Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated
EF5	Incredible tornado	> 200 mph	Incredible Damage: Strong frame houses lifted off foundations and carried considerable distance

HAZARD HISTORY

Although Delaware County and its encompassing jurisdictions do not experience tornadoes as frequently as other regions of the Midwest, the potential devastation suggests the need for consideration within this Plan. All recorded tornado incidents in Delaware County are listed below and shown in Figure 27.

1929- On May 14th, 1929 the county experienced an F2 tornado at 3:00 pm. The tornadoes path length was 1 mile long and 100 yards wide. It reportedly moved northeast and hit a home 1 mile north of Radnor causing the roof and walls of a brick home to be destroyed. There were no injuries or fatalities. The exact location of this tornado was not documented. The representation of this tornado on the Tornado Paths Maps is only a speculation of the location based on the written description recorded.

1965- On April 11th, 1965 the county experienced an F2 tornado at 10:30 pm reaching across the northern part of county across the top of the Delaware Lake (12.3 miles) resulting in 4 fatalities and 62 injuries. It has been nicknamed the “Palm Sunday tornado”.

1973- On May 8th, 1973 the county experienced an F2 at 1:10 pm touching down in the Dublin Ohio area and then traveled Northeast through the Powell area and what is now the Lewis Center area. It also hit the Alum Creek State Park in its path with a length of 17.3 miles.

1974- On April 4th, 1974 the county experienced an F2 tornado which appeared to be a part of the Super Outbreak of 1973. The tornado caused damage to a mobile home park in the extreme southeastern corner of Delaware County and also affected Madison and Franklin counties.

1978- On April 19th, 1978 the county experienced an F1 tornado at 6:00 pm touching outside the southwestern portion of the county then stretching across Shawnee Hills and into Powell with a length of 6.8 miles.

1997- On August 17th, 1997 the county experienced an F0 at 12:15 pm in the southeastern portion of the county in a mostly rural area. The tornado made a brief touchdown damaging numerous trees, destroying a barn, damaged 2 homes, and carried away a swing set.

2000- On Sep 20th, 2000 the county experienced an F2 tornado in Harlem Township at 6:31 pm with 0 fatalities and 2 injuries. Two high tension power line towers were bent over and 14 houses were either damaged or destroyed.

2010- On Sep 16th, 2010 the county experienced an F0 tornado reaching in close proximity to the Hoover Reservoir at 2:38 pm. Trees were damaged along the path due to the tornado. In addition, a few shingles were torn off of a house. Based on the damage, wind speeds were estimated around 75 miles per hour.



2013- On June 12th, 2013 the county experienced an F0 tornado briefly touching down on the west side of Highway 257 southwest of Radnor at 12:15 am. This event lasted from the late evening hours of June 12 into the early morning hours of June 13. The tornado initially hit two barns, destroying one and heavily damaging another.

2014- On Feb. 21st, 2014 the county experienced an F0 tornado on the edge of a field along North Old State Road in Kilbourne at 12:54 am. Trees and a barn sustained significant damage as well as nearby utility pole and transformer causing lines to be down. The maximum estimated wind speed of this tornado as 85 miles per hour.

2016- On August 20th, 2016 the county experienced an F0 tornado in Delaware at 5:37 pm. The tornado initially touched down just south of the Buckeye Valley Middle School through Delaware Dam and ended at the Delaware State Park, with a length of 3.3 miles.

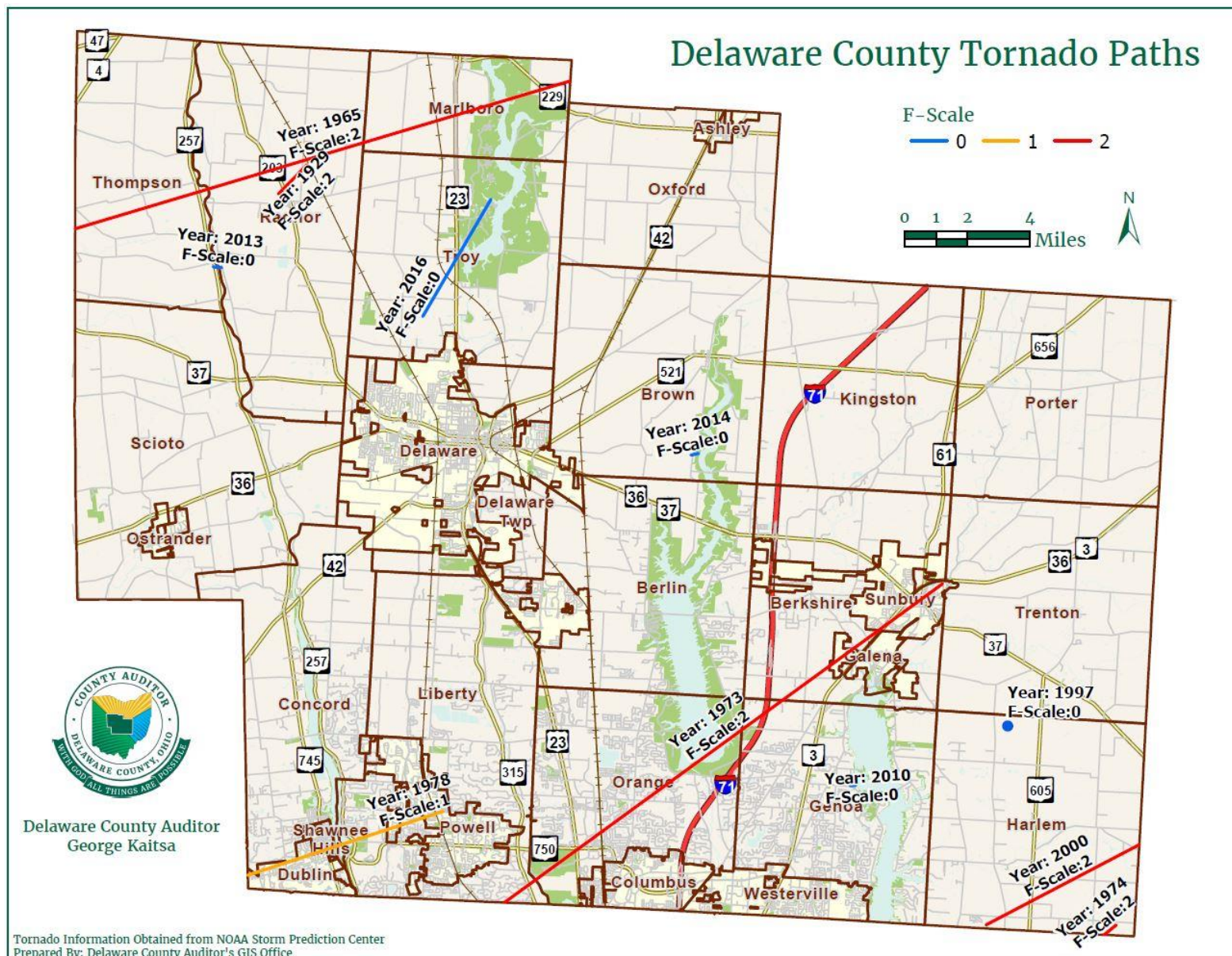


Figure 27: Delaware County Tornado Paths. Map displays all recorded tornadoes that occurred in Delaware County along with their F-scale rating and path effected. Prepared by: Delaware County Auditor's GIS Office. 2018.

Table 19: Tornadoes Located in Delaware County

Tornadoes Located in Delaware County								
Location	Date	Scale	Length / Width	Deaths	Injuries	Property Damage (\$)	Crop Damage (\$)	Notes
Radnor	1929	F2	1 mi. / 100 yds.	0	0	N/A	0	Damage to one house not recorded. Not included in Probability Assessment.
Northern Part of County	1965	F2	12.3 mi. / 400 yds.	4	62	2.5 M	0	“Palm Sunday Tornado”
Powell through Alum Creek State Park	1973	F2	17.3 mi. / N/A	0	0	50. K - 500. K	0	Damages provided by (tornadohistoryproject.com)
SE Harlem	1974	F2	~.5 mi. / ~90yds.	0	0	N/A	0	Length of tornado is estimated.
Shawnee Hills through Powell	1978	F1	6.8 mi. / 33 yds.	0	0	250. K	0	
Sunbury	1997	F0	.5 mi. / 100yds.	0	0	50. K	0	
Harlem	2000	F2	5 mi. / 100yds.	0	2	1. M	0	
Galena	2010	F0	.12 mi. / 100yds.	0	0	3.00 K	0	
Radnor	2013	F0	.21 mi. / 50yds.	0	0	200. K	5.00 K	
Kilbourne	2014	F0	.13 mi. / 80 yds.	0	0	100. K	0	
Delaware	2016	F0	3.3 mi. / 100yds.	0	0	20. K	0	
Total				4	64	~4.4 M	5.00 K	

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Since tornadoes are highly unpredictable, it must be assumed that all areas of the county are vulnerable to a tornado. Since tornadoes can occur anywhere in the county, any future development will have to be made with this hazard in mind. Mobile home parks, campgrounds, or any other infrastructure without a secure foundation or basement will always be particularly more vulnerable. History has also shown that majority of tornadoes affecting Delaware County have either been in the early summer months (April, May) or the late summer months (August, September); although it is imperative that people remember a tornado can occur during any season. Since Delaware has seen ten registered tornadoes during 1950-2018, the DMPG estimates a probability of 10/68 years or a 15.0% that a tornado might occur within the county each year. While there are eleven tornadoes that are recorded as occurring in Delaware County throughout the plan, the tornado from 1929 was not included in the Probability Assessment due to spotty records of events pre-1950 provided by NOAA.

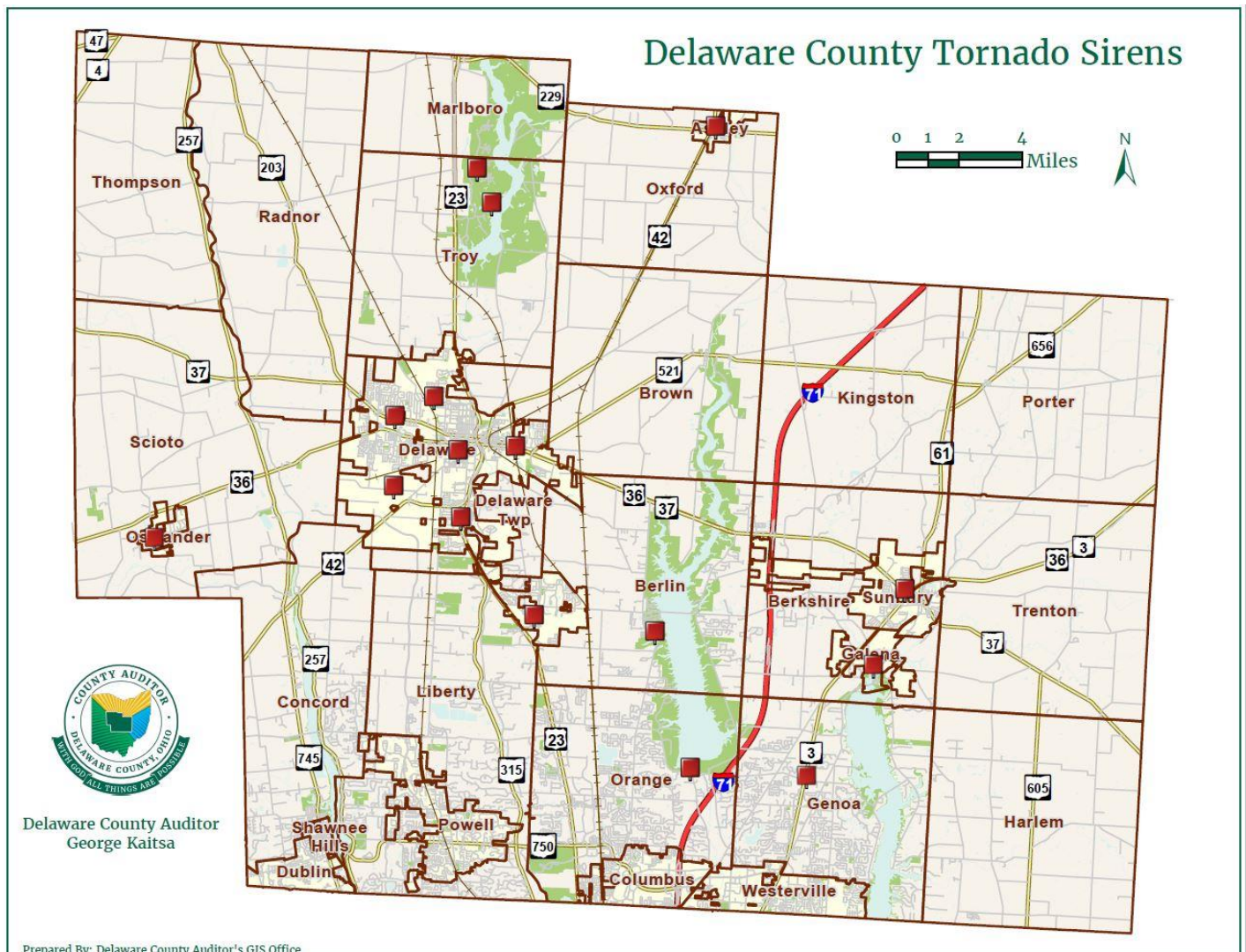


Figure 28: Delaware County Tornado Sirens. Map shows the locations of Delaware County's tornado sirens, represented by red squares. Prepared by: Delaware County Auditor's GIS Office. 2018.

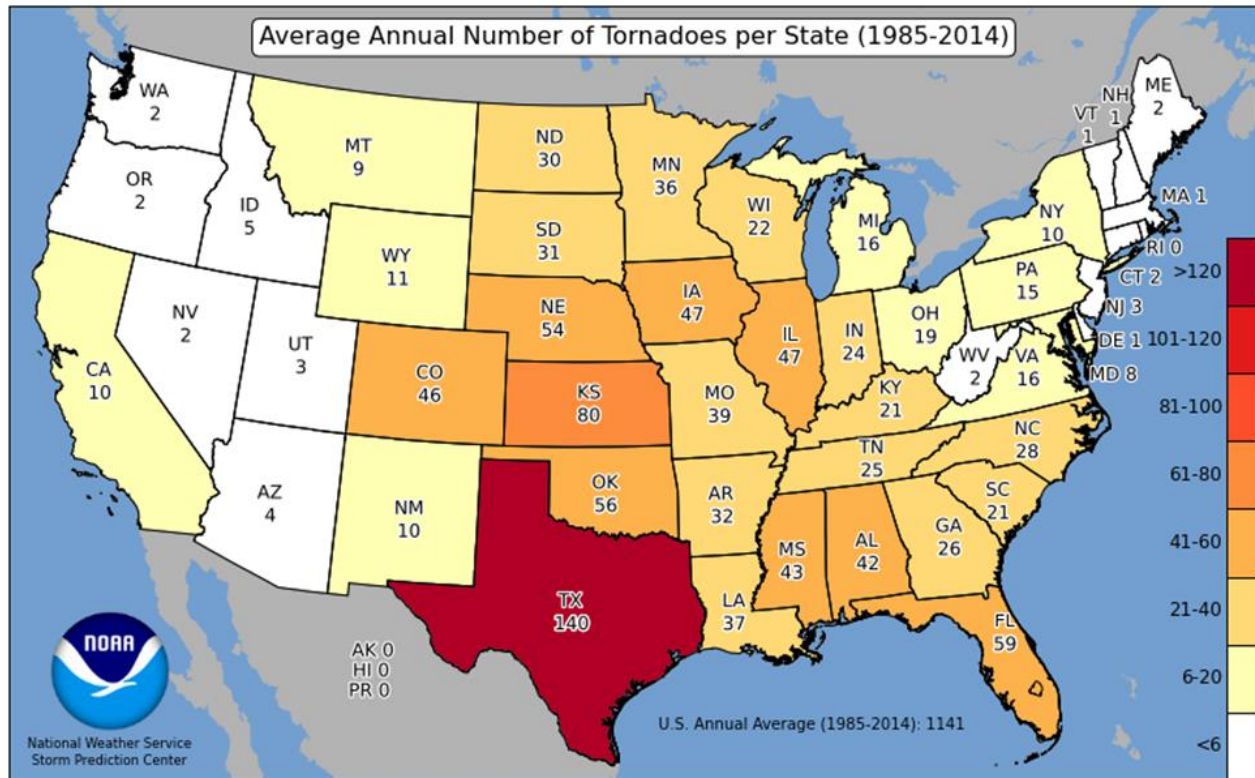


Figure 29: Average Annual Number of Tornadoes per State. Map displays the average number of tornadoes to occur annual per state over a 30 year timespan from 1985-2014. Source: NOAA/NWS. 2014.

In regards to the potential magnitude of the previous tornadoes seen within Delaware County, the highest ranked tornadoes registered at a level EF2 on the Fujita scale; although there have been four EF5 tornadoes within the state of Ohio since 1968 which suggests that there is still a possibility that Delaware County could experience a tornado more severe than it has seen before.

RISK ASSESSMENT

Tornadoes have occurred evenly around the county, because of that it was decided to assess the most at risk structures to tornadoes. Mobile home parks, campgrounds, or any other infrastructure without a secure foundation or basement will always be particularly more vulnerable. For the case of this analysis, only mobile homes structures were included in the assessment. In order to determine the number of structures that are most vulnerable (mobile homes) to tornadoes the Delaware County Auditor's Office completed a search for properties types listed as "mobile home" throughout all of Delaware County excluding those structures in Dublin, Westerville, and Columbus. An average sales price of mobile homes in Delaware County was used to calculate the damage that could be caused. The table below shows the results for structures most vulnerable to tornado events in Delaware County (Table 20).

Table 20: Structures Most Vulnerable (mobile homes) to Tornadoes. Shows the structures at risk and the economic damages associated for each jurisdiction in Delaware County.

STRUCTURES MOST VULNERABLE TO TORNADO										
	Structures at Risk					Damage in Dollars				
JURISDICTION	Residential	Non-Residential	Critical	Publicly Owned	Total	Residential	Non-Residential	Critical	Publicly Owned	Total
Delaware	281	N/A	N/A	N/A	281	\$2,541,734.92	N/A	N/A	N/A	\$2,541,734.92
Powell	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Galena	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Shawnee Hills	1	N/A	N/A	N/A	1	\$9045.32	N/A	N/A	N/A	\$9045.32
Ashley	111	N/A	N/A	N/A	111	\$1,004,030.52	N/A	N/A	N/A	\$1,004,030.52
Ostrander	4	N/A	N/A	N/A	4	\$36,181.28	N/A	N/A	N/A	\$36,181.28
Sunbury	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other	881	N/A	N/A	N/A	881	\$7,968,926.92	N/A	N/A	N/A	\$7,968,926.92
TOTAL	1,278	N/A	N/A	N/A	1,278	\$11,559,918.96	N/A	N/A	N/A	\$11,559,918.96

Structures in Dublin, Westerville or Columbus that were also located within Delaware County were not included in these figures. Market improvement values were not able to be used for this hazard, instead an average sales price for mobile homes in the county was determined by the Delaware County Auditor's office and were utilized in the determine the damage in dollars. The average sales price used is 9045.32, which was found by determining the average sale price for a mobile home in the county during 2018, excluding those with a zero dollar sale. *The above figures only include mobile homes, they do not include year round or seasonal campgrounds. Figures represent all mobile homes located in Delaware County.

