

2.2.8 Invasive Species

Species that are both non-native (or alien) to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health are considered invasive.				
	RISK	Period of Occurrence:	Can occur at any time	Risk Ranking: Medium
		Warning Time:	More than 24 hours	Type of Hazard: Natural
		Probability:	Frequent (Will occur during a year)	Impact: Critical (25-50% of land are affected)
		Disaster Declarations:	USDA FSA S3344 (2012)	

Hazard Introduction and Overview

The National Wildlife Federation defines invasive species as any living organism, whether amphibian, plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs, that is not native to an ecosystem and causes harm. Invasive species can harm the environment, the economy, and even human health. In addition, species that can grow and reproduce quickly, spread aggressively, and have potential to cause harm are identified as "invasive."

Human actions are the primary cause of invasive species transfer. There are four main types of invasive species: aquatic species, plants, animals, and microbes (USDA, n.d.).

Without natural predators or controls, invasive, non-native plants are able to spread quickly and force out native plants. Other non-native plants are impacting our wetlands by creating monocultures. Native plant diversity is important for wildlife habitat, as many animals depend on a variety of native plants for food and cover. Ohio has a large number of invasive plants and animals. A description of each type of invasive organism appears below.

Location and Extent

Invasive Terrestrial Plants

Invasive terrestrial plants are those that displace or crowd native plant species, impact wildlife, which relies on native plant communities for food, shelter, and breeding habitat, and for monoculture plant communities, which reduces biological diversity. According to the ODNR, Division of Natural Areas & Preserves, of the approximately 2,300 vascular plant species growing in the wild in Ohio, about 78 percent (78%) are native. The other 22 percent (22%), more than 500 species are not native to Ohio, having been introduced from other states or countries. Most

non-native plants have been introduced for erosion control, horticulture, forage crops, culinary and medicinal use, wildlife foods, and by accident. The negative effects of invasive species can occur anywhere in Clermont County. See Table 2.2.8.1 below which outlines the most common invasive terrestrial plant species known to be in Clermont County.

Table 2.2.8.1

Invasive Terrestrial Plant Species – Clermont County	
<i>Common Name</i>	<i>Distribution</i>
Amur Honeysuckle: A fast-growing, deciduous shrub with hollow, tan-colored stems, opposite, dark green leaves, and fragrant, tubular flowers that are white and turn yellow with age. It produces small, bright red berries that persist into winter, and its bark is deeply fissured and peels in strips on older plants. It is an invasive species known for forming dense thickets that outcompete native plants and can spread rapidly in disturbed areas.	
Autumn-Olive: A deciduous shrubs or small trees that grow to a height of 30 feet. Autumn-olive has nitrogen-fixing root nodules, which allow them to adapt to many poor soil types including bare mineral substrates. It is found throughout Ohio, occurring in various open to semi-shaded habitats including old fields, grasslands, barrens, woodlands, savannahs, alvars (limestone prairies), roadsides, reclaimed strip-mined areas, and open disturbed sites.	
Garlic Mustard: A biennial herb that emits a garlic-like odor from crushed leaves. Garlic mustard prefers some shade in mesic upland and floodplain forests, savannas, pastures, lawns, and along fencerows and roadsides. It invades forest edges and progresses into the interior along streams and trails.	
Japanese Knotweed An upright, shrub-like, herbaceous perennial that can grow to over 10 feet in height. The plant was introduced from Asia in the late 1800s as an ornamental and used for erosion control and landscape screening. The plant poses a significant threat to riparian areas. It is found along roadsides, low lying areas, utility rights-of-way and along woodland edges and openings. It grown aggressively by extensive rhizome and seed contaminants in fill dirt.	
Japanese Stiltgrass An invasive, annual Asian grass that forms dense patches, resembling delicate bamboo and reaching 1-3.5 feet tall. Its most distinctive feature is a pale, silvery, reflective stripe on the upper surface of its otherwise pale green, lance-shaped leaves. The plant produces slender, yellow-reddish flower spikes in late summer and fall, then dies back, leaving behind a thick, tannish thatch	
Kudzu A plant that can grow up to 60 feet in a year. The plant is native to Asia and was brought to North America in the 1870s as an ornamental plant. Kudzu typically invades the forest edge or open fields, overtaking other types of vegetation which may be more desirable. The Kudzu plant also supports the kudzu bug which also feeds on soybeans, wisteria, and other plants.	

Invasive Terrestrial Plant Species – Clermont County	
Common Name	Distribution
Moneywort: Also called pennywort and creeping jenny, moneywort is a member of the primrose family that was once used as an ornamental form of ground cover. It grows close to the ground and forms a thick mat up to two feet long and up to four inches tall. Moneywort spreads rapidly by creeping stems and dispersing seeds. Seeds can be spread by floodwaters or human activity.	
Multiflora Rose: Multiflora rose is a thorny shrub with arching stems (canes). The compound leaves are divided into 5-11 sharply toothed leaflets. Multiflora roses prefer sunny to semi-shaded habitats with well-drained soils but can tolerate a wide range of habitats including mesic upland and flood plain woods, forest edges, old fields, savannas, prairies, fens, roadsides, fencerows, and lawns.	
Purple Loosestrife: Purple loosestrife is an erect perennial with opposite or whorled leaves. The thick taproot supports thirty to fifty stems that can attain a height of 3-6 feet. Purple loosestrife thrives in wetlands, including marshes, fens, wet meadows, stream and riverbanks, lake shores, and ditches. It can also survive in drier conditions.	
Reed Canary Grass: Reed canary grass is a large, coarse grass that attains a height of 2 to 7 feet. The erect, hairless stem supports rough-textured, tapering leaves of 3 ½ to 10 inches long and 1/4 to 3/4 inch wide. Reed canary grass grows best on fertile, moist organic soils in full sun. It can grow in standing water by producing special roots along the submersed portion of the stem. It also grows on dry soils in upland sites and under partial shade.	
Tree of Heaven A fast growing, invasive tree known for its large, compound leaves, foul odor, and ability to outcompete native plants. Native to China, it was introduced to the US in the late 1700s and has since become widespread due to its adaptability and rapid growth. The spotted lanternfly is known to suck sap from the stems and branches of tree of heaven.	

Source: ODNR

The three primary methods of control (mechanical, chemical, and biological) can help abate the spread of these plants, but some methods work better than others.

- **Mechanical control methods** involve cutting, digging, burning, or otherwise physically removing the plant. Mechanical control methods are labor-intensive and ultimately unsuccessful at eradicating invasive plants long-term.
- **Chemical control methods** involve herbicides that target specific plant species while protecting native species. Some herbicides are non-selective and have the ability to kill or contaminate the surrounding ecosystem.

- **Biological control methods** involve introducing natural enemies that destroy the invasive plant species. Care is necessary so that the introduced species does not itself become a problem for the area in which they are introduced.

Invasive Terrestrial Wildlife

Invasive terrestrial wildlife include animals or other organisms that evolved to live on land rather than aquatic habitats; these organisms cause damage to important habitat that other wildlife depends on. In Ohio, the primary invasive terrestrial animal is the feral hog. Originally introduced to the United States in 1539, these animals were once domestic pigs that escaped, bred with Eurasian wild boars, and are now present in 35 states. These animals can weigh up to 200 pounds and cause significant damage to crops (i.e., corn and soybean) and property.

The greatest concentration of verified populations can be found in the unglaciated region of southeastern Ohio; however, according to the ODNR there are no established feral swine populations in Clermont County.

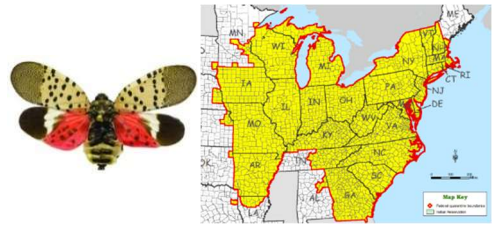
Invasive Insects

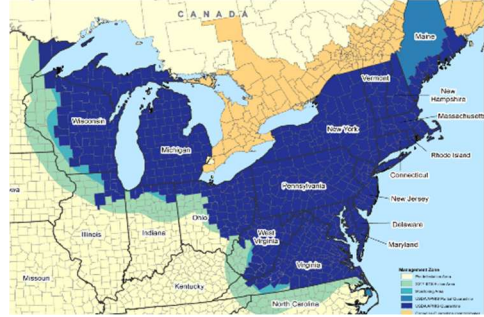
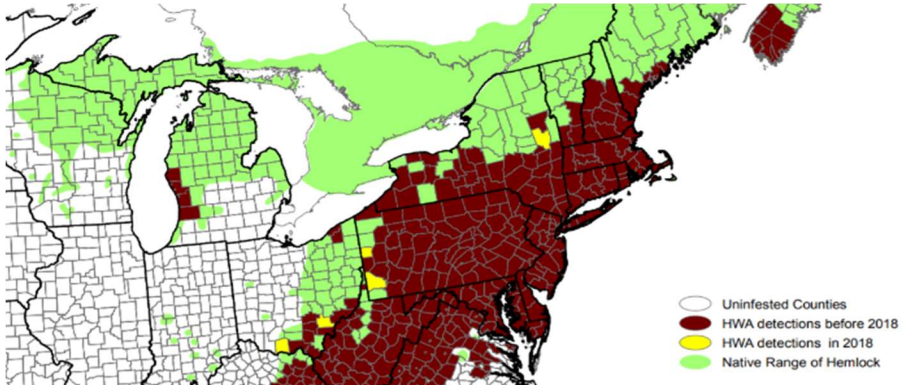
Invasive insects and diseases are other tiny organisms that can cause a great deal of damage to plant, forest, and wildlife health. Non-native insects, fungus, and microbes can cause significant damage to forests and other wildlife. The spread of these organisms, such as the Emerald Ash Borer (EAB), can be controlled by taking care not transporting firewood long distances. According to the ODNR, Division of Forestry, one of the most invasive insect species in Ohio is the EAB, which can now be found in all 88 counties in Ohio, as well as six neighboring states and the province of Ontario.

This Asian pest is part of a group of insects known as metallic wood-boring beetles. The EAB affects all species of native ash trees found in Ohio. Because North American ash trees did not coexist in association with this pest, they have little or no resistance to its attack. In three to five years, even the healthiest ash tree is unable to survive an attack.

The Asian Longhorned Beetle (ALB) has been detected in southwestern portion of Ohio, including Clermont County. The infestation of the ALB has led to the establishment of a federal quarantine area covering 44 square miles of Clermont County. Eradication efforts in Ohio have been ongoing, with reductions in the quarantine area, including parts of East Fork State Park, Tate Township, and East Fork Wildlife Area. Table 2.2.9.2 below presents the most prominent invasive insect species in Ohio.

Table 2.2.8.2

Invasive Insects – Clermont County	
Common Name	Description
Asian Longhorned Beetle: The Asian Longhorned Beetle (ALB) is native to Japan, Korea, and southern China. Experts believe that the beetle "hitchhiked" to the U.S. during the early 1990s in solid wood packing or crating materials on a cargo ship arriving from China. When the eggs hatch, the beetle grubs bore into hardwood trees. Once they mature, they chew exit holes in branches and trunks. The larvae eventually burrow deep enough to damage the living portion of the trunk, ultimately killing the tree.	
Box Tree Moth The invasive Box Tree Moth was first confirmed in southwest Ohio in June 2023 and has since led to quarantines in several counties, including Clermont. The moths, which feed exclusively on boxwoods, can defoliate and kill the shrubs. Residents should monitor for green-black caterpillars, webbing, and chewed leaves and report sightings to the Ohio Department of Agriculture.	
Brown Marmorated Stink Bug The Brown Marmorated Stink Bug consumes numerous breeds of agronomic and specialty crops, which include corn, soybean, fruit crops, and vegetable crops. Ohio is rated by the USDA as having this insect at levels considered as "agricultural and nuisance problems."	
Emerald Ash Borer: The Emerald Ash Borer (EAB) is a small, wood-boring beetle native to Asia. These beetles affect all species of ash tree by eating the living portion of the tree directly underneath the bark. Adult beetles are dark metallic green and up to half an inch long. Larvae are about an inch long and carve S-shaped tunnels while feeding, which kills the tree. The EAB has spread across much of the East Coast. As of September 8, 2010, all of Ohio has been quarantined.	
Spotted Lanternfly: Spotted lanternflies, feed on grapevines, hops, and fruit trees, and was recently discovered in Ohio, and could become established and spread quickly. In October 2020 adult lanternflies were found outside a business in Jefferson County. Native to Asia, spotted lanternflies were first found in the US in 2014 in Pennsylvania. They typically only travel a radius of about 30 feet, but they can hitchhike to an area, riding on trains, cars, or trucks.	

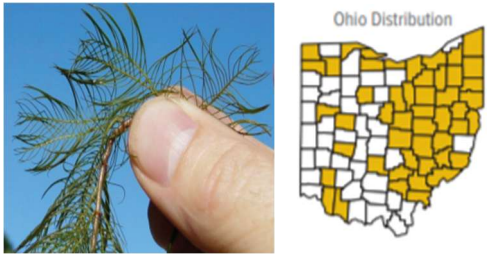
Invasive Insects – Clermont County	
Common Name	Description
Spongy Moth: The spongy moth, formerly known as the Gypsy Moth, native to Europe, Asia, and North Africa, was established in North America in 1869 when they were brought to Massachusetts in an unsuccessful attempt to cross breed them with silkworms. Caterpillars are dark gray or brown and grow to about 2.5 inches long. Adult male moths are gray-brown while female moths are whitish with brown markings. Caterpillars feed on the leaves of trees and cause mass defoliation. The spongy moth has an expansive quarantine zone that encompasses much of Ohio.	 
Hemlock Woolly Adelgid: The hemlock woolly adelgid (HWA) is a small, aphid-like insect that feeds on stored nutrients in young hemlock branches. Young adelgids cover themselves with a white substance until they mature into adults. Adults are black and all females that can lay up to 300 eggs twice a year. Juveniles attach themselves to the tree in one spot for and feed continuously for the rest of their lives, disrupting the flow of nutrients to the rest of the branch. This eventually kills the tree.	 

Source: ODNR

Invasive Aquatic Species

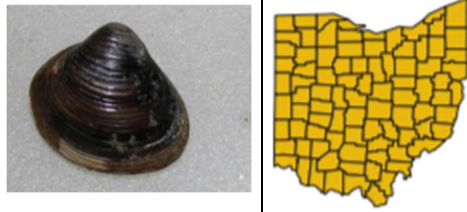
Aquatic invasive species are plants and animals living in and degrading the quality of waterways. In many cases, the spread of these organisms can be abated by taking care to wash recreational water equipment before transportation. Additionally, residents should avoid the release of plants and animals from personal aquariums.

Table 2.2.8.3

Aquatic Invasive Species, Plants – Clermont County	
<i>Common Name</i>	<i>Description</i>
Algal Bloom Harmful Algal Blooms (HABs) are toxic dense growths of cyanobacteria (blue-green) blooms that can occur on Lake Harsha and the Ohio River. HABs can negatively impact recreational and athletic water events. They can also be toxic for pets, livestock, and sometimes humans. While many HABs are native to Ohio, their growth can be impacted by human activity including fertilizer runoff (i.e., nitrogen and phosphorus). Not all algae blooms are harmful; water testing is required to make a determination.	
Eurasian Watermilfoil: A feathery submerged aquatic plant that was sold as an aquarium plant. It forms thick mats that cause harm to shallow areas of lakes and rivers. The plant is very hardy and can survive a wide range of temperatures, still or flowing water, and even under ice. Eurasian Watermilfoil reproduces by fragmentation. Pieces break off and float to new locations or are transported by boats, trailers, and fishing gear. It is known to exist in the Ohio River.	

Source: ODNR

Table 2.2.8.4

Aquatic Invasive Species, Invertebrates – Clermont County	
<i>Common Name</i>	<i>Description</i>
Asian Clam: Also called the Asiatic clam, pygmy clam, or gold clam, the Asian clam is a small freshwater clam that rarely grow more than an inch in diameter. The shell is typically yellowish green to brown. The clams can be found in streams, rivers, ponds, lakes, and canals, but prefer running waters with a sand or gravel bed. It is capable of self-fertilization and can release up to thousands of young a day that are then spread by currents and human activity. The Asian clam was originally introduced to the west coast of the US but has spread to the eastern US. They attach themselves to boating, fishing, and scuba diving equipment and their young can be transferred by buckets or live wells.	

Aquatic Invasive Species, Invertebrates – Clermont County		
Common Name	Description	
Rusty Crayfish: A large, aggressive crayfish that outcompetes native species. They are typically three to five inches long and are usually grayish green or reddish brown in color. Rusty crayfish are pollution tolerant and prefer areas with adequate cover. They can survive in lakes, ponds, and streams. Rusty crayfish are used as fishing bait and can be accidentally introduced to new areas. They are capable of hybridization, and it is not necessary to have both a male and female rusty crayfish in the same area to begin new invasions.		Ohio Distribution  Orange - Invasive Green - Native Blue - Both Native & Invasive
Zebra Mussel: Small freshwater mollusks that attach to hard surfaces including other mussels and crayfish. They can be found in lakes, rivers, reservoirs, ponds, and quarries. Zebra mussels require environments rich in calcium to aid in shell production and waters above 50°F to reproduce. Young zebra mussels float for up to five weeks before settling. The control and removal of zebra mussels costs billions of dollars. They have quickly spread across North America and have become one of the most intrusive, prolific, and costly aquatic alien species. Once established in open-water environments, they are virtually impossible to eradicate.		Ohio Distribution 

Source: ODNR

Table 2.2.8.5

Aquatic Invasive Species, Fish – Clermont County		
Common Name	Description	
Common Carp: The common carp is the largest member of the minnow family. It can live up to 50 years and has a voracious appetite. They can grow up to 22 inches long and weigh up to ten pounds, but some can reach 48 inches long and weigh 40 pounds or more. They tend to live in lakes, ponds, and calmer rivers. Common carp can spread through connected bodies of water once they have been established in a waterway. Juvenile carp are used as bait and can be released by anglers or escape into new territories.		Ohio Distribution 

Aquatic Invasive Species, Fish – Clermont County		
Common Name	Description	
Goldfish: Goldfish are a freshwater species of carp that was originally introduced to North America as an ornamental fish in the 1600s. They can grow up to 23 inches long and weigh almost seven pounds but are typically up to eight inches long and weigh less than a pound. Goldfish prefer muddy water with thick vegetation, but are tolerant to pollution, fluctuating temperatures, and otherwise murky waters. Goldfish are intentionally introduced to lakes, ponds, and fountains as ornamental fish. They are also popular pets and are used as bait. Sometimes these animals are released by owners or anglers without them realizing the potential environmental impact.		Ohio Distribution 
Grass Carp: The grass carp, or white amur, was originally introduced into the ecosystem to control aquatic weed growth. However, these fish voraciously feed on different animals and other plant life. They typically vary between 65-80 pounds. They prefer to live in shallow waters of lakes, ponds, and backwaters. Grass carp are intentionally stocked in private ponds to control aquatic vegetation but only sterilized triploid grass carp can be stocked or owned within Ohio. If they are released or escape into other waterways, they can easily spread into tributaries, waterways, river systems, canals, and dams.		Ohio Distribution 

Source: ODNR

Impacts and Vulnerability

Invasive species pose a significant threat to the ecological, economic, and cultural integrity of Clermont County's lands and waters and the communities they support. Controlling them can be complex, expensive, and often continues indefinitely.

Invasive species can harm wildlife in several different ways. When a species enters an ecosystem, it can breed or spread quickly and take over an area if it has no natural predators. Native species may not be able to defend their habitats from the invasive species. Native species may also become prey or have to compete for food. Invasive species can carry disease, prevent native species from reproducing or kill native species offspring (National Wildlife Federation, 2018).

There are also indirect results of an alien species moving into a new habitat. Invasive species can change the food web in an ecosystem by destroying or replacing native food sources. Though a new species may become an optional food source, it may not produce enough to supply the wildlife around it. Some species can completely reconstruct an ecosystem; aggressive plant

species can take over ecosystems and replace every plant with a form of itself (National Wildlife Federation, 2018).

Harmful Algae Blooms (HABs) and feral swine can potentially impact water quality. Feral swine can introduce harmful bacteria into the water system, and certain HABs can be toxic. Significant tree and crop damage can result from certain invasive plants and insects.

Historical Occurrences

Most invasive species have been introduced due to human intervention, whether intentionally or accidentally. Invasive species have been around since the settlers of the 1750's. The movement of people and transportation of goods around the world via airplanes and shipping vessels has made the spread of invasive species more prevalent. The Emerald Ash Borer (EAB) was introduced in the U.S. in the 1990's from wood packing material from China, first being discovered in lower Michigan, spreading to Ohio, Maryland, Pennsylvania, Northern Indiana, West Virginia, Virginia, and the Chicago area in Illinois. In almost all cases, once an invasive species is introduced, they are a continuous issue due to the difficulty in not only eliminating but also eradicating them from the area.

The spotted lanternfly is an invasive species from China that was accidentally introduced to eastern Pennsylvania in 2014. The insect is commonly spread by trains and cars. Right now, the insect has no native predators; however, one could develop.

Asian Longhorn Beetle – September 8, 2010

The Asian Longhorn Beetle has negatively impacted Tate Township, the East Fork State Park, and portions of Stonelick and Batavia Townships. Quarantines were established in these areas.

Brown Marmorated Stink Bug – September 2017

During the fall of 2017, there were four reports of significant populations of Brown Marmorated Stink Bugs in areas of Clermont County.

Ohio River Harmful Algae Bloom – 2008 through 2019.

Harmful Algae Blooms (HABs) were observed in the Ohio River in 2008, 2015, and 2019. Lake Harsha in East Fork State Park has experienced two HABs in June of 2014 and 2016.

Loss and Damages

Economic impacts can vary greatly depending on the target of the invasive species. Invasive species will likely cause no damage to structural assets; however, they can put human health and economies at risk. These organisms can threaten the livelihoods of people who depend on agriculture for financial stability by destroying crops and decreasing the availability of water. Spotted lanternfly are known to feed on a wide variety of plants, including grapevines and can cause significant damage to vineyards. This could result in significant losses to the vineyards at Harmony Hill in Bethel, and the Fulton Grove Winery.

Invasive species can cause significant economic damage to industries like fishing, tourism, and even water treatment facilities by clogging pipes and impacting infrastructure. The cost of repairing damages or controlling populations can drain budgets whereas the cost of lost crops can harm farmers. The devastation of ash trees from the emerald ash borer could result in significant increases in fuel for wildfires in Ohio and lead to an increase in vehicular accidents from dead trees falling into roadways.

