# Severe Weather

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# 2.0 RISK ASSESSMENT

### 2.2.9 Severe Weather

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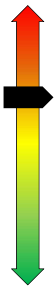
Vulnerability




| | | | |
|---|---|---|---|
| Period of Occurrence: | Thunderstorms, typically during the late spring and summer months. Winter storms from November through March. | Hazard Index Ranking: | Medium |
| Warning Time: | 12-24 hours | State Risk Ranking: | 3 |
| Probability: | Frequent (Will occur on an annual basis) | Severity: | Catastrophic (more than 50% of land area affected) |
| Type of Hazard: | Natural | Disaster Declarations: | DR-1065 DR-1097 DR-1164 DR-1227 DR-1453 DR-1556 DR-1580 DR-3029 DR-3055 DR-4002 DR-4077 DR-4360 DR-4424 |

*Hazard Introduction and Overview*

Thunderstorms are local storms accompanied by lightning and thunder that are capable of producing strong winds, tornadoes, hail, and flash flooding. There are five types of thunderstorms, each described in detail in the table below.

| TYPES OF THUNDERSTORMS | | | | |
|---|---|---|---|---|
| *Type* | *Description* | *Duration* | *Wind Speeds* | *Associated Hazards* |
| Single Cell | Uncommon | 20 - 30 minutes | N/A | • Non-damaging hail<br>• Microbursts<br>• 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<br>• Downbursts<br>• Hail<br>• Weak tornadoes |
| Mesoscale Convective System (MCS) | A well-organized system of thunderstorms | Up to 12 hours or more | 55 mph or more | • Torrential rainfalls<br>• Derechos<br>• Tornadoes |
| Squall Lines | May extend over 250 to 500 miles and 10 to 20 miles wide | Individual cells last from 30 to 60 minutes | N/A | • Significant rain after the storm<br>• Derechos |
| Super Cells | Most dangerous storms, visible with Doppler radars | 1 - 6 hours | Updrafts and downdrafts of more than 100 mph | • Tornadoes<br>• Hail |



A thunderstorm is "severe" when it produces a tornado, winds of at least 58 mph, or hail at least one inch in diameter. Hazards associated with severe thunderstorms include lightning, heavy rain, hail, damaging wind, and tornadoes. For more information on severe winds, and tornadoes refer to "Hazard Profile 2.2.10 Severe Wind and Tornado" of this plan. 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.

A hailstorm is defined as an atmospheric disturbance manifested in strong winds and accompanied by precipitation. The precipitation is made of hailstones, or hard pellets of snow and ice. Hail is a form of precipitation that occurs when updrafts from a thunderstorm carry raindrops into colder temperatures. The drops of water freeze together in the cold upper regions of the thunderstorm clouds. Hailstones grow by colliding with super-cooled water droplets, the stronger the updraft of the storm the longer the drops of water can freeze together, thus the larger the hailstone. When a hailstone becomes too heavy for the updraft to support it, or the updraft weakens, the hailstone falls to the ground. 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. The TORRO Hailstorm Intensity Scale (Voss Law Firm, n.d.) measures hail, H0 – H10, based on diameter. The TORRO scale and reference objects appear in the table below.

| TORRO HAILSTORM INTENSITY SCALE | | | |
|---|---|---|---|
| *TORRO Intensity* | *Intensity Category* | *Diameter (mm)* | *Reference Object* |
| H0 | Hard Hail | 5 | Pea |
| H1 | Potentially Damaging | 5-15 | Mothball |
| H2 | Significant | 10-20 | Marble, Grape |
| H3 | Severe | 20-30 | Walnut |
| H4 | Severe | 25-40 | Pigeon's egg > Squash ball |
| H5 | Destructive | 30-50 | Golf ball > Pullet's egg |
| H6 | Destructive | 40-60 | Hen's egg |
| H7 | Destructive | 50-75 | Tennis ball > Cricket ball |
| H8 | Destructive | 60-90 | Large orange > Softball |
| H9 | Super Hailstorms | 75-100 | Grapefruit |
| H10 | Super Hailstorms | >100 | Melon |

Lightning is a naturally-occurring spark of electricity in the air between clouds, the air, or the ground. Air acts as an insulator between the cloud and the ground, but when the charge difference becomes great enough, this insulating capacity breaks down, allowing the rapid discharge of electricity. This electrical discharge is known as lightning. Lighting 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 lighting observed in a storm will strike the ground.

During winter, there are multiple instances of cold weather, snow, and storms. This profile includes only those winter weather events that are damaging enough to be considered "severe." These include NOAA-labeled winter storms, heavy snow, blizzards, and ice storms.

- **Winter Storm:** A winter storm is a combination of heavy snow, blowing snow, and dangerous wind chills.
- **Heavy Snow:** Heavy snow refers to snowfall accumulating to 4" or more in 12 hours or less, or snowfall accumulating to 6" or more in 24 hours or less.
- **Blizzard:** A blizzard is a dangerous winter storm that is a combination of blowing snow and wind and results in very low visibility. Heavy snowfall and severe cold usually accompany blizzards, but not always. Sometimes strong 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 30 knots (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 Storm:** An ice storm is a storm that results 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.