THREAT ANALYSIS

The worst tornado to hit Ohio was the Xenia tornado of 1974. On April 3rd, an EF5 tornado ripped directly through the town of Xenia, Ohio just outside of Dayton leading to 36 deaths and 1150 injuries. It was approximately 47 miles long and was 533 yards at its widest point. We decided to overlay a 500-yard wide path in a northeasterly direction across the southern portion of Delaware County signifying a devastating F5 tornado in the most densely populated area of the county (Figure 30). The results of the tornado would damage 6,503 structures in the county. It is important to note that there were 3 HAZMAT Sites, 67 Special Needs sites, and 1 Nursing Home that would be impacted by this event.

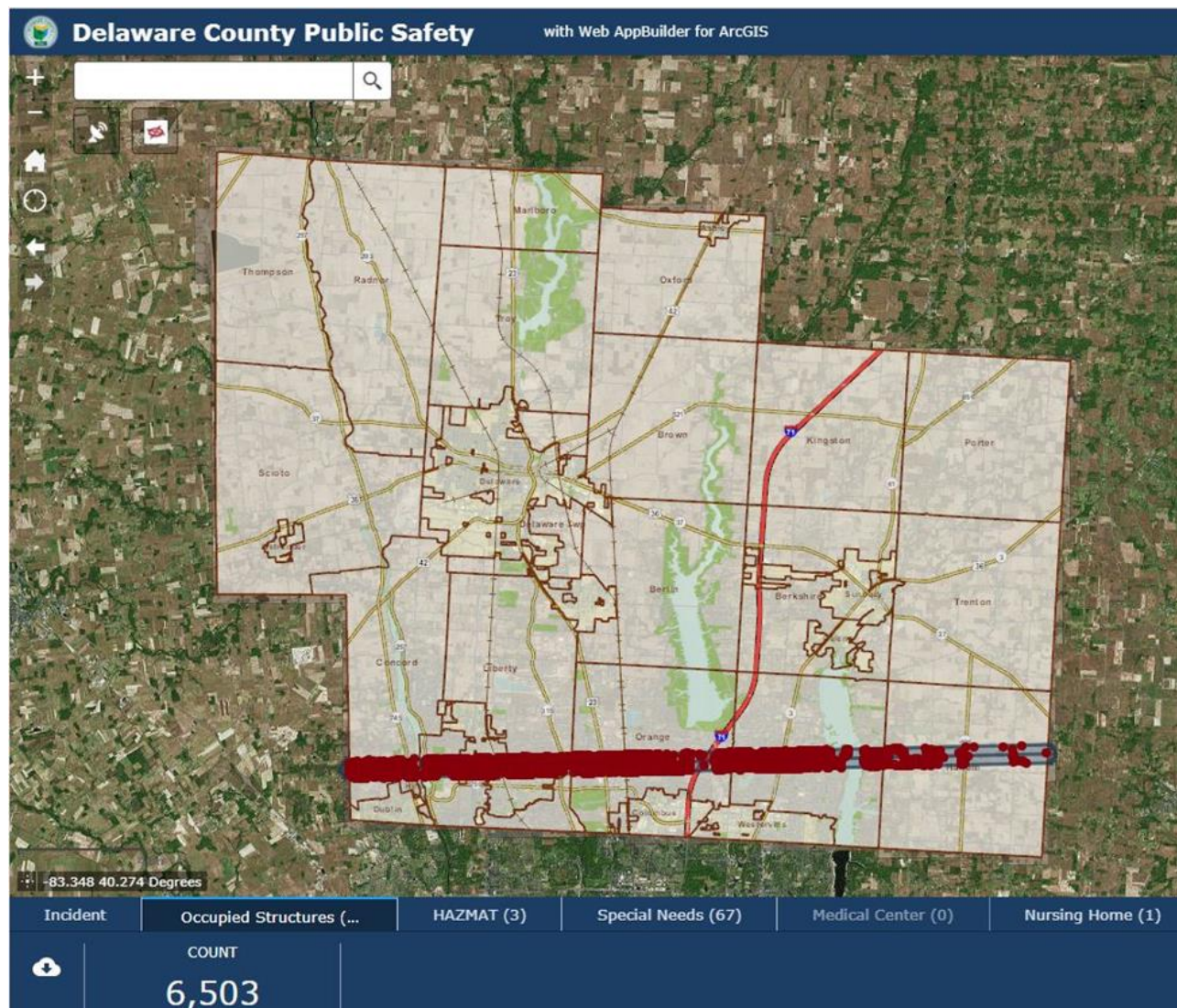


Figure 30: Estimated Path of a F5 Tornado in Delaware County. Displays what a potential F5 tornado could impact if it struck a densely populated section of the county. A total of 6,503 occupied structures could be damaged in its path. Created using: Delaware County's Public Safety Application. 2018.



Unlike many other natural hazards which result in minor to moderate damages, tornadoes can cause complete damage to properties that fall within their path. After running this model over the southern area of the county, it is estimated that such a tornado could result in millions of dollars in property damages. Xenia was completely devastated by the tornado of 1976, and it is highly likely that such a massive tornado would be detrimental to the local economy and local governments as they would be forced to designate their time and resources to recovery efforts. In regards to the environment, a tornado can do minor damage to a local ecosystem or potentially cause the release of hazardous materials from residences and non-residences which could potentially contaminate sites and water sources.

3.3.8 Civil Disturbance/Shooting/Small Bomb

Although Delaware County has not experienced a major civil disturbance, a public shooting, detonation of a small bomb, or public unrest, there have been several threats in the county. There have also been several towns across the United States that have unfortunately fallen victim to such an attack, drawing attention to the need for the County and its encompassing jurisdictions to consider the possibility and implications of this hazard. This hazard was ranked 11th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

Civil disturbance including, riots, public shooting, small bomb, or labor disputes, can disrupt civil order and require public safety support in their control or suppression. This hazard can affect the whole county, but would probably be limited to the larger cities and may occur at any time. A civil disturbance/event differs from terrorism in its motivation and its consequences. A civil disturbance is considered a violent form of public unrest whether conducted by one or many individuals such as a riot without concern for political gain. This may sometimes involve a threat or actual use of firearms or the detonation of a small bomb.

HAZARD HISTORY

Delaware County has had five recorded forms of civil disturbance in the county. It is important to note that these are only the documented incidents of civil disturbance, but there have been cases of threats that were undocumented and unrepresented in the plan. The events included below are both attack threats and attack events that did occur involving residents of the county.

2002- On August 20th, 2002 a Delaware County Employee at the Hayes building shot and killed another employee in the parking lot and turned the gun on himself. All County Buildings were put on lock-down till the scene secure. Both subjects were dead at the scene. Police Captain Pat Yankee advised the subjects knew each other and this was, no doubt, a planned event.

2010- On December 2nd, 2010 a Delaware County employee left a voicemail for the county's juvenile courthouse threatening to go to court with a gun and harm people. The building was secured and the employee was arrested shortly after and charged with inducing panic.

2012- On April 4th, 2012 in Lewis Center, located in southern Delaware County, the FBI investigated a bomb threat on Olentangy High School. Students were evacuated, but no arrests were made.

2017- On June 15th, 2017 two high school students in the Olentangy School district of Delaware County were charged with possession of bomb-making materials after an explosive device was found attached to a fire hydrant in a pond. Approximately 15 other improvised explosive devices, approximately 5 pounds of explosive powders and many other components of explosives and improvised explosive devices were found in the home of one of the students.

2018- On November 8th, 2018 the Hayes High School of Delaware County was closed due to a violent threat on the school. The Hayes High School student was charged with a felony count of inducing panic after threats he made caused officials to cancel classes. The threat was allegedly referring to a planned school shooting.

Some other events that occurred throughout the United States that provided the DMPG with historical instances which provided a basis for mitigation analysis and planning are listed below:

1927- Bath School disaster which was the deadliest mass murder in a school in U.S. history, killing 38 elementary school children, 2 teachers, 4 adults, and the bomber.

1999- Columbine High School Massacre, 12 students and 1 teacher were killed and 24 others were injured when two students entered into the high school shot several people before killing themselves at the sight.

2007- On April 16th, 2007 a school shooting took place on the Virginia Tech campus in which a student shot and killed 32 people while wounding 17 others before he committed suicide.

2012- On December 14th, 2012 a school shooting took place at Sandy Hook Elementary School in Newton, Connecticut. The shooter killed 20 children and 6 adult faculty members before he committed suicide.

2017- On October 1st, 2017 a shooting took place at a concert in Las Vegas, Nevada. The assailant killed 58 people and injured almost 500, he was later found dead in a hotel room.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Although a civil disturbance could hypothetically occur anywhere, history has shown that critical facilities such as schools, hospitals, banks, and government buildings tend to result in the highest profile cases of civil disturbance. Areas that have a higher probability of events with large numbers of the public participating are most vulnerable to incidences. The geographic extent of such an attack would most likely be highly contained due to the nature of the act, but the actual magnitude could result in a number of deaths and injuries that might surpass those associated with natural hazards. Like many other man-made hazards, it is difficult to quantify the probability of such an event; although because by definition it is something that is only incited by deliberate human choice, it is less likely to occur.

Although these events are infrequent to Delaware County, protests or demonstrations linked to political movements, views, and racially charged events are a growing concern due to the increasing incidents in the United States. While these events on their own are not illegal there may be an added risk with this type of gathering.

RISK ASSESSMENT

The losses incurred by a civil disturbance are highly circumstantial and depend on the form of violence, the use of weaponry, the population present and other factors. If a small bomb is not

involved, then the risk to infrastructure is at a minimum and the majority of the consequences would be felt in injuries, loss of human health, and indirect economic consequences; however, should a small bomb be detonated, it would most likely place the building or area in which it exploded at risk. The structural losses would be highly circumstantial, but would most likely be isolated to a few numbers of buildings, if any were to be damaged.

In order to determine the number of structures and their value that are most vulnerable to a small bomb, parcel data from the auditor's office was utilized. Structures with a market improvement value greater than \$0 that was located in Delaware County but within the municipalities of Dublin, Columbus and Westerville were not included within the figures. Residential structures were not considered as it is highly unlikely they would be the target of a small bomb. Structures that were classified as motels, hotels, nursing homes, hospitals, shopping centers or a theater were considered vulnerable non-residential structures. Buildings owned by the U.S. Government, the state of Ohio, Delaware County, a local township or municipality were considered publicly owned. Structures apart of the Board of Education, a park district, a university, church, cemetery, or monument, were considered critical facilities (Figure 31 & 32).

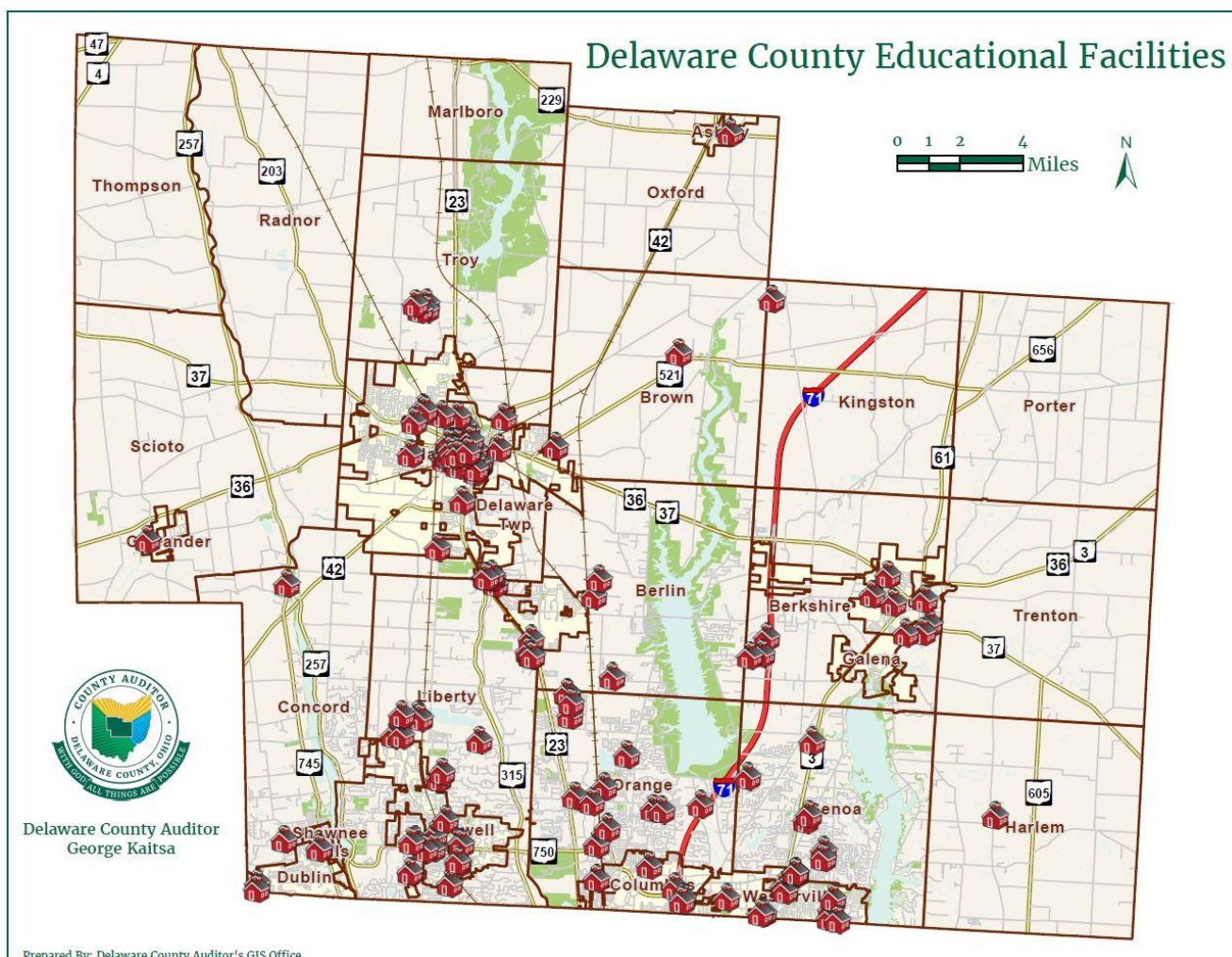


Figure 31: Educational Facilities in Delaware County. Map shows the locations of all educational facilities in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

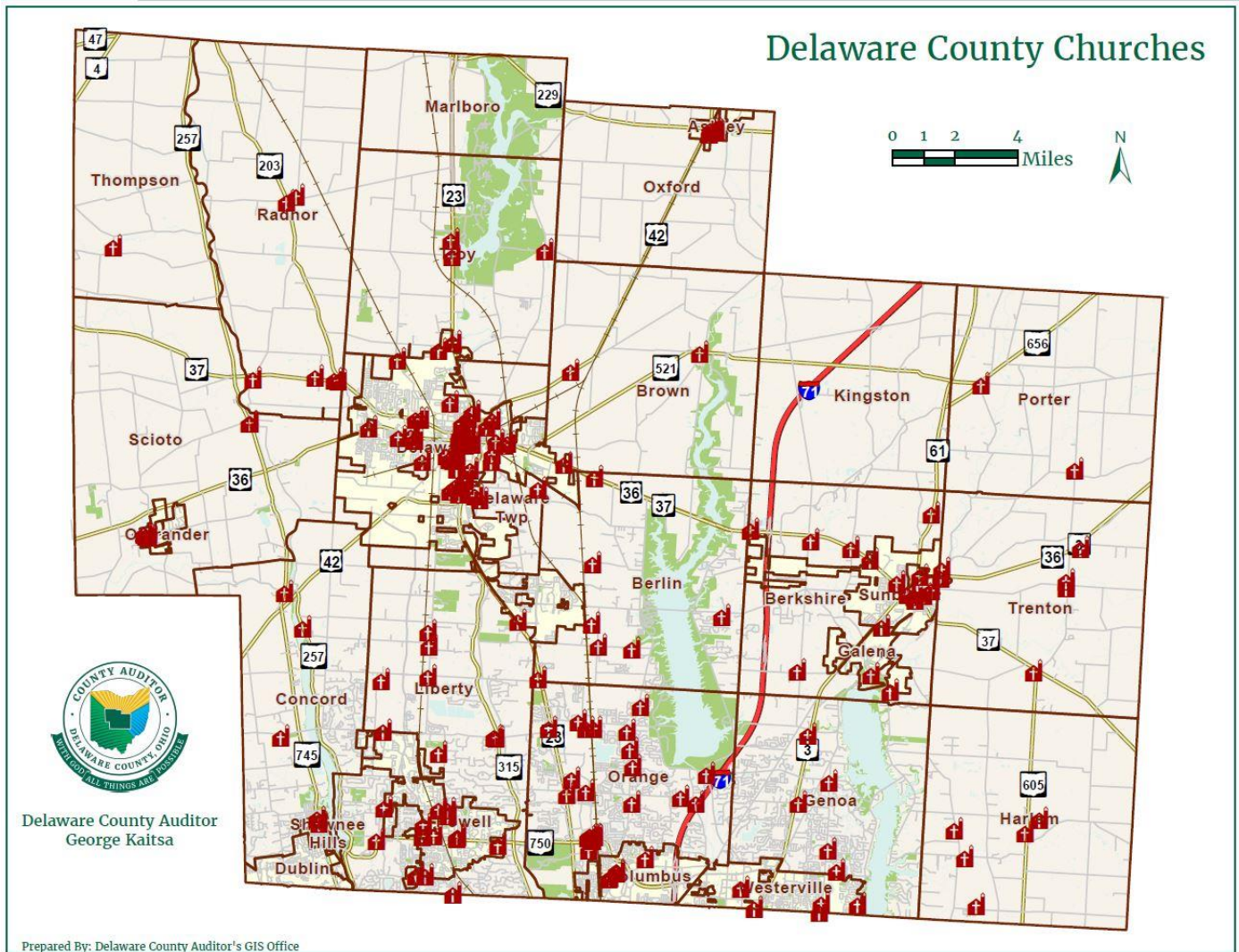


Figure 32: Churches in Delaware County. Map shows the locations of all churches located in Delaware County. Prepared by: Delaware County Auditor's Office. 2018.

3.3.9 Cyber-Attack or Ransomware

A cyber-attack is an intentional human-caused hazard that is a growing concern for all local government organizations. Cyber-attacks or ransomware is the illegal access to a computer or computer system to expose, alter, disable, destroy, steal or gain unauthorized information to or make unauthorized use of an asset for the purpose of causing damage, harm or financial gain. A sharp increase in the number of cyber incidents involving government and corporate computer networks in America has caused Delaware County to launch initiatives to combat cyber threats. Many of the initiatives have focused on protecting critical infrastructure command and control systems, preventing access to sensitive government information, and thwarting acts of fraud and theft targeting business financial systems. This hazard was ranked the 13th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

The cybercrimes vary in how they scam individuals and governments, but typically involve an email – a practice known as ‘phishing’ – that contains either a link or an attachment that, when opened, infects computers or entices the recipient to share account information and passwords. Some of the attachments launch viruses that essentially take data hostage until a ransom is paid (known as ransomware).

Ransomware – Considered the biggest threat in the information security industry today. Ransomware is a malware that is installed on your computer by clicking on links in emails. Ransomware holds your computer hostage by locking your screen or encrypting your files until you pay a specified amount of money for a key that will unlock your system. It is usually infected from macros in Microsoft Office documents delivered via email. From December 2015 to May 2016, half of all ransomware attacks were in the United State, according to Microsoft.

Phishing – The practice of luring unsuspecting Internet users to a fake website by using authentic-looking email with the real organization’s logo. The emails are loaded with viruses that launch when opened and typically include methods to trick you into providing your passwords or other financial or personal information. These usually look like emails from a bank, and once you “log in” they have your account information and can then gain access to your account to transfer money. Usually, these types of emails are sent out in the thousands.