The following table lists estimated adverse economic impacts and management expenditures of selected invasive species. “Actual” estimates represent known or modeled adverse impacts or costs related to current infestations. “Projected” estimates represent anticipated adverse impacts or costs if an invasive species is unmanaged and spreads or becomes established in an area where the species is not currently found.

Table 2.2.8.6

Invasive Species – Adverse Economic Impacts & Management Expenditures			
<i>Invasive Species</i>	<i>Impacted Sectors</i>	<i>Estimated Adverse Economic Impacts</i>	<i>Estimated Management Expenditures</i>
Asian Carps 	Fisheries, Recreation, Tourism	Actual: \$58 million in 2017 for Asian carps (Ohio and Upper Mississippi River Basins)	
Feral Swine 	Agriculture, Infrastructure, Livestock	Actual: \$190 million in 2014 (Crop production losses across 10 states); \$40 million in 2017 (livestock damages across 13 states)	
Emerald Ash Borer 	Agriculture, Electric Power, Forestry	Actual: \$60 million per year (timber losses, nationwide); \$380 million per year (residential property value losses, nationwide), especially in Midwestern States	Projected: \$10.7 billion over ten years (nationwide, given a projected expansion of emerald ash borer from its distribution in 2009)

Source: U.S. Dept. of Interior Invasive Species Strategic Plan 2021 - 2025

Future Occurrences

Invasive species vulnerability in Clermont County is driven by a combination of human activity, land use patterns, and environmental conditions. “The county's location within the Ohio River watershed, its growing population, and the surrounding natural areas create conditions ripe for invasive species introduction and establishment, (Ohio River Foundation, 2024).

With the increase in global trade and travel, the probability of new and unexpected species arriving in Ohio will continue to grow. Clermont County is part of the larger Cincinnati metropolitan area, a major hub for commerce and transportation. Increased shipping and travel create more pathways for invasive plants, insects, and other organisms to be introduced accidentally.

Vessels on the Ohio River can contribute to the introduction of aquatic invasive species. Large vessels use ballast water to maintain stability. This water, taken on at one port, can contain a variety of aquatic organisms. When the ship discharges its ballast water, it can release these foreign species into the new environment. Some infamous invasive species introduced to the Ohio via ballast water include zebra mussels. While ballast water is a primary concern, invasive species can also enter through other means, such as hitching rides on boat hulls, propellers, or other equipment.

Warmer temperatures can allow existing invasive species to expand their range into habitat that is currently too cool” (USGS, 2023). “The increase in temperatures, rainfall, humidity, and drought can facilitate the spread and establishment of invasive species. Research suggest that invasive species take advantage of the earlier spring warmup by sprouting and leafing out before the native species do. This gives them an advantage by allowing them to monopolize the soil space, nutrients, and sunlight to outcompete native species and create monocultures” (NAISMA, 2023).

Legislation is in place around the world in an attempt to control the migration of unwanted species between ecosystems. It is certain that new wanted and unwanted species will arrive in Ohio. The importance of controlling the integrity of existing ecosystems will require ongoing state, national and international efforts to avoid unwanted infestations. To this end, the Ohio Administrative Code has been updated in 2023 to make the sale, propagation, distribution, and dissemination of 61 invasive species illegal.

Mitigation efforts for all types of invasive species should be closely coordinated with the Ohio Division of Forestry and the Ohio Department of Agriculture. Current practices by these organizations, including quarantining infested areas, have shown as in the case of the spongy moth to be very successful. Some infested areas have also begun spraying crops or infested foliage to prevent further infestation. This has also proven to be very successful.

Risk Assessment

This section summarizes the vulnerability of Clermont County to invasive species. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. The following table presents the results of that survey, specifically regarding invasive species.

Table 2.2.8.7

Public Sentiment, Invasive Species					
Hazard	Level of Concern				Total Responses
	Not at All	Somewhat	Concerned	Very	
INVASIVE SPECIES	21 (40.38%)	16 (30.77%)	7 (13.46%)	8 (15.38%)	52
In the past five years, do you remember this hazard occurring in your community?				10 (19.23%)	52
Have you noticed an increase in the occurrences or intensity of this hazard?				18 (34.62%)	52
Have you noticed a decrease in the occurrences or intensity of this hazard?				1 (1.92%)	52

Source: Online Public Survey Results

Table 2.2.8.8 assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

Table 2.2.8.8

Rish Ranking, Invasive Species			
Category	Points	Description	Notes
Frequency	5	Frequent (Will occur during a year)	There are 24 known species of invasive organisms in Clermont County. With the increase in global trade and travel, the probability of new and unexpected species arriving in the county will continue to grow.
Response	5	More than a month	Response measures put in place to control or eliminate the spread of invasive species are complex and often continue indefinitely.
Onset	1	More than 24 hours	Once introduced to a new area, invasive species need time to become established.
Magnitude	3	Critical (25-50% land area affected)	Over time, certain invasive species can spread to large areas of the county.
Business	1	Less than a day	Impacts to the agricultural sector of the county could extent into weeks or months. However, minor impacts are excepted to local business operations.
Human	1	Minimum (Minor injuries)	Invasive species can impact human health by acting as disease vectors, causing allergic reactions, or physical harm through bites, stings, or toxins.
Property	2	10-25% property affected	Certain invasive plants (i.e., Japanese knotweed and kudzu) can spread aggressively and damage property infrastructure like foundations and pipes. They can also cause less productive agricultural areas. Certain invasive insects can also destroy crops and timber.
Totals	18	MEDIUM	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The probability and severity of impacts from invasive species is equal across the entirety of Clermont County; no jurisdiction is more or less at risk. As such, there is no image identifying jurisdictional fluctuation.

2.2.9 Landslides

Landslides occur when areas of relatively dry rock, soil, or debris move uncontrollably down a slope.				
 RISK HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	On-going; currently, there are 58 active landslide sites and 38 active rockslide sites in the county.	Risk Ranking:	Medium
	Warning Time:	6-12 hours	Type of Hazard:	Natural
	Probability:	Frequent (Will occur in a year)	Impact:	Less than 10% of property affected
	Disaster Declarations:	USDA FSA S3934 (2015) DR-4360-OH (2018) DR-4361-OH (2018)	DR-4424-OH (2019) DR-4428-OH (2019)	

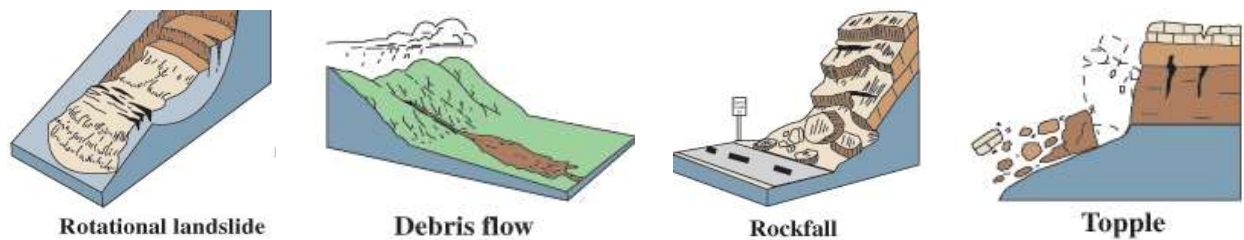
Hazard Overview

Landslides involve the movement of debris sliding uncontrollably down a slope. Landslides may be localized or massive in size and can move at high rates of speed. Some of these slides occur rapidly (within seconds), other can take several hours, weeks, or longer to develop. In Ohio, landslides are common after heavy rainfall or a snow melt event, and when heavy equipment operates at the top edge of a steep slope. Landslides can involve debris flows, rockfalls, and toppling effects (see Figure 2.2.9.a below). The signs of areas susceptible to landslides include leaning and bent trees or utility poles, seeps and sag ponds (i.e., water-filled depressions), and old or recent landslides where horizontal and vertical movement has occurred. The conditions in the county that contribute to the frequency of landslides include the hilly terrain (particularly in the southern portions of the county) and a high average annual precipitation.

- **Rotational Slump** Characterized by the movement of a mass of weak rock or sediment as a block unit along a curved slip plane. The slumps generated by this type of landslide are the largest in Ohio, with a rotational slump often involving hundreds of thousands of cubic yards of material and extending for hundreds of feet. This type of landslide develops slowly relative to other landslides and commonly require several months or even years to reach stability.
- **Mudflows** are water-saturated rivers of earth, rock, and debris. Mudflows develop when water rapidly accumulates in the material, such as during heavy rainfall or rapid snowmelt. Mudflows can develop and move quickly, giving little to no warning. This type of landslide is the most common in Ohio and are often smaller in size.

- **Rock falls or toppling** occur when rocks or other materials detach from a slope or cliff and descend in a freefall, rolling, or bouncing manner. Rock falls can occur naturally, through faults and seismic activity, or as a product of human activity, such as blasting. This type of landslide occurs rapidly.

Figure 2.2.9.a



Although an area might possess one or more of the above conditions, landslides require a trigger that will initiate the downslope movement of material. These triggers include both human and natural causes, such as vibration, over-steepened slopes, increased weight on a slope, and removal of vegetation and trees.

Location and Extent

According to the Ohio Department of Natural Resources (ODNR), landslides are a significant problem in many areas of Ohio, including the Cincinnati area just to the west of Clermont County, which has one of the highest per-capita costs due to landslide damage of any city in the United States.

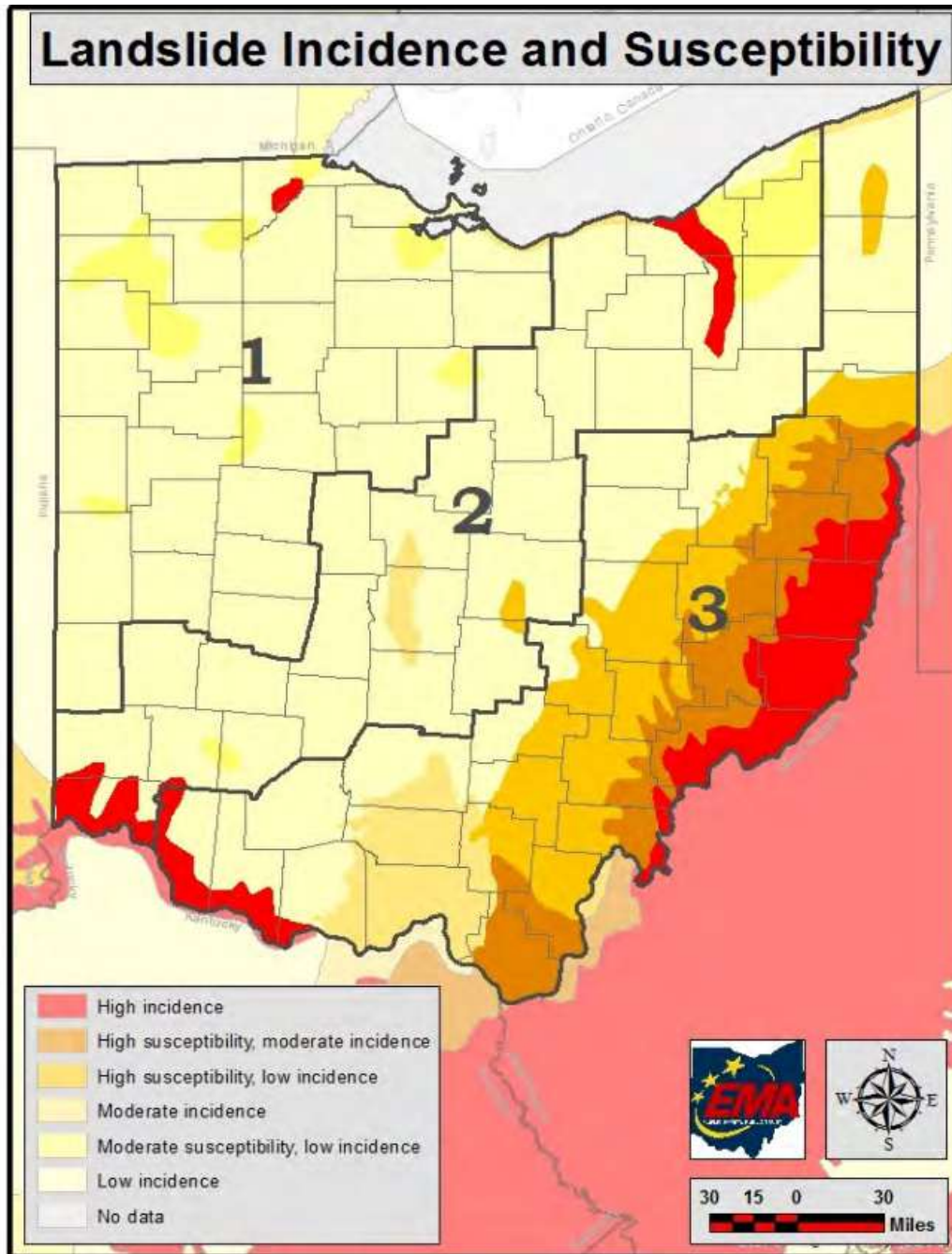
According to the U. S. Geological Survey (USGS), a section of southwestern Ohio along the Ohio River including Clermont County is located within a high landslide incidence area (Radbruch-Hall, Colton, Davies, Lucchitta, Skipp, & Varnes, 1982). Figures 2.2.9.b depicts these incidence areas.

Figure 2.2.9.b



The *State of Ohio Hazard Mitigation Plan* (OEMA, 2024) provides a Landslide Incidence and Susceptibility Map. The map illustrates that a large portion of western and southern Clermont County are considered areas of high landslide incidence. The remainder of the county is considered to be in a “moderate susceptibility with low incidence,” area. Figure 2.2.9.c (OEMA, 2024, p. 2-83) shows these areas in more detail.

Figure 2.2.9.c



The Ohio Department of Transportation (ODOT) maintains the number of geological hazards, including rock slopes, landslides, and abandoned underground mine areas that impact roadways throughout the state on an online dashboard. The following tables illustrate how ODOT determines probability and tier determinations for rock slopes.

Table 2.2.9.1

Probability Table – Rock Slope				
Potential of Rockfall Occurrence (A)	Potential of Rockfall to Impact Roadway (B)			
	Very High (10)	High (8)	Moderate (4)	Low (1)
Very High (10)	Very High (20)	Very High (18)	High (14)	Moderate (11)
High (8)	Very High (18)	High (16)	High (12)	Moderate (9)
Moderate (4)	High (14)	High (12)	Moderate (8)	Low (5)
Low (1)	Moderate (11)	Moderate (9)	Low (5)	Low (2)

Table 2.2.9.2

Tier Based on Tier Determination Score – Rock Slope	
Tier Determination Score	Tier Action
2 to 5	Tier 1 Site – No Detailed Rating Needed
8 to 11	Tier 2 Site – Detailed Rating Needed
12 to 16	Tier 3 Site – Detail Rating Needed
18 to 20	Tier 4 Site – Detailed Rating Needed

According to ODOT's landslide dashboard, there are 58 active landslide sites in Clermont County along with 21 remediated sites (ODOT OGE, n.d.). Of the sites, 30 are Tier 1, 14 are Tier 2, and 14 are Tier 3. None are Tier 4, the most severe of ODOT's tiers. Figure 2.2.9.d shows the dashboard entry for landslides.

The rock slope dashboard lists 38 active rock slopes in the county, with 31 of those being Tier 1 sites. Again, none are Tier 4. Figure 2.2.9.e below shows the same data for rock slopes. Finally, ODOT's Abandoned Underground Mine Inventory and Risk Assessment (AUMIRA) dashboard indicates that there are no known AUM sites in Clermont County.

Figure 2.2.9.d

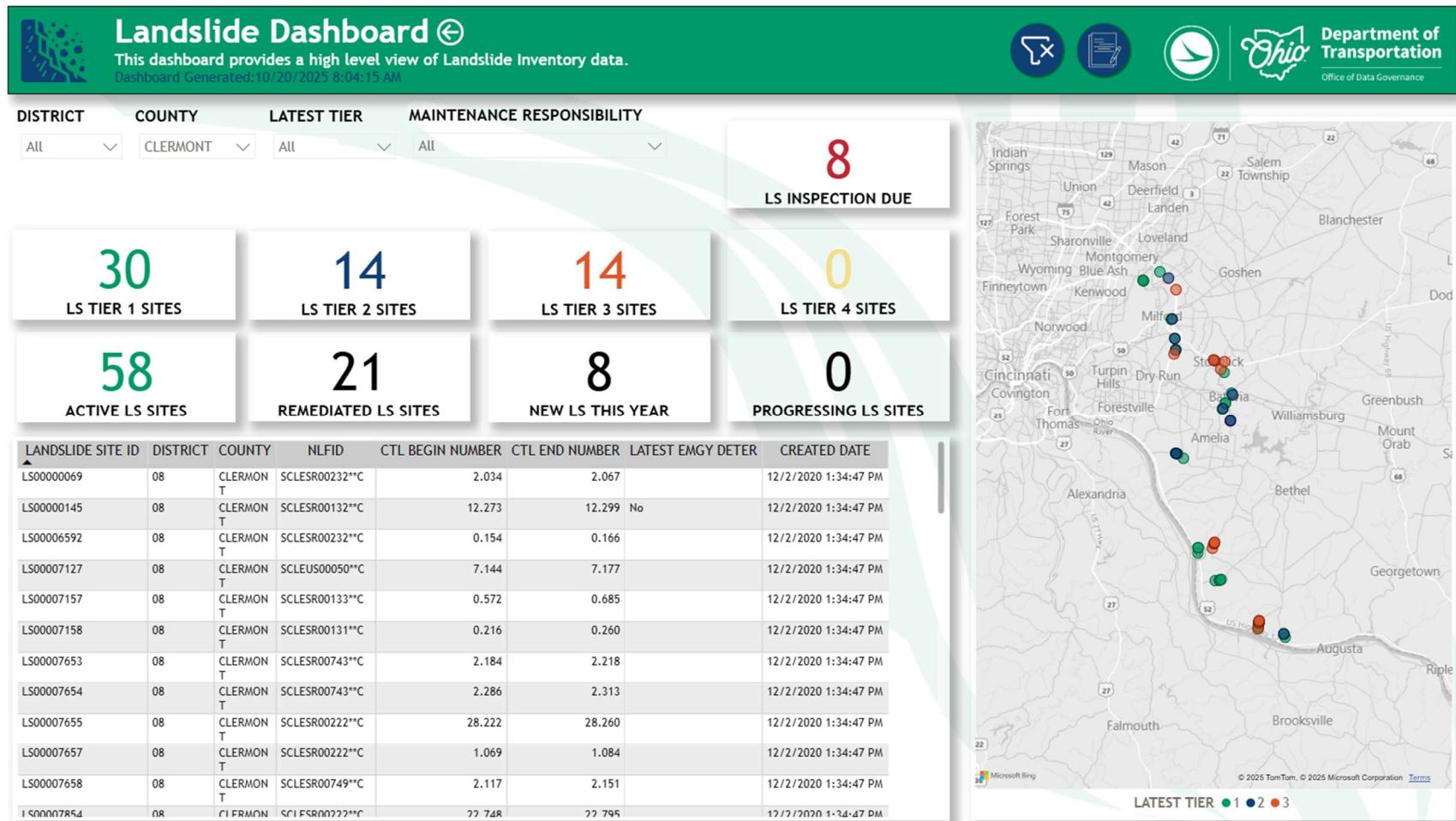
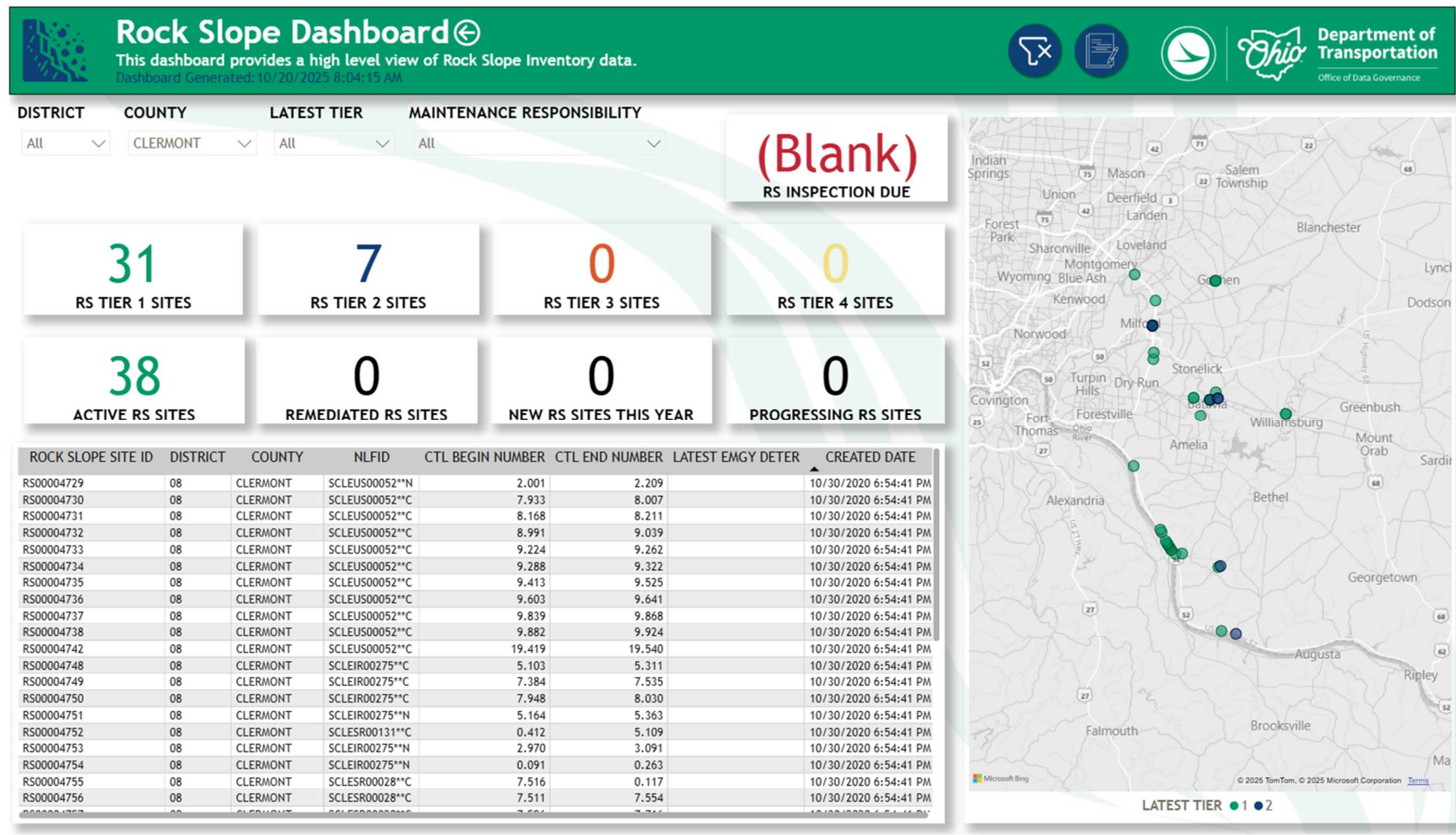


Figure 2.2.9.e



Impacts and Vulnerability

Landslides are not random, but also not always predictable. Certain geologic conditions are a prerequisite, and one or more of the following can serve as an alert to geologic issues.