Spear phishing – Spear phishing is more targeted form of phishing. Emails are designed to appear to come from someone the recipient knows and trusts, usually a colleague, and can include a subject line or content that is specifically tailored to the victim’s work. For high dollar victims, attackers may study their social networking accounts to gain further intelligence and then choose the names of trusted people in their circle to impersonate or topic of interest to lure the victim and gain their trust.

Whaling – Spear-phishing targeted to high profile targets such as executive officers or elected officials within a business or government organization.

The Cybercrimes ...



RANSOMWARE

» Malware is installed on your computer when you click on a link in an email. It holds your computer hostage by locking your screen or encrypting your files until you pay a specified amount of money for a key to unlock the system.



PHISHING

» The attacker will send an authentic-looking email, perhaps with a real organization's logo, attempting to steal passwords, financial or personal information, and introduce a virus. These emails are sent in bulk.



SPEAR PHISHING

» This is a more targeted form of phishing. Emails appear to come from someone the recipient knows and trusts and can include a subject line or content tailored to the victim's work. Attackers may gain information from social media networks.

... and how to avoid them

Always back up data!	then you won't have to pay the ransom
Anti-virus software and pop-up blockers	check for updates manually once a week
Don't click on links in emails	type in the URL manually to check its validity
Don't put individual email addresses on website	set up a catch-all account such as contact@agency.com

Figure 33: Types of Cybercrimes. Shows common cybercrimes and way to potentially avoid being affected by them. Source: Ohio Auditor of State. 2016.

HAZARD HISTORY

Although Delaware County has only experienced one significant cyber-attack event in its history, it is undoubtedly a necessary new concern that government agencies and all critical infrastructure operations will have to be prepared to handle. On average, more than 4,000 ransomware attacks have occurred daily since January 1, 2016. This is a 300-percent increase over the approximately 1,000 attacks per day seen in 2015. The likelihood of cybercrimes has continued to be on the rise, which can be seen the number of incidents that have occurred in various counties in Ohio over the last few years.

2016- In early May of 2016, an employee in the treasurer's office of Big Walnut Local School District in Delaware County received an official-looking email from the treasurer asking that a vendor be promptly paid. The email had all of the markings of a district email, including the appropriate email address and letterhead, but was in fact cybercriminals. The employee and an individual who was appearing to be her boss exchanged several emails to answer questions before the transfer of \$38,520 was made. Fortunately, all the money was later recovered back to the school district through the bank and other sources. This attack is an example of spear phishing.

Other Ohio County Attacks:

2015- Miami County fell victim to a crypto virus. There were not many documents that were impacted, but the county did end up being forced to pay hackers \$700, plus consulting fees to a security firm that handled the ransom payment to regain their network and documents.

2015- Ohio-based Miami Valley Regional Planning Commission reported that ransomware attacked and compromised 15,000 of its files, according to SC Magazine. While the ransomware's perpetrators demanded about \$1,400; the commission did not pay the money and was able to restore its files in about 30 minutes.

2016- In May, a virus encrypted Columbiana County's court data. The virus had encrypted the court's data and hackers demanded \$2,500 for the key to unlock the information. Because a recent copy of the data wasn't available, the county agreed to pay the \$2,500.

2016- In September, Madison County Agricultural Society was scammed out of \$60,491 by a cybercriminal posed as the Internal Revenue Service, collecting back taxes.

2017- Licking County detected ransomware virus on January 31st, 2017. The county's phones and computer systems, including part of its 911 system, were locked down. IT staff members quickly shut down the countywide network to prevent the virus from spreading. Rather than pay the ransom, Licking County decided to rebuild their system, a move that officials say was possible because of good backups and the quick system shutoff.

2017- In March, Morrow County's Peru Township the fiscal officer's computer began screeching on March 9th before a notice appeared on the screen advising that a solution was available by calling a 1-800 number. The township paid \$200 to stop the attack.

2017- In April, ransomware attack hit Vernon Township in Clinton County, but no ransom was paid because the township's data was backed up.

2017- In June, several Ohio government websites were hacked with messages supporting Islamic terrorist groups. Those sites impacted included those of the governor, his wife, the lieutenant governor, and inspector general, and Ohio's Medicaid and prison agencies.

2017- In December, hackers encrypted the Mad River Township Fire and EMS servers with ransomware in Clark County.

2017- Marion County has had a handful of ransomware attacks in recent years, the incidents were less disruptive because backups were sufficient to restore affected systems, there were no ransoms paid.

2018- Two ransomware attacks hit the city of Riverside in Montgomery County in April and May, and had been attacked several years before as well. They lost data because of the malicious virus in 2018. In the previous incident, hackers hit the Riverside's police computers with ransomware.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Cyber-attacks occur virtually. They can originate from anywhere in the world and can target anywhere in the world. Although a cyber or ransomware attack could occur anywhere, history has shown that critical facilities tend to result in the highest profile cases of cybercrimes. Local government agencies of Delaware County and critical infrastructures, such as, hospitals, EMS, 911-operations, Fire and Police Departments, or any public service that has access to important public records and financial backing are the most at risk. The geographic extent of such an attack would most likely be highly contained due to the nature of the act, but the actual magnitude could result in the loss of critical facilities that could lead indirectly to a limited treatment of those injured and the extortion of funds. Like many other man-made hazards, it is difficult to quantify the probability of such an event; although the probability of a major event is low there is still a high possibility that it could occur when looking at the number of surrounding counties in Ohio that have occurred attacks. Delaware County has a great deal of economic activity and is moderately larger than some other counties and because of that our chance of a cybercrime may be higher than other smaller counties.

Local government agencies are one of the easiest targets for those hackers that are skilled. These local governments tend to be attractive targets, in part because of their connection to state systems or other large networks.

The losses incurred by cyber events are highly circumstantial and depend on the form of cybercrime, the targeted group, and other factors involved.

RISK ASSESSMENT

Since a cyber-attack only directly has an effect on economic consequences, there is little to no risk in resultant property damages. A significant cyber-attack would stress county resources and available facilities, but would not likely cause any permanent property damage or long term devaluation.

Cyber-attacks carried out on public infrastructure can directly impact the County's ability to operate essential facilities and provide services. Forms of sabotage to computer systems include the introduction of viruses, malware or spyware that can cripple a computer network or steal private and public information.

Emergency services, such as 911 dispatch would have difficulties because most phone lines work via the Internet. Medical response and care are reliant on electricity, water, information systems, and the Internet to access medical records. If the Internet was not available, many information systems would be useless and operations for many of the critical infrastructure sectors may stop altogether, causing major problems for both the public and private sector.

While sabotage to computer systems normally would not lead to harm to health and safety, it is possible. As technology becomes more integrated into society, the more access hackers will



have to sensitive systems. Integration of systems (such as electrical grids, air traffic control centers, traffic lights, etc.) can leave these systems vulnerable to attack. If these critical systems are compromised, it is possible that people may be indirectly injured or killed in their absence.

Resources:

<https://www.justice.gov/criminal-ccips/file/872771/download>

<https://ohioauditor.gov/publications/cybercrime.pdf>

https://www.sans.org/security-resources/IAD_top_10_info_assurance_mitigations.pdf

3.3.10 HAZMAT Incident

Chemicals are a part of everyday life in Delaware County, and although most chemical injuries come from people misusing them at home, there is still a concern that the County could experience a large hazardous material incident, especially since there are 17 facilities within the county that fall under Extremely Hazardous Substances (EHS) sites, as defined by Ohio Revised Code Section 3750.02(B) (1) (a). This hazard was ranked 7th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

A HAZMAT incident is an event in which there is a large and extensive release of hazardous materials. Such an incident can occur on its own or it can be incited by a natural disaster such as a tornado or an earthquake. It could even be incited by an act of civil disturbance or terrorism. Communities with industries or companies that utilize hazardous materials are more likely than others to have a HAZMAT incident. Such an event can occur either at the location in which the material is used or when it is being moved in transport by truck or railroad.

During the winter months, the main routes used for evacuation in the event of a HAZMAT incident can be reduced to one lane or closed due to snow and wind directions. A transportation hazard exists as a result of hazardous materials being transported throughout the county by roadway and by railroad. A spill/incident involving a truck or railcar could result in the release of a hazardous material placing people, property and the environment at risk of being injured or damaged.

Only the most impactful and harmful hazardous events have been counted towards the risk assessment. These events were ones that fell into one or more qualifications that were predetermined to define what an impactful event would look like in Delaware County. As used in this rule, qualifications were as listed below:

- Event with 500 + gallons of hazardous materials spilled
- Event caused the full activation of the HAZMAT Team
- Event caused the direct injury to people or property
- Events with extremely hazardous materials, which included: Fluorine / Fluorite, Acetone, Sulfuric Acid, Cobalt, Acrylonitrile.

HAZARD HISTORY

There have been several HAZMAT incidents recorded in Delaware County since 1990, but only 10 are considered an impactful event either due to the type hazardous material released, the quantity of material released, or because the event caused a HAZMAT Team activation to the scene. To date, no one has been directly injured due to a HAZMAT incident. The impactful incidences are listed below:



1999- On February 4th, 1999 there was a tanker on Berkshire I-71 / Northbound with substance coming from the fill port. The hazardous substance was Fluorspar (Fluorite). The quantity was not listed.

1999- On June 6th, 1999 there was a semi accident in Troy on US 23 at the Tractor Supply Company. The hazardous substance released was diesel fuel, acetone, and paint. The quantity was not listed.

2007- On May 18th, 2007 a third party company was moving equipment from a dock area of PPG in Delaware City. A floor scrubber and forklift fell off the truck or dock because the driver did not secure the loads down. The battery of the floor scrubber cracked, releasing 30 gallons of sulfuric acid, which mixed with water. The forklift, with propane tank, was lying within the sulfuric acid. The HAZMAT Team was activated to the incident.

2007- On November 2nd, 2007 a broken valve in a transfer line malfunctioned causing approximately 2,000 gallons of raw sewage to be dumped in Alum Creek waterway located in Berlin Township at Cheshire Road and Route 21. The Olentangy Environmental Control Center (OECC) wastewater treatment facility was contacted. The pump station on Cheshire Rd. was shut down and OECC made repairs to the valve. Ohio Environmental Protection Agency (OEPA) was notified of the incident, but did not respond.

2008- On January 13th, 2008 a tractor semi tanker carrying 5,500 gallons of phenol sulfonic acid leaked approximately 50 gallons of the chemical into the Wal-Mart Super Center parking lot in Orange Twp. This was caused by a hole located on the bottom side of the tank in front of the rear axle. The HAZMAT Team was activated to the incident.

2008- On July 8th, 2008 a dump truck that was being used by Shelly Company to re-surface the Sunbury Road at Hoover Gate Lane, dumped 20 tons of asphalt into a drainage ditch and onto the roadway. The truck was dumping asphalt into the paving machine when its load shifted causing the truck to roll onto its side causing the accident to occur. This was located in Genoa Township.

2009- On December 1st, 2009 in Berkshire Township on 7682 SR 37 E. at Pilot Travel Center a semi trailer's damaged drum leaked 55 gallons of potassium hydroxide solution. The HAZMAT Team was activated to the incident.

2011- On February 17th, 2011 I-71 was shut down for several hours as emergency crews investigated a car they believed to have contained hazardous materials. Stopped by an officer who thought he smelled Anhydrous Ammonia, officers found magnesium carbonate, powdered lidocaine and some form of bath salts. Four law enforcement officials and two men riding in the car were taken to receive medical treatment. While this event did not have strong HAZMAT implication, it did have strong repercussions that developed due to the incident, having to do with closing the highway down.



2016- On January 27th, 2016 a facility had a fire in Orange Township on Green Meadows Drive. The fire caused damage to a 55 gallon drum of toluene. The HAZMAT Team was activated to the incident.

2016- On August 5th, 2016 a tanker trailer had a faulty/cracked overflow drain that caused 5,000 gallons of asphalt emulsion (tar) to be released on US HWY 23 in Delaware City.

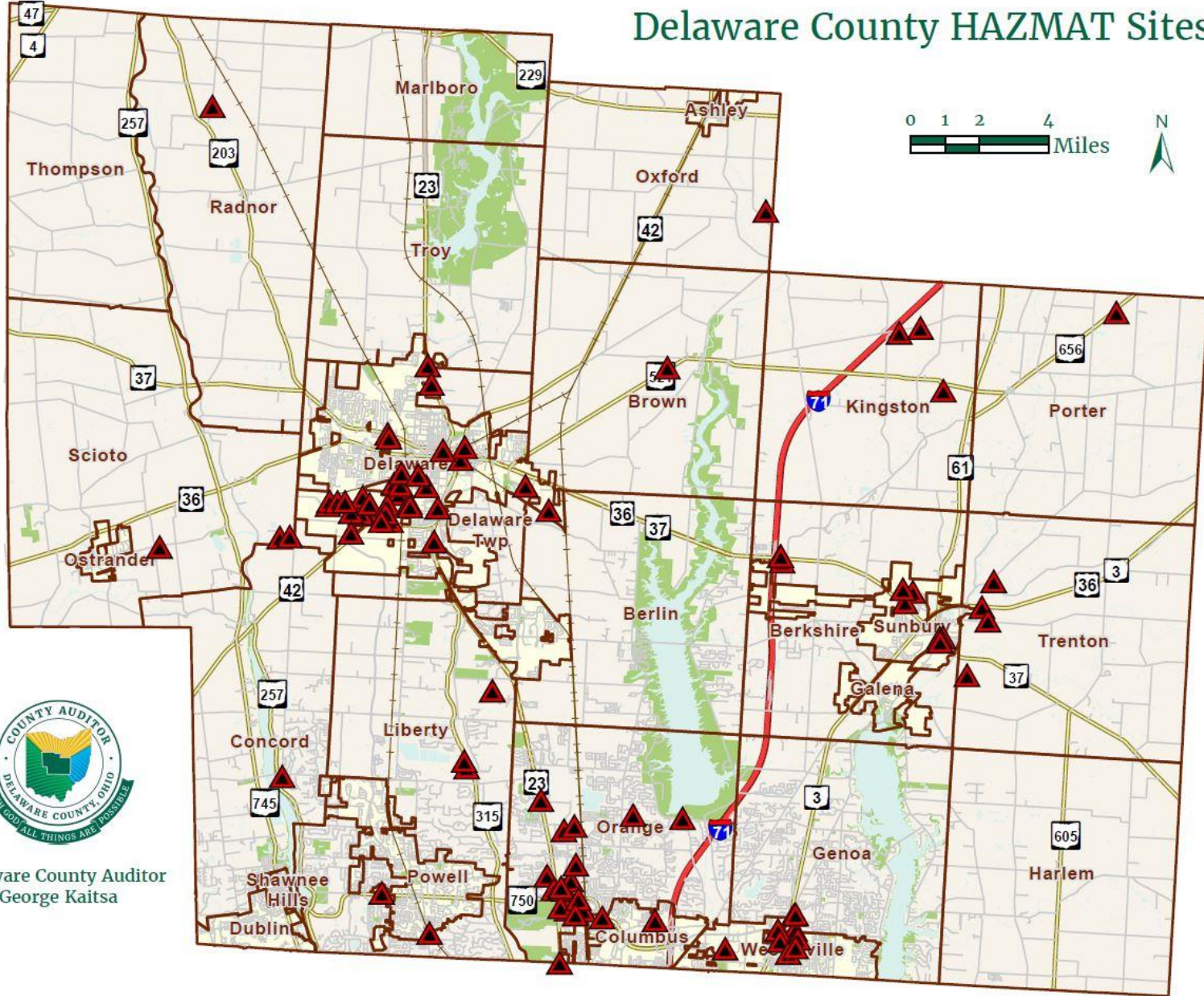
LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

As mentioned above, the most likely locations of a HAZMAT incident would be at the location of a company, industry, etc. containing hazardous materials or along a road or railway while hazardous materials are being transported. Taking this into consideration, all of Delaware County's HAZMAT sites are mapped below with the areas of most concern should a HAZMAT release and/or spill should occur at each location (Figure 34). It is extremely difficult to quantify the possibility of a HAZMAT incident as it can be incited by many different causes such as unintentional human action, deliberate human terrorism, misuse, accidents, or natural disasters and occur by many different types of hazardous materials.

RISK ASSESSMENT

Features were selected from parcels that had their centroid within a 1000 ft. buffer around each individual hazard site recorded in Delaware County and all jurisdictions covered within this plan. In this case, the TOTAL market value (including land and improvement) was included because a HAZMAT incident would cause significant damage to the land. See the table below showing the structures at risk (Table 22).

Delaware County HAZMAT Sites



Delaware County Auditor
George Kaitsa

Prepared By: Delaware County Auditor's GIS Office

Figure 34: HAZMAT Sites in Delaware County. Shows the locations of HAZMAT Facility Sites in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

3.3.12 Large Utility Disruption/Failure

As public utilities are a critical part of the local infrastructure, their failure at the very minimum disrupts community operation, but can also lead to indirect injuries or deaths. Delaware County's utility infrastructure contains 175 miles of water mains and 5 miles of sanitary sewer 'force' mains. The County's citizens share a water service agreement with Del-Co Water Company and a sanitary sewer agreement with Delaware County. This hazard was ranked 9th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

A utility disruption is the disturbance or failure of public facilities such as water, electric or sewage. This can either be the result of a deliberate action, by accident or by a natural disaster. Such a disaster can affect transportation routes, the operation of schools, local businesses and other critical facilities, telecommunication traffic and simple day-to-day activity. These failures can last from a period of hours to several days, depending on the severity of the crisis and any accompanying disasters to the incident.

As used in this rule (Code: 4901; 1-10-7), "outage" means an interruption of service to:

1. Two thousand five hundred or more customers in an area for a projected or actual period of four hours or more
2. One hundred or more customers in an area for a projected or actual period of twenty-four hours or more.
3. A facility of any telephone company, electric light company, natural gas company, water-works company, or a sewage disposal system company, as defined in section 4905.03 of the Revised Code and including a company that is operated not-for-profit, or owned or operated by a municipal corporation, when an interruption to that facility for a projected period of four hours or more, affects or will affect public safety.
4. Any police department, fire department, hospital, or countywide 9-1-1 system, for a projected period of four hours or more.

HAZARD HISTORY

Delaware County has not yet encountered a deliberate utility disruption or failure caused by an act of civil disturbance or terrorism; however, it has experienced large utility disruption as a result of severe storms, winter weather and by accident.

2003- On August 12th, 2003 10 million people in eight states and a large portion of Canada experienced a massive blackout or loss of electrical power due to a large cascading surge throughout the power grids. Approximately 540,000 of these were in Ohio, some in the northern part of Delaware County. Cellular communications were disrupted, factories were closed, and regional airports were shut down.

2012- On June 29th – July 8th, 2012 Delaware County and other areas of Central Ohio experienced a large summer storm that incited widespread power outages leaving people without power for 1 – 10 days. Concerns were raised about the possibility of heat-related illnesses as temperatures reached high in the 90's throughout the outage.

2016- On June 23rd, 2016 high winds and lightning moved through multiple counties. This caused outages for 20,389 AEP customers in Delaware, McConnelsville, Canton, Chillicothe, and Columbus. Outages lasted for a period of around 8 hours while being restored.

2017- On June 13th, 2017 the Dublin Fire Department and Water Tower in Delaware County experienced outages due to a third-party dig-in which damaged the primary wire. Ohio Edison Company had crews on site making repairs, estimated outage time was around 11 hours.

2018- On May 31st, 2018 a storm moved through Ohio at 3 a.m. and caused 2085 outages for AEP customers in Delaware due to a tree falling on three phase lines. Outages were restored by noon of May 31, 2018.