- Joined rocks
- Fine-grained, permeable rock or sediment
- Areas of abandoned underground mines
- Areas with large, buried pipelines

Landslides have the capability of damaging and destroying homes, businesses, utilities, and highways, resulting in annual costs of millions of dollars. These events typically affect residential areas and transportation infrastructure. Subsidence clean-up and restoration projects can range in cost from \$10,000 to \$6,000,000. Large-scale or catastrophic landslide events can result in fatalities, numerous injuries, and trauma stemming from suffocation and entrapment. Depending on the location of an event, landslides can damage or destroy critical infrastructure and facilities, and isolate entire communities. Rapid slide or flow movement usually happens without warning, breaking apart house walls, tilting floors, and pulling apart buried water, gas, and sewer lines. Houses are often pushed off their foundations and are occasionally even buried by debris.

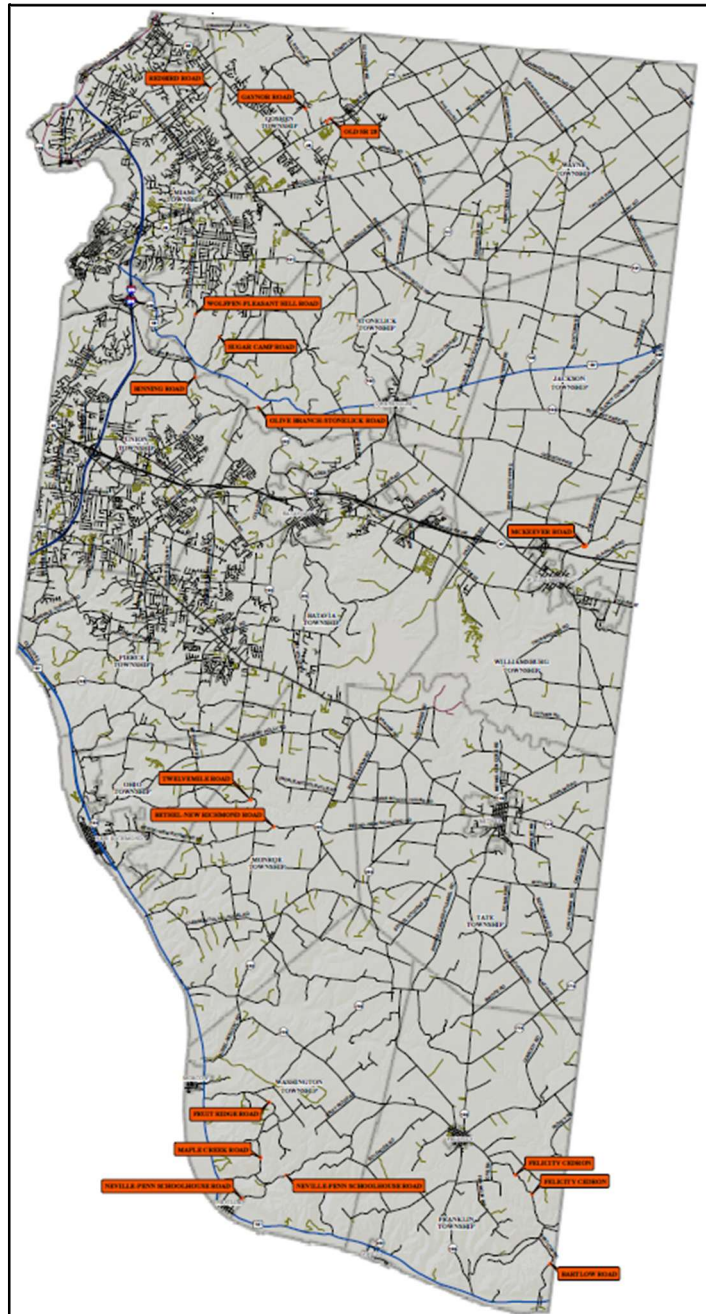
Rockfalls can constitute a major hazard along the roadways of Clermont County, posing a risk to life, property, and traffic safety.

Historical Occurrences

The Clermont County Engineer's Office provided the map below (Figure 2.2.9.f), which illustrates locations where landslide repairs have been made along roadways over the past few

Figure 2.2.9.f

Clermont County Landslide Repairs



Source: Clermont County Engineer's Office

- Redbird Road
- Gaynor Road
- Old State Route 28
- Wolfpen-Pleasant Hill Road
- Sugar Camp Road
- Binning Road
- Olive Branch-Stonelick Road
- McKeever Road
- Twelvemile Road
- Bethel-New Richmond Road
- Fruit Ridge Road
- Maple Creek Road
- Felicity Cedron (two locations)
- Neville-Penn Schoolhouse Road (two locations)
- Bartlow Road

During the first Stakeholder's Planning meeting it was mentioned that the Alpine Terrace in Pierce Township is experiencing landslide issues. It is difficult to get public safety vehicles into the neighborhood due to damages sustained to the roads.

Additionally, the disaster declaration data for the county includes several incidents that note the presence of landslides and mudslides (though the landslide or mudslide may not have occurred in Clermont County). Those incidents were as follows. As can be seen, the landslides and mudslides could be a part of a more general naming convention.

- S3934: Farm Service Agency (FSA) declaration for flash flooding in 2015, listing Clermont County as a primary county with landslides and mudslides as a documented impact.
- DR-4360-OH: Severe storms in 2018, listing Clermont County as a contiguously impacted county, listing landslides as a documented impact.
- DR-4361-OH: Severe storms in 2018, listing Clermont County as a contiguously impacted county, listing landslides and mudslides as an impact.
- DR-4425-OH: Severe storms in 2019, listing Clermont County as a contiguously impacted county, listing landslides as an impact.
- DR-4428-OH: Severe storms in 2019, listing Clermont County as a contiguously impacted county, listing landslides and mudslides as an impact.

The most reliable estimate of previous occurrences comes from the ODOT data cited above. The figures show 58 active landslides plus 21 remediated, non-active slides, as well as 38 active rockslides.

Loss and Damages

Clermont County referred to the National Risk Index (FEMA, 2023) when considering potential loss and damages from landslides. Table 2.2.9.3 depicts the expected annual loss from landslides.

Table 2.2.9.3

Clermont County Landslide NRI Exposure / Expected Annual Loss Estimates					
<i>Census Tract</i>	<i>Exposure (Buildings)</i>	<i>Exposure (Pop)</i>	<i>EAL (Buildings)</i>	<i>EAL (Pop Equivalence)</i>	<i>EAL (Total)</i>
39025040101	\$12,008,891	97	\$141	\$38	\$179
39025040102	\$20,490,672	154	\$240	\$60	\$300
39025040202	\$0	0	\$0	\$0	\$0
39025040203	\$342,209,138	2,130	\$4,012	\$832	\$4,844
39025040205	\$0	0	\$0	\$0	\$0
39025040206	\$0	0	\$0	\$0	\$0
39025040301	\$394,004,701	1,616	\$4,620	\$631	\$5,251
39025040302	\$83,092,166	270	\$974	\$106	\$1,080
39025040303	\$206,805,200	1,058	\$2,425	\$413	\$2,838

Clermont County Landslide NRI Exposure / Expected Annual Loss Estimates					
Census Tract	Exposure (Buildings)	Exposure (Pop)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Total)
39025040401	\$808,381,654	2,624	\$9,478	\$1,025	\$10,503
39025040403	\$252,346	1	\$3	\$1	\$4
39025040404	\$379,913,011	1,784	\$4,455	\$697	\$5,151
39025040405	\$219,983,376	1,666	\$2,579	\$651	\$3,230
39025040500	\$852,978,630	4,092	\$10,001	\$1,598	\$11,599
39025040600	\$674,153,226	2,131	\$65,871	\$6,935	\$72,805
39025040702	\$0	0	\$0	\$0	\$0
39025040703	\$0	0	\$0	\$0	\$0
39025040704	\$17,137,569	150	\$201	\$59	\$260
39025040800	\$257,592,078	1,576	\$3,020	\$615	\$3,636
39025040900	\$263,014,629	1,674	\$3,084	\$654	\$3,737
39025041001	\$105,860,588	654	\$1,241	\$255	\$1,497
39025041002	\$539,057,331	2,025	\$52,671	\$6,592	\$59,262
39025041101	\$515,803,151	2,650	\$6,048	\$1,035	\$7,083
39025041102	\$453,128,952	1,937	\$5,313	\$757	\$6,070
39025041104	\$0	0	\$0	\$0	\$0
39025041105	\$1,498,458	18	\$18	\$7	\$25
39025041201	\$110,473,300	1,031	\$1,295	\$403	\$1,698
39025041202	\$16,711,453	100	\$196	\$39	\$235
39025041303	\$52,945,830	395	\$621	\$154	\$775
39025041304	\$23,261,608	4	\$273	\$1	\$274
39025041305	\$0	0	\$0	\$0	\$0
39025041306	\$0	0	\$0	\$0	\$0
39025041307	\$275,661,535	1,951	\$3,232	\$762	\$3,994
39025041403	\$201,851,359	1,246	\$2,367	\$486	\$2,853
39025041404	\$0	0	\$0	\$0	\$0
39025041405	\$6,174,718	31	\$72	\$12	\$85
39025041406	\$370,889,131	1,796	\$4,349	\$701	\$5,050
39025041503	\$89,847,900	831	\$1,053	\$325	\$1,378
39025041504	\$70,809,486	269	\$830	\$105	\$935
39025041505	\$186,955,865	1,139	\$2,192	\$445	\$2,637
39025041506	\$283,270,834	1,514	\$27,678	\$4,927	\$32,605
39025041600	\$415,561,099	2,242	\$40,604	\$7,298	\$47,902
39025041701	\$40,083,045	355	\$470	\$139	\$609
39025041702	\$142,102,159	776	\$1,666	\$303	\$1,969
39025041800	\$2,355,638	33	\$28	\$13	\$40
39025041900	\$54,418,239	371	\$638	\$145	\$783
39025042001	\$140,614,045	840	\$13,739	\$2,733	\$16,472
39025042002	\$323,818,931	1,323	\$3,797	\$517	\$4,314
Grand Total	\$8,955,171,944	44,553	\$281,495	\$42,467	\$323,962

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Future Occurrences

Landslides and rockslides are site-specific hazards; however, specific locations cannot be predicted with pinpoint accuracy over a large area (like Clermont County). Images above suggest areas that might experience these site-specific slides (i.e., the western and southern areas of the county, particularly along the Ohio River). Soils and slopes in these areas are the most conducive in the county to slides. Any future development near steep slopes is at risk of landslides.

Many of the historical occurrences have been related to precipitation events. Section 2.2.11: Severe Summer Weather notes the potential for future high-intensity precipitation, particularly in small, hyper-local areas. This torrential precipitation may increase the probability of landslides.

Risk Assessment

This section summarizes the vulnerability of the county to landslide. Planning stakeholders conducted an online survey for the public to share their thoughts on the hazards listed in this plan. The following table presents the results of that survey, specifically regarding landslides.

Table 2.2.9.4

Public Sentiment, Landslide					
Hazard	Level of Concern				Total Responses
	Not at All	Somewhat	Concerned	Very	
LANDSLIDE	36 (69.23%)	6 (11.54%)	4 (7.69%)	6 (11.54%)	52
In the past five years, do you remember this hazard occurring in your community?				2 (3.85%)	52
Have you noticed an increase in the occurrences or intensity of this hazard?				10 (19.23%)	52
Have you noticed a decrease in the occurrences or intensity of this hazard?				2 (3.85%)	52

Source: Online Public Survey Results

Table 2.2.9.5 assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

Table 2.2.9.5

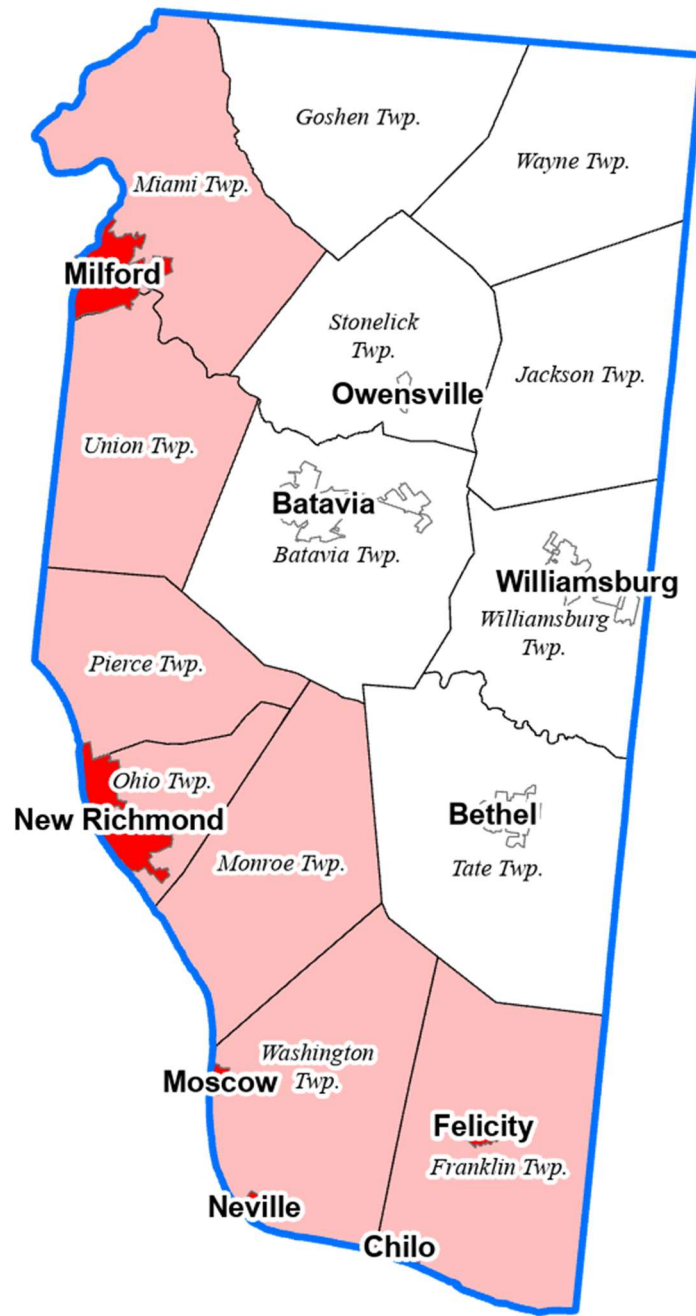
Risk Ranking, Landslide			
Category	Points	Description	Notes
Frequency	5	Frequent (Will occur during a year)	The data above suggests 58 active landslide sites and 38 active rockslide sites. These sites are active, meaning "ongoing," and as such, planners noted regular occurrence.
Response	2	One day	Many local media reports indicate one day for opening roadways impacted by landslides and rockslides.
Onset	3	6-12 hours	Landslides and rockslides, particularly those tracked by the ODOT, develop slowly over time (as indicated by inspection frequency based on tier designations). Landslides caused by heavy precipitation, though, develop more quickly. As such, planners utilized the midpoint figure of 6-12 hours for consideration of onset.
Magnitude	3	Critical (25- 50% of land area affected)	Data cited above suggest that approximately 50% of the county's land area is susceptible to landslides, but no actual incident would impact that much of the county. Actual incidents would impact far less than 10% of the land area. As such, planners ranked the magnitude category based on susceptibility and the property category (below) lower based on previous occurrences.
Business	1	Less than 24 hours	Generally, landslides would not impact businesses on a grand scale. If a slide were to impact a single business, it would be impacted for more than 24 hours; however, historical data do not show widespread and significant business impacts.
Human	2	Low (Some injuries)	Though landslides can damage property in localized areas and disrupt travel, they rarely result in significant injuries.
Property	1	Less than 10% of property affected	As noted in the discussion of magnitude above, despite much of the county being susceptible, actual landslide occurrences impact far less than 10% of the total property in Clermont County.
Totals	17	Medium	

FEMA's *Local Mitigation Planning Handbook* (2025b) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map

identifies those multi-jurisdictional risks for landslide. The jurisdictions labeled in white are not more or less at risk of landslide. Those in red are more at risk.

Figure 2.2.9.g

Landslide Multi-Jurisdictional Risk Map



2.2.10 Public Health Emergencies

A public health emergency is any adverse event (natural or human-caused) that compromises the health of the population and has the potential to cause widespread illness.				
	RISK	Period of Occurrence:	At any time	Risk Ranking: Medium
	HIGH	Warning Time:	Over 24 hours	Type of Hazard: Natural & Human-Caused
	MEDIUM	Probability:	Occasional (May or may not occur in a year)	Impact: Low (Some severe illnesses)
	LOW	Disaster Declarations:	DR-4507-OH (2020) EM-3457-OH (2020)	
	LOWEST			

Hazard Introduction and Overview

A public health emergency exists when the occurrence, or imminent threat of an illness or health condition, caused by bioterrorism, an epidemic or pandemic disease outbreak, or an infectious agent or biological toxin, poses a substantial risk to humans by either causing a significant number of fatalities or permanent or long-term disability. Public health emergencies are defined as much by their health consequences as by their causes and precipitating events. A situation becomes emergent when its health consequences have the potential to overwhelm routine community capabilities to address them. Potential causes of public health emergencies that lead to widespread illnesses include the following.

- Naturally occurring illnesses such as seasonal flu, or human-caused incidents such as the intentional release of anthrax
- Illnesses amongst the public that may cause a larger number of deaths or serious disabilities
- Illnesses resulting from highly infectious agents that are hard to control
- Illnesses resulting from a chemical attack on the public
- Illnesses resulting from the release of nuclear materials
- Other illnesses that can severely impact public health, whether resulting from natural hazards (i.e., drought, floods, invasive species, etc.) or emerging infectious diseases

In the United States, what is commonly referred to as the opioid epidemic, not for being a contagious or infectious disease, but by acting like one, has grown to alarming proportions. Opioids are drugs primarily used for pain relief; they include legal and illegal substances. Legally prescribed opioids include oxycodone, hydrocodone, and morphine. Illicit drugs include substances such as heroin and fentanyl.

Location and Extent

As the COVID-19 pandemic demonstrated, a public health emergency could occur at any time and simultaneously impact the entire county, the state of Ohio, the Nation, and even the entire world. Although the probability of a public health emergency of that magnitude striking Clermont County is relatively low, the associated vulnerability would be very high.

The most probable causes of a public health emergency in the county would be a naturally occurring illness such as seasonal flu, an illness resulting from an emerging highly infectious disease, or illnesses stemming from the occurrence of a natural disaster (i.e., severe drought, significant flooding, etc.). Instances of these illnesses could be small- or large-scale outbreaks, epidemics, or pandemics. According to the Centers for Disease Control and Prevention (CDC), there are three widely accepted “levels” of disease presence (CDC, 2015).

- **Endemic** refers to the baseline level of a particular disease in a population or area. This level is not necessarily the desired level, but the observed level.
- **Epidemic** refers to an increase in the number of cases of a disease above the usual level in that population or area. Epidemics may result from an increase in the disease's virulence, presence of a disease in a new outbreak, enhanced disease transmission, increased susceptibility among exposed persons, or increased exposure to the disease-causing agent. Note that, while the term "epidemic" originally only included infectious diseases, some non-infectious health conditions (such as obesity and opioid misuse) have reached epidemic status in the United States.
- **Outbreak** carries the same definition of an epidemic but often for a more limited geographic area.
- A **pandemic** refers to an epidemic that has spread over several countries or continents, typically affecting a large number of people.

This hazard profile considers epidemic and pandemic situations, as well as those quick and emergent outbreaks of non-novel diseases (e.g., norovirus, whooping cough, flu, covid-19) because those situations could strain the capabilities of participating jurisdictions to respond.

Epidemic outbreaks are more probable in densely populated areas, such as Union, Miam, Batavia, and Goshen townships, (though other areas with a smaller population may have a higher population density), and especially at facilities containing large numbers of occupants (e.g., multi-unit residential developments, commercial and industrial sites at which a large workforce is employed, nursing homes, hospitals, schools, and large correctional institutions), regardless of location. Figure 2.2.10.a shows the Census tracts with populations in “institutionalized group quarters” (ATSDR, 2022) identified.

According 2024 statistical data contained in the Naloxone Administration by County database, obtain from Ohio Emergency Medical Services, the following jurisdictions in Clermont County had the highest rates (i.e., rate per 10,000) of naloxone doses administered by EMS, Felicity (n=41), New Richmond (n=26), Monroe Township (n=26), and Bethel (n=18).

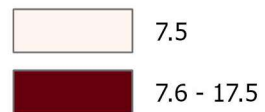
The rate of insurance coverage plays a part in the accessibility of healthcare among a population. The majority of residents in Clermont County have health insurance. Approximately 93.8% of residents aged 0 to 64 are insured (U.S. Census Bureau 2023). This is above the state rate of insured individuals, which is 92.6%. Ohio has a higher rate of insured individual rate than the national average.

CLERMONT COUNTY HAZARD MITIGATION PLAN

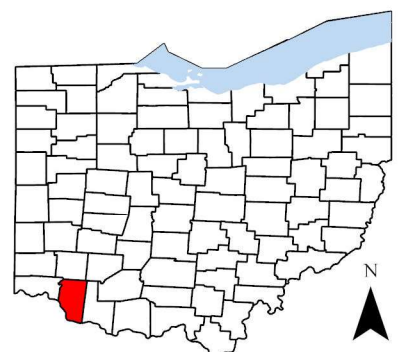
**Figure 2.2.10.a:
(SVI) % Pop. by Group
Quarters**

Data Source(s):
CDC ATSDR SVI (2020)

>5%, Group Quarters



DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



0 0.9 3.85 3.7 5.55 7.4
Miles

Provisional data from the CDC shows that 80,499 people died from a drug overdose in 2024. While still a staggering number, it reflects a 23.3% decrease from the previous year. This marks a notable decline after years of rising or plateaued overdose rates. The majority of overdose deaths continue to be driven by opioids. According to the CDC approximately 68% of all overdose deaths in 2024 included opioids. Of those, 88% were due to fentanyl and other synthetic opioids. The vast majority these opioids (i.e., fentanyl) is being brought into the U.S. by crossing the country's southern border with Mexico (DEA Intelligence Report, 2020). The opioid epidemic has, in some way, reached into the lives of nearly every person in the U.S. This disease does not have a preference for age, class, economic status, or even gender.

The Secretary of Health and Human Services issued a Determination of a Public Health Emergency on October 23, 2017, that has been renewed annually (by subsequent HHS secretaries). Along with overdose fatalities, medical professionals and researchers have linked opioid abuse to increases in other medical conditions, including Hepatitis C, HIV, and neonatal abstinence syndrome.

Although the use of prescription opioids under physician's care has made it possible for some individuals with injuries to return to work, opioids have lowered labor force participation. Federal and state budgets have also been affected by the opioid epidemic as costs for subsidized health insurance, rehabilitation, preventative programs, and child welfare programs have increased.

Impacts and Vulnerability

As noted, public health emergencies take on many forms. In these cases, communication among providers, public health officials, and the public is crucial. "Responsibility for the preparedness of a community lies not only with governmental agencies but also with active, engaged, and mobilized community residents, and businesses." (Nelson, Lurie, Wasserman, & Zakowski, 2007). Major concerns during a public health emergency include the ability of local healthcare providers to give medical attention to everyone who becomes ill, and the ability of health officials to identify the source of illness in the population. The cascading effects of public health emergencies can include:

- Illness or death,
- Civil disturbance,
- Distrust of government,
- Supply chain issues,
- Poor water quality, and
- Temporary loss of income.

An epidemic is a contagious disease that attacks many people at the same time. Epidemics can develop with little or no warning and quickly erode the capacity of local medical care providers. The potential impacts of an epidemic include severe illnesses or fatalities, disruption or closing of schools, and the forced closure of businesses and industrial operations. The extent of illness caused by a communicable or infectious disease depends on both the individual infected and the pathogen infecting them. Unlike seasonal influenza, pandemic strains of the flu virus are easily circulated and affect healthy individuals (see the table below).

Table 2.2.10.1

Seasonal Flu	Flu Pandemic
Outbreaks occur every year, usually in winter.	This occurs only rarely (only five times since 1918).
Caused by influenza viruses that are similar to those already affecting people.	Caused by a new influenza virus that people have not been exposed to before.
Healthy adults are usually not at risk for serious complications.	Healthy adults may be at increased risk for serious complications.
Hospitals and healthcare providers can usually meet public needs.	Hospitals and healthcare providers may be overwhelmed and difficult to access.
The vaccine is available at the beginning of flu season.	A vaccine would probably not be available in the initial stages of a pandemic.
It causes an average of 36,000 deaths each year in the United States.	The number of deaths could be significantly higher. In the 1918 pandemic, approximately 675,000 people died in the United States. The COVID-19 pandemic claimed more than 1,000,000 lives in the United States.
Generally, does not have a severe impact on daily life.	May have a severe impact on daily life, including widespread restrictions on travel, closings of schools and businesses, and cancellation of public events.

Public health emergencies can be exacerbated by the fact that healthcare resources can become scarce during an event. An increased number of cases and a reduced number of caregivers can overload jurisdictional or healthcare system abilities to provide medical attention to everyone who becomes ill. Further, preventative measures, such as vaccinations or prophylactic medication, may be in short supply or unavailable in a novel strain of a virus.

Public health emergencies can last several days, extend into several weeks, and in some cases, they can last for several months or years. The Clermont County Health Department has taken many steps to ensure a base level of preparedness for epidemic and pandemic conditions. Since many county residents travel, the possibility exists for novel strains to be introduced to the local population, thus validating epidemic/pandemic planning efforts.

The most probable public health emergencies within the county (i.e., naturally occurring illnesses such as seasonal flu, an emerging highly infectious disease) could affect all land areas

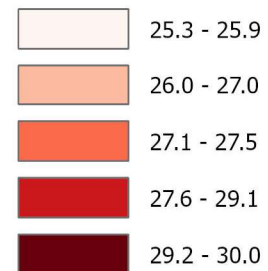
and jurisdictions equally, but certain sub-sections of the population may be more negatively impacted than others. Those most vulnerable to public health emergencies include children, the elderly, and individuals with pre-existing medical conditions and chronic illnesses. The following maps illustrate the Census block groups with the highest concentrations of those aged 17 and under (i.e., Figure 2.2.10.b) and those over 65 (i.e., Figure 2.2.10.c).

CLERMONT COUNTY HAZARD MITIGATION PLAN

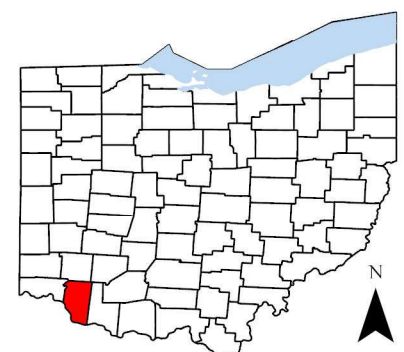
**Figure 2.2.10.b:
(SVI) Age 17 & Under**

Data Source(s):
CDC ATSDR SVI (2020)

>25%, Age 17 & Under



DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



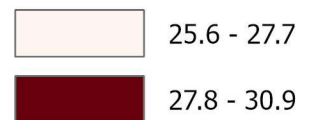
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Miles

CLERMONT COUNTY HAZARD MITIGATION PLAN

**Figure 2.2.10.c:
(SVI) Age 65+**

Data Source(s):
CDC ATSDR SVI (2020)

>25%, Age 65+

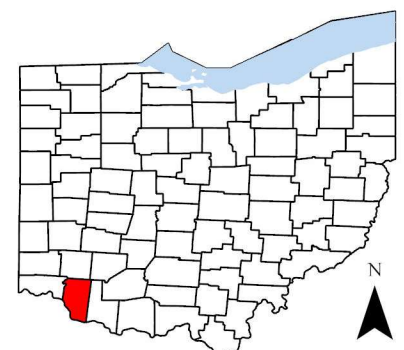


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0 0.9 3.85 3.7 5.55 7.4
Miles

Though age is a known and critical social vulnerability variable for public health situations, others with chronic conditions may find themselves more at risk. During the COVID-19 pandemic, for example, health officials generated long lists of comorbidities that could amplify the effects of COVID-19 infection. The potentially extensive and changing nature (contingent on the disease in question) makes it difficult to definitively list those at extra risk due to chronic conditions.

The impacts of the opioid crisis are numerous, and they range from individual to community levels. Losing loved ones, having children taken away and placed in foster care, worsening financial hardships, turning to prostitution, theft, etc. to pay for drugs, are some of the individual impacts. Strains on local economies and threats to local emergency services and medical officials constitute some of the community effects.

Table 2.2.10.2

Opioid Epidemic Consequence Analysis	
<i>Type of Impact</i>	<i>Description</i>
Public/Responder Health & Safety	The hazard manifests within the general population. Residents should be aware of higher crime and how to manage and handle people who exhibit addictive behavior. Having a loved one addicted to opioids may cause financial, physical, and emotional stress. First responders can be in danger when responding to overdose incidents due to the nature of unknown drugs and their side effects.
Continuity of Operations	Businesses whose employees suffer from addiction may see reduced productivity, possibly leading to a deficit of available human resources.
Property, Facilities, & Infrastructure	An increase in crime may cause some property damage.
Economic Condition	The opioid epidemic is becoming increasingly costly to residents and governments. Costs include an increase in first-response activities, hospital care, treatment, etc.
Environmental	The environmental impacts of the opioid epidemic are minimal.

Historical Occurrences

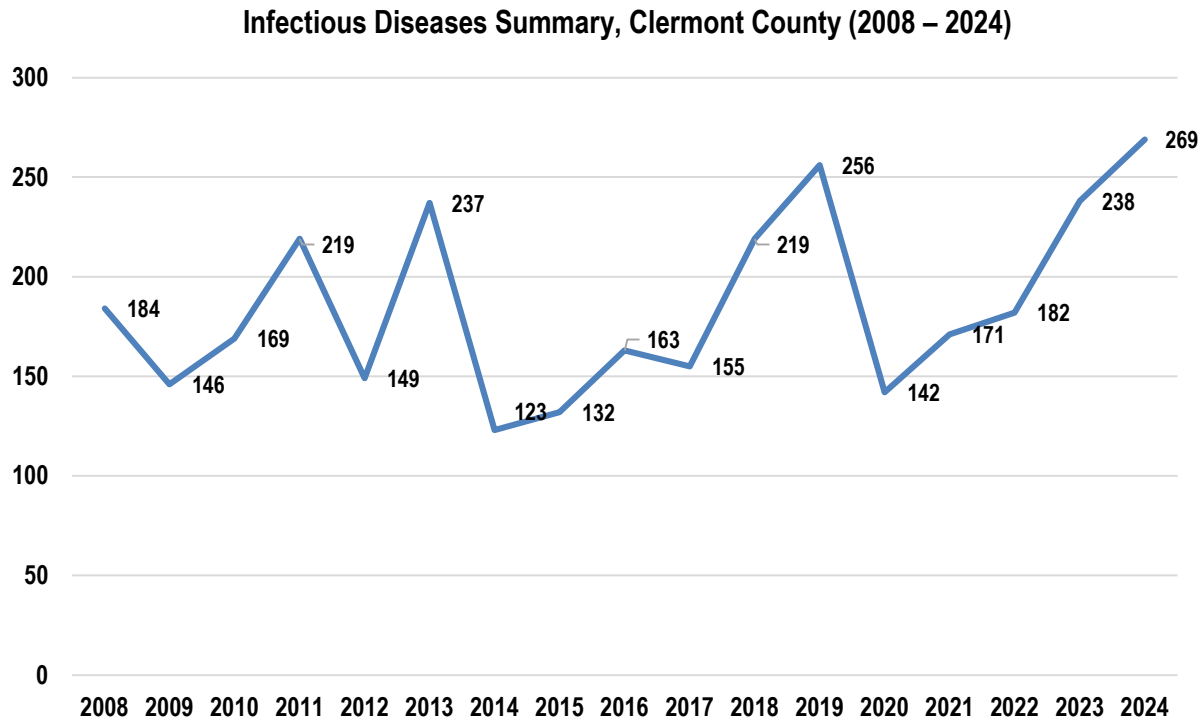
According to the Clermont County Health Department and the Ohio Department of Health (ODH), there are outbreaks of infectious disease every year. The county has experienced several outbreaks of influenza and gastroenteritis in long-term care facilities, pertussis associated with schools and daycares, and influenza at schools and correctional facilities. Specific outbreaks listed by either the ODH or the Centers for Disease Control and Prevention (CDC) appear in Table 2.2.10.3 below.

Table 2.2.10.3

Federal and State Outbreaks, 2010-2024		
Year(s)	Agent	Reporting Agency
2010	<i>Salmonella</i>	CDC
2011	<i>Listeria monocytogenes</i>	CDC
2012	Meningitis, Fungal	CDC
2012	West Nile Virus	CDC
2012	<i>E. coli</i> O145	CDC
2013	Cyclosporiasis	CDC
2013	MERS (Middle East Respiratory Syndrome)	CDC
2014	Ebola virus	CDC
2014-2015	Enterovirus	CDC
2014	Chikungunya virus	CDC
2016-2017	Zika virus	CDC
2017-2018	Hepatitis A	CDC, ODH
2019	Measles	CDC, ODH
2020-2023	Coronavirus Disease 2019 (COVID-19)	CDC, ODH
2024-Present	Dengue	CDC
2025-Present	Measles	CDC, ODH
2025-Present	<i>Salmonella</i> (linked to geckos)	CDC
2025-Present	<i>Salmonella</i> (linked to backyard poultry)	CDC
2025-Present	<i>Listeria</i> (linked to ready-to-eat foods)	CDC
2025-Present	<i>Salmonella</i> (linked to eggs)	CDC
2025-Present	<i>Salmonella</i> (linked to pistachio cream)	CDC
2025-Present	<i>Listeria</i> (linked to chicken fettuccine alfredo meals)	CDC

Planners collected information regarding reported infectious disease cases from the ODH surveillance records within the DataOhio portal (2025). Figure 2.2.8.d presents a summary of infectious diseases in Clermont County between 2008 and 2024. There were 3,154 total cases in Clermont County over the 16 year period, approximately 22.4% (i.e., 708) of which required hospitalization.

Figure 2.2.10.d



Five pandemic influenza events have occurred in the last century. The 1918 Spanish Influenza outbreak remains the worst-case pandemic on record, with the number of deaths dramatically decreasing with each event, with the exception of the recent Corona Virus, 2019 (COVID-19) pandemic.

Table 2.2.10.4

Previous Worldwide Pandemic Events		
<i>Date</i>	<i>Pandemic Name/Subtype</i>	<i>Worldwide Deaths</i>
1918 – 1920	Spanish Flu / H1N1	50 million
1957 – 1958	Asian Flu / H2N2	1 – 3 million
1968 – 1969	Hong Kong Flu / H3N2	1 million
2009 – 2010	Swine Flu / A/H1N1	25,174
2019 – 2023	Corona Virus 2019 (COVI-19) (SARS)	6.8 million (on-going)

The following narratives seek to provide context for public health emergencies in the county and wider region.

H1N1 Swine Flu Pandemic, 2009

A recent pandemic event was H1N1 (swine flu), discovered in 2009. The CDC monitored the spread of the disease on a near-daily basis. The H1N1 flu was relatively mild for most people, but the virus spread with unprecedented speed; more than 700 schools in the United States closed, and many hospitals quarantined infected individuals. H1N1 was almost entirely responsible for total anomalies resolved as health events for 2009. Ohio reported over 200 cases by late July 2009. Though relatively minor, the H1N1 pandemic was the first event to necessitate activation of many communities' pandemic response plans (following focused efforts to upgrade said plans in the mid-2000s).

Coronavirus Disease 2019 (COVID-19 / SARS-CoV-2) Pandemic (DR-4507-OH)

The most recent pandemic to impact the United States was the Coronavirus Disease 2019 (COVID-19), which is a Severe Acute Respiratory Syndrome (SARS). The virus is believed to have started spreading as early as 2018, originating from the Wuhan Institute of Virology laboratory in Wuhan, China which experiments with corona viruses. To date, there have been over 778 million confirmed cases of the virus, resulting in over seven million deaths worldwide (WHO, 2025). The virus spread to every country and continent of the world.

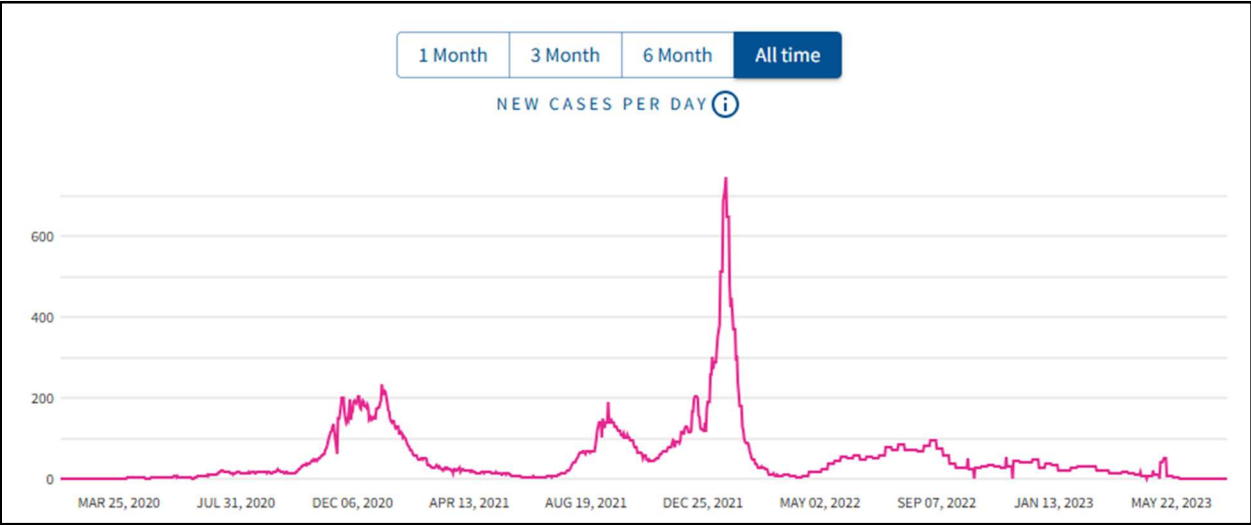
The pandemic completely shut-down the entire United States for several months due to stay-at-home and social distancing order, isolation and quarantine mandates, global air travel was restricted for several months, the pandemic had a long-term negative effect on the countries supply-chain. The overall cost of the pandemic on the US economy is in the trillions.

As of July 2023, there were approximately 3.5 million confirmed cases and over 42,000 deaths in Ohio as a result of the pandemic. USA Facts noted a total of 66,584 total reported cases of COVID-19 in Clermont County, with 622 deaths (2023). The highest spike in new cases per day occurred in January 2022, as shown in Figure 2.2.8.e below.

Highly Pathogenic Avian Influenza (HPAI) – Pierce Township, December 2025.

According to officials with the Clermont County Public Health Department final lab test results for dead vultures found in Pierce Township confirmed the birds died from Highly Pathogenic Avian Influenza (HPAI), H5, otherwise known as the “bird flu”. “The birds were first spotted in early December, with more than 70 found dead on the athletic fields near St. Bernadette School in Pierce Township (WLWT5 News, Sanderson, Jan. 5, 2026)”.

Figure 2.2.10.e



Opioid Crisis of 2017 – Ongoing

The state has seen a substantial increase in opioid overdose deaths over the years, with the rate tripling between 2010 and 2017. **Figure 2.2.8.f**

The Ohio Department of Health (ODH) maintains a record of unintentional drug overdoses. Illicit fentanyl or fentanyl analogs were involved in 78% of unintentional drug overdose deaths in 2023. Figure 2.2.8.f illustrates that Clermont County's average age-adjusted rate of unintentional drug overdose deaths was 37.3 per year over the three year period of 2020 to 2023.

According to information obtained from Ohio Public Health and the Clermont County Coroner's Office drug overdose deaths have decreased 70% in Clermont County since 2021.

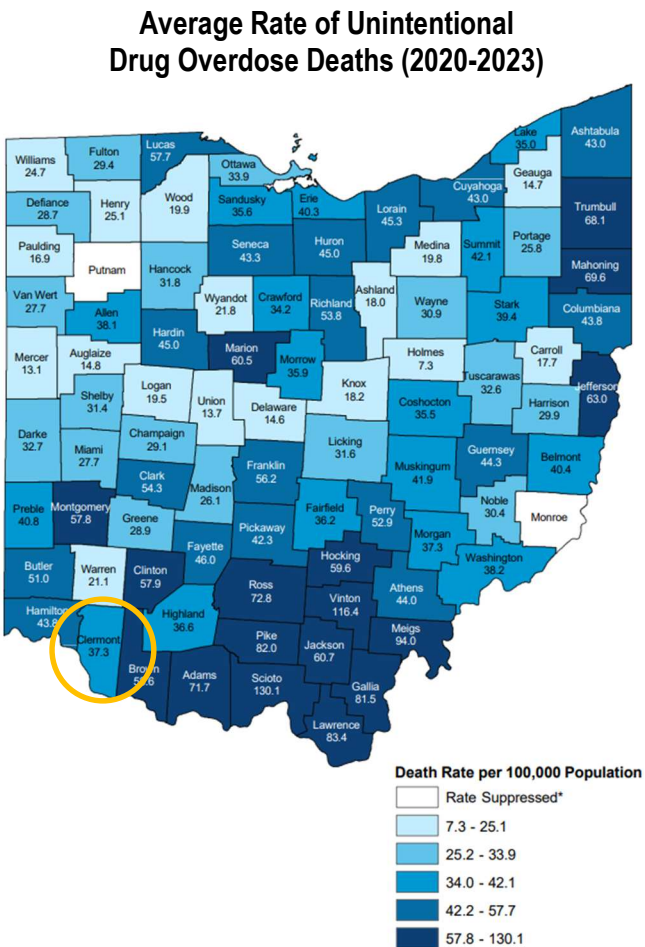
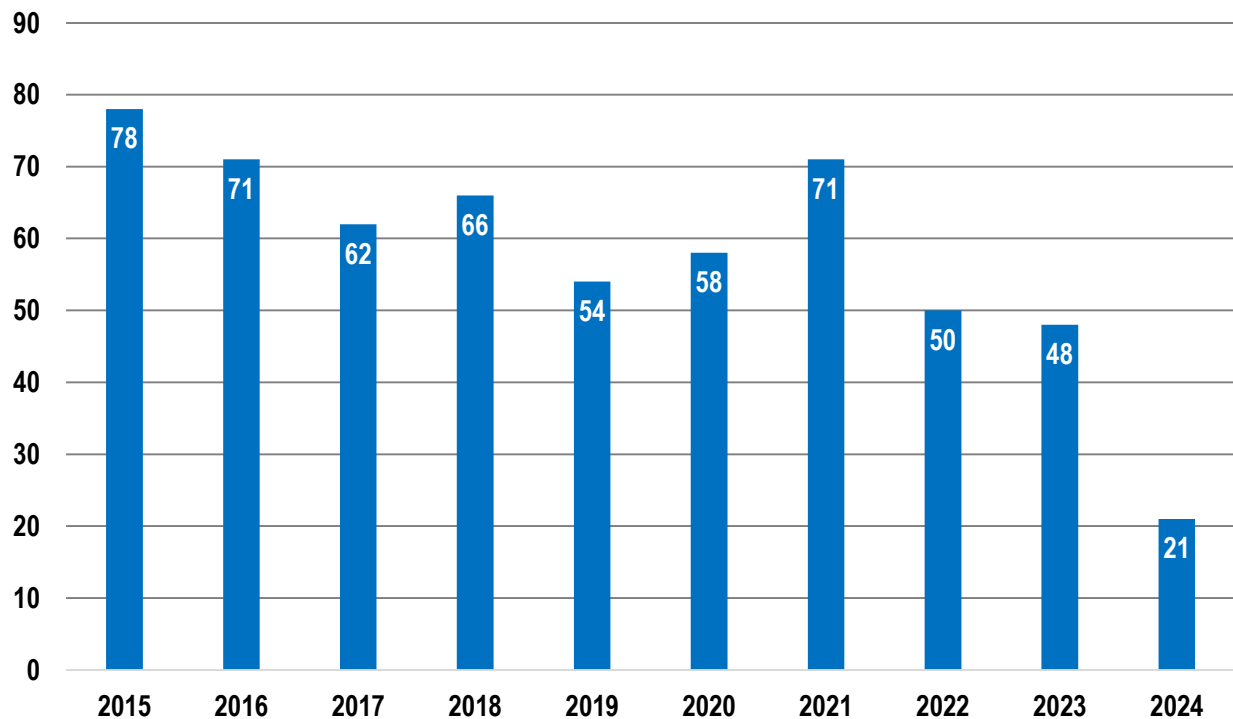


Figure 2.2.10.g

Unintentional Drug Overdose Fatalities Clermont County 2015 – 2024



Source: Ohio Public Health Info. Warehouse & Clermont County Coroner's Office

Loss and Damages

Losses based on historic epidemics are difficult to estimate. Epidemics rarely affect structures, but because they affect people, the operations of critical facilities, businesses, and other community assets may be impacted. According to a study, seasonal influenza results in a substantial economic impact, estimated, in part, at \$16.3 billion in lost earnings (Molinari et al., 2007). By population, Clermont County represents 0.06% of the population of the United States. Since seasonal influenza primarily impacts the human population, using the county's composition in the U.S. as a multiplier (i.e., 0.0006296) and applying it to the potential economic impact, lost earnings in the county could reach \$10,262,480 each year. Though that number appears high, it equates to approximately \$211 per year for each person listed by the U.S. Census Bureau as "in civilian labor force (i.e., 48,700)."