2018- On July 2nd, 2018 a severe thunderstorm developed around 2 p.m. and moved through Franklin and Delaware Counties. Additional storms followed within the state. The storms caused trees and wires to be down around the area. Around 11,244 AEP customers were affected by outages and were completely restored by 3:30 p.m. the next day July 3rd, 2018.

2018- On October 19th-22nd, 2018 a severe wind storm caused outages of power for around 23,000 customers of AEP. High winds with gusts exceeding 60 mph, took down poles, trees, and powerlines. The majority of outages were restored by Monday the 22nd, 2018.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Each utility behaves differently in the distribution of its services throughout the County. See the maps below for the city and county water service areas and for the electrical areas. Every jurisdiction in the county could be impacted by a utility failure.

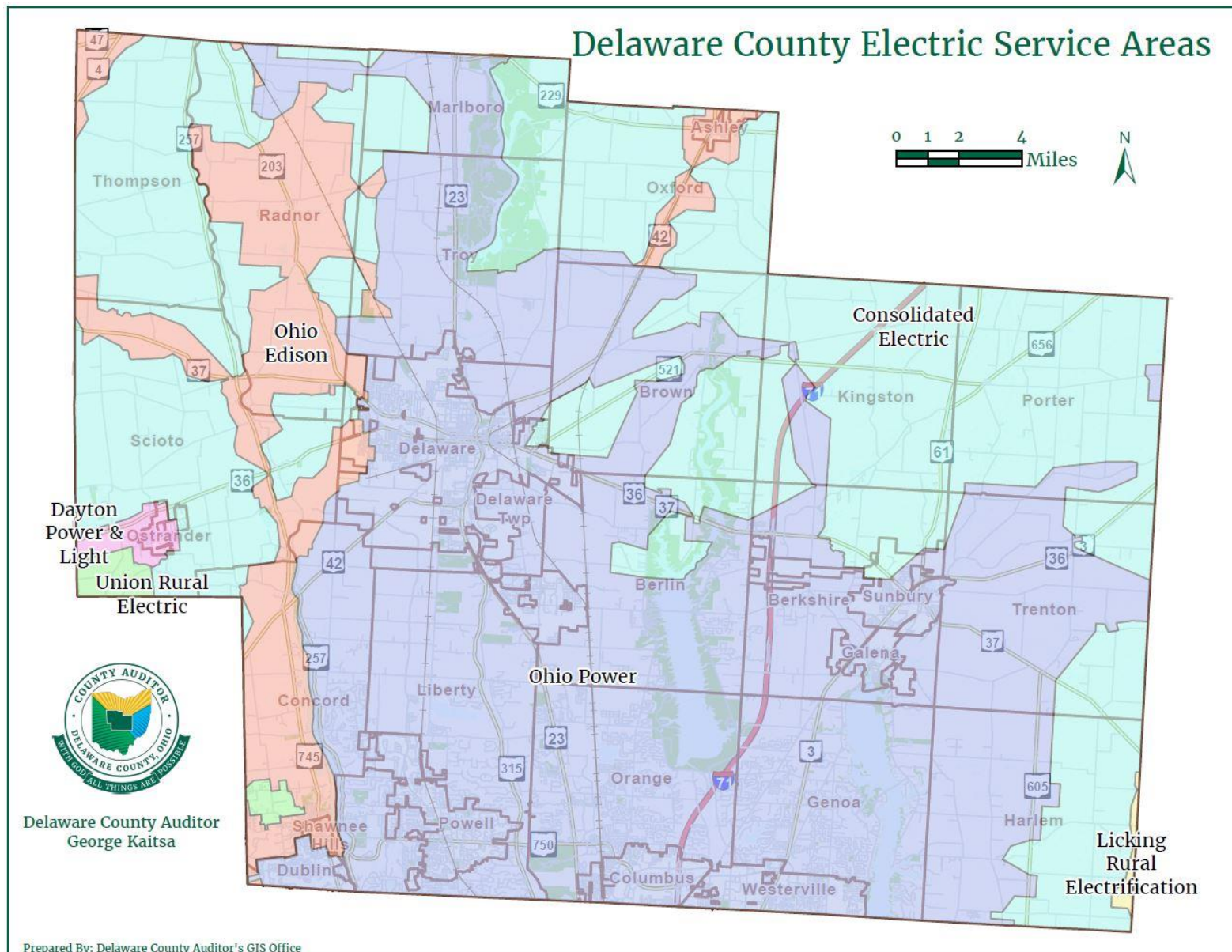


Figure 35: Delaware County Electric Service Areas. Map displays the service areas of various electric companies in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

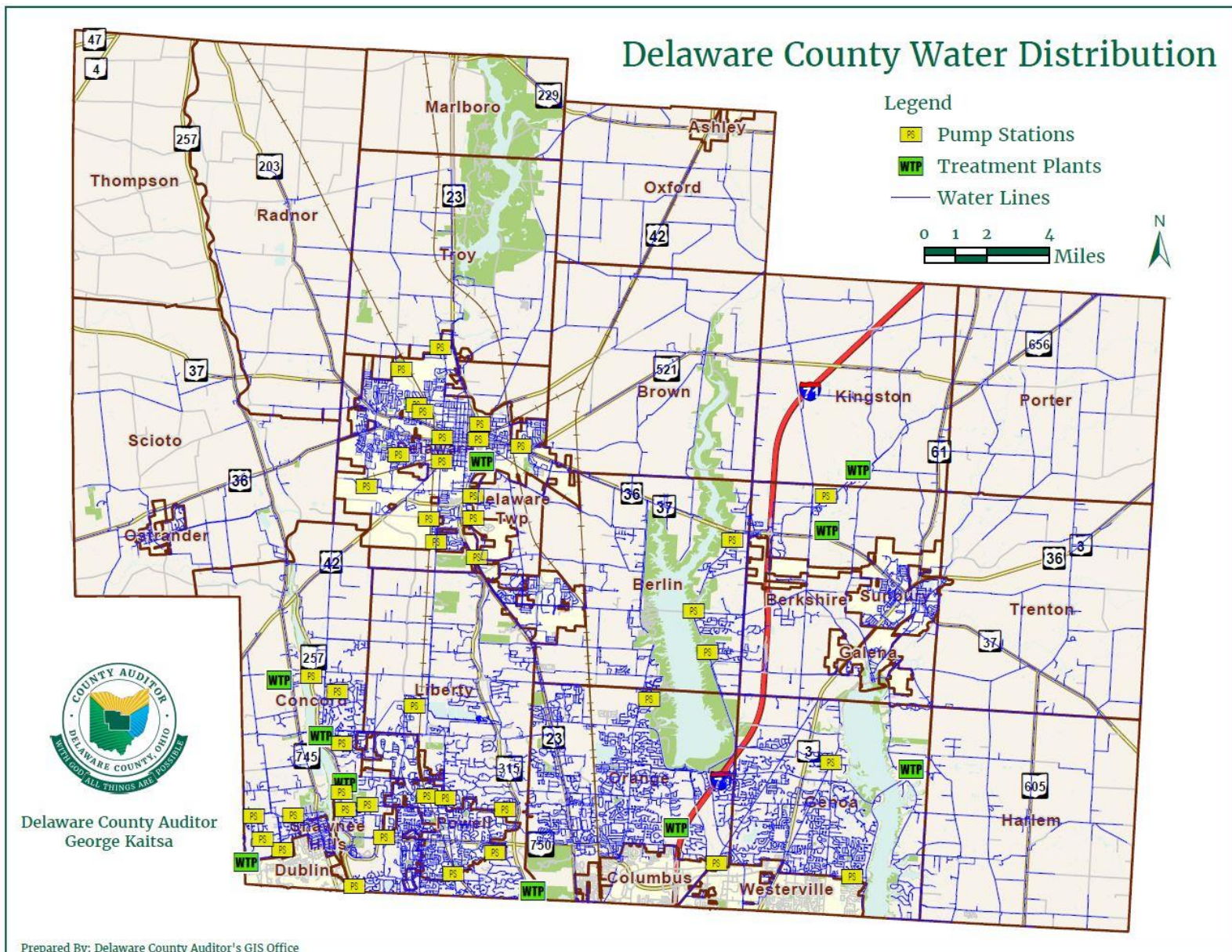


Figure 36: Water Distribution in Delaware County. Map displays the pump stations, treatment plants, and water lines located in Delaware County.
 Prepared by: Delaware County Auditor's GIS Office. 2018.

RISK ASSESSMENT

A large utility failure, depending on the nature of its cause whether natural or human-induced is highly unlikely to cause any damage to infrastructure and thus does not require any form of asset assessment; however, as mentioned above, utility failure or disruption can still be very disruptive to structures within the utility service areas. Columbus Southern Power (CSP), a subsidiary of American Electric Power (AEP), covers the greatest area and largest number out of any of the electrical company that services Delaware County. Should the company somehow lose its ability to provide service unexpectedly, it surely would cause massive disruptions to social and economic activity. Should something like this occur during times of extreme heat or cold, its consequences might be even worse.

In order to estimate the number of structures that could potentially be affected by an event such as a massive power outage, local GIS utility data, and Delaware County parcel data were overlaid. The GIS Department estimated that approximately 73,000 structures lie within Ohio Power service area. An estimated 5% of these structures are commercial, 0.6% exempt/utility, 0.5% agricultural, 0.4% industrial and the remaining structures are residential. According to city-data.com, Delaware County contains an average of 2.9 people per household meaning that upwards of 197,000 people might be affected should Ohio Power electrical service fail.

Table 23: Extent of Power Companies in Delaware County.

EXTENT OF POWER COMPANIES IN DELAWARE COUNTY		
Power Company	Number of Structures in Service Area	20% Outage
Consolidated Electric	13,186	2,637
Dayton Power & Light	657	131
Licking Rural Electrification	72	14
Ohio Edison	6,585	1,317
Ohio Power (AEP)	73,462	14,692
Union Rural Electric	405	81
Structures determined from 2018 Building Outlines provided by the Delaware County Auditor's GIS Office. Note: Building Outlines include outbuildings and accessory structures.		

3.3.11 Pandemic/Infectious Disease

Although an infectious disease or pandemic bears little to no risk to infrastructure, it does threaten the lives of the citizens and Delaware County and its encompassing jurisdictions, particularly during winter months when people are more susceptible to infection. Several public health officials and other concerned policymakers fear a future strain of flu that will not be able to be diminished by a vaccine. Thus, it is necessary to consider the possibility of such a disease touching the lives of Delaware County's citizens. This hazard was ranked 4th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

Various diseases and environmental conditions can result in widespread illness or threats to life if localities are unprepared or the spread goes unchecked. Diseases can be spread through direct contact, food, insects, and water or by airborne methods. Foodborne illnesses are a growing concern, especially since food is distributed across greater distances than in years before.

Only the most impactful and harmful pandemic events have been counted towards the risk assessment. These events were ones that affected 7% of Delaware County's population or 14,000+ people.

Characteristics	Pandemic Severity Index				
	Category 1	Category 2	Category 3	Category 4	Category 5
Case Fatality Ratio (percentage)	<0.1	0.1-<0.5	0.5-<1.0	1.0-<2.0	≥2.0
Excess Death Rate (per 100,000)	<30	30-<150	150-<300	300-<600	≥600
Illness Rate (percentage of the population)	20-40	20-40	20-40	20-40	20-40
Potential Number of Deaths (based on 2006 U.S. population)	<90,000	90,000-<450,000	450,000-<900,000	900,000-<1.8 million	≥1.8 million
20 th Century U.S. Experience	Seasonal Influenza (illness rate 5-20%)	1957, 1968 Pandemic	None	None	1918 Pandemic

Figure 37: Pandemic Severity Index. Displays the various severity categories of a pandemic and the associated characteristics. Source: CDC, Interim Pre-Pandemic Planning Guidance. 2007.

HAZARD HISTORY

The CDC and the Ohio Department of Health frequently publish reports, press releases and other publications that provide a general history, details and estimated figures of pandemics that have touched Ohio, including Delaware County, and the rest of the United States. The most important

recorded incident are listed below. Important to note that only events that affect 7% of Delaware County's population were included in the risk assessment. Listed below includes those in the risk assessment, events that affected 100+ people or are one that is considered to be close calls.

2009- In the fall of 2009, the H1N1 virus gained momentum as a new strain of flu that was not recognized by our immune systems. The Ohio Department of Health used CDC recommended methodology to estimate 10,266 hospitalizations and 471 deaths in the State of Ohio from this virus.

2014- In October 2014, a nurse in the United States contracted Ebola and then flew to Ohio. There were 29 Ohioans, 87 airline passengers and 177 other individuals that were placed under quarantine U.S. wide. No Ohioans were diagnosed with Ebola, but this scare led to extensive coordination and planning with state and federal partners.

2015-2018- From January 1st, 2015 to October 31st, 2018, there were 5,728 symptomatic Zika virus disease cases reported, 86 cases specific for Ohio.

2018- In July 2018, Delaware County health officials identified 647 customers of Chipotle located in Powell that reported becoming ill after eating at the restaurant. It was caused by a toxin formed in the gastrointestinal tract by the *Clostridium perfringens* bacteria, commonly found when food is left at an unsafe temperature. Included symptoms were nausea, vomiting, diarrhea, fever and other ailments.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

A pandemic can spread not only across a region but across continents; therefore it is not locally contained and should be considered potentially threatening to all of Delaware County. There is no geographic location for this hazard, beyond that outbreaks typically begin in areas with high populations. As for the potential magnitude, it is best to turn to the CDC's Pandemic Severity Index below (Figure 38).

In the case of pandemics, it is difficult to utilize the past history of infectious diseases in order to estimate the probability of future occurrences simply because pandemics are a rapidly increasing threat to citizens as international travel and trade expands, global population grows, and viruses become more and more resistant to the vaccines and remedies created by health officials.

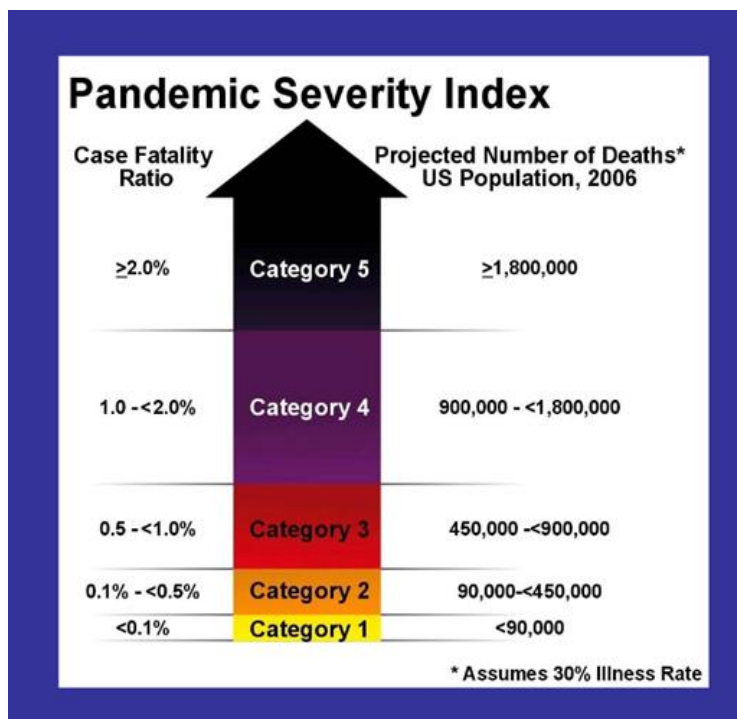


Figure 38: Pandemic Severity Index. Uses case fatality ratio as the critical driver for categorizing the severity of a pandemic. Source: CDC, Interim Pre-Pandemic Planning Guidance. 2007.

RISK ASSESSMENT

Since a pandemic only affects humans and potentially livestock, there is little to no risk in resultant property damages. A significant pandemic would stress county resources and available facilities, but would unlikely cause any permanent property damage or long term devaluation.

Essential facilities will not be physically impacted by this hazard. They may be impacted by the loss of workers who are ill or need to care for others who are ill. Local hospitals and clinics may experience a surge of patients while dealing with a decrease in available staff.

3.3.13 Terrorism

Terrorism, unlike civil disturbance, is a deliberate act of violence used for political gain. Ever since the United States witnessed the attack on the World Trade Center in September 2001, citizens, emergency responders, public officials and many more have grown more cautious and concerned about the prospect of their locale being subject to an act of terrorism. Thus the DMPG felt it necessary to consider terrorism as a hazard. This hazard was ranked 8th highest in regards to its potential impact on Delaware County.

HAZARD PROFILE

Terrorism, unlike civil disturbance, is a deliberate act of violence used for political gain. The state of Delaware's Delaware Criminal Justice Council summarizes its nature by claiming it has six components. In order to be properly considered as terrorism, the act must be intentional, rational, violent, fear-inducing, targeted towards a specific audience or society, and done with the purpose of changing behavior in a society. The types of acts of terrorist acts can be reduced to the following categories: attacks involving weapons of mass destruction, weapons of mass casualty or weapons of mass disruption. The impetus for terrorism can be but are not limited to political, religious, social, or environmental causes. There is a growing concern within the country of biological, chemical or cyber terrorism due to technological advancements in these areas.

HAZARD HISTORY

Although Delaware County has not witnessed a significant terrorist event in its history, it is undeniable that the successful attacks on the World Trade Center on September 11, 2001 definitely altered US perspectives about terrorism and the likelihood of an attack within its borders. There have been several events within the past decade in which potential terrorist incidents almost occurred or did occur involving Ohio residents.

2003- On May 1st, 2003 an Ohio truck driver with a license to carry hazardous material, pleaded guilty to providing material support to Al-Qaida and conspiring to do so. He and another Al-Qaida member later revealed their intention to target the Brooklyn Bridge.

2003- A Somali man based in Columbus, Ohio owner of a small cell phone business was charged for conspiring with an Al-Qaida member for planning to detonate a bomb at a shopping mall in the Columbus Area. Federal authorities announced that a secret cell of Al-Qaida terrorists plotted to bring "death and destruction" to Columbus by blowing up shopping malls. An indictment unsealed in U.S. District Court in Columbus said Somali immigrant and admitted Al-Qaida member plotted with a third Columbus man to bring down a mall, perhaps during the Christmas season.

2008- A Worthington man accused of plotting to help Al-Qaida, pleaded guilty to conspiring with terrorists to use weapons of mass destruction in Europe and the United States. He was sentenced to 20 years in prison in 2009.

2011- On June 2011 a Somali man living in Franklin County was arrested by FBI agents after he was charged in Minnesota with providing money and other assistance to the Somali terrorist group Al-Shabab, which has been linked to Al-Qaida. He had moved to the Westerville area that year and appeared in federal court in Columbus, but was transferred to Minnesota to face charges there.

2016- On February 2016 a Somali man attacked patrons in the Nazareth Mediterranean Cuisine restaurant located in Columbus with a machete, wounding four patrons. At the time, FBI agents said there was no indication that the man was working with anyone, or being directed by someone. But that he had been on a watch list for “espousing extremist views.” This appeared to be a “lone-wolf” terrorist attack.

2016- A man from the Northeast Side of Columbus was arrested at John Glenn Columbus International Airport after it was found that he provided material support to a foreign terrorist group. Federal agents said he intended to fly to Libya to fight for the Islamic State. He also sent \$250 to a known intermediary of ISIS recruiter in January, according to an indictment in U.S. District Court in Columbus.

2016- On November 28th, a terrorist vehicle-ramming and stabbing attack occurred at 9:52 a.m. EST at Ohio State University's Watts Hall in Columbus, Ohio. The attacker, a Somali refugee, was shot and killed by the first responding OSU police officer, and 13 people were hospitalized for injuries. The assailant rammed his car into a group of people on the Columbus campus and then got out and charged at passersby with a knife. The attack appeared to be inspired by terrorist propaganda from ISIS and is considered as “lone-wolf” terrorism.