Billings (1997) indicated that the impact of the 1918 pandemic was a 2% drop in the world's gross domestic product. Further, the United States Bureau of Economic Analysis indicates that a community can use its median household income multiplied by its total number of households to determine an approximate Gross Domestic Product (GDP) for its area. As such, the average

median household income (\$83,178) and number of households (89,383) provided by the Census (U.S. Census Bureau, 2020) estimate a GDP for Clermont County of \$7,434,699,174. Using the 2% figure, the impact on the county could be as much as \$148,693,983.

Future Occurrences

Seasonal influenza activity peaks every winter, generally from December to February (CDC, 2018). These spikes may reach outbreak status, particularly in congregate settings such as nursing homes, detention facilities, and schools. Other bacterial and viral sicknesses, such as the common cold, RSV, hand-foot-mouth disease, etc., may also yield localized (i.e., site-specific) outbreaks. In the United States, the CDC surveils various conditions in concert with state and local public health entities.

The number of opioid-related deaths will likely continue to rise due to the manufacturing of synthetic opioids. Individuals who had been prescribed medication for injuries or acute pain in the past can substitute these synthetic opioids to feel the same relief or high they felt before. To combat the manufacturing and distribution of these synthetic drugs, Congress passed the Combat Methamphetamine Epidemic Act in 2005, requiring pharmacies to log all purchases of pseudoephedrine, the main ingredient used in methamphetamine. However, most methamphetamines used in the United States are manufactured in Mexico and shipped into the U.S. (NIH, 2019).

At the local level, the Clermont County Addiction and Recovery Partnership (CARP), formerly the Clermont County Opiate Task Force (OTF) has implemented multi-sector efforts to minimize substance misuse, distribution, addiction, and overdoses throughout the county.

Risk Assessment

This section summarizes the vulnerability of Clermont County to public health emergencies. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. Table 2.2.10.5 presents the results of that survey, specifically regarding health related emergencies.

Table 2.2.10.5

Public Sentiment, Public Health Emergencies					
Hazard	Level of Concern				Total Responses
	Not at All	Somewhat	Concerned	Very	
HEALTH EMERGENCIES	17 (32.69%)	20 (38.46%)	9 (17.31%)	6 (11.54%)	52
In the past five years, do you remember this hazard occurring in your community?				9 (17.31%)	52
Have you noticed an increase in the occurrences or intensity of this hazard?				21 (40.38%)	52
Have you noticed a decrease in the occurrences or intensity of this hazard?				5 (9.62%)	52

Source: Online Public Survey Results

The following table assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

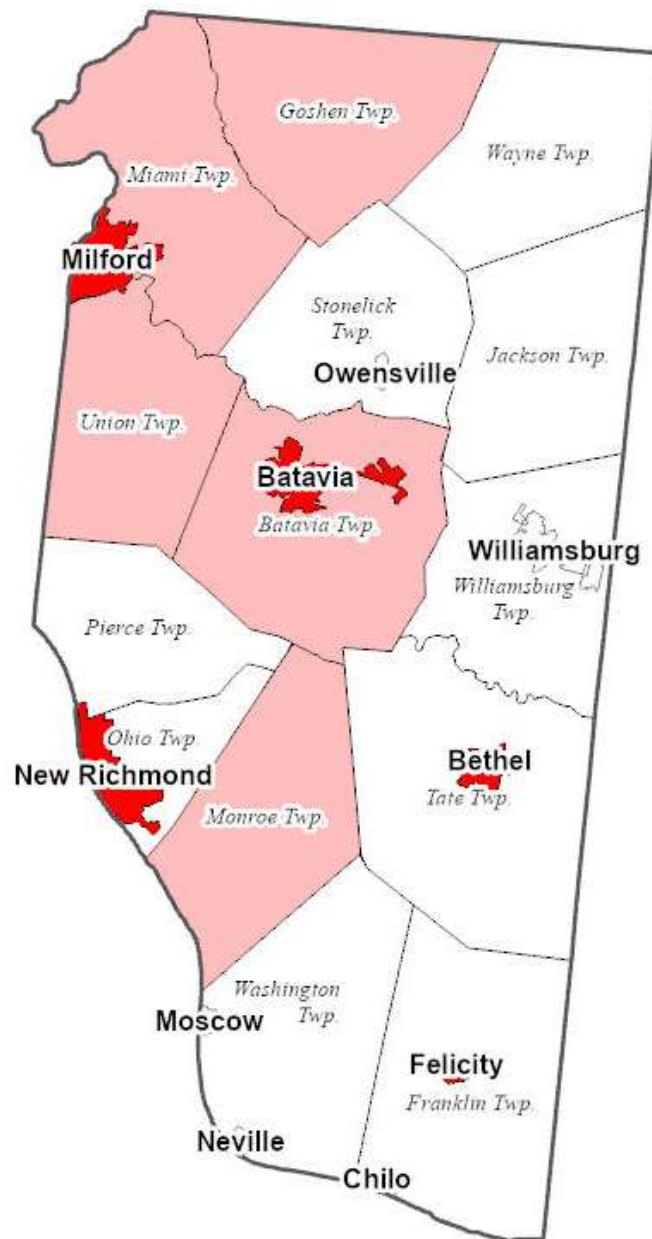
Table 2.2.10.6

Risk Ranking, Public Health Emergencies			
Category	Points	Description	Notes
Frequency	3	Occasional (May or may not occur in a year)	Clermont County can expect seasonal outbreak of infectious diseases annually. Even when considering the 2020 COVID-19 pandemic, large-scale situations would not likely occur every year.
Response	5	More than one month	Significant outbreaks and pandemic response operations can extend into months (e.g., H1N1 swine flu pandemic) or years (e.g., COVID-19 pandemic).
Onset	1	Over 24 hours	Though disease onset may be rapid, the development of large-scale impacts develop over time.
Magnitude	4	Catastrophic (More than 50% of land area affected)	Though the term <i>catastrophic</i> sounds urgent, in this case, it refers to the reality that the entire county would likely be impacted by (i.e., the entire population could be susceptible to) a public health emergency.
Business	2	One week	Even during the COVID-19 pandemic when businesses shut down, officials worked to identify alternate ways for the population to work, stores to sell their wares, etc. Thus, planners selected "One week" as a planning average.
Human	2	Low (Some severe illnesses)	Though several people may become ill, most recover from communicable diseases.
Property	1	Less than 10% of property affected	The effects of public health emergencies typically impact people not property; thus, planners selected the lowest category for property impacts.
Totals	18	MEDIUM	

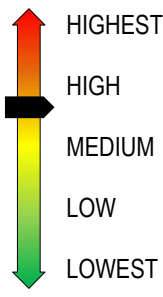
FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map identifies those multi-jurisdictional risks concerning public health emergencies. Those labels not underlaid by a shaded drop shadow are not more or less at risk. Those with red drop shadows are more at risk.

Figure 2.2.10.h

Public Health Emergencies Multi-Jurisdictional Risk Map



2.2.11 Severe Summer Weather

A severe thunderstorm is one that produces a tornado, winds in excess of 58 miles per hour, or hail one inch in diameter or larger. These storms are accompanied by lightning.				
	RISK	Period of Occurrence:	At any time, typically during late spring and summer months	Risk Ranking: Medium
		Warning Time:	12-24 hours	Type of Hazard: Natural
		Probability:	Frequent (Will occur during a year)	Impact: > 50% of land area affected)
		Disaster Declarations:	DR-238-OH (1968) DR-4002-OH (2011) DR-870-OH (1990) EM-3346-OH (2012) DR-1097-OH (1996) USDA FSA S3934 (2015) DR-1164-OH (1997) DR-4360-OH (2018) DR-1390-OH (2001) DR-4361-OH (2018) OH-L0146 (2001) DR-4424-OH (2019) DR-1556-OH (2004) DR-4428-OH (2019) DR-1805-OH (2008)	

Hazard Introduction and Overview

A thunderstorm is a local storm that is produced by a cumulonimbus cloud, accompanied by lightning and thunder, often accompanied by gusty winds, heavy rain, and occasionally by hail, and sometimes can be violent at the surface (NWS, n.d.). Table 2.2.11.1 defines the different types of thunderstorms.

Table 2.2.11.1

Types of Thunderstorms				
Type	Description	Duration	Wind Speeds	Associated Hazards
Single Cell	Uncommon	20 - 30 minutes	N/A	• Non-damaging hail • Microbursts • Weak tornadoes
Multi Cell	Common, organized cluster of two or more single cells.	Each cell lasts approximately 20 minutes	Downbursts of up to 80 mph	• Heavy rainfall • Downbursts • Hail • Weak tornadoes
Mesoscale Convective System (MCS)	Well organized system of thunderstorms	Up to 12 hours or more	55 mph or more	• Torrential rainfalls • Derechos • Tornadoes
Squall Lines	May extend over 250 to 500 miles and 10 to 20 miles wide	Individual cells last from 30 to 60 minutes		• Significant rain after the storm • Derechos

Types of Thunderstorms				
Type	Description	Duration	Wind Speeds	Associated Hazards
Super Cells	Most dangerous storms, visible with Doppler radars	1 - 6 hours	Updrafts and downdrafts of more than 100 mph	• Tornadoes • Hail

Sources: IS-271 Anticipating Hazardous Weather and Community Risk; Keller & DeVecchio, 2015

A thunderstorm that produces a tornado, winds of at least 58 mph (50 knots), and/or hail at least one inch (1") in diameter is a severe thunderstorm (NWS, 2009). Thunderstorm-associated natural hazards include lightning, hail, heavy rain, damaging winds, and tornadoes. This profile includes descriptions on thunderstorm winds, lightning, and hail; Section 2.2.14 describes tornadoes associated with thunderstorms. Thunderstorms are a seasonal hazard and can be expected to occur every year. According to the NWS the most active thunderstorm season in Ohio is late spring and early summer.

Because the potential damage severe winds and tornadoes cause and the difference in mitigation actions relating to the hazard, this profile does not include a detailed description of them. Furthermore, the IS-271 FEMA course *Anticipating Hazardous Weather and Community Risk* describes thunderstorms and tornadoes separately.

- **Lightning:** Lightning is a naturally occurring giant spark of electricity between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground; however, when the differences in the charges becomes too great, this insulating capacity of the air breaks down, and there is a rapid discharge of electricity known as lightning (NWS). Individual lightning strikes occur with no warning and kill between 75 and 100 Americans every year (Haddow, Bullock, & Coppola, 2014, p. 51.) Lightning can reach a significant distance from a storm, up to 25 miles according to the National Severe Storms Library (NSSL). While lightning is a common occurrence and can be seen in most thunderstorms, only about 20% of the lightning observed in a storm will strike the ground.
- **Hail:** Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice; the drops of ice can move upwards and downwards within the draft and become larger. When the hailstone is heavy enough, it will fall to the ground (NSSL, n.d.). Hailstones less than one inch in diameter typically fall to the ground at nine to 25 mph. Hailstones typically associated with severe thunderstorms (i.e., 1" to 1 3/4" in diameter) can fall to the ground at 40 mph. In 1986, Jonathan Webb, a member of the Tornado and

Storm Research Organization (TORRO) in England, developed the TORRO Hailstorm Intensity Scale as a way to measure and categorize hailstorms (Voss Law Firm, n.d.), see Table 2.2.11.2 below.

Table 2.2.11.2

TORRO Hailstorm Intensity Scale				
Intensity		Hail Diameter (in)	Typical Damage	Example Size Description
H0	Hard Hail	Up to 0.33	No damage.	Pea
H1	Potentially Damaging	0.33 – 0.60	Slight general damage to plants and crops.	Mothball
H2	Significant	0.60 – 0.80	Significant damage to fruit, crops, vegetation.	Marble, Grape, Dime
H3	Severe	0.80 – 1.2	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored.	Walnut, Nickel to Quarter
H4	Severe	1.2 – 1.6	Widespread glass damage, vehicle bodywork damage.	Pigeon's egg > squash ball
H5	Destructive	1.6 – 2.0	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries.	Golf ball > Pullet's egg
H6	Destructive	2.0 – 2.4	Bodywork of grounded aircraft dented, brick walls pitted.	Hen's egg
H7	Destructive	2.4 – 3.0	Severe roof damage, risk of serious injuries.	Tennis ball > Cricket ball
H8	Destructive	3.0 – 3.5	(Severest recorded in the British Isles) Severe damage to aircraft bodywork.	Large orange > Soft ball
H9	Super Hailstorms	3.5 – 4.0	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open.	Grapefruit
H10	Super Hailstorms	4.0+	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open.	Melon

Severe wind includes non-tornadic winds from thunderstorms. There are six types of severe wind: straight-line wind, downbursts, macrobursts, microbursts, gust fronts, and Derechos.

- **Straight-line Wind:** Straight-line wind is a term used to define any thunderstorm wind not associated with rotation, used mainly to differentiate from tornadic winds.
- **Downburst:** Downburst is the general term for all localized strong wind events caused by a strong downdraft within a thunderstorm.
- **Macroburst:** An outward burst of strong winds at or near the surface with a diameter larger than 2.5 miles that occurs when a strong downdraft reaches the surface.

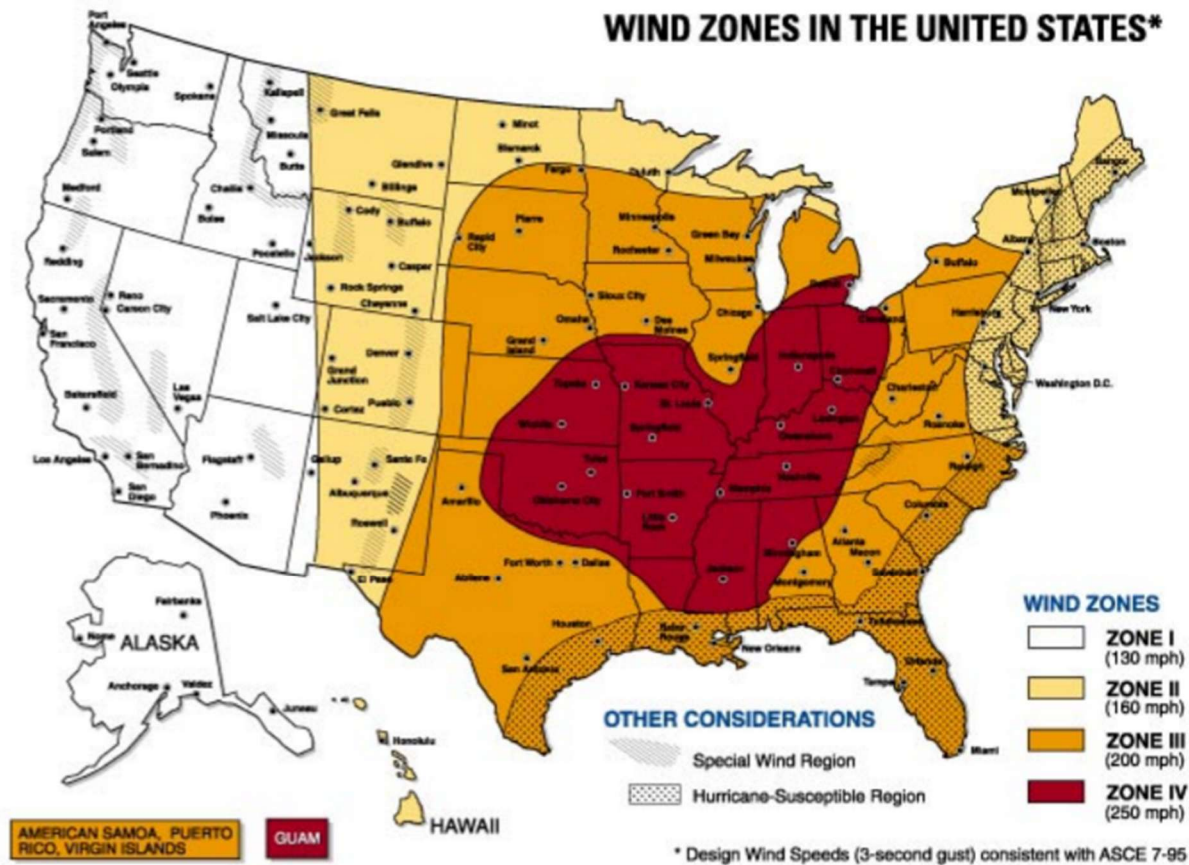
- **Microburst:** A small, concentrated downburst that produces an outward burst of strong winds near the surface. Microbursts are small and short-lived, with a diameter less than 2.5 miles and lasting only 5-10 minutes.
- **Gust Front:** The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. It is characterized by a wind shift, temperature drop, and gusty winds ahead of a thunderstorm.
- **Derecho:** A widespread, long-lived windstorm associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts and downbursts. An event with wind speeds of at least 58mph and a diameter of 240 miles is a derecho.

Location and Extent

Severe thunderstorms and associated hail and lightning are hazards that can affect all areas and jurisdictions of the county. Clermont, as well as surrounding counties, is at similar risk of exposure to severe thunderstorms. Severe thunderstorms have the potential of lasting seconds (i.e., lightning), a few minutes (i.e., tornadoes), several hours (i.e., thunderstorms, hailstorms, etc.), or even days (i.e., high winds).

The wind is a commonplace phenomenon across the globe. Wind events can impact several jurisdictions at the same time, with varying duration and severity. All of Clermont County is at an equal risk of experiencing severe wind. FEMA's wind zone map classifies wind zones in the United States. As shown in Figure 2.2.11.a below, the majority of the state of Ohio is located in the highest zone (i.e., Zone IV), the entirety of Clermont County also lies within the Zone IV area. Buildings located in a Zone IV area should be constructed to withstand three-second gusts of up to 250 mph.

Figure 2.2.11.a



The Beaufort Wind Scale measures wind. This scale characterizes wind using a 0-12 metric based on observation rather than exact measurements. Table 2.2.11.3 outlines the scale in detail.

Table 2.2.11.3

Beaufort Wind Scale					
Force	Wind Speed		Description	Appearance of Wind Effects	
	Knots	MPH		On Water	On Land
0	>1	>1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	4-7	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	8-12	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended

Beaufort Wind Scale					
Force	Wind Speed		Description	Appearance of Wind Effects	
	Knots	MPH		On Water	On Land
4	11-16	13-18	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	19-24	Fresh Breeze	Moderate waves 4-8 ft. taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	25-31	Strong Breeze	Larger waves 8-13 ft., whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	32-38	Near Gale	Sea heaps up, waves 13-19 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	39-46	Gale	Moderately high (18-25 ft.) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	41-47	47-54	Strong Gale	High waves (23-32 ft.), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	55-63	Storm	Very high waves (29-41 ft.) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	64-72	Violent Storm	Exceptionally high (37-52 ft.) waves, foam patches cover sea, visibility more reduced	N/A
12	64+	72+	Hurricane	Air filled with foam, waves over 45 ft., sea completely white with driving spray, visibility greatly reduced	N/A

Impacts and Vulnerability

There are many impacts of severe summer weather events. Here are a few listed under each category.

- **Lightning:** Can cause injury and even death. In some cases, lightning is known to cause fires in structures and open land or forests.
- **Hailstorms:** Can cause injury to humans and animals if directly exposed, damage to vegetation and infrastructure.
- **Thunderstorm Winds:** Causes respiratory illnesses, damage to the vegetation (fallen trees), and can cause damage to infrastructure due to flying debris.

The impacts of severe thunderstorms can include widespread property damage, injuries, and even fatalities. Hailstones can be the most damaging part of a severe thunderstorm, inflicting injuries and destroying crops like a giant pummeling machine. Hailstone damage is often confined to automobiles and crops; however, structural damage is a possibility in the form of broken windows, damaged gutters, HVAC systems, and siding. Table 2.2.11.4 outlines the typical impacts of a hailstorm.

Table 2.2.11.4

Intensity (TORRO Scale)	Typical Damage Impacts
H0	No Damage
H1	Slight damage to plants, crops
H2	Significant damage to fruit, crops, vegetation
H3	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Widespread glass damage, vehicle bodywork damage
H5	The wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Bodywork of grounded aircraft dented, brick walls pitted
H7	Severe roof damage, risk of serious injuries
H8	Severe damage to aircraft bodywork
H9	Extensive structural damage. Risk of severe or fatal injuries to persons caught in the open
H10	Extensive structural damage. Risk of severe or fatal injuries to persons caught in the open

In some cases, lightning has caused fires in structures and open land or forests. A bolt of lightning reaches a temperature of 50,000 degrees Fahrenheit in a split second. Ohio averages four deaths and 15 injuries per year as a result of lightning. Individual lightning strikes occur with no warning and kill between 75 and 100 Americans every year (Haddow, Bullock, & Coppola, 2014, pg.51.) Heavy rains can damage vegetation and infrastructure and cause flash flooding. Recently, some of the most damaging impacts of severe thunderstorms have been the cascading effects of long-duration power outages.

Severe wind events can cause a variety of secondary and tertiary hazard events. In addition to damaging roofs and other home finishing's, wind can cause damage to trees that may interrupt power service or block roadways. Such damages could be widespread and severe, potentially overwhelming the capacity of local responders to address the situation. Individuals living in mobile homes are especially at risk of injury and death due to strong thunderstorm winds. Even anchored mobile homes can be seriously damaged if winds gust over 80 mph.

As with all hazards, severe thunderstorms can also affect the mental health of the population causing anxiety, panic attacks, and post-traumatic stress. Vulnerable populations can

include those who are unable to evacuate during a severe weather event, those with health issues that may be exacerbated, as well as children and elderly adults. If poor populations are unable to obtain necessary shelter during an event, they will be at higher risk and may be more vulnerable to the effects of that event.

Historical Occurrences

According to the National Oceanic and Atmospheric Administration's (NOAAs) National Centers for Environmental Information (NCEI) Storm Events Database, Clermont County has experienced 301 severe summer weather events since 1965. This rate is an average of 5.10 severe summer weather events per year. Thunderstorm winds accounted for 73% of the total events and accounted for the most property damage at approximately \$3 million. Table 2.2.11.5 summarizes those incidents.

Table 2.2.11.5

Historical Severe Summer Weather Occurrences								
Thunderstorm Winds (1965 to 2024)								
Total Events	Areas Affected	Avg. Events / Year	Wind Speeds		Injuries	Fatalities	Damages	
			Avg.	Highest			Property	Crop
219	48	3.71	50 kts.	78 kts.	1	0	\$2.8M	\$0
Most thunderstorm events in one year = 12 in 2019					Most common months = June, July			
Hail (1977 to 2024)								
Total Events	Areas Affected	Avg. Events / Year	Hail Size		Injuries	Fatalities	Damages	
			Avg.	Largest			Property	Crop
76	23	1.62	0.75"	2.5"	0	0	\$2.7M	\$550K
Most hail events in one year = 8 in 2012					Number of events with property damage = 18			
Lightning (1996 to 2024)								
Total Events	Areas Affected	Avg. Events / Year	Injuries	Fatalities	Damages			
					Property	Crop		
6	4	0.21	5	0	\$61K	\$0		
Most lightning events in one year = 4 in 1996			Most common months = May and June					

Source: NOAA – NCEI, Storm Event Database

Miami & Wayne Townships – April 8, 2020

Severe thunderstorms moved east-southeast through Clermont County during the evening hours. The storms evolved into a well-organized bow echo, producing widespread straight line wind damage in Miami Township (Day Heights), and produced two tornadoes in Wayne Township. The NWS confirmed windspeeds of 80 to 90 mph in the Day Heights area.

Countywide Derecho – June 29, 2012

A very hot and potentially unstable airmass interacted with northwesterly flow aloft to produce a derecho. This derecho rapidly moved east across the Ohio Valley producing widespread straight line wind damage and power outages regionwide during a period of extreme heat. Trees were down throughout all of Clermont County. Isolated large hail also occurred with the stronger portions of the system. The storm's path extended from the Midwest to the Mid-Atlantic. The derecho resulted in approximately \$2.9 billion in damages across all states affected (NWS, 2012).

Felicity Village Hailstorm – July 14, 2000

A supercell thunderstorm dropped hail across the Felicity area for more than 10 minutes. The largest hail reported during this event was the size of tennis balls (i.e., 2.5" diameter). Significant damage was sustained to tobacco and corn crops in the area. There were also reports of damages to car and house windows. This hailstorm resulted in approximately \$100,000 in reported property damage and \$500,000 in crop damage.

Union Townships Lightning – May 24, 1996

On May 24, 1996, at approximately 10:00 p.m., lightning struck a 48-unit apartment complex. This strike resulted in half of the complex sustaining major to moderate damages. This event resulted in \$50,000 in reported property damage.

Loss and Damages

Severe summer weather events have resulted in approximately \$6.1 million in reported property and crop damages over a 59-year period in Clermont County. The average loss associated with these events was \$20,302 per event; therefore, \$20,302 can serve as a severe summer weather loss estimate. As implied above, lightning result in substantially fewer losses than severe thunderstorm winds and hail. For hailstorms, the 76 hail events that have occurred in Clermont County have caused approximately \$3.3 million worth of damages. As such, the average loss from hail events is \$43,000. And for lightning, the six events that have occurred have resulted in approximately \$61,000 in reported property damages, thus an average loss from lightning is \$10,000 per event.

Information obtained from FEMA's National Risk Index (NRI) was utilized to assess severe summer weather impacts (i.e., hail, lightning, and strong winds) for each participating jurisdiction, see Table 2.2.11.6 through 2.2.11.8 below.

Table 2.2.11.6

Clermont County Hail NRI Exposure / Expected Annual Loss Estimates							
Census Tract	Exposure (Buildings)	Exposure (Pop)	Exposure (Ag)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Ag)	EAL (Total)
39025040101	\$565,964,912	5,071	\$11,863,729	\$3,503	\$72	\$1,917	\$5,492
39025040102	\$296,093,220	2,648	\$1,640,799	\$1,821	\$38	\$264	\$2,122
39025040202	\$332,271,724	2,215	\$1,802,394	\$2,123	\$33	\$300	\$2,456
39025040203	\$1,022,070,560	6,230	\$732,952	\$6,519	\$92	\$122	\$6,733
39025040205	\$341,676,114	3,192	\$26,858	\$2,088	\$45	\$4	\$2,137
39025040206	\$894,653,283	4,463	\$852,559	\$5,658	\$64	\$137	\$5,859
39025040301	\$889,865,533	3,979	\$8,845	\$5,691	\$59	\$1	\$5,751
39025040302	\$950,572,549	3,900	\$85,348	\$6,079	\$57	\$14	\$6,151
39025040303	\$1,429,187,632	7,628	\$41,135	\$8,955	\$110	\$7	\$9,072
39025040401	\$968,154,343	3,349	\$16,266	\$5,931	\$47	\$3	\$5,981
39025040403	\$499,144,737	2,786	\$1,421	\$3,047	\$39	\$0	\$3,087
39025040404	\$988,884,593	3,974	\$3,570	\$6,057	\$56	\$1	\$6,114
39025040405	\$549,076,131	3,101	\$5,525	\$3,506	\$46	\$1	\$3,552
39025040500	\$1,064,910,314	5,082	\$8,913	\$6,501	\$72	\$1	\$6,574
39025040600	\$1,669,457,750	7,439	\$119,637	\$10,192	\$105	\$19	\$10,316
39025040702	\$565,211,242	4,351	\$48,809	\$3,451	\$61	\$8	\$3,520
39025040703	\$538,186,019	3,479	\$152	\$3,286	\$49	\$0	\$3,335
39025040704	\$624,067,866	3,949	\$1,000	\$3,810	\$56	\$0	\$3,866
39025040800	\$959,839,371	5,663	\$1,864,725	\$5,860	\$80	\$297	\$6,237
39025040900	\$1,041,851,226	5,682	\$3,329,092	\$6,361	\$80	\$530	\$6,971
39025041001	\$970,109,996	5,861	\$761,073	\$5,923	\$82	\$121	\$6,126
39025041002	\$894,322,825	3,092	\$669,277	\$5,460	\$44	\$107	\$5,610
39025041101	\$613,673,503	3,411	\$86,377	\$3,747	\$48	\$14	\$3,808
39025041102	\$957,999,896	5,352	\$134,546	\$5,849	\$75	\$21	\$5,945
39025041104	\$710,098,998	3,822	\$4,882	\$4,335	\$54	\$1	\$4,390
39025041105	\$610,093,661	6,110	\$42,215	\$3,725	\$86	\$7	\$3,817
39025041201	\$525,625,929	4,125	\$2,223	\$3,209	\$58	\$0	\$3,267
39025041202	\$1,271,849,462	5,024	\$27,920	\$7,765	\$71	\$4	\$7,840
39025041303	\$704,821,673	5,036	\$5,454	\$4,303	\$71	\$1	\$4,375
39025041304	\$26,506,533	23	\$1,446	\$162	\$0	\$0	\$162
39025041305	\$815,199,374	5,269	\$2,303	\$4,977	\$74	\$0	\$5,051
39025041306	\$1,086,996,949	5,438	\$35,432	\$6,636	\$77	\$6	\$6,718
39025041307	\$948,021,715	4,896	\$335,035	\$5,788	\$69	\$53	\$5,910
39025041403	\$704,717,021	4,378	\$3,140	\$4,302	\$62	\$1	\$4,364
39025041404	\$648,431,113	4,834	\$349	\$3,959	\$68	\$0	\$4,027
39025041405	\$611,782,206	5,384	\$4,874	\$3,735	\$76	\$1	\$3,812
39025041406	\$1,115,877,913	5,230	\$20,319	\$6,813	\$74	\$3	\$6,889
39025041503	\$597,864,510	4,730	\$68,123	\$3,650	\$67	\$11	\$3,727
39025041504	\$724,979,932	3,958	\$38,036	\$4,426	\$56	\$6	\$4,488
39025041505	\$677,709,159	3,600	\$38,988	\$4,137	\$51	\$6	\$4,194
39025041506	\$533,329,739	2,794	\$78,225	\$3,256	\$39	\$12	\$3,308
39025041600	\$825,972,684	5,533	\$167,793	\$5,043	\$78	\$27	\$5,147
39025041701	\$483,864,900	4,308	\$774,370	\$2,954	\$61	\$123	\$3,138
39025041702	\$474,675,733	3,223	\$1,066,047	\$2,898	\$45	\$170	\$3,113

Clermont County Hail NRI Exposure / Expected Annual Loss Estimates							
Census Tract	Exposure (Buildings)	Exposure (Pop)	Exposure (Ag)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Ag)	EAL (Total)
39025041800	\$556,003,358	3,637	\$231,955	\$3,394	\$51	\$37	\$3,483
39025041900	\$791,512,363	5,525	\$4,780,435	\$4,832	\$78	\$761	\$5,671
39025042001	\$505,801,751	3,401	\$2,639,954	\$3,088	\$48	\$420	\$3,556
39025042002	\$499,144,852	2,352	\$1,968,343	\$3,047	\$33	\$314	\$3,394
Grand Total	\$36,078,126,867	208,527	\$36,442,863	\$221,852	\$2,953	\$5,854	\$230,660

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Table 2.2.11.7

Clermont County Lightning NRI Exposure / Expected Annual Loss Estimates					
Census Tract	Exposure (Buildings)	Exposure (Pop)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Total)
39025040101	\$565,964,912	5,071	\$105	\$5,802	\$5,907
39025040102	\$296,093,220	2,648	\$55	\$3,061	\$3,117
39025040202	\$332,271,724	2,215	\$62	\$2,552	\$2,614
39025040203	\$1,022,070,560	6,230	\$195	\$7,341	\$7,535
39025040205	\$341,676,114	3,192	\$67	\$3,877	\$3,944
39025040206	\$894,653,283	4,463	\$172	\$5,341	\$5,514
39025040301	\$889,865,533	3,979	\$179	\$4,947	\$5,126
39025040302	\$950,572,549	3,900	\$177	\$4,483	\$4,660
39025040303	\$1,429,187,632	7,628	\$291	\$9,639	\$9,930
39025040401	\$968,154,343	3,349	\$205	\$4,369	\$4,574
39025040403	\$499,144,737	2,786	\$108	\$3,726	\$3,834
39025040404	\$988,884,593	3,974	\$213	\$5,296	\$5,510
39025040405	\$549,076,131	3,101	\$112	\$3,904	\$4,016
39025040500	\$1,064,910,314	5,082	\$232	\$6,847	\$7,079
39025040600	\$1,669,457,750	7,439	\$357	\$9,941	\$10,298
39025040702	\$565,211,242	4,351	\$115	\$5,485	\$5,599
39025040703	\$538,186,019	3,479	\$117	\$4,659	\$4,776
39025040704	\$624,067,866	3,949	\$136	\$5,330	\$5,466
39025040800	\$959,839,371	5,663	\$190	\$6,933	\$7,123
39025040900	\$1,041,851,226	5,682	\$205	\$6,920	\$7,125
39025041001	\$970,109,996	5,861	\$191	\$7,170	\$7,361
39025041002	\$894,322,825	3,092	\$184	\$3,942	\$4,126
39025041101	\$613,673,503	3,411	\$130	\$4,438	\$4,568
39025041102	\$957,999,896	5,352	\$193	\$6,560	\$6,752
39025041104	\$710,098,998	3,822	\$138	\$4,572	\$4,710
39025041105	\$610,093,661	6,110	\$124	\$7,678	\$7,802
39025041201	\$525,625,929	4,125	\$107	\$5,154	\$5,260
39025041202	\$1,271,849,462	5,024	\$256	\$6,288	\$6,544
39025041303	\$704,821,673	5,036	\$149	\$6,554	\$6,702
39025041304	\$26,506,533	23	\$5	\$28	\$33
39025041305	\$815,199,374	5,269	\$166	\$6,613	\$6,779
39025041306	\$1,086,996,949	5,438	\$233	\$7,157	\$7,390

Clermont County Lightning NRI Exposure / Expected Annual Loss Estimates					
Census Tract	Exposure (Buildings)	Exposure (Pop)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Total)
39025041307	\$948,021,715	4,896	\$199	\$6,302	\$6,501
39025041403	\$704,717,021	4,378	\$162	\$6,216	\$6,378
39025041404	\$648,431,113	4,834	\$135	\$6,205	\$6,339
39025041405	\$611,782,206	5,384	\$137	\$7,425	\$7,562
39025041406	\$1,115,877,913	5,230	\$234	\$6,751	\$6,985
39025041503	\$597,864,510	4,730	\$125	\$6,141	\$6,266
39025041504	\$724,979,932	3,958	\$150	\$5,067	\$5,217
39025041505	\$677,709,159	3,600	\$140	\$4,581	\$4,721
39025041506	\$533,329,739	2,794	\$109	\$3,533	\$3,642
39025041600	\$825,972,684	5,533	\$163	\$6,772	\$6,935
39025041701	\$483,864,900	4,308	\$96	\$5,279	\$5,375
39025041702	\$474,675,733	3,223	\$96	\$4,012	\$4,107
39025041800	\$556,003,358	3,637	\$114	\$4,597	\$4,710
39025041900	\$791,512,363	5,525	\$165	\$7,161	\$7,326
39025042001	\$505,801,751	3,401	\$101	\$4,226	\$4,327
39025042002	\$499,144,852	2,352	\$103	\$3,023	\$3,126
Grand Total	\$36,078,126,867	208,527	\$7,397	\$263,896	\$271,294

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Table 2.2.11.8

Clermont County Strong Wind NRI Exposure / Expected Annual Loss Estimates							
Census Tract	Exposure (Buildings)	Exposure (Pop)	Exposure (Ag)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Ag)	EAL (Total)
39025040101	\$565,964,912	5,071	\$11,863,729	\$16,618	\$6,872	\$7	\$23,498
39025040102	\$296,093,220	2,648	\$1,640,799	\$9,090	\$3,815	\$1	\$12,906
39025040202	\$332,271,724	2,215	\$1,802,394	\$7,425	\$2,313	\$1	\$9,739
39025040203	\$1,022,070,560	6,230	\$732,952	\$23,250	\$6,603	\$0	\$29,854
39025040205	\$341,676,114	3,192	\$26,858	\$10,977	\$4,779	\$0	\$15,756
39025040206	\$894,653,283	4,463	\$852,559	\$22,065	\$5,596	\$1	\$27,662
39025040301	\$889,865,533	3,979	\$8,845	\$19,717	\$4,108	\$0	\$23,826
39025040302	\$950,572,549	3,900	\$85,348	\$21,063	\$4,026	\$0	\$25,089
39025040303	\$1,429,187,632	7,628	\$41,135	\$38,131	\$9,659	\$0	\$47,790
39025040401	\$968,154,343	3,349	\$16,266	\$30,557	\$4,902	\$0	\$35,458
39025040403	\$499,144,737	2,786	\$1,421	\$16,124	\$4,193	\$0	\$20,317
39025040404	\$988,884,593	3,974	\$3,570	\$31,239	\$5,857	\$0	\$37,096
39025040405	\$549,076,131	3,101	\$5,525	\$12,373	\$3,232	\$0	\$15,605
39025040500	\$1,064,910,314	5,082	\$8,913	\$34,399	\$7,649	\$0	\$42,048
39025040600	\$1,669,457,750	7,439	\$119,637	\$53,928	\$11,197	\$0	\$65,124
39025040702	\$565,211,242	4,351	\$48,809	\$18,258	\$6,549	\$0	\$24,807
39025040703	\$538,186,019	3,479	\$152	\$17,385	\$5,236	\$0	\$22,621
39025040704	\$624,067,866	3,949	\$1,000	\$20,159	\$5,944	\$0	\$26,103
39025040800	\$959,839,371	5,663	\$1,864,725	\$31,005	\$8,523	\$1	\$39,530
39025040900	\$1,041,851,226	5,682	\$3,329,092	\$33,655	\$8,552	\$2	\$42,209

Clermont County Strong Wind NRI Exposure / Expected Annual Loss Estimates							
Census Tract	Exposure (Buildings)	Exposure (Pop)	Exposure (Ag)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Ag)	EAL (Total)
39025041001	\$970,109,996	5,861	\$761,073	\$31,337	\$8,821	\$1	\$40,159
39025041002	\$894,322,825	3,092	\$669,277	\$28,889	\$4,654	\$0	\$33,543
39025041101	\$613,673,503	3,411	\$86,377	\$19,823	\$5,134	\$0	\$24,957
39025041102	\$957,999,896	5,352	\$134,546	\$30,946	\$8,055	\$0	\$39,001
39025041104	\$710,098,998	3,822	\$4,882	\$22,938	\$5,753	\$0	\$28,691
39025041105	\$610,093,661	6,110	\$42,215	\$19,708	\$9,196	\$0	\$28,904
39025041201	\$525,625,929	4,125	\$2,223	\$16,979	\$6,209	\$0	\$23,188
39025041202	\$1,271,849,462	5,024	\$27,920	\$41,084	\$7,562	\$0	\$48,646
39025041303	\$704,821,673	5,036	\$5,454	\$22,768	\$7,580	\$0	\$30,347
39025041304	\$26,506,533	23	\$1,446	\$856	\$35	\$0	\$891
39025041305	\$815,199,374	5,269	\$2,303	\$26,333	\$7,930	\$0	\$34,264
39025041306	\$1,086,996,949	5,438	\$35,432	\$35,113	\$8,185	\$0	\$43,298
39025041307	\$948,021,715	4,896	\$335,035	\$30,624	\$7,369	\$0	\$37,993
39025041403	\$704,717,021	4,378	\$3,140	\$22,764	\$6,589	\$0	\$29,354
39025041404	\$648,431,113	4,834	\$349	\$20,946	\$7,276	\$0	\$28,222
39025041405	\$611,782,206	5,384	\$4,874	\$19,762	\$8,104	\$0	\$27,866
39025041406	\$1,115,877,913	5,230	\$20,319	\$36,046	\$7,872	\$0	\$43,918
39025041503	\$597,864,510	4,730	\$68,123	\$19,313	\$7,119	\$0	\$26,432
39025041504	\$724,979,932	3,958	\$38,036	\$23,419	\$5,957	\$0	\$29,376
39025041505	\$677,709,159	3,600	\$38,988	\$21,892	\$5,418	\$0	\$27,310
39025041506	\$533,329,739	2,794	\$78,225	\$17,228	\$4,205	\$0	\$21,433
39025041600	\$825,972,684	5,533	\$167,793	\$26,681	\$8,328	\$0	\$35,009
39025041701	\$483,864,900	4,308	\$774,370	\$15,630	\$6,484	\$1	\$22,115
39025041702	\$474,675,733	3,223	\$1,066,047	\$15,333	\$4,851	\$1	\$20,185
39025041800	\$556,003,358	3,637	\$231,955	\$17,960	\$5,474	\$0	\$23,435
39025041900	\$791,512,363	5,525	\$4,780,435	\$25,568	\$8,316	\$3	\$33,887
39025042001	\$505,801,751	3,401	\$2,639,954	\$16,339	\$5,119	\$2	\$21,459
39025042002	\$499,144,852	2,352	\$1,968,343	\$16,124	\$3,540	\$1	\$19,665
Grand Total	\$36,078,126,867	208,527	\$36,442,863	\$1,109,820	\$300,740	\$24	\$1,410,584

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Future Occurrences

Severe thunderstorms may impact infrastructure systems like the power grid and stormwater management features. High winds can affect electricity distribution systems, and as those systems age, they may be more prone to the effects of said weather. Thus, future severe thunderstorms may be accompanied by more frequent (and longer-duration) power outages. Additionally, more intense precipitation compounded by the rapid gathering of increased runoff may strain the ability of aging dams to perform as designed.

According to the USEPA, annual precipitation in most of Ohio has increased since the first half of the 20th century, “and precipitation from extremely heavy rainstorms in the eastern United

States increased by more than 25 percent since 1958” USEPA, 2016). The USEPA anticipates continued increases in average annual precipitation as well as in the frequency of heavy downpours.

Clermont County includes communities that range from very rural to more urban. In the rural areas with fewer impervious surfaces, the natural features will manage increased precipitation differently than the more urbanized areas. Increased runoff will be a countywide concern, but in the rural areas, the natural features will absorb more of the water than in the urban areas with more land covered by impervious materials.

Risk Assessment

This section summarizes the vulnerability of Clermont County to severe summer weather. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. The following table presents the results of that survey, specifically regarding severe summer weather.

Table 2.2.11.9

Public Sentiment, Severe Summer Weather					
Hazard	Level of Concern				Total Responses
	Not at All	Somewhat	Concerned	Very	
SEVERE SUMMER WEATHER	13 (25.0%)	14 (26.92%)	14 (26.92%)	11 (21.15%)	52
In the past five years, do you remember this hazard occurring in your community?				20 (38.46%)	52
Have you noticed an increase in the occurrences or intensity of this hazard?				24 (46.15%)	52
Have you noticed a decrease in the occurrences or intensity of this hazard?				0 (0.00%)	52

Source: Online Public Survey Results

The following table assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA’s Mitigation Information Portal (MIP) tool.

Table 2.2.11.10

Risk Ranking, Severe Summer Weather			
Category	Points	Description	Notes
Frequency	5	Frequent (Will occur during a year)	There have been 301 severe summer weather events since 1965, a 59-year period, for an average of 5.1 incidents per year.
Response	2	One day	The average loss for each type of incident is less than \$45,000 (i.e., hail), suggesting minimal damage and minimal need for response.
Onset	2	12-24 hours	NWS officials forecast severe weather events at least 12 hours in advance.
Magnitude	5	>50% land area affected	The entire county is susceptible to severe summer weather events; the hazard can occur anywhere.
Business	2	One week	Businesses would not typically close for a severe summer weather event. Damages from a significant storm may cause a short (one week or less) disruption of services.
Human	2	Low (Some injuries)	Of the 301 recorded incidents, a total of six injuries and zero fatalities were reported. While injury and death are possible, it is unlikely that severe summer weather events would cause significant human injuries.
Property	2	10-25% of property affected	Though impacting large land areas, severe summer weather events often result in minimal property damage (when considering it at a countywide level).
Totals	20	MEDIUM	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The probability and severity of severe summer weather is equal across the entirety of Clermont County; no jurisdiction is more or less at risk. There are few, if any, major features in Clermont County (including the Ohio River) that would alter risks for severe summer weather.