LOCATION, EXTENT, AND PROBABILITY OF FUTURE OCCURRENCE

Like many man-made hazards, the geographic location of areas vulnerable to terrorism varies although it is based around highly visible and heavily occupied structures. Firstly, the critical infrastructure is subject to great threat because their disruption or destruction can result in massive economic, social, and environmental consequences. Secondly, there are critical points of interest in Delaware County that might incite an attack due to their nature.

The nature of a terrorist attack would determine the magnitude of the incident, and like other man-made hazards, it is difficult to quantify a probability, particularly since such an event has never occurred in Delaware County's history.

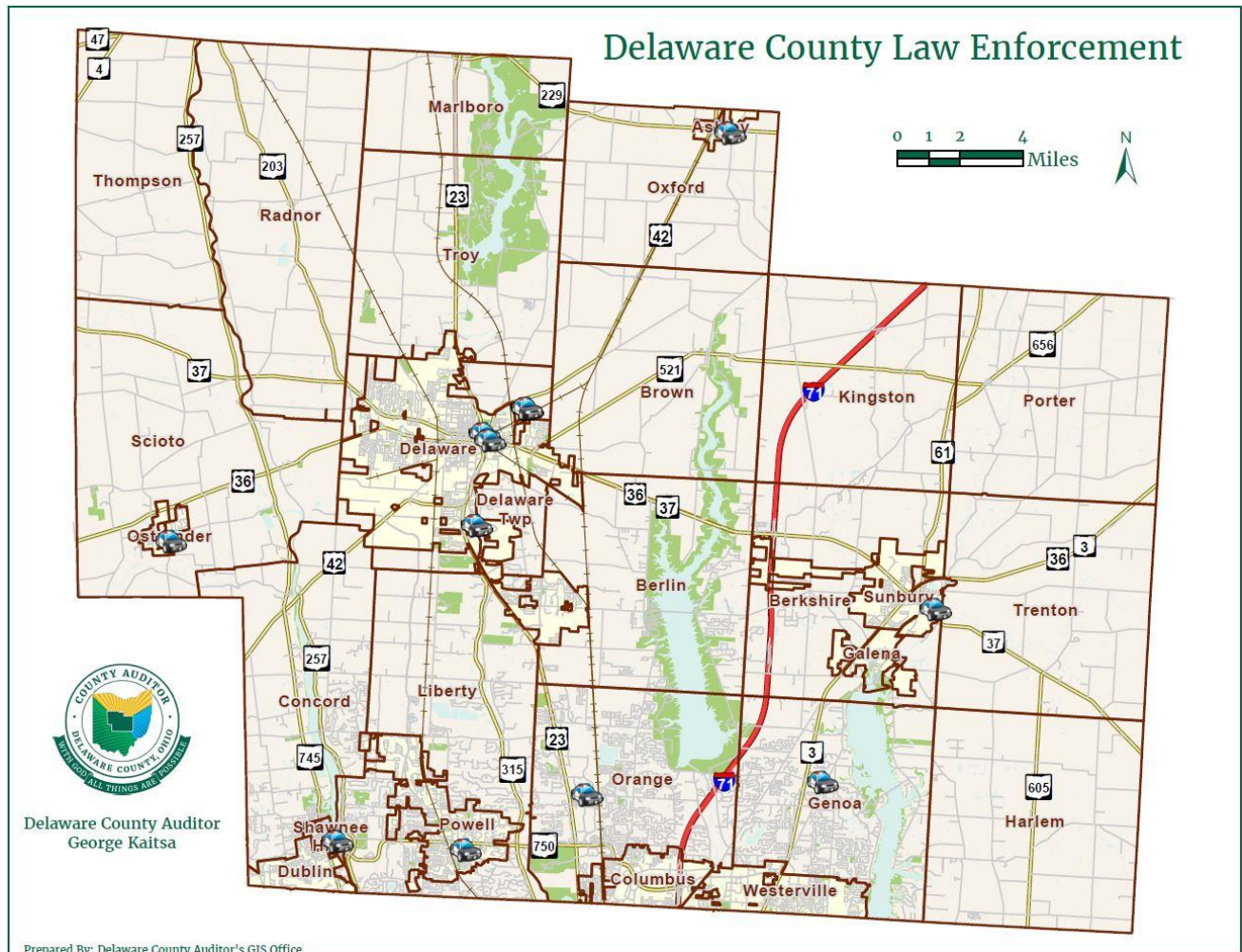


Figure 39: Law Enforcement locations in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018.

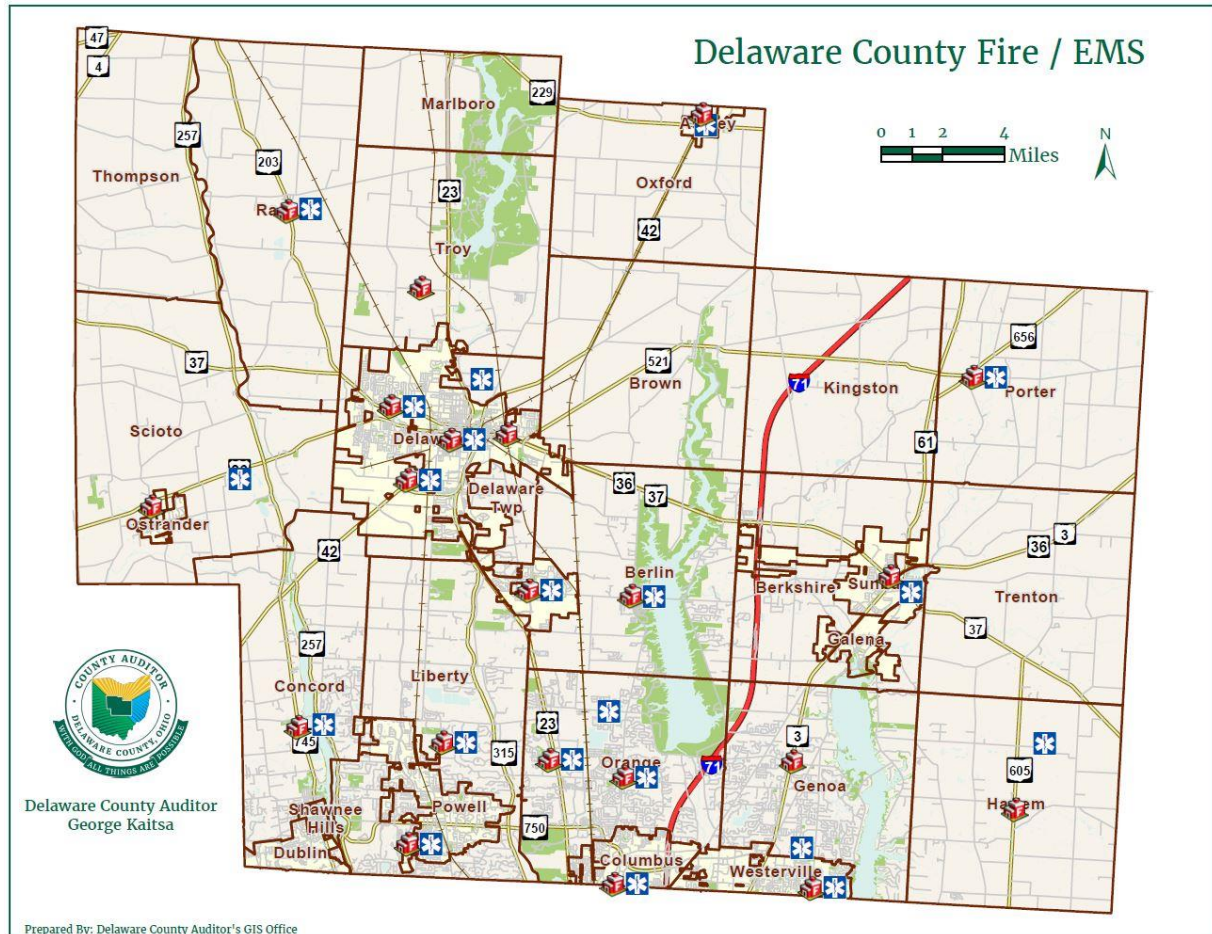


Figure 40: Fire Departments and EMS located in Delaware County. Prepared by: Delaware County Auditor's GIS Office. 2018

RISK ASSESSMENT

The first location of concern is the award-winning Columbus Zoo and Aquarium because it has been named the number 1 zoo in the United States by the USA Travel Guide and continues to gain recognition across the United States. It is also home to the popular animal expert, Jack Hanna, who is internationally known and recognized. The zoo spans 582 acres, is home to 9,400 animals and sees more than 2 million visitors annually. In 2010, there was a record-breaking near 2.4 million visitors annually. One event by the name of “KidFest” saw 22,000 attendees and another 2010 Winter Wildlights events drew over 300,000 attendees. With its increasing national visibility, the zoo is Delaware County’s number one concern in regards as a potential target of terrorism, particularly from violent animal rights groups.



The second location of concern is the Polaris Shopping Center and Outlet Mall off Routes 36/37 near I-71. The unsuccessful 2003 Columbus Shopping Mall Plot, raised concerns that Central Ohio shopping malls might be potential targets of local terrorist groups connected to international organizations like Al-Qaida. The Polaris Mall sees upwards of 8 million people year with daily and seasonal attendance varying greatly meaning a daily average of nearly 22,000 visitors.

Table 24: SHARPP Multi-Hazard Structure Vulnerability Analysis. Shows the total structures in the county at risk and economic damages associated with those for all hazards.

SHARPP MULTI-HAZARD STRUCTURE VULNERABILITY ANALYSIS										
	Structures at Risk					Damage in Dollars				
HAZARD	Residential	Non-Residential	Critical	Publicly Owned	Total	Residential	Non-Residential	Critical	Publicly Owned	Total
Dam Inundation	6,093	1,699	123	151	8,066	\$135,085,300	\$120,273,200	\$119,307,900	\$55,195,500	\$429,861,900
Drought	0	0	0	0	0	\$0	\$0	\$0	\$0	\$0
Earthquake	73,922	12,147	752	498	87,319	\$12,650,100,870	\$2,246,372,900	\$588,690,200	\$218,005,000	\$15,703,168,970
Flooding	723	536	27	16	1,302	\$100,503,700	\$129,508,800	\$75,345,800	\$55,243,100	\$360,601,400
Severe Summer	73,922	12,147	752	498	87,319	\$12,650,100,870	\$2,246,372,900	\$588,690,200	\$218,005,000	\$15,703,168,970
Severe Winter	73,922	12,147	752	498	87,319	\$12,650,100,870	\$2,246,372,900	\$588,690,200	\$218,005,000	\$15,703,168,970
Tornado	1,278	N/A	N/A	N/A	1,278	\$11,559,918.96	N/A	N/A	N/A	\$11,559,918.96
Civil Disturbance	0	133	761	385	1,279	\$0	\$231,148,900	\$589,982,300	\$69,630,400	\$890,761,600
Cyber-Attack	0	0	0	0	0	\$0	\$0	\$0	\$0	\$0
HAZMAT	945	820	36	61	1,862	\$152,823,600	\$730,948,600	\$10,479,200	\$71,766,600	\$966,018,000
Utility Failure	73,922	12,147	752	498	87,319	\$12,650,100,870	\$2,246,372,900	\$588,690,200	\$218,005,000	\$15,703,168,970
Pandemic	0	0	0	0	0	\$0	\$0	\$0	\$0	\$0
Terrorism	0	2	0	0	0	0	unknown	0	0	0

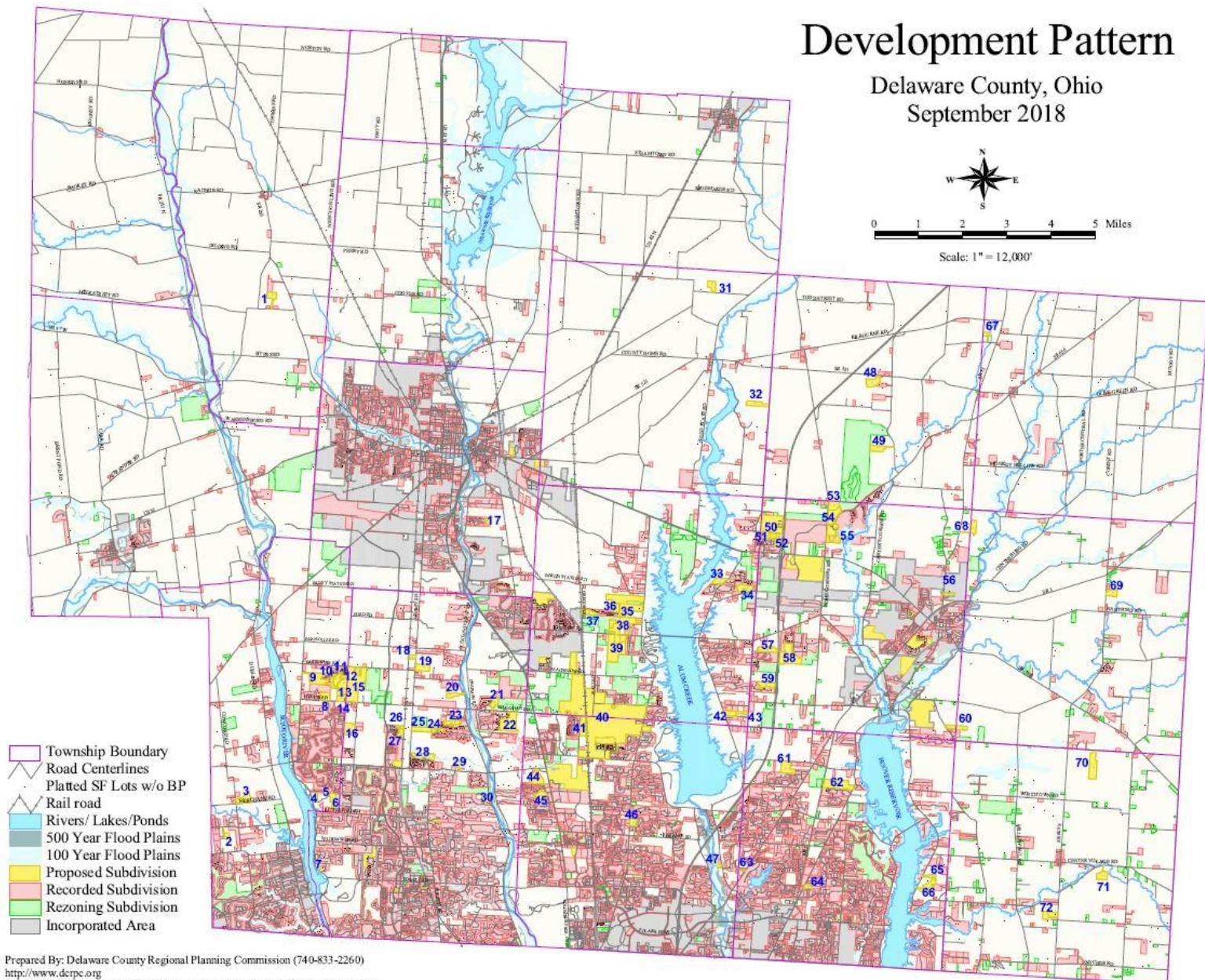
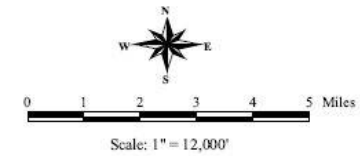
3.4 TRENDS IN DEVELOPMENT

Although Delaware County is still the fastest growing county in Ohio, there has been an overall decline in residential and commercial building permits issued since 2006. Permits began to first decline in 2002 and continued to decline until 2015; when there was a large yearly increase possibly due to the outlet mall permitting (Appendix F). Permits have since begun to increase in 2018. Because of domestic migration into Central Ohio, Delaware County should continue to see an increase in its population over the coming years, meaning there will be more lives to consider in the evaluation of various hazards' effects on the population covered by this plan. The Ohio Development Service Agency predicts Delaware County's population will be 210,630 at the end of 2020 with a 5.07% growth rate from 2017.

The most threatening place-based hazards are tornadoes, severe winter weather, and flooding. There are a few subdivisions proposed along the Olentangy River that would be threatened by the Delaware Dam failure. There are a number of subdivisions that fall close to the floodplains, but are by other subdivisions and are within an already heavily populated area; therefore, the completion of these new developments will add to the total number of properties that may be vulnerable to broader, countywide hazards, but do not increase the vulnerability of any of the jurisdictions within the plan. See the Delaware County Regional Planning Commission's Development Pattern map below.

Development Pattern

Delaware County, Ohio
September 2018



Prepared By: Delaware County Regional Planning Commission (740-833-2260)
<http://www.dcrpc.org>
 Some GIS data provided by The Delaware County Auditor's Office DALIS project
 (Township Boundary, Municipal Boundary, Road Centerlines, Hydrology) (740-833-2070)
 Data to 9/2018

Figure 41: Development Patterns in Delaware County. Prepared by: Delaware County Regional Planning Commission. 2018.

Table 25: Description List of Development Pattern Map

Development Pattern Map: Subdivision List			
ID	SUBDIVISION	LOTS / UNITS	STATUS
1	Tranel	SF 3 Lots	Sketch Review
2	Grace Haven	SF 2 Lots	Final
3	Concord Estates	SF 15 Lots	Draft Final
4	Boothman CAD	SF 3 Lots	Sketch Review
5	Marckel CAD	SF 8 Lots	Sketch Review
6	4910 Rutherford Road CAD	SF 7 Lots	Draft Final
7	Sushant Residences	SF 4 Lots	Sketch Review
8	The Cottages at Hyatts	SF 57 Lots	Preliminary
9	Scioto Ridge Crossing	SF 77 Lots	Preliminary
10	Clarkshaw Moors, Sec 3	SF 18 Lots	Draft Final
11	Clarkshaw Moors, Sec 4	SF 46 Lots	Preliminary
12	Clarkshaw Moors, Sec 5	SF 61 Lots	Preliminary
13	Heather Ridge, Sec 2	SF 42 Lots	Draft Final
14	Heather Ridge, Sec 1	SF 32 Lots	Final
15	Woodcrest Crossing	SF 190 Lots	Preliminary
16	Harvest Curve	SF 38 Lots	Draft Final
17	Riverby Estates, Ph 5	SF 3 Lots	Draft Final
18	Kipling Knoll	SF 6 Lots	Sketch Review
19	Sizemore Tract	SF 18 Lots	Draft Final
20	Zajac	SF 5 Lots	Sketch Review
21	Olentangy Falls, Sec 4, Ph B	SF 13 Lots	Draft Final
22	Olentangy Falls East	SF 93 Lots	Preliminary
23	Liberty Bluff, Sec 2	SF 29 Lots	Draft Final
24	Nelson Farms, Sec 2, Ph C, Pt 2	SF 11 Lots	Final
25	Nelson Farms, Sec 3, Ph A & B	SF 34 Lots	Preliminary
26	The Heathers at Golf Village, Sec 3, Ph A	SF 20 Lots	Draft Final
27	The Heathers at Golf Village North	SF 26 Lots	Preliminary
28	Liberty Trace	SF 25 Lots	Preliminary
29	Koban CAD	SF 3 Lots	Sketch Review
30	Whetstone Ridge	SF 9 Lots	Preliminary
31	Twin Oaks	SF 4 Lots	Sketch Review
32	Four Doctors Drive	SF 4 Lots	Final
33	Sycamore Trail	SF 18 Lots	Draft Final
34	Brookview Manor	SF 26 Lots	Preliminary
35	The Pines	SF 176 Lots	Preliminary
36	Glenmead, Sec 2	SF 65 Lots	Preliminary

Development Pattern Map: Subdivision List Conti.			
ID	SUBDIVISION	LOTS / UNITS	STATUS
37	Glenmead, Sec 2	SF 65 Lots	Preliminary
38	Berlin Manor	SF 95 Lots	Preliminary
39	Howard Farms	SF 131 Lots	Preliminary
40	Evans Farm	SF 2186 Lots	Preliminary
41	North Farms	SF 66 Lots	Preliminary
42	Maple Glen	SF 14 Lots	Preliminary
43	Harbor View	SF 22 Lots	Draft Final
44	The Courtyards at Clear Creek	SF 130 Lots	Preliminary
45	North Orange SF	SF 45 Lots	Sketch Review
46	The Enclave at Abbey Knoll	SF 26 Lots	Preliminary
47	Africa Road Estate	SF 3 Lots	Final
48	KSM 521	SF 4 Lots	Sketch Review
49	Prather CAD	SF 2 Lots	Sketch Review
50	Northlake Preserve	SF 228 Lots	Sketch Review
51	Northlake Woods, Sec 1	SF 42 Lots	Draft Final
52	Northlake Woods, Sec 2	SF 47 Lots	Draft Final
53	North Star Sec 1, Ph B-E	SF 22 Lots MF 414 Units	Preliminary
54	Northstar Goldwell Neighborhood	SF 199 Lots	Sketch Review
55	North Star Sec 1, Ph B	SF 52 Lots	Preliminary
56	Warner Farms	SF 4 Lots	Sketch Review
57	The Reserve at Hidden Creek	SF 40 Lots	Final
58	Cheshire Woods Sec 2-4	SF 102 Lots	Preliminary
59	Summerwood Lakes, Sec 2	SF 37 Lots	Draft Final
60	Sage Creek, Sec 6	SF 4 Lots	Sketch Review
61	Mirasol, Sec 2	SF 53 Lots	Preliminary
62	Vinmar Village, Sec 4 & 5	SF 71 Lots	Preliminary
63	Genoa Place	SF 4 Lots	Sketch Review
64	Grace's Place	SF 14 Lots	Preliminary
65	Britonwoods, Sec 2	SF 3 Lots	Draft Final
66	Britonwoods, Sec 1	SF 13 Lots	Draft Final
67	Wolfe CAD	SF 2 Lots	Preliminary
68	Hastilow	SF 3 Lots	Final
69	Cochran CAD	SF 2 Lots	Sketch Review
70	Harvest Homesteads	SF 5 Lots	Sketch Review
71	Duncan Run CAD	SF 4 Lots	Preliminary
72	Davis Property CAD	SF 5 Lots	Preliminary



SECTION 4. MITIGATION STRATEGY

Following review of the natural and man-made hazards that may potentially threaten Delaware County in previous sections of the plan, the DMPG took steps to create an updated mitigation strategy by assessing the status and success of previous actions, identifying the available mitigation resources in the county, creating a list of mitigation actions for each hazard that can be implemented by one or all of the jurisdictions and determining those which were viable.

4.1 PLAN ACTIONS PRIOR TO 2014

Table 26: Plan Actions and Status

Action	Status
Perform study of cost impacts of a county warning system.	<i>completed</i>
Update the 100 year flood plain map for Delaware County.	<i>completed</i>
Purchase and distribute NOAA weather radios in Delaware County.	<i>in progress, near completion</i>
Build a multi-use facility to serve as an emergency shelter to the residents of the City of Delaware and the immediate area. Shelter built outside of the City.	<i>completed</i>
Erect outdoor warning sirens.	<i>ongoing</i>
Build a multi-use facility to serve as an emergency shelter to the residents of the Village of Shawnee Hills and the immediate area.	<i>delayed, until funding secured</i>
Educate residents in high-risk areas of “warning signs” of flash floods	<i>delayed, until funding secured</i>
Evaluate stricter development standards and management of the floodplains with countywide coordination	<i>ongoing, continued effort under floodplain management program</i>
Increase awareness of programs for stream maintenance.	<i>delayed, continues to be a part of strategy</i>



Action	Status
Determine areas of concern in regard to public infrastructure that is continually being damaged or destroyed by flooding.	<i>completed</i>
Hold innovative PSA about severe weather.	<i>ongoing, through scheduled activities</i>
Evaluate other communities and their response to severe weather.	<i>completed</i>
Increase awareness of tornadoes in Delaware County.	<i>ongoing, continues to be a part of strategy</i>
Increase awareness of other means of emergency notification systems.	<i>ongoing, through Everbridge promotion and IPAWS application</i>
Evaluate other communities' responses to tornadoes.	<i>completed</i>
Increase awareness and potential damaging effects of droughts.	<i>ongoing, through Delaware EMA outreach</i>

4.2 AVAILABLE RESOURCES

Two tables of potential mitigation resources were created to assess the capabilities of Delaware County and each jurisdiction included within this plan. The first determines what entity has the authority over this resource and the second table determines who has the capabilities to maintain this resource.

Table 27: Available Resources

Entity with AUTHORITY over the resource	Delaware County & Unincorporated Areas	Delaware City	City of Powell	Village of Sunbury	Village of Ashley	Village of Shawnee Hills	Village of Ostrander	Village of Galena
Planner(s) or engineer(s) with knowledge of land development and land management practices.	Regional Planning; County Engineers' office	City Engineering Services, City Planning & Community Development	City Engineering Department, City Development Department					Mayor, Village Admin. & Zoning Insp.
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure.	Building - Code Compliance; Infrastructure – County Engineer, Regional Sewer District	City Planning & Community Development, City Engineering Services, City Public Utilities	City Building Department, City Engineering Department					Mayor, Zoning Insp., Village Admin. & Wastewater
Floodplain manager	Code Compliance	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Mayor &/or Council	Village Zoning & Planning



Staff with education or expertise to assess the community's vulnerability to hazards.	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement
Grant writers.	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement
Building code	Code Compliance	City Planning & Community Development (Building Dept.)	City Building Department	Residential – Village Building Department; Commercial – State of Ohio	Delaware County Code Compliance	Delaware County Code Compliance	Delaware County Code Compliance	Residential - Code Delaware County Compliance; Commercial –State of Ohio
Zoning ordinance	See List of Zoning Inspectors	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Zoning	Village Zoning & Planning



Growth management ordinances	Township or County Zoning; Regional Planning	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Zoning	Village Zoning & Planning
Site plan review requirements	Regional Planning	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Zoning	Village Zoning & Planning
An emergency response plan	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement
A post-disaster recovery plan	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement



Capital improvements project funding	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
Entity with CAPABILITY to maintain the resource	Delaware County & Unincorporated Areas	Delaware City	City of Powell	Village of Sunbury	Village of Ashley	Village of Shawnee Hills	Village of Ostrander	Village of Galena
Authority to levy taxes for specific purposes	Levy	Levy	Levy	Levy	Levy	Levy	Levy	Levy
Impact fees for homebuyers or developers for new developments/homes	Not applicable in Delaware County	City Planning & Community Development						
Planner(s) or engineer(s) with knowledge of land development and land management practices.	Regional Planning; County Engineers' office	City Engineering Services, City Planning & Community Development	City Engineering Department, City Development Department					



Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure.	Building - Code Compliance; Infrastructure – County Engineer, Regional Sewer District	City Planning & Community Development, City Engineering Services, City Public Utilities	City Engineering Department, City Development Department					
Floodplain manager	Code Compliance	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Mayor &/or Council	Village Zoning & Planning
Staff with education or expertise to assess the community's vulnerability to hazards.	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement
Grant writers.	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement



Building code	Code Compliance	City Planning & Community Development (Building Dept.)	City Building Department	Residential – Village Building Department; Commercial – State of Ohio	Delaware County Code Compliance	Delaware County Code Compliance	Delaware County Code Compliance	Residential – Delaware County Code Compliance; Commercial – Delaware County Code Compliance
Zoning ordinance	See List of Zoning Inspectors	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Zoning	Village Zoning & Planning
Growth management ordinances	Township or County Zoning; Regional Planning	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Zoning	Village Zoning & Planning
Site plan review requirements	Regional Planning	City Planning & Community Development	City Development Department	Village Zoning & Planning	Village Zoning	Village Code Enforcement	Village Zoning	Village Zoning & Planning
An emergency response plan	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC	Via Delaware County EMA via ORC	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC



				5502.26 and Agreement	5502.26 and Agreement			5502.26 and Agreement
A post-disaster recovery plan	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement	Via Delaware County EMA via ORC 5502.26 and Agreement
Capital improvements project funding	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
Authority to levy taxes for specific purposes	Levy	Levy	Levy	Levy	Levy	Levy	Levy	Levy
Impact fees for homebuyers or developers for new developments/homes	Not applicable in Delaware County	City Planning & Community Development						

4.3 MITIGATION GOALS, OBJECTIVES AND ACTIONS

The Delaware County Mitigation Planning Group reviewed the Hazard Identification and Risk Assessments of each natural and man-made hazard and discussed ways in which to formulate a comprehensive and practical mitigation strategy composed of goals, objectives, and actions for Delaware County and its encompassing jurisdictions, which are spelled out under “Lead Organizations” in the tables below. This strategy will ultimately serve as an invaluable tool for future mitigation efforts and local applicants for mitigation funding as it is often a requirement to have an action included in a mitigation plan before it can be accepted for funding.

Between the completion of the previous plan and the current one, there have not been many significant changes in the priorities of the DMPG’s overall strategy, besides an overall expansion of the breadth of the plan and inclusion of other hazards in the consideration of the strategy. The DMPG evaluated the mitigation strategy and actions outlined in the previous plan to determine their completion status. Some previous actions, a total of 12, were found to not be within the scope of the plan and were decidedly deleted, the reasoning behind each are listed in the remarks column.

Following a review of the previous plans actions and the resources available in Delaware County and the jurisdictions covered within this plan, the DMPG determined that ongoing and delayed actions in the previous plan would be reintegrated into the current plan by explicitly listing them as an action in the current strategy or compiling them into a new and broader mitigation action. The overall mitigation strategy is composed of 13 goals, 20 objectives, and 54 actions. Goals are general aspirations of the mitigation plan that embody long-term plans. Objectives are strategies that have been identified to achieve the aforementioned goals. Mitigation actions are the specific projects that can be implemented to satisfy objectives and future progress towards meeting the mitigation goals.

DELAWARE COUNTY MULTI-HAZARD MITIGATION STRATEGY

4.3.1 Goal 1: Tornado

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to tornadoes.

Objective 1. A: Develop a comprehensive approach to prevent damages and losses to property, crops, and lives from tornadoes.								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
1. A. 1.		Assess and improve current construction standards and techniques	5/22/2019	5/22/2024	Building Regulations Department, Code Compliance, Engineer, Delaware County EMA, Commissioners	Building Regulations Department, Code Compliance, Engineer, EMA, Commissioners	Delete	Building codes are adopted by the Ohio Board of Building Standards. Delaware County not able to adopt “higher standards” for building codes.
1. A. 2.	Medium	Improve and expand early warning system	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley,	FEMA FMA grant, Local Match	Ongoing	Delaware County has numerous warning systems, however, technological upgrades and



					Galena, Shawnee Hills, and the unincorporated areas of Delaware County			innovation occur frequently.
1. A. 3.	Medium	Construct safe rooms and /or shelters in vulnerable public areas – this would include building of community safe rooms and promotion of residential safe room rebate program	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County - Trailer parks & campgrounds may also play a role	FEMA FMA grant, Local Match	Ongoing with Completed Projects	Safe Room built at Delaware State Park is complete, but there are other areas that will be reviewed as funding becomes available.
1. A. 4.	Medium	Coordinate temporary debris removal sites	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Delaware Solid Waste Transfer Station, DMMK	Emergency Operations Center	Ongoing with Completed Projects	Incorporated in Delaware County debris management functional plan. Sites will be evaluated during plan updates.
1. A. 5.	Low	Conduct manufactured home tie-downs for vulnerable	5/22/2019	5/22/2024	Mobile Home Parks, Delaware County EMA, EMA Board, Cities of Delaware and Powell, and the	FEMA FMA grant, Local Match	Ongoing	Tie down inspections are conducted during the setting of all new manufactured



		properties (mobile homes).			Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County, Ohio Manufactured Homes Commission / Code Compliance			homes. The standard is based on requirements established by the Ohio Manufactured Homes Commission and HUD.
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4.3.2 Goal 2: Severe Winter Weather

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to severe winter weather.

Objective 2. A: Develop a comprehensive approach to prevent damages and losses to property from severe winter weather								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
2. A. 1.		Assess and improve code enforcement and building maintenance.	5/22/2019	5/22/2024	Building Regulations/Code Compliance, Facilities department, Delaware County EMA	Building Regulations and Code Compliance	Delete	Improvement of code enforcement would require the addition of personnel licensed by the Board of Building Standards. Improvement of maintenance would be by adopting an existing housing code.



2. A. 2.	Low	Implement snow load design standards	5/22/2019	5/22/2024	Building Regulations/Code Compliance, Facilities Department, Delaware County EMA	Code Compliance	Ongoing with Completed Projects	Ohio Building Codes have snow load design standard requirements that are already enforced through building code regulation. Minimum design standards for snow loads are incorporated in the adopted building codes. This action has been completed.
Objective 2. B: Develop a comprehensive approach to prevent disruption or losses of lives								
2. B. 1.		Construct severe weather shelters for vulnerable populations	5/22/2019	5/22/2024	Trailer parks, Campgrounds	FEMA FMA grant, Local Match	Delete	The Red Cross maintains a list of county shelters, which can be activated to fill this role.
2. B. 2.	Low	Implement an animal protection plan	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Humane Society, Dog Shelter	FEMA FMA grant, Local Match	Ongoing	Arrangements exist with Delaware County dog warden and humane society



2. B. 3.	Medium	Promote preparedness best practices for severe winter weather. This could include public and private sectors to prepare for ice storms, etc.	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing Budget	Ongoing	Ongoing through multiple agencies through outreach. Delaware County EMA has recently become a weather-ready nation ambassador.
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4.3.3 Goal 3: Flood

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to floods.

Objective 3. A: Develop a comprehensive approach to prevent damages and losses to infrastructure and property from flooding.

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
3.A.1	Medium	Remove or elevate structures identified as repetitive loss structures within floodplains	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers; Code Compliance; Floodplain Administrator, Delaware County EMA	FEMA HMGP Local Match	Ongoing with Completed Projects	Two houses on St. Rt. 257 have been mitigated. However, this action is limited by staff hours and grant funding. During this next plan cycle, effort will be given to such projects.
3.A.2	Medium	Conduct wet and/or dry flood proofing of vulnerable critical infrastructure	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers; Code	FEMA HMGP Local Match	Not Started	Limited due to staff hours and funding



					Compliance; Floodplain Administrator, Delaware County EMA			
3.A.3	Low	Implement storm water reduction incentive	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers; Code Compliance; Floodplain Administrator, County Engineer	FEMA FMA grant, Local Match	Not Started	Limited due to grant funding and time. Would require funding to promote incentives and verify compliance.
3.A.4	Medium	Adopt stricter storm water management standards	5/22/2019	5/22/2024	Delaware and Powell City Councils, Mayors & councils of the Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury; County Commissioners, County Planning Dept.	Existing budget	Ongoing	Promote meetings with townships to discuss flood damage prevention and the adopted NFIP standards. Work with Regional Planning, County Engineer and partners noted to adopt stricter storm water management standards.



Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
3.A.5	Medium	Complete requirements to participate in FEMA's Community Rating System (CRS)	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers; Code Compliance; Floodplain Administrator	Existing budget	Not Started	Participation in CRS would require amending the Delaware County Flood Prevention Resolution to include additional higher standards along with other required public communication and outreach. However, this action would be limited by staff hours and funding.
3.A.6	Low	Transfer or purchase development rights to prevent development in vulnerable spaces	5/22/2019	5/22/2024	Delaware and Powell City Councils, Mayors & councils of the Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury; County Commissioners, County Planning Dept.	Grants funding	Not Started	Work with parks districts to use grant funds to purchase properties or easements along flood routes for recreational use. However, this is depended on grant funding.



3.A.7	Low	Adopt conservation easements in vulnerable areas	5/22/2019	5/22/2024	Delaware and Powell City Councils, Mayors & councils of the Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury; County Commissioners, County Planning Dept.	Existing budget	Not Started	<p>Conservation easements or development buffers can be adopted as a higher standard within the Delaware County Flood Prevention Resolution.</p> <p>Some Townships (through zoning) require this.</p> <p>Conservation easements, drainage easements often are created during subdivision platting.</p>
3.A.8	Low	Implement balanced growth plans to prevent development in vulnerable spaces	5/22/2019	5/22/2024	City of Delaware Planning & Community Development, City of Powell Development Dept., Fiscal Officers of the Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury; County Planning Dept.	Existing budget	Ongoing	Continue to work with Delaware County Flood Plain Administrator, Delaware County Regional Planning and relevant political subdivisions to appropriately plan for growth.


Objective 3. B: Improve public awareness, safety, and recovery from losses and damages incurred from flooding.

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
3.B.1	Medium	Implement a public awareness program educating citizens about flooding	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers	Existing budget	Ongoing with Completed Projects.	<p>Would be required as part of CRS participation.</p> <p>Code Compliance could provide additional information on the current website for education and awareness.</p> <p>Post related article in local papers.</p>
3.B.2	Low	Assess and update the current flood warning system	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers	Grant funding	Not started	Could request to have additional gages added to streams that have been prone to flooding, gages could be linked to provide warnings to authorities or public.


Objective 3. C: Address data limitations related to efforts assessing vulnerability to flooding.

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
3.C.1	Medium	Upgrade and improve current flood maps	5/22/2019	5/22/2024	FEMA	FEMA Risk MAP	Ongoing	Upper Scioto Risk map study is currently being done. Multiple streams and tributaries were earmarked for restudy or updates.
3.C.2	Medium	Promote community monitoring of development in floodplain areas	5/22/2019	5/22/2024	Cities of Delaware and Powell Floodplain Administrators, Villages of Ashley, Galena, Ostrander, Shawnee Hills, and Sunbury Fiscal Officers; Code Compliance; Floodplain Administrator, Delaware County EMA	Existing budget	Ongoing	Continue to work with Delaware County Flood Plain Administrator, Delaware County Regional Planning and relevant political subdivisions to appropriately plan for growth.



4.3.4 Goal 4: Pandemic Event

Reduce the probability of damages or losses of existing assets, people, and the economy due to a pandemic event.

Objective 4. A: Develop a comprehensive approach to prevent loss of life and major economic consequences from a pandemic event								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
4. A. 1.		Analyze and improve ventilation in vulnerable areas and /or facilities	5/22/2019	5/22/2024	Delaware County EMA, Building Regulations, Local contractors, Health Department, local government	FEMA FMA grant, Local Match	Delete	This action is up to individual facility owners and is outside of the scope of this plan.
4. A. 2.		Demolish and or clear vacant structures	5/22/2019	5/22/2024	Delaware County EMA, Fire Departments, Building Regulations, Local contractors, local government	FEMA FMA grant, Local Match	Delete	This is more of a blight issue. This is not within the scope of this plan.
4. A. 3.		Create and update plans to prevent and contain	5/22/2019	5/22/2024	Delaware County EMA, Health Department, EPA,	EMA existing resources	Delete	To vague



		contaminated sites or waters			local government, sanitation department			
Objective 4. B: Increase public awareness about the ways to prevent a pandemic event								
4. B. 1	High	Promote immunization throughout the community	5/22/2019	5/22/2024	Delaware County EMA, Health Department, local government, Hospitals and pharmacies	EMA existing resources	Ongoing	Ongoing public education campaign through Delaware General Health District
4. B. 2.		Conduct waste education and disposal measures	5/22/2019	5/22/2024	Delaware County EMA, Health Department, EPA, local government, sanitation department, DKMM	Existing resources	Delete	This is more of a solid waste disposal action vs. a mitigation action.
4. B. 3	Medium	Increase community education on disease prevention and control	5/22/2019	5/22/2024	Delaware General Health District, Delaware County EMA	Existing resources	Ongoing	New addition to the Pandemic section. Educate on ways community members can protect themselves and the public. Use of “Sick Stay Home” and “Wash Your Hands” campaigns; or discourage/cancel big



								events if a pandemic is occurring.
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4.3.5 Goal 5: Severe Summer Weather

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to severe summer weather and extreme heat.