When consulting resources such as FEMA's National Risk Index (2023), there is only marginal fluctuation amongst the Census tracts in the county for hail and lightning. As such, there is no image identifying jurisdictional fluctuation because all participating jurisdictions are assumed to be at similar risk of severe summer weather.

2.2.12 Severe Winter Weather

Severe winter weather includes blizzards, heavy snow fall, blowing snow, ice storms, and dangerous wind chills that could threaten life or property.				
 RISK HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	Typically during the winter months	Risk Ranking:	Medium
	Warning Time:	Over 24 hours	Type of Hazard:	Natural
	Probability:	Frequent (Will occur during a year)	Impact:	Critical (25-50% land area affected)
	Disaster Declarations:	EM-3029-OH (1977) EM-3055-OH (1978) DR-1580-OH (2004)	EM-3286-OH (2008) USDA FSA S4732 (2020)	

Hazard Introduction and Overview

During the winter, there are many instances of freezing weather, snow, and storms. This profile considers only those winter storms that are damaging enough to be considered *severe*. These include NOAA-labeled winter storms, heavy snow, blizzards, and ice storms.

- **Winter Storms:** A winter storm is a combination of heavy snow, blowing snow, and dangerous wind chills.
- **Heavy Snow:** Heavy snow refers to snowfall accumulating to four inches (4") or more in 12 hours or less, or snowfall accumulating to six inches (6") or more in 24 hours or less.
- **Blizzards:** A blizzard is a dangerous winter storm that is a combination of blowing snow and wind, which results in extremely low visibility often referred to as whiteouts. Heavy snowfall and severe cold usually accompany blizzards, but not always. Sometimes intense winds can pick up fallen snow, creating a ground blizzard. A Blizzard is a winter storm which produces the following conditions for three hours or longer: (1) sustained winds or frequent gusts of 35 mph or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than ¼ mile, on a widespread or localized basis.
- **Ice Storms:** Ice storms are prolonged periods of freezing rain where ice can accumulate on cold surfaces (Keller & DeVecchio, 2015). Ice storms result in the accumulation of at least 0.25" of ice on exposed surfaces. It can create hazardous driving and walking conditions, and tree branches and power lines can easily snap under the weight of the ice.

The different routes these storms can take are called storm tracks; storm tracks are named for geographic origin or the direction of the prevailing winds (e.g., Alberta Clipper, and Nor'easter).

Alberta Clippers are winter “storms that often form over the province of Alberta, Canada, east of the Rocky Mountains” (Rice, 2015). Typically, this type of storm moves quickly to the southeast across the northern Plains and finally to the Atlantic Coast. These storms usually are drier and have less snow but extremely cold temperatures.

A Nor'easter is a storm along the East Coast of the U.S., so called because the winds over the coastal area are generally progressing northeastward and typically attain maximum intensity near New England and the Maritime Provinces of Canada. These storms may occur at any time of year but are most frequent and most violent between September and April. They nearly always bring precipitation in the form of heavy rain or snow, as well as winds of gale force, rough seas, and, occasionally, coastal flooding to the affected regions. The warm waters of the Gulf Stream help keep the coastal waters relatively mild during the winter, which in turn helps warm the cold winter air over the water. This difference in temperature between the warm air over the water and cold Arctic air over the land is the fuel that feeds Nor'easters (NWS, n.d.).

In the winter months, weather patterns continue throughout the area; these can generate storms. However, three elements that must be present to generate a winter storm (NSSL, n.d.).

- **Cold Air:** Below freezing temperatures in the clouds and near the ground are necessary to make snow and ice.
- **Lift:** Something to raise the moist air to form clouds and cause precipitation. An example of a lift is warm air colliding with cold air and being forced to rise over the cold dome. The boundary between the warm and cold air masses is called a front. Another example of a lift is air flowing up a mountainside.
- **Moisture:** To form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean, is an excellent source of moisture.

Location and Extent

The image below (Figure 2.2.12.a), obtained from NOAA's National Gridded Snowfall Analysis, illustrates that Clermont County experiences one to two feet of snowfall annually. As can be seen, the southern portion

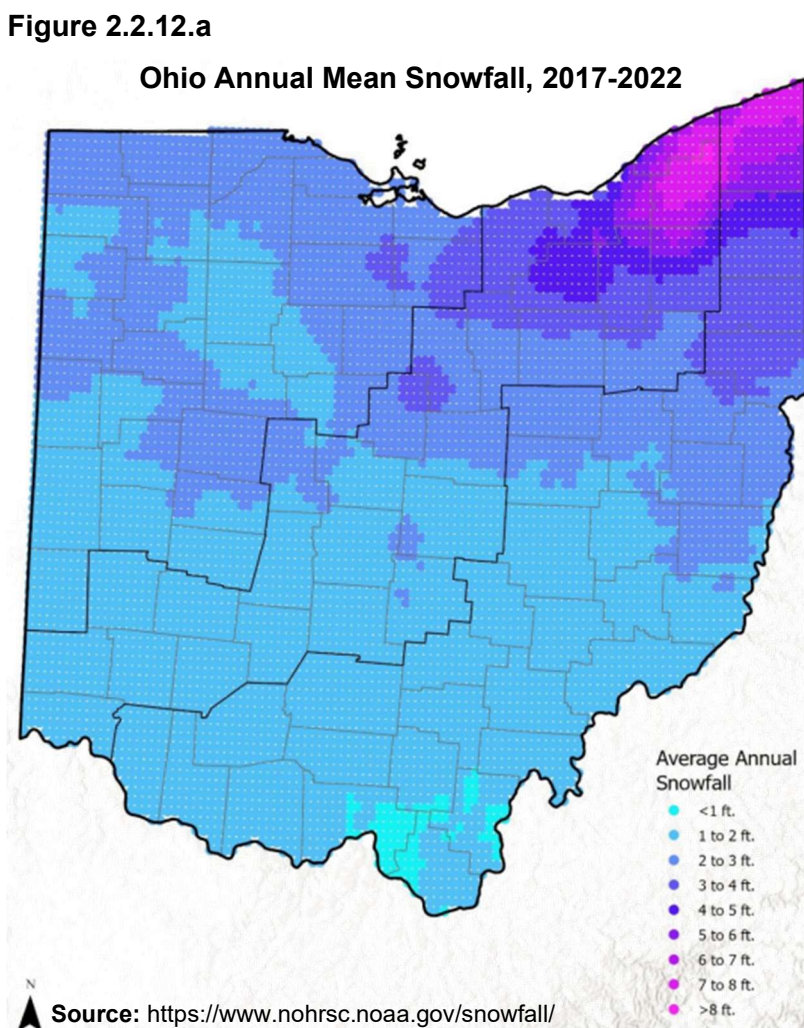
of Ohio including Clermont County receives less snowfall than northeastern portion of the state.

A severe winter storm could affect the entire county at the same time, virtually bringing all county operations to a standstill. This type of hazard creates a difficult emergency response effort; adverse road conditions and the closure of airports can impede or prohibit all vehicle movement, including emergency response vehicles.

Severe winter weather can affect several jurisdictions simultaneously, yet with varying severity and duration. There is no widely used scale to classify

snowstorms, but Paul Kocin and Louis Uccellini from the National Weather Service (NWS) developed the Northeast Snowfall Impact Scale (NESIS). The NESIS characterizes and ranks high-impact Northeastern snowstorms from "notable" to "extreme."

The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS indicates a storm's societal impacts. This scale was developed because of the impact Northeast snowstorms can have on the rest of the country in terms of transportation and economic impact. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information combine in an equation that calculates a NESIS score which varies from around one for smaller storms to over ten for



extreme storms. The raw score is then converted into one of the five NESIS categories (NOAA, n.d.), see Table 2.2.12.1 below.

Table 2.2.12.1

Northeast Snowfall Impact Scale (NESIS)		
Category	NESIS Value	Description
1	1.0-2.499	Notable
2	2.5-3.99	Significant
3	4.0-5.99	Major
4	6.0-9.99	Crippling
5	10.0+	Extreme

Source: National Weather Service

Impacts and Vulnerability

While the residents of Clermont County are accustomed to handling winter storm events, occasional extreme events can make conditions dangerous and disruptive. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents. Severe winter storms create treacherous driving conditions, according to a *FEMA Winter Storm Fact Sheet*, the leading cause of fatalities during winter storms is from automobile or other transportation accidents.

According to the NSSL (n.d.), most deaths from winter storms are not directly related to the storm itself; people die in traffic accidents on icy roads, of heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold. During severe winter storms, everyone is potentially at risk; particularly those stranded in their vehicle or outside during the storm. Recent observations show that of injuries related to ice and snow, about 70% occur in automobiles, about 25% are people caught out in the storm, and the majority of victims are males over 40 years old. Of injuries related to exposure to cold, 50% are people over 60 years old, over 75% are males, and about 20% occur in the home.

Heavy snow can result in property damage from roof collapses. The most vulnerable structures to roof collapse include those with large-span roofs, those that are poorly built or are dilapidated. Approximately 7% (n=6,000) of the residential structures in Clermont County were constructed in 1939 or earlier (Ohio Development Services Agency, 2024). Extreme cold temperatures can cause waterlines to freeze and bust.

Ice accumulation can topple power lines, utility poles, and communication towers causing electrical power to be lost, which for nearly 50% of the county's population means the loss of a critical home heating source (see Table 2.2.12.2 below). Electrical power is also crucial for critical

facilities such as hospitals and nursing homes. The resultant disruption in communication and utility services can last several days while utility companies repair extensive damage. Even minimal ice accumulation can pose a serious threat to motorists and pedestrians. Bridges and overpasses are particularly dangerous, as they freeze before other surfaces (NWS, n.d.).

Severe winter weather can result in economic losses, which can include businesses being shut down for extended periods of time. Dangerous road conditions can completely halt economic activity.

Table 2.2.12.2

Occupied Housing Units Heating Fuels – Clermont County		
<i>Heating Fuel Type</i>	<i>Number</i>	<i>Percent</i>
Utility Gas	30,976	37.5%
Bottled, tank or LP	4,552	5.5%
Electricity	39,634	49.7%
Fuel Oil, kerosene	4,059	4.9%
Coal or wood	1,400	1.7%
Solar Energy, other	1,563	1.9%
No fuel used	528	0.6%

Source: Ohio Development Services Agency, 2024

Health hazards generated from severe winter storms include frostbite and hypothermia. Frostbite is a severe reaction to cold exposure that can permanently damage its victims. A loss of feeling and a white or pale appearance in the victim's fingers, toes, nose, and ear lobes are symptoms of frostbite. Hypothermia is a condition brought on when the body temperature drops to less than 55 degrees Fahrenheit. Symptoms of hypothermia include uncontrollable shivering, slow speech, memory lapses, frequent stumbling, drowsiness, and exhaustion.

Historical Occurrences

According to NOAA's National Centers for Environmental Information (NCEI) Storm Events Database, there has been 120 winter weather events in Clermont County since 1996. These events are summarized by category in Table 2.2.12.3 below.

Table 2.2.12.3

Historical Severe Winter Weather Occurrences – Clermont County									
ICE STORM (1996 to 2024)									
Total Events	Areas Affected	Area w/ Most Events	Avg. Events / Year	Injuries	Fatalities	Damages			
						Property	Crop		
6	CW ¹	N/A	0.21	1	1	\$0	\$0		
Most common month = January									
HEAVY SNOW (1996 to 2024)									
Total Events	Areas Affected	Area w/ Most Events	Avg. Events / Year	Snow Depth		Injuries	Fatalities	Damages	
				Avg.	Highest			Property	Crop
11	CW	Northern Portion	0.40	7"	10"	0	0	\$1,000	\$0
Most heavy snow events in one year = 3 events in 2010									
Most common month = February									
WINTER STORM (1996 to 2024)									
Total Events	Areas Affected	Month w/ Most Events	Avg. Events / Year	Injuries	Fatalities	Damages			
						Property	Crop		
39	CW	Jan & Feb	1.39	0	0	\$500K	\$0		
Most winter storms in one year = 5 in 2014									
WINTER WEATHER (2007 to 2024)									
Total Events	Areas Affected	Month w/ Most Events	Avg. Events / Year	Injuries	Fatalities	Damages			
						Property	Crop		
64	CW	January	3.76	0	0	\$0	\$0		
Most winter storms in one year = 6 in 2013, 2018 and 2020									

Source: NCEI Storm Event Database 1 CW = Countywide

Countywide Ice Storm – February 13, 2007

A low pressure system tracked through the Ohio Valley, bringing a variety of winter weather conditions to the region. In west central Ohio, a blizzard dumped around a foot of snow and the resulting winds produced three to four foot drifts. In the I-71 corridor from Cincinnati to Columbus a swath of significant icing brought down countless trees and power lines. Duke Energy had peak outages at 125,000 with over 330,000 customers losing power at some point in time and dubbed this the worst wintertime outage locally in 18 years for Hamilton and Clermont counties. Power was still out four days later in some locations. A nine year old girl, was killed by a falling ice covered branch while walking her dog.

Countywide Heavy Snow – February 3, 2009

Low pressure tracked east through the Ohio Valley during the afternoon. This set up a boundary extending from just west of Richmond, Indiana, through eastern Cincinnati, to Maysville, Kentucky. A mid-level disturbance created a very strong source of localized lift, which produced snowfall rates exceeding two inches per hour. Nine inches of snow fell in Goshen; seven inches fell in Milford.

Countywide Winter Storm – December 22, 2004 (DR-1580-OH):

Clermont County received \$278,285 in Public Assistance from a severe winter storm. The storm left more than 20 inches of snow in some areas and then was followed by unseasonably warmer temperatures which resulted in flooding and mudslides. The federal list of declared counties included 62 of Ohio's 88 counties. Approximately 3,700 private structures were damaged or destroyed throughout Ohio. The estimated damages resulting from this winter storm in Clermont County was \$780,900, (NOAA, 2025).

Loss and Damages

Information obtained from FEMA's National Risk Index (NRI) was utilized to assess severe winter weather impacts (i.e., ice storms and winter weather) for each participating jurisdiction.

Table 2.2.12.4

Clermont County Ice Storm NRI Exposure / Expected Annual Loss Estimates					
<i>Census Tract</i>	<i>Exposure (Buildings)</i>	<i>Exposure (Pop)</i>	<i>EAL (Buildings)</i>	<i>EAL (Pop Equivalence)</i>	<i>EAL (Total)</i>
39025040101	\$565,964,912	5,071	\$385	\$4,257	\$4,642
39025040102	\$296,093,220	2,648	\$195	\$2,123	\$2,318
39025040202	\$332,271,724	2,215	\$265	\$2,164	\$2,429
39025040203	\$1,022,070,560	6,230	\$808	\$6,043	\$6,850
39025040205	\$341,676,114	3,192	\$216	\$2,480	\$2,696
39025040206	\$894,653,283	4,463	\$678	\$3,947	\$4,625
39025040301	\$889,865,533	3,979	\$712	\$3,908	\$4,620
39025040302	\$950,572,549	3,900	\$761	\$3,830	\$4,591
39025040303	\$1,429,187,632	7,628	\$1,035	\$6,704	\$7,739
39025040401	\$968,154,343	3,349	\$622	\$2,651	\$3,273
39025040403	\$499,144,737	2,786	\$315	\$2,155	\$2,469
39025040404	\$988,884,593	3,974	\$635	\$3,128	\$3,763
39025040405	\$549,076,131	3,101	\$436	\$3,032	\$3,468
39025040500	\$1,064,910,314	5,082	\$671	\$3,930	\$4,601
39025040600	\$1,669,457,750	7,439	\$1,052	\$5,753	\$6,805
39025040702	\$565,211,242	4,351	\$356	\$3,365	\$3,721
39025040703	\$538,186,019	3,479	\$339	\$2,691	\$3,030

Clermont County Ice Storm NRI Exposure / Expected Annual Loss Estimates					
Census Tract	Exposure (Buildings)	Exposure (Pop)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Total)
39025040704	\$624,067,866	3,949	\$393	\$3,054	\$3,447
39025040800	\$959,839,371	5,663	\$605	\$4,380	\$4,984
39025040900	\$1,041,851,226	5,682	\$656	\$4,394	\$5,051
39025041001	\$970,109,996	5,861	\$611	\$4,533	\$5,144
39025041002	\$894,322,825	3,092	\$564	\$2,391	\$2,955
39025041101	\$613,300,777	3,411	\$386	\$2,638	\$3,024
39025041102	\$957,999,896	5,352	\$604	\$4,139	\$4,743
39025041104	\$710,098,998	3,822	\$447	\$2,956	\$3,403
39025041105	\$610,093,661	6,110	\$384	\$4,725	\$5,110
39025041201	\$525,625,929	4,125	\$331	\$3,190	\$3,521
39025041202	\$1,271,849,462	5,024	\$801	\$3,885	\$4,687
39025041303	\$704,821,673	5,036	\$444	\$3,895	\$4,339
39025041304	\$26,506,533	23	\$17	\$18	\$34
39025041305	\$815,199,374	5,269	\$514	\$4,075	\$4,589
39025041306	\$1,086,996,949	5,438	\$685	\$4,206	\$4,891
39025041307	\$948,021,715	4,896	\$597	\$3,786	\$4,384
39025041403	\$704,717,021	4,378	\$444	\$3,386	\$3,830
39025041404	\$648,431,113	4,834	\$409	\$3,739	\$4,147
39025041405	\$611,782,206	5,384	\$385	\$4,164	\$4,549
39025041406	\$1,115,877,913	5,230	\$703	\$4,045	\$4,748
39025041503	\$597,864,510	4,730	\$377	\$3,658	\$4,035
39025041504	\$724,979,932	3,958	\$457	\$3,061	\$3,518
39025041505	\$675,146,995	3,586	\$425	\$2,774	\$3,199
39025041506	\$533,329,739	2,794	\$336	\$2,161	\$2,497
39025041600	\$825,972,684	5,533	\$520	\$4,279	\$4,800
39025041701	\$483,863,723	4,308	\$305	\$3,332	\$3,637
39025041702	\$474,675,733	3,223	\$299	\$2,493	\$2,792
39025041800	\$556,003,358	3,637	\$350	\$2,813	\$3,163
39025041900	\$791,512,363	5,525	\$499	\$4,273	\$4,772
39025042001	\$505,801,751	3,401	\$319	\$2,630	\$2,949
39025042002	\$499,144,852	2,352	\$315	\$1,819	\$2,133
Grand Total	\$36,075,190,799	208,513	\$23,663	\$167,050	\$190,713

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Table 2.2.12.5

Clermont County Winter Weather NRI Exposure / Expected Annual Loss Estimates							
Census Tract	Exposure (Buildings)	Exposure (Pop)	Exposure (Ag)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Ag)	EAL (Total)
39025040101	\$565,964,912	5,071	\$11,863,729	\$860	\$1,447	\$44	\$2,351
39025040102	\$296,093,220	2,648	\$1,640,799	\$450	\$755	\$6	\$1,212
39025040202	\$332,271,724	2,215	\$1,802,394	\$505	\$632	\$7	\$1,144
39025040203	\$1,022,070,560	6,230	\$732,952	\$1,553	\$1,777	\$3	\$3,333
39025040205	\$341,676,114	3,192	\$26,858	\$519	\$911	\$0	\$1,430

Clermont County Winter Weather NRI Exposure / Expected Annual Loss Estimates							
Census Tract	Exposure (Buildings)	Exposure (Pop)	Exposure (Ag)	EAL (Buildings)	EAL (Pop Equivalence)	EAL (Ag)	EAL (Total)
39025040206	\$894,653,283	4,463	\$852,559	\$1,360	\$1,273	\$3	\$2,636
39025040301	\$889,865,533	3,979	\$8,845	\$1,353	\$1,135	\$0	\$2,488
39025040302	\$950,572,549	3,900	\$85,348	\$1,445	\$1,113	\$0	\$2,558
39025040303	\$1,429,187,632	7,628	\$41,135	\$2,172	\$2,176	\$0	\$4,348
39025040401	\$968,154,343	3,349	\$16,266	\$1,472	\$955	\$0	\$2,427
39025040403	\$499,144,737	2,786	\$1,421	\$759	\$795	\$0	\$1,553
39025040404	\$988,884,593	3,974	\$3,570	\$1,503	\$1,134	\$0	\$2,637
39025040405	\$549,076,131	3,101	\$5,525	\$835	\$885	\$0	\$1,719
39025040500	\$1,064,910,314	5,082	\$8,913	\$1,619	\$1,450	\$0	\$3,068
39025040600	\$1,669,457,750	7,439	\$119,637	\$2,537	\$2,122	\$0	\$4,660
39025040702	\$565,211,242	4,351	\$48,809	\$859	\$1,241	\$0	\$2,100
39025040703	\$538,186,019	3,479	\$152	\$818	\$992	\$0	\$1,810
39025040704	\$624,067,866	3,949	\$1,000	\$949	\$1,127	\$0	\$2,075
39025040800	\$959,839,371	5,663	\$1,864,725	\$1,459	\$1,615	\$7	\$3,081
39025040900	\$1,041,851,226	5,682	\$3,329,092	\$1,584	\$1,621	\$12	\$3,217
39025041001	\$970,109,996	5,861	\$761,073	\$1,474	\$1,672	\$3	\$3,149
39025041002	\$894,322,825	3,092	\$669,277	\$1,359	\$882	\$2	\$2,244
39025041101	\$613,673,503	3,411	\$86,377	\$933	\$973	\$0	\$1,906
39025041102	\$957,999,896	5,352	\$134,546	\$1,456	\$1,527	\$1	\$2,983
39025041104	\$710,098,998	3,822	\$4,882	\$1,079	\$1,090	\$0	\$2,170
39025041105	\$610,093,661	6,110	\$42,215	\$927	\$1,743	\$0	\$2,670
39025041201	\$525,625,929	4,125	\$2,223	\$799	\$1,177	\$0	\$1,976
39025041202	\$1,271,849,462	5,024	\$27,920	\$1,933	\$1,433	\$0	\$3,366
39025041303	\$704,821,673	5,036	\$5,454	\$1,071	\$1,437	\$0	\$2,508
39025041304	\$26,506,533	23	\$1,446	\$40	\$7	\$0	\$47
39025041305	\$815,199,374	5,269	\$2,303	\$1,239	\$1,503	\$0	\$2,742
39025041306	\$1,086,996,949	5,438	\$35,432	\$1,652	\$1,551	\$0	\$3,204
39025041307	\$948,021,715	4,896	\$335,035	\$1,441	\$1,397	\$1	\$2,839
39025041403	\$704,717,021	4,378	\$3,140	\$1,071	\$1,249	\$0	\$2,320
39025041404	\$648,431,113	4,834	\$349	\$986	\$1,379	\$0	\$2,365
39025041405	\$611,782,206	5,384	\$4,874	\$930	\$1,536	\$0	\$2,466
39025041406	\$1,115,877,913	5,230	\$20,319	\$1,696	\$1,492	\$0	\$3,188
39025041503	\$597,864,510	4,730	\$68,123	\$909	\$1,349	\$0	\$2,258
39025041504	\$724,979,932	3,958	\$38,036	\$1,102	\$1,129	\$0	\$2,231
39025041505	\$677,709,159	3,600	\$38,988	\$1,030	\$1,027	\$0	\$2,057
39025041506	\$533,329,739	2,794	\$78,225	\$811	\$797	\$0	\$1,608
39025041600	\$825,972,684	5,533	\$167,793	\$1,255	\$1,578	\$1	\$2,834
39025041701	\$483,863,723	4,308	\$774,370	\$735	\$1,229	\$3	\$1,967
39025041702	\$474,675,733	3,223	\$1,066,047	\$721	\$919	\$4	\$1,645
39025041800	\$556,003,358	3,637	\$231,955	\$845	\$1,038	\$1	\$1,883
39025041900	\$791,512,363	5,525	\$4,780,435	\$1,203	\$1,576	\$18	\$2,797
39025042001	\$505,801,751	3,401	\$2,639,954	\$769	\$970	\$10	\$1,749
39025042002	\$499,144,852	2,352	\$1,968,343	\$759	\$671	\$7	\$1,437
Grand Total	\$36,078,125,690	208,527	\$36,442,863	\$54,836	\$59,487	\$136	\$114,459

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Future Occurrences

The “Ohio Valley” which includes Clermont County is likely to continue to experience various forms of severe winter weather, particularly during the late fall and winter months. While specific forecasts for future winter weather events in southwestern Ohio are difficult to pinpoint, long-range forecasting suggests above-average snowfall and colder than average temperatures.