Objective 5. A: Develop a comprehensive approach to prevent damages and losses to property from severe summer weather and extreme heat								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
5. A. 1.		Require or promote use of strong roofing shingles	5/22/2019	5/22/2024	Jurisdictional Code Compliance, Delaware County, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing budget	Delete	The Residential Code of Ohio (RCO) and the Ohio Building Code (OBC) address roof covering standards based on wind loads. Already addressed through Ohio Building Code
5. A. 2.	Low	Create and implement a tree management program to reduce the risk of trees falling on	5/22/2019	5/22/2024	Power Companies, PUCO Delaware County EMA, LEPC, EMA Board,	FEMA FMA grant,	Ongoing	AEP has a tree management program in place. The circuits are cleared end to end



		property or powerlines			Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Local Match		on a 4-year rotating cycle. Hotspot trimming is also available if need. Other providers are likely to have a similar program.
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Objective 5. B: Engage in proactive measures to prevent public, economic and personal disruptions as a result of severe summer weather.

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
5. B. 1.	Low	Promote further use of designed-failure mode power line design	5/22/2019	5/22/2024	Power Companies, PUCO, Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing budget	Ongoing with Completed Projects	AEP engineer and design their facilities in such a manner that the least impactful device fails first. Allowing outages to be much shorter in length. They also implement fuse saving on our circuits. Which increases momentary outages, but ultimately



								<p>reduces lengthy outages.</p> <p>Other providers are likely to have similar programs.</p>
5. B. 2.	Low	Install surge protection on critical electronic equipment	5/22/2019	5/22/2024	Power Companies, PUCO, Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing budget	Ongoing	Delaware County Emergency communications 911, has surge protectors
5. B. 3.		Bury power lines	5/22/2019	5/22/2024	Power Companies, PUCO, Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee	FEMA FMA grant, Local Match	Delete	Not feasible on a large scale. Cost prohibitive. Outages tend to be fewer on underground lines, but when they occur they last much longer.



					Hills, and the unincorporated areas of Delaware County			
5. B. 4.	Low	Incorporate a responsible generator program to ensure the safety of critical facilities and vulnerable populations.	5/22/2019	5/22/2024	Power Companies, PUCO, Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	FEMA FMA grant, Local Match	Ongoing	Many critical facilities have generator backups.
Objective 5. C: Coordinate efforts between public officials, law enforcement and citizens to bolster safety measures before, during and after severe summer weather.								
5. C. 1.	Low	Assess and improve current communication plan and measures between critical county officials to	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee	Existing resources	Ongoing	Delaware County public safety officials have redundant communication systems at their disposal.



		ensure sufficient communication.			Hills, and the unincorporated areas of Delaware County			
5. C. 2.	Medium	Implement public awareness and education program to inform citizens about the trends and dangers of severe weather.	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing resources	Ongoing	Delaware County EMA promotes public education on severe weather preparedness.



4.3.6 Goal 6: Dam Failure

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to dam failure.

Objective 6. A: Develop a comprehensive approach to prevent damages and losses to infrastructure and lives from dam failure

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
6. A. 1.	Medium	Implement a public awareness and education program.	5/22/2019	5/22/2024	Army Corps, ODNR	FEMA FMA grant, Local Match	Ongoing	<p>Army Corps is evaluating public awareness and education programs.</p> <p>ODNR maintains an ongoing Dam Safety program, which they may expand in the future.</p>
6. A. 2.	Medium	Create or update warning systems in the incident of impending dam inundation and or failure	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated	FEMA FMA grant, Local Match	Ongoing	Delaware County has numerous warning systems, however, technological upgrades occur frequently.



					areas of Delaware County			
6. A. 3.	Medium	Create or update Dam Safety Program for each dam within Delaware County	5/22/2019	5/22/2024	Army Corps, ODNR	Existing budget	Ongoing	<p>The Army Corps has an internal dam safety program.</p> <p>ODNR maintains an ongoing Dam Safety program, which they may expand in the future.</p>
Objective 6. B: Address data limitations related to efforts assessing vulnerability to dam failure.								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
6. B. 1.	Medium	Create Inundation Maps for Sunbury and Ashley Dams	5/22/2019	5/22/2024	Sunbury & Ashley Officials, Delaware County EMA	GIS, Map Department	Not started	GIS shapefiles not yet available
6. B. 2.	Low	Update contents of current dam plans and implement plans for dams without a plan	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board	Existing budget	Ongoing	It is the responsibility of individual dam owners to update dam specific plans. Delaware County EMA coordinates with ODNR Dam



								Safety to promote plan adoption.
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4.3.7 Goal 7: HAZMAT Incidents

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to hazmat incidents

Objective 7. A: Develop a comprehensive approach to prevent damages and losses to lives, property and the environment.								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
7. A. 1	Medium	Engage in public awareness and worker education programs	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Local Businesses, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	EMA existing resources	Ongoing	Delaware County EMA/LEPC engages in public information outreach for sheltering in place and performs LEPC facility visits.
7. A. 2	High	Implement safety procedure and policy trainings	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Local Businesses, Cities	EMA existing resources	Ongoing	Delaware County EMA/LEPC seeks grant funding for training within hazmat for responders.



		regarding hazardous materials			of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County			
7. A. 3	Low	Conduct commodity flow studies	5/22/2019	5/22/2024	Delaware County EMA, EMA Board, LEPC	EMA existing resources	Ongoing	Limited to staff time and funding
7. A. 4	Medium	Implement outreach, shelter in place education programs	5/22/2019	5/22/2024	Delaware County EMA, Local Schools & businesses, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	EMA existing resources	Ongoing	Delaware County EMA/LEPC engages in public information outreach for sheltering in place and performs LEPC facility visits.



4.3.8 Goal 8: Terrorism

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to terrorism.

Objective 8. A: Develop a comprehensive approach to prevent loss of life and major economic consequences from terrorism								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
8. A. 1.	Medium	Conduct community risk assessment	5/22/2019	5/22/2024	Delaware County EMA, Local Law Enforcement, LEPC	Existing resources	Ongoing	Several community risk assessments have been performed by numerous agencies.
8. A. 2.	Medium	Implement local monitoring and reporting program to prevent terrorist incidents or sabotage	5/22/2019	5/22/2024	Delaware County EMA, Local Law enforcement, Public	Existing resources	Ongoing	Promotion of “see something, say something” campaign.
8. A. 3.	High	Increase emergency responder preparedness through planning and training	5/22/2019	5/22/2024	Delaware County EMA, First Responders in Law, Fire and Medical	Existing resources	Ongoing	Delaware County public safety agencies maintain a rigorous training and exercise schedule. In 2019, Delaware County public safety agencies coordinated a



								terrorism resiliency recovery seminar for the “whole community”.
8. A. 4.	Low	Implement a buffer zone protection planning for utilities, critical facilities and other vulnerable areas or sites	5/22/2019	5/22/2024	Safety and Security, Delaware County EMA, First Responders in Law, Fire and Medical, Local Government, Local businesses, Utility companies	Existing resources	Ongoing	Newly constructed courthouse takes into account buffer zone planning through the use of setbacks and bollards. County Safety and Security Director has made changes at existing facilities such as fencing, signage, and additional cameras.
8. A. 5.	Low	Implement source water protection planning for vulnerable areas	5/22/2019	5/22/2024	Delaware County EMA, Law Enforcement, Utility Companies, local water supply companies and water systems, Local Government	Existing resources	Ongoing	Coordinates with local emergency response agencies including the Delaware County Sheriff’s Office to create strategies for protecting the groundwater protection areas. Training for drinking water protection also in place for response agencies.
8. A. 6.	Medium	Leverage grants to procure mobile vehicular barricades	5/22/2019	5/22/2019	Delaware County EMA, Law Enforcement	Grants	Ongoing	Delaware County EMA will work within the grants framework to look at funding options.



4.3.9 Goal 9: Large Utility Disruption/Failure

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to utility disruption or failure.

Objective 9. A: Develop a comprehensive approach to prevent loss of life and major economic consequences from a utility disruption								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
9. A. 1.		Bury electric and telephone lines	5/22/2019	5/22/2024	Delaware County EMA, Building Regulations, Local contractors, Utility companies	Existing resources	Delete	Not feasible on a large scale.
9. A. 2.		Address redundancies in utility and communication systems	5/22/2019	5/22/2024	Delaware County EMA, Utility companies, local contractors, local businesses	Existing resources	Delete	Limited ability to affect change in this area.
9. A. 3.	Low	Protect electrical and communications systems from lightning strikes	5/22/2019	5/22/2024	Delaware County EMA, Utility companies, local contractors,	FEMA FMA grant, Local Match	Ongoing	Numerous agencies and companies implement lightning protection strategies.



9. A. 4.	Low	Engage in tree trimming and maintenance	5/22/2019	5/22/2024	Utility companies, local government road crews	Existing resources	Ongoing	Electric companies maintain tree trimming programs.
9. A. 5.	High	Coordinate a program to contact and assist vulnerable populations during periods of utility and infrastructure failure	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Utility companies	Existing resources	Ongoing	Delaware County EMA maintains a county special needs registry



4.3.10 Goal 10: Earthquake

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to an earthquake.

Objective 10. A: Develop a comprehensive approach to prevent damages and losses to property and lives from an earthquake

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
10. A. 1.	Low	Promote earthquake exercise participation and preparedness information	5/22/2019	5/22/2024	Delaware County EMA	Existing resources	Not Started	New hazard / Objective



4.3.11 Goal 11: Civil Disturbance

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to civil disturbance, a small shooting or small bomb.

Objective 11. A: Develop a comprehensive approach to prevent damages and losses to property and lives from a civil disturbance

Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
11. A. 1.	High	Institute active shooter training program	5/22/2019	5/22/2024	Delaware County EMA, Sheriff's Office, all law enforcement, LEPC, EMA Board	Existing resources	Ongoing	Delaware County Law Enforcement, Fire, and EMS agencies have implemented an active threats training program and have established unified response policy. Additionally, schools plan and train for incidents.
11. A. 2.	High	Assess and updates planning and documentation in preparation for civil disturbance incidents	5/22/2019	5/22/2024	Delaware County EMA, Sheriff's Office, all law enforcement, LEPC, EMA Board	Existing resources	Ongoing	Delaware County Law Enforcement has implemented an active threat training program for county employees and schools plan and train for incidents.



4.3.12 Goal 12: Drought

Reduce the probability of damages or losses of existing assets, people, critical facilities/infrastructure, and publicly owned facilities due to drought.

Objective 12. A. Develop a comprehensive approach to prevent damages and losses to crops and lives from drought								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
12. A. 1.	Medium	Implement a public awareness and education program concerning water saving and other preventative measures.	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing budget	Ongoing	The SWCD addresses Water conservation in their public education and outreach efforts on a routine basis. Agricultural conservation practices that are beneficial for both water quality and quantity, much of this work is in partnership with USDA-NRCS programs. Also, provide workshops for "Back Yard" Conservation projects. They are also beginning a pilot project with DEL-CO Water that involves landscape irrigation



								strategies that reduce water consumption using "Smart" technology, Wi-Fi based irrigation control.
12. A. 2.	Low	Develop a contingency plan should the County experience severe drought conditions	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	Existing budget	Ongoing	Opportunities for farms to create an individualized drought financial mitigation plan is available with OSU Extension Offices.
12. A. 3.		Create a water monitoring program	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated	FEMA FMA grant, Local Match	Delete	Water Providers are already required to monitor their water quality through Ohio EPA laws and regulations.



					areas of Delaware County			
12. A. 4.	Low	Invest in a new water storage facilities or upgrade older ones	5/22/2019	5/22/2024	Delaware County EMA, LEPC, EMA Board, Cities of Delaware and Powell, and the Village of Sunbury, Ostrander, Ashley, Galena, Shawnee Hills, and the unincorporated areas of Delaware County	FEMA FMA grant, Local Match	Ongoing through providers	<p>Del-Co Water Company has invested in the John R. Doult Upground Reservoir. The Doult Reservoir is a 9 Billion gallon off-stream reservoir (off-stream of the Scioto River). It is projected that this source water supply will guard against adverse drought-related issues for Del-Co Water until the year 2030.</p> <p>The City of Columbus added large reservoir in Thompson TWP.</p>



4.3.13 Goal 13: Cyber-Attack

Reduce the probability of damages or losses of existing assets, critical facilities/infrastructure, and publicly owned facilities due to a cyber-attack.

Objective 13. A: Develop a comprehensive approach to prevent damages and losses to property from a cyber attack								
Action No.	Priority	Mitigation Action	Start Date	End Date	Lead Organizations	Resources	Status	Remarks
13. A. 1	High	Continue to update, install and maintain sufficient firewalls, data back-ups, malware detection and anti-virus software.	5/22/2019	5/22/2024	County Data Center, Delaware County EMA, Local Law Enforcement	Existing resources	Ongoing	Delaware County implemented two (for high availability) advanced firewalls in 2018 that are designed to mitigate malware, and other cyber threats.
13. A. 2	High	Promote “best practices” for cybersecurity through education campaign to employees and the public	5/22/2019	5/22/2024	County Data Center, Delaware County EMA, Local Law Enforcement	Existing resources	Ongoing	Delaware County continues to promote awareness to its employees. Such as recently implementing a training program which targets users through a simulated phishing exercise.



13. A. 3	Medium	Continue to test disaster recovery and business continuity drills	5/22/2019	5/22/2024	County Data Center, Delaware County EMA, Local Law Enforcement	Existing resources	Ongoing	Utilize existing exercise cycle to focus specifically on cyber scenarios for business continuity.
----------	--------	---	-----------	-----------	--	--------------------	---------	---

Once the Delaware Mitigation Planning Group completed the above mitigation strategy with a comprehensive list of goals, objectives, and actions, the actions were discussed and prioritized. They were prioritized to determine the most acceptable and beneficial mitigation actions for Delaware County and all jurisdictions included within this plan.

A scale of the relative priority of facilities, assets, conditions, maintenance and other matters, which is determined by relative criticality. Purpose of prioritization is to rank action items in order from highest to lowest importance and to help facilitate decision-making. The actions were prioritized with a cost benefit review, implementation, and administration view in mind.

High: High chance of being the most beneficial to mitigate hazard damages. Also involves actions that would be the easiest to complete with time and funding resources available. The action is essential to combat damaging hazard impacts. Action has the potential to save lives if the hazard were to occur.

Medium: The action item can be scheduled routinely within the capability of the facilities involved. Work is subject to availability of resources and staffing. Action will take longer to accomplish and will have a medium benefit associated with it.

Low: Action is desired, but not essential to alleviate hazard impacts. Or the action is already completed or ongoing so the risk level is already lowered.

Note: Grants were available for the development and implementation of some of the items listed. All jurisdictions and their governing bodies, within Delaware County, have complied with and will adopt all regulations listed in this plan. This Plan was approved and will be formally adopted, by The County Board of Commissioners following State and Federal approval.

4.4 MITIGATION PROJECTS

Completed Project

Scioto Township FY 2011 Repetitive Flood Claims Acquisition and Demolition Project

This project initially started in 2010 with an application to the Federal Emergency Management Agency (FEMA). Delaware County EMA worked with OEMA to put together a strong application, with a solid benefit-cost analysis. The project and associated properties belong to Scioto Township and Delaware County EMA provided assistance. Eventually, the grant was awarded to Scioto Township and there were no local matching funds required; funding was 100% federal.

The rationale behind flood mitigation projects is to remove people from harm's way and to alleviate the burden on the National Flood Insurance Program (NFIP), which is publicly funded. By purchasing properties that flood waters ravage repeatedly (once deemed cost-effective), and demolishing them and deed-restricting the land to open space, it will greatly reduce detrimental flood effects. The purchase price was through an independent appraiser looking for current market value and the appraisals were approved by the state. The entire process was voluntary for the homeowners and they could opt out of the project at any time prior to closing.

ReStore of Delaware County was approached to see if they would be interested in taking some of the items in the homes prior to demolition after the purchases of the houses were complete. They took the items that interested them and paid Scioto Township \$1.00 for the items. This way the items went to a good use and did not end up in a landfill. Scioto Township Fire Department assisted with the demolition and received good training burns from the project. Many other public safety entities trained in the houses prior to demolition.

The properties involved were 1763 and 1803 SR 257 S. Delaware, OH 43015.

Safe Room

Delaware County EMA previously identified the need to build multi-purpose safe rooms, with an emphasis on the most vulnerable populations and locations. Two of the most vulnerable places to severe summer weather in the county are Delaware and Alum Creek State Parks. In 2012, Delaware County EMA erected two outdoor warnings sirens at each of the aforementioned parks. This was possible through a Grant and funds from the Delaware County Board of Commissioners. This was a necessary first step for safe room grant funding as there must be a way to warn those who would use the shelters.

In 2017 and 2018, Delaware County EMA was able to construct a safe room at Delaware State Park Campground with a capacity of roughly 850 persons. This project was possible through federal, state and local funding. The federal funding was through the Hazard Mitigation Grant

Program (HMGP). The Ohio Emergency Management Agency provided some matching funds and Ohio Department of Natural Resources (ODNR) assisted financially, as well. The Delaware County Board of Commissioners provided the local funds.

The safe room was completed in late summer of 2018.



Figure 42: Constructed Safe Room. Autumn 2018.

Future Mitigation Projects

Future flood mitigation and wind mitigation projects were identified as high priorities as funding and staff hours are available. These actions are high priorities because of the highly ranked hazards they mitigate.

Other, smaller-scale projects, as identified in the goals, objectives, and actions, will be ongoing as feasible.



Table 28: General Comments Area for Plan throughout its Enactment

General Comment Area for Plan Throughout Its Enactment	
Year	Comment
2014	
2015	<p>Chief Morris, Tri-Township Fire Department: Added comments updating a tornado event and had a question about the addition of unincorporated townships.</p> <p>Bob Lavender, EMA: Made changes to HMPG members, updates to include current charts and information. Suggested changes to hazard profile events and details. Update of mitigation projects and current projects.</p>
2016	
2017	
2018	
2019	
2020	
2021	
2022	
2023	
2024	



4.4.1 Integration into Local Planning Mechanisms

In addition to the Resolutions from each jurisdiction referenced below Delaware County Emergency Management Agency will integrate the 2019 Multi-Hazard Mitigation Plan into other local plan mechanisms. This will be done by incorporating it into the Long-Term Strategic Plan and into the Annual Planning Update Schedule and Checklist. Delaware County Emergency Management Long-Term Strategic Plan is currently in draft format, but will include how the Plan will be incorporated into local planning and facilitate feedback, local adoption and grant funding.