Risk Assessment

This section summarizes the vulnerability of Clermont County to severe winter weather. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. Table 2.2.11.7 presents the results of that survey, specifically regarding severe winter weather.

Table 2.2.12.6

Public Sentiment, Severe Winter Weather					
Hazard	Level of Concern				Total Responses
	Not at All	Somewhat	Concerned	Very	
WINTER WEATHER	11 (21.15%)	14 (26.92%)	17 (32.69%)	10 (19.23%)	52
In the past five years, do you remember this hazard occurring in your community?				27 (51.92%)	52
Have you noticed an increase in the occurrences or intensity of this hazard?				27 (51.92%)	52
Have you noticed a decrease in the occurrences or intensity of this hazard?				0 (0.00%)	52

Source: Online Public Survey Results

The following table assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA’s Mitigation Information Portal (MIP) tool.

Table 2.2.12.7

Risk Ranking, Severe Winter Weather			
Category	Points	Description	Notes
Frequency	5	Frequent (Will occur during a year)	Since 1996, the NOAA NCEI Storm Event Database lists 120 winter weather events, for an average of 4.3 events per year.
Response	2	One day	The impacts of winter storms in Clermont County typically last approximately one day.
Onset	1	Over 24 hours	Weather forecasting officials typically predict the onset of severe winter weather at least 24 hours in advance.
Magnitude	3	Critical (25-50% land area affected)	Severe winter weather events typically affect large portions of the county simultaneously.
Business	1	Two days	Businesses may be required to close for a few days due to poor road conditions and not being able to get to the business.
Human	3	Medium (Multiple severe injuries)	Several people could be injured in vehicle accidents, and /or suffer heart attacks while shoveling snow.
Property	3	25-50% of property affected	Heavy snow and ice can damage a significant amount of property and critical infrastructure.
Totals	18	MEDIUM	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The probability and severity of severe winter weather is equal across the entirety of Clermont County; no jurisdiction is more or less at risk. As such, there is no image identifying jurisdictional fluctuation.

2.2.13 Terrorism / Civil Disturbance

Terrorism is the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. Civil disturbances include active assailants, bomb threats, and riots.				
 RISK HIGHEST HIGH MEDIUM LOW LOWEST	Period of Occurrence:	At any time	Risk Ranking:	Low
	Warning Time:	No warning	Type of Hazard:	Human-Caused
	Probability:	Remote (Unlikely to occur in a year)	Impact:	Localized (Less than 10% of land are affected)
	Disaster Declarations:	None		

Hazard Introduction and Overview

“Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb threats and bombings; cyber-attacks (computer-based); and the use of chemical, biological, nuclear, and radiological weapons. High-risk targets for acts of terrorism include but are not limited to military and civilian governmental facilities, international airports, large cities, and high-profile landmarks. Terrorists might also target large public gatherings, water and food supplies, utilities, and financial centers. Further, terrorists are capable of spreading fear by sending explosives or chemical and biological agents through the mail.” (Source: USDHS FEMA)

International terrorism involves violent, criminal acts committed by individuals and/or groups who are inspired by, or associated with, designated foreign terrorist organizations or nations. Domestic terrorism involves violent, criminal acts committed by individuals and/or groups to further ideological goals stemming from domestic influences, such as those of a political, religious, social, racial, or environmental nature.

According to the FBI, the terrorism threat has continued to evolve since the September 11, 2001, attacks. The threat landscape has expanded considerably, international terrorism remains a serious threat, and domestic terrorism also remains persistent overall. Several factors have contributed to the evolution of the terrorism threat on both the international and domestic fronts, such as:

- **Lone Offenders:** Terrorist threats have evolved from large-group conspiracies toward lone-offender attacks. These individuals often radicalize online and mobilize to violence quickly. Without a clear group affiliation or guidance, lone offenders are challenging to identify, investigate, and disrupt.
- **Internet and Social Media:** International and domestic violent extremists have developed an extensive presence on the Internet through messaging platforms and online images, videos, and publications. These facilitate the groups' ability to radicalize and recruit individuals who are receptive to extremists messaging.

Social media has also allowed both international and domestic terrorists to gain unprecedented, virtual access to people living in the United States in an effort to enable homeland attacks. The Islamic State of Iraq and ash-Sham (ISIS), in particular, encourages sympathizers to carry out simple attacks wherever they are located.

There is no single cause of acts of violence or terrorism; there are typically non-rational, complicated, intertwined, series of reasons that results in violence. In his article *Causes of Terrorism* (2011), Nick Grothaus lays out the most common causes cited by leaders in the field of counterterrorism. These categories may apply to other types of violence not related to terrorism.

- **Ethno-Nationalism:** The desire of a population to break away from a government or ruling power and create a state of their own.
- **Alienation/Discrimination:** Individuals or groups face discrimination leading to further feelings of isolation. These people may become jaded towards society and feel excluded.
- **Religion:** Religion as a part of terrorism has been mainly attributed to Islamic fundamentalism although other religions have also had involvement in terrorist activities. (Post, 2007, pp. 211-212).
- **Socio-Economic Status:** Individuals and groups may be driven by a sense of relative deprivation and lack of upward mobility within society.
- **Political Grievances:** A lack of political inclusiveness or grievances against a certain political order may cause individuals to join or create terrorist groups.

***NOTE:** Throughout the remainder of this profile, terrorism will be discussed generally. This profile does not include any information on any threats that have been received, or specific listings of potential targets in Clermont County, etc.

Anecdotally, the nation has seen an upswing in violent acts, and it is beneficial to profile types of violence and the potential impacts they could have in Clermont County. Civil disturbances, for this plan, encompass those acts that law enforcement does not consider routine, including the following topics.

- **Active Assailant:** “An active assailant is an armed person(s) who uses any type of weapon to inflict serious harm and/or deadly physical force on others in public and continues to do so while having access to additional victims. Examples of active assailant attacks include an active shooter incident, mass stabbings, explosives, vehicle-as-a-weapon, fire-as-a-weapon, and so forth. (These are also known as active shooter events, hostile incidents, mass violence attacks, rampage violence, spree killings, and so forth.)” (North Carolina Active Assailant and Active Shooter Work Group, 2017).
- **Bomb Threat:** An actual or rumored threat of a bomb. Perpetrators often call-in bomb threats to an office or person to disrupt normal business and activities, and these threats do not usually involve a bomb. Nonetheless, every bomb threat must be considered real until authorities investigate and determine it is safe (Ohio State University, n.d.)
- **Riots:** Group protests that become or have the potential to become violent. A riot is a violent offense against public order involving three or more people; it involves a gathering of persons for an illegal purpose. It is the most elementary form of collective violence, and it is also referred to as “social unrest.” Riots can include such events as gang violence, coups, rebellions, and revolutions (Encyclopedia Britannica, 2018).

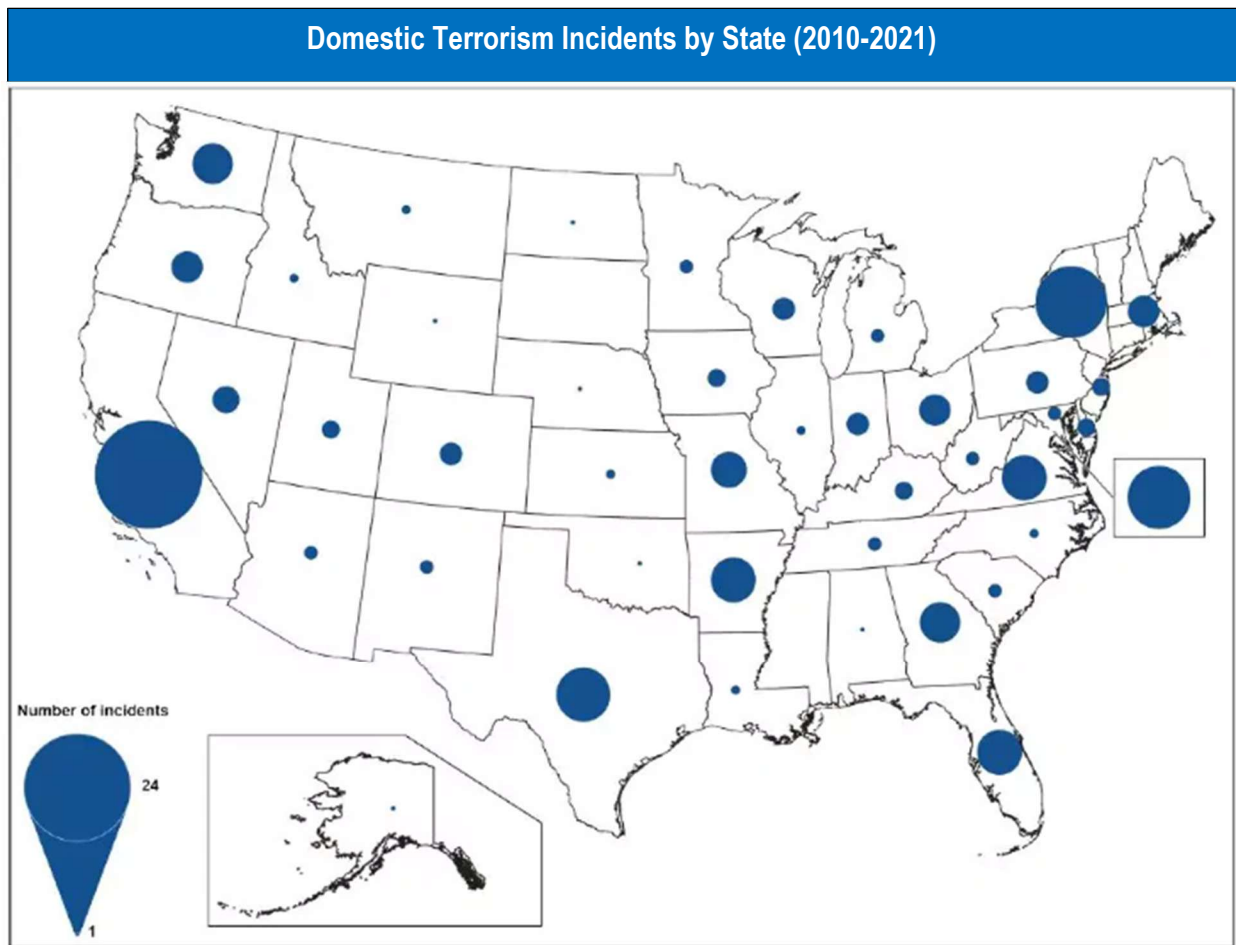
Location and Extent

Clermont County does contain what could be considered “targets.” In general, military installations, governmental, educational, power generation, and industrial facilities could be considered *targets*, but such a consideration usually has more to do with other circumstances surrounding the facility than the facility’s identification. Due to the high unpredictability of terrorist acts, any location could be a target of an attack. The extent of damages or impact from an attack is also unpredictable.

Terrorism is not always accomplished on a “grand scale,” as is the case with international terrorists who are attempting to coerce the federal government. Clermont County is more likely to experience what is known as “domestic terrorism.” Domestic terrorism can involve disgruntled employees (in the case of large industrial plants), upset citizens (at government facilities), etc. Domestic terrorists may often only intend to harm a single individual or a small group of individuals, but the threat of their actions can be highly disruptive.

According to the U.S. Department of Homeland Security there were 231 incidents (i.e., attacks or plots) that met the definition of domestic terrorism between 2010 and 2021. They occurred across the United States, but the greatest number of incidents occurred in states with major metropolitan areas (see Figure 2.2.13.a below).

Figure 2.2.13.a



Source: GAO analysis of DHS Counterterrorism Mission Center Data

Any location or community asset can be the target of violence or civil disturbance. Historically, there have been violent acts at malls, schools, universities, workplaces, government buildings, and places of worship. The location itself, or the people inside could be the intended target. Bomb threat targets are similar. Typically, the incident is limited to a specific location or building. Riots are not typically location-targeted events and generally occur in the streets of a city or village; they can be localized to just one city block or spread in pockets nationwide.

Due to the high unpredictability of violent acts, any location could be a target. The extent of damages or impact from an attack is also unpredictable. However, there may be areas or types of locations that may be more prone to attacks.

Impacts and Vulnerability

Symbolically, an implemented act of terrorism would erode the feeling of security that the region enjoys and create a growing distrust of government. It would also likely result in a loss of faith in local decision makers and public safety officials. A loss of public support, especially in the public safety and emergency services sectors, could affect agency operating budgets, personnel recruitment, etc., thus adversely affecting the level of service that could be provided in subsequent years.

The most obvious effects of a terrorist incident would be economic. Infrastructure, including “hard” infrastructure such as facilities and systems, but also “soft” infrastructure such as people could be diminished or destroyed. Any loss of tax base and employment would be extremely hard for the county to overcome.

Survivors of violence will most likely experience common stress reactions lasting several days to a few weeks. These reactions can include the following:

- **Emotional Reactions:** Shock, fear, grief, anger, guilt, shame, helplessness, numbness, sadness.
- **Cognitive Reactions:** Confusion, indecisiveness, worry, shortened attention span, trouble concentrating.
- **Physical Reactions:** Tension, fatigue, edginess, insomnia, body aches, easily startled, tachycardia, nausea, loss of appetite.
- **Interpersonal Reactions:** distrust, conflict, withdrawal, irritability, loss of intimacy, feeling abandoned.

Some individuals may experience severe stress symptoms following a violent incident. Individuals experiencing the following are at a higher risk for posttraumatic stress disorder:

- **Intrusive Re-Experiencing:** Terrifying memories, nightmares, and flashbacks.
- **Extreme Emotional Numbing:** Inability to feel emotions, feeling empty.
- **Extreme Attempts to Avoid Disturbing Memories:** Such as through substance abuse.
- **Hyperarousal:** Panic attacks, rage, extreme irritability, intense agitation, acting out with violence.
- **Severe Anxiety:** Debilitating worry, extreme helplessness, compulsions, or obsessions.
- **Severe Depression:** Loss of ability to feel hope, pleasure, or interest; feeling worthless, suicidal ideations or intent.
- **Dissociation:** Fragmented thoughts, spaced out, unaware of surroundings, amnesia (National Center for PTSD, 2018).

Historical Occurrences

There are no documented occurrences of terrorism, domestic or international, within the borders of Clermont County. The county has experienced one active assailant event and various cyberattacks. The county faces cyberattacks to their computer network firewall regularly. Phishing attempts, scareware threats, and denial of service attacks have also occurred, (See Section 2.2.1 – Cyber Incident Hazard Profile).

No Kings Protests – June 14 & October 18, 2025

“Clermont County residents gathered along Eastgate Boulevard and Veterans Park in Union Township to participate in a nationwide “No Kings” protest, (The Clermont Sun, Earl, October 28, 2025)”.

Civil Disturbance – June 15, 2020

The mayor’s office and the Bethel Police Department enacted a 9:00 p.m. curfew in response to the threat of continued and escalating violence and unrest between Black Lives Matter protesters and anti-protesters (Back the Blue, Second Amendment advocates), and the need for security and enforcement support for the village during a second day of protests. “The protest was expected to draw around 25 people, according to the Village of Bethel Administrator; however, it ended up drawing around 800, including 250 motorcycles that occupied the protest area and forced the protesters to move. Approximately 10 altercations and five arrests reportedly occurred. (Cincinnati Enquirer, McKenzie, Mazade, June 15, 2020).”

Pierce Township Active Assailant – February 2, 2019

On February 2, 2019, at approximately 7:00 p.m., an individual called 911 informing dispatchers that a man had barricaded himself in his apartment, was armed, and refused to leave. A 12-hour standoff and shootout at the Royal Oaks Apartments in Pierce Township, Ohio, resulted in the death of a Clermont County Sheriff's Detective and injuries to a second deputy.

The area around the apartment building was shut down throughout the night. The alleged shooter was taken into custody Sunday around 6:30 a.m. following another gunfight with the Clermont County Special Response Team (SRT) and a SWAT team from the Cincinnati Police Department. The Clermont County Sheriff said in a statement Sunday morning. "This will forever change the atmosphere of the Clermont Sheriff's Office" (ABC News, 2019).

Loss and Damages

A large-scale terrorist event could cripple the county. The effects of a terrorist incident are not only monetary; they are often emotional and symbolic. Several of the communities throughout the county are rural and small. Any Mass Casualty Incident (MCI) would take an emotional toll on the affected and nearby communities.

Estimating the economic impact of terrorism and civil disturbance events is difficult. Initial impacts can be the immediate costs for a response to the event and business closures in the vicinity. The full economic impact could include long-term costs, emotional costs, etc. A large-scale event could significantly affect industry and government as well as privately-owned infrastructure. A terrorist incident involving wastewater, drinking water, or chemical facilities could have long-term environmental effects. The potential losses due to these variables make it difficult to quantify the cost of repair or replacement of infrastructure.

Future Occurrences

According to the U.S. Government Accountability Office domestic terrorism is on the rise in the U.S. "FBI open cases have grown 357% from FY2013 – 2021 and 231 incidents tracked from 2010-2021, primarily racially/ethnically motivated (35%) or anti-government (32%), leading to over 145 deaths and 370 injuries."

There is concern over illegal immigration at the U.S. Southwest border and the growing number of individuals on the terrorist watchlist entering the United States. According to statistics obtained from the House Committee on Homeland Security "the number of individuals apprehended illegally crossing the U.S. Southwest border found to be on the terrorist watchlist has increased 2,500 percent (2,500%) from 2017 to 2023, this percentage does not include got-

a-ways. The Department of Homeland Security (DHS) Secretary and U.S. Customs and Border Protection (CBP) sources have confirmed over 1.7 million known got-a-ways at the Southwest border. In Fiscal Year 2023, CBP arrested 35,433 illegal aliens with criminal convictions nationwide, in addition, 294 illegal aliens on the terrorist watchlist have been apprehended between ports of entry on the Southwest border since the beginning of 2021, and those are only individuals Border Patrol agents have caught” (Homeland Security Committee, 2023).

During the House Committee on Homeland Security’s annual Worldwide Threats hearing, the FBI Director confirmed the national security threat posed by the growing number of got-a-ways at the Southwest border.

Recent developments and ongoing efforts that have contributed to decrease the risk of terrorism in Clermont County including Ohio’s Intelligence Liaison Officer (ILO) Program which fosters intelligence collaboration at the local, state, and regional levels, and building relationships with local representatives who report to the Ohio Fusion Center Network (OFCN), which is responsible for analysis, sharing, and dissemination of intelligence.

Risk Assessment

This section summarizes the vulnerability of Clermont County to terrorism and civil disturbance. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. Table 2.2.13.1 presents the results of that survey.

Table 2.2.13.1

Public Sentiment, Terrorism / Civil Disturbance					
Hazard	Level of Concern				Total Responses
	Not at All	Somewhat	Concerned	Very	
TERRORISM	20 (38.46%)	22 (42.31%)	7 (13.46%)	3 (5.77%)	52
In the past five years, do you remember this hazard occurring in your community?				0 (0.00%)	52
Have you noticed an increase in the occurrences or intensity of this hazard?				17 (32.69%)	52
Have you noticed a decrease in the occurrences or intensity of this hazard?				3 (5.77%)	52

Source: Online Public Survey Results

The following table assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA’s Mitigation Information Portal (MIP) tool.

Table 2.2.13.2

Risk Ranking, Terrorism / Civil Disturbance			
Category	Points	Description	Notes
Frequency	2	Remote (Unlikely to occur in a year)	Because the occurrence of this hazard is based on human-activity it is difficult to determine the frequency. Planners based frequency on past occurrences. There are no documented occurrences of international or domestic terrorist events in the county, and instances of civil disturbances or rare.
Response	3	One week	Based on impacts from events that have occurred within proximity of the county, a response of one week would be most likely.
Onset	5	No warning	Terrorist attacks and civil disturbances are not typically proceeded with a warning.
Magnitude	1	Localized (< 10% land area affected)	An attack or incident in the county would most likely be localized or targeted towards a specific location rather than widespread.
Business	1	One day	Based on impacts from previous events that have occurred in similar areas, businesses would only be affected for one day.
Human	2	Low (Some injuries)	The magnitude of events that have occurred in similar areas have resulted in a very limited number of injuries or fatalities.
Property	1	Less than 10% of property affected	An event within the county would most likely be on a specific, single target or location, rather than a widespread event.
Totals	15	LOW	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map identifies those multi-jurisdictional risks concerning terrorism and civil disturbance. Those labels not underlaid by a shaded drop shadow are not more or less at risk. Those with red drop shadows are more at risk.

Figure 2.2.13.b
Terrorism / Civil Disturbance Multi-Jurisdictional Risk Map