Table 29: Jurisdiction Resolution Adoption

Resolutions			
Jurisdiction	Date Adopted	File On Hand	Resolution Page Location
City of Delaware		Y / N	Appendix:
City of Powell		Y / N	Appendix:
Village of Galena		Y / N	Appendix:
Village of Shawnee Hills		Y / N	Appendix:
Village Ashley		Y / N	Appendix:
Village of Ostrander		Y / N	Appendix:
Village of Sunbury		Y / N	Appendix:
Delaware County Board of Commissioners (Unincorporated Areas)		Y / N	Appendix:

Appendices

Appendix A: Public Advertisements

Public Announcement:



2 Bedroom, \$650/mo
plus all utilities,
No Pets
240 S. Washington
Call 740-815-4447

COLTS TRUCKS
Check out the autos for
sale in the classifieds!

The Delaware County Office of Homeland Security and Emergency Management (DCOHSEM) is currently updating the Delaware County Mitigation Plan. The existing plan will be offered for review at the Delaware District Library (84 E. Winter St. Delaware, OH), Sunbury Community Library (44 Burrer Dr. Sunbury, OH), and Ostrander Branch Library (75 N. Fourth St. Ostrander, OH) for two weeks, starting on 10/16/18, for commenting. The plan will also be offered online on the DCOHSEM's website (delcoema.org) located under the "About" then "Plans" tab. Comments should be sent to Jodi Elam at jelam@delcoema.org. Plan review/update meeting dates will be posted to the DCOHSEM website.

October 3 2018 1T
90041400

LEGAL NOTICE

Notice is hereby given that the Orange Township Zoning Commission will hold their 7th special meeting on Tuesday, October 9, 2018 beginning at 7:00 p.m. to discuss the Comprehensive Land Use Plan Update.

Comprehensive Land Use Update

Copy of the advertisement that was ran in the Delaware Gazette (10/3/2018) to announce the start of the mitigation plan update. Offers the public a way to review and comment on the current plan for any input that they would like to see included in the new plan.



NATURAL DISASTERS

TORNADO

FLOODING

HAZMAT

SEVERE WEATHER

Hazard Mitigation Plan

Delaware County Office of Homeland Security and Emergency Management (DCOHSEM) is Updating its County Multi-Hazard Mitigation Plan and Wants Your Feedback!

You can learn more about the existing Mitigation Plan by visiting the library's front desk for a loaned copy that will be available for 2 weeks. The plan will also be offered online on the DCOHSEM's website (delcoema.org) located under the "About" then "Plan" tab.

Please send comments and feedback to Jodi Elam at jlam@delcoema.org
For additional questions contact EMA Office at (740)-833-2180.

Flyer used to announce the upcoming update of the Hazard Mitigation Plan. Placed in three libraries around the county to encourage the public to review the plan.

NATURAL DISASTERS

TORNADO

FLOODING

HAZMAT

SEVERE WEATHER

Hazard Mitigation Plan

Delaware County Office of Homeland Security and Emergency Management (DCOHSEM) is Updating its County Multi-Hazard Mitigation Plan and Wants Your Feedback!

You can review and comment on the Draft Multi-Hazard Mitigation Plan by visiting the library's front desk for a loaned copy that will be available for 2 weeks, ending Dec. 9th 2019. The plan will also be offered online on the DCOHSEM's website (delcoema.org) located under the "About" then "Plan" tab.

Please send comments and feedback to Jodi Elam at jlam@delcoema.org
For additional questions contact EMA Office at (740)-833-2180.

Second flyer used to announce the Draft Hazard Mitigation Plan. Placed in the same three libraries around the county to encourage the public to review the newly updated draft plan.

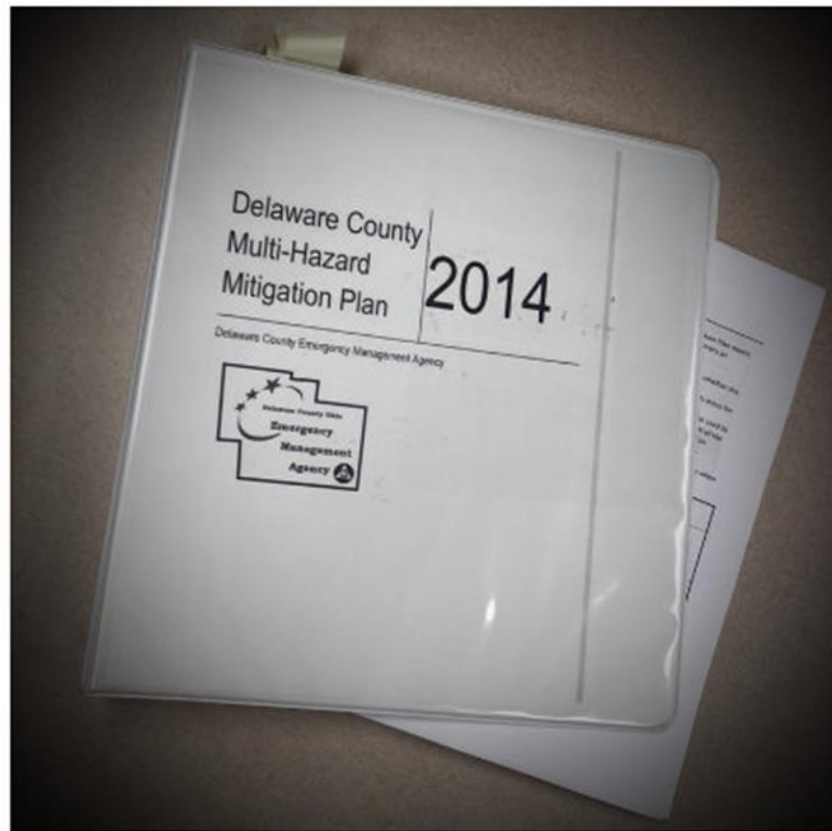
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 Messages

Search T

**Delaware Co. Emergency Management** @DelCoEMA · 29m

The Delaware County Office of Homeland Security and Emergency Management (DCOHSEM) is currently updating the Delaware County Mitigation Plan. The existing plan will be offered for review at the... read more at facebook.com/DelCoEMA



Social Media Posting: Twitter posting to announce the start of the mitigation plan update. Offers the public a way to review and comment on the current plan for any input that they would like to see included in the new plan.



Social Media Posting: Facebook posting to announce the start of the mitigation plan update. Offers the public a way to review and comment on the current plan for any input that they would like to see included in the new plan.



Second Round of Social Media Postings: Twitter posting to announce the Draft Hazard Mitigation Plan update. Explains where to review and send comments.



Second Round of Social Media Postings: Facebook posting to announce the Draft Hazard Mitigation Plan update. Explains where to review and send comments.



Appendix B: Plan Location



Delaware County EMA Website



Location of the Hazard Mitigation Plan



Appendix C: Meeting Material



Delaware County Office of Homeland Security and Emergency Management

Mitigation Plan Update – First Meeting Agenda – 6.28.2018

- Introductions
- Overview of Mitigation and Mitigation Plans and Benefits (Luan)
- Planning Process and Involvement
- Discussion of Existing Plan and Hazards
- Survey Discussion
- Next Steps and Action Items
- Adjournment



Delaware County Office of Homeland Security and Emergency Management

Mitigation Planning Team – Initial Questionnaire

- 1.) Do any hazards need to be added to the existing list? If so, which?
- 2.) Do any hazards need to be omitted from the existing list? If so, which?
- 3.) Do you have any objections to the current rankings of hazards? If so, what are they?
- 4.) Please fill in the chart below based on a scale of 1 to 10 (1 being no threat and 10 being a detrimental/highest threat).

Here are the definitions for each category:

Life Safety Impact - The likelihood that there will be injuries and/or loss of life.

Impact on Property - The likelihood that there will be damage and/or destruction of structures within the community including residential, non-residential, public, and critical structures.

Impact on Economy - The likelihood that there would be short-term and/or long term consequences on the local economy and businesses.

Impact on Environment - The likelihood that there would be short-term and/or long term damage to the environment and local ecosystems.

Hazards	Life Safety Impact	Property Impact	Econ. Impact	Environ. Impact
Dam Failure				
Flood				
Tornado				
Severe Winter				
Pandemic				
Severe Summer				
Utility				
Drought				
Terrorism				
HAZMAT				
Civil Disturbance				
Earthquake				
Cyber				

NAME _____

AFFILIATION

PHONE NUMBER

email address

[illegible]



Second Meeting Materials



Delaware County Office of Homeland Security and Emergency Management

Mitigation Plan Update – Second Meeting
Agenda – 11.8.2018 at 2 p.m.

- Introduction
- Overview of Questionnaire Results
- Discussion of Changes to Methodology
- Actions so far
- Public Involvement
- Next Steps and Action Items
- Adjournment



Multi-Hazard Mitigation Plan Update (Second Meeting)
November 8, 2018 | EMA, 10 Court St. Delaware
2:00 p.m.

SIGN-IN SHEET

NAME	ORGANIZATION	EMAIL
1. <i>Sam Mikh</i>	<i>Del. Co. EMA</i>	<i>Sam@delcoema.org</i>
2. <i>Bobs Lavender</i>	<i>Del. Co. EMA</i>	<i>Bobs@delcoema.org</i>
3. <i>Bob Egan</i>	<i>Delco EMA</i>	<i>jelam@delcoema.org</i>
4. <i>Russ Beyer</i>	<i>Sharon Hillis PD</i>	<i>Russ.Beyer@SharonHillisOH.org</i>
5. <i>Luan Nguyen</i>	<i>OHIO EMA</i>	<i>Lknguyen@ohio.gov</i>
6. <i>Diane Matlock</i>	<i>CODE COMPLIANCE</i>	<i>dmatlock@delcoema.org</i>
7. <i>Michelle Hopper</i>	<i>C. & Del. Fire Dept.</i>	<i>mhopper@delawarechis.net</i>
8. <i>Sandy Mackey</i>	<i>Delco EMA</i>	<i>Sandy@delcoema.org</i>
9. <i>Tom Hopper</i>	<i>Village of Galena</i>	<i>mayor@galenachio.org</i>
10. <i>Allen Rothman</i>	<i>Sunbury</i>	<i>rothman@sunburyva.org</i>



Multi-Hazard Mitigation Plan Update (Second Meeting)
November 8, 2018 | EMA, 10 Court St. Delaware
2:00 p.m.

NAME	ORGANIZATION	EMAIL
11. FRED FOWLER	DELAWARE CO. CODE COMPLIANCE	FFOWLER@CO.DELAWARE.OH.US *SEND RANKINGS PLEASE
12. BOBEXT PARSONS	Delaware Co. Auditor	parsons@co.delaware.oh.us
13. John Donahue	Dolzner FD	
14. Paula Lewis	Commissioner	
15.		
16.		
17.		
18.		
19.		



Third Meeting Materials



Delaware County Office of Homeland Security and Emergency Management

Mitigation Plan Update – Third Meeting
Agenda – 1.9.2019 at 2:30 p.m.

- Introduction
- Overview of Hazard Mitigation Plan Draft Results
- Discussion of Changes to Goals, Objectives, Actions
- Discussion with Planning Team on Comments and Changes to Incorporate
- Public Involvement and Comments
- Next Steps and Action Items
- Adjournment

(Agenda ran and posted in the lobby of 10 Court St, Delaware County Building 2 weeks prior to meeting.)



Multi-Hazard Mitigation Plan Update (Third Meeting)
January 9, 2018 | EMA, 10 Court St. Delaware
2:30 p.m.

SIGN-IN SHEET

NAME	ORGANIZATION	EMAIL
1. Sean Miller	Delaware Co EMA	sean@delcoema.org
2. Sandy Mackey	Delaware Co EMA	Sandy@delcoema.org
3. Jodi Elam	Delaware EMA	jodi@delcoema.org
4. Chris Beddoes	American Red Cross	christopher.Beddoes@redcross.org
5. Greg Feustel	Delaware Lake U.S. Army Corps of Engineers	Gregory.Feustel@usace.army.mil
6. Michelle Hopper	Delaware City PD	mhopper@delawarecity.net
7. FRED FOWLER	DELAWARE COUNTY CODE COMPLIANCE	FFOWLER@CO.DELAWARE.OH.US
8. ROBERT PARSONS	DELAWARE COUNTY AUDITOR BIS	rparsons@co.delaware.oh.us
9. Tom Hopper	Village of Galena	mayor@galenaohio.org
10. Julie Jorgensen	Commissioner	



Multi-Hazard Mitigation Plan Update (Third Meeting)
January 9, 2018 | EMA, 10 Court St. Delaware
2:30 p.m.

NAME	ORGANIZATION	EMAIL
11. Scott Sanders	Regional Planning	ssanders@co.delaware.oh.us
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		



Multi-Hazard Mitigation Plan Update (Third Meeting)
January 9, 2018 | EMA, 10 Court St. Delaware
2:30 p.m.

NAME	JURISDICTION	COMMENT
Stephen Haytkik	Powell PD	
Luan Nguyen	Ohio EMA	
Allen Rothenshl	Sumbury	
Chris Beddoes	Red Cross	Thank you for the research and Time Placed on organizing this plan!



Appendix D: Plan Comments

From: John Donahue <jdonahue@delawareohio.net>
Sent: Monday, January 07, 2019 5:48 PM
To: Miller, Sean; Elam, Jodi
Cc: Michelle Hooper
Subject: Mitigation Comments

CAUTION EXTERNAL EMAIL

DO NOT open attachments or click on links from unknown senders or unexpected emails

Sean/Jodi:

Just a reminder, I will not be there, but I will have Michelle attend. I have also reached out to Dave Efland for any comments he may have. This was sent out to our pertinent Department Heads for feedback. As yet, none have been received. GREAT JOB on this!! I have a few requests and comments.

1. Can you provide Michelle copy of the following GIS maps for our ESRI Files.
 - a. Pg 39-Dam Maps
 - b. Pg 41-43 - Inundation Maps
 - c. Pg 114 - Electric Maps
 - d. Pg 128 - Developmental Map
2. Pg 140 - In the Status section, several notes state "Delete". Are these going to be removed from the plan provided agreement of the committee? If so, I assume the Action # will be update? If "Delete" does not mean this, what does this mean?
3. Pg 140 - Noticed throughout the Strategy, that the Priorities are spelled out at times and just use letter. These need to be consistent.
4. Pg 166 - Please ad that Both the Fire and EMS agencies in Delawre Co have been training for an active aggressor. We have also established a unified policy on our response.

John L. Donahue, Fire Chief
Delaware Fire Department
99 South Liberty Street
Delaware, Ohio 43015
740.203.1300 Phone
740.203.1399 Fax
jdonahue@delawareohio.net



- 1.2.1 SUBDIVISION REGS - LAST REVISED 1997
(PG. 10) > HAS SINCE BEEN UPDATED
- 2.1 CODE COMPLIANCE - ADD D. MATLACK
(PG. 15)
- 2.3 FLOOD DAMAGE PREVENTION REGS. UNDER
REGIONAL PLANNING (PG. 19) SHOULD
BE CODE COMPLIANCE
- 3.3 DAM FAILURES - INUNDATION MAPS? ✓
- 4.2 AVAILABLE RESOURCES - GALENA COMMERCIAL
BLDG CODE ADMINISTRATION & DELAWARE C
PG. 136

Fred Fowler - Code Comp.

1.9.19



From: mayorjnelson@villageofashley.org [mailto:mayorjnelson@villageofashley.org]
Sent: Friday, January 11, 2019 3:50 PM
To: Miller, Sean <sean@delcoema.org>
Subject: Multi-Hazard Mitigation Plan

CAUTION EXTERNAL EMAIL

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Jodi/Sean,

Sorry for not responding to this important issue, but have had several issues that have occupied a lot of my time lately. I did a review of the documents, the Village of Ashley agrees with this plan, and want to say thank you for the work put forth. I see nothing that needs changed.

Thank You,

Jim Nelson, Mayor

From: Larry Crile <larrycrile@gmail.com>
Sent: Wednesday, January 16, 2019 8:21 AM
To: Elam, Jodi
Subject: Re: Draft 2019 Multi-Hazard Mitigation Plan Review

CAUTION EXTERNAL EMAIL

DO NOT open attachments or click on links from unknown senders or unexpected emails

Jodi,

I have worked through the document and am very supportive of the plan as presented. The Village Council has had opportunity to review and comment and I do appreciate that copies were available at the Library as well. Thank you for all the hard work and diligence to detail.

Larry Crile

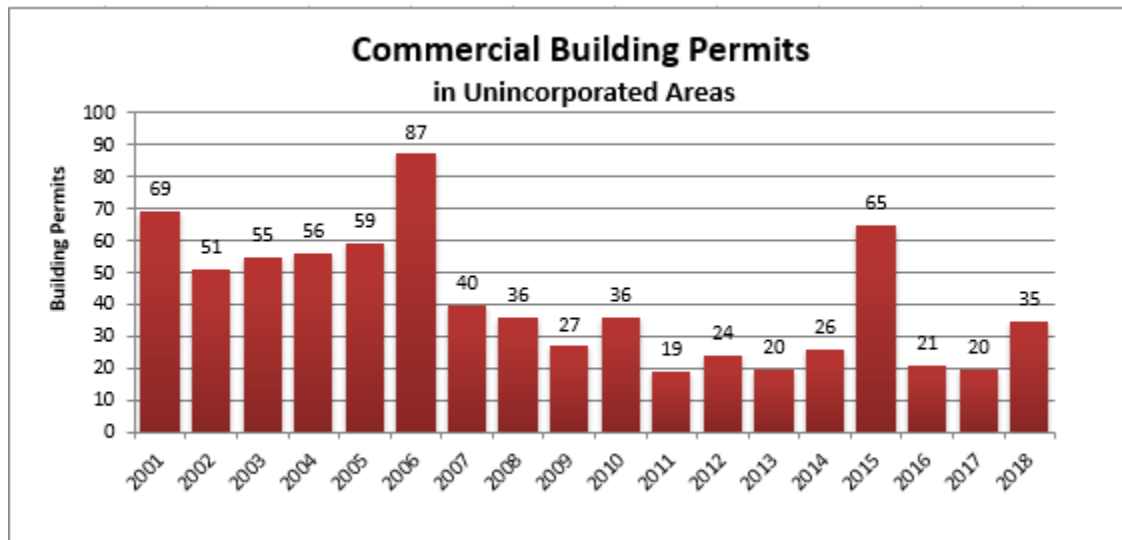
(Above is feedback given by Larry Crile, Mayor of Ostrander.)



Appendix E: Relevant Training Material

Relevant Hazard Trainings/Exercises		
Year	Month	Training
2018	September	- Dam Emergency Exercise - Monthly Siren Test
	December	- Drinking Water Exercise - Monthly Siren Test
2019	January	- DART (Co. HazMat Team) Quarterly Training - Monthly Siren Test
	February	- Weather Spotter Training - Monthly Siren Test
	March	- Statewide Tornado Drill, EOC Exercise - Statewide Siren Test - Monthly Siren Test - Terrorism Resiliency Recovery Seminar
	April	- LEPC Exercise / DART (Co. HazMat Team) Quarterly Drill - Spotter's Course - Monthly Siren Test
	May	- Kids Safety Scenes - Monthly Siren Test
	June	- HazMat IQ Classes - Monthly Siren Test
	July	- DART (Co. HazMat Team) Quarterly Training - Monthly Siren Test
	August	- Monthly Siren Test
	September	- Monthly Siren Test
	October	- Great US Central US Shakeout Earthquake Drill - DART (Co. HazMat Team) Quarterly Training - Monthly Siren Test
	November	- Monthly Siren Test
	December	- G-271 Hazardous Weather - Monthly Siren Test

Appendix F: New Construction Trends



Graph shows only the new construction in Delaware County and the trends throughout the years.