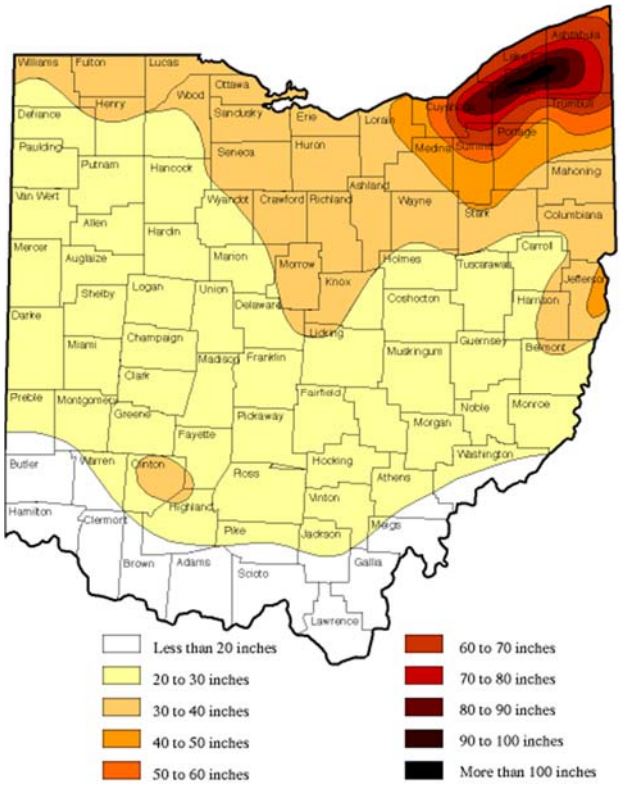
Just like with other storms, the right combination of ingredients is necessary for a winter storm to develop. The three key components of a winter storm are cold air, lift, and moisture.

*Location and Extent*

Severe thunderstorms and associated hail and lightning can affect all areas of the county. These events can last a few seconds (i.e., lightning), minutes (tornadoes), hours (thunderstorms and hailstorms), or days (high winds). All of Washington County is equally susceptible to winter storms (i.e., blizzards, heavy snow fall, ice storms, and extreme cold temperatures); however, the northern portion of the county is more susceptible to heavy snow fall due to the higher elevations in this portion of the county. The highest elevation in the county is that of Dodd Hill, located near the community of Rinard Mills at 1,125 feet.



The image at right, obtained from the Ohio Department of Transportation, illustrates that Washington County is divided between two average snow fall categories. The upper half of the county, including Beverly, Macksburg, Lowell, and Lower Salem receive between 20 and 30 inches of snow annually. The rest of the county, including Marietta, Belpre, and Matamoras receive less than 20 inches of snow annually.




**Source:** Ohio Department of Transportation

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

Winter weather affects 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 developed the Northeast Snowfall Impact Scale (NESIS). The NESIS characterizes and ranks high-impact Northeastern snowstorms from "notable" to "extreme."

| NORTHEAST SNOWFALL IMPACT SCALE | | |
|---|---|---|
| *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

Significantly, the NESIS does not predict the impacts of a forecasted storm; instead, it is a mechanism for rating impacts after a storm occurs.



*Hazard Impacts*

The impacts of 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. The table below outlines the typical impacts of a hailstorm.

| 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 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 National Severe Storms Laboratory (NSSL), most deaths from winter storms are not from the storm itself. People die from traffic accidents on icy roads, heart attacks while shoveling snow, and hypothermia from prolonged exposure to cold. During severe storms, everyone is potentially at risk, particularly those stranded in their vehicle or outside during the storm. Recent data shows that 70% of injuries related to ice and snow occur in automobiles, and 25% are people caught out in the storm. Most victims are males over 40 years old.



Heavy snow can result in property damage from roof collapses, and 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 several means a loss of a critical home heating source. The resultant disruption in communication and utility services can last several days. 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.

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*

Washington County has experienced 205 severe weather events since 1974. This rate is an average of 4.46 severe weather events per year. These events appear by category in the table below. Thunderstorms accounted for 53% of the total severe weather events, and also accounted for the most injuries and property damage. There were no records of blizzards or ice storms in the NCEI Storm Events Database for Washington County.

HISTORICAL SEVERE WEATHER OCCURRENCE – WASHINGTON COUNTY

**THUNDERSTORM (1974 to 2020)**

| *Total Events* | *Areas Affected* | *Area w/ Most Events* | *Avg. Events / Year* | *Wind Speeds* | | *Injuries* | *Fatalities* | *Damages* | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Avg. | Highest | | | Property | Crop |
| 109 | 37 | Marietta (25%) | 2.26 | 55 kts. | 78 kts. | 3 | 0 | $5.83M | $50K |
| Most thunderstorm events in one year = 7 in 1990 and 2017 | | | | | | | | | |

**HAIL (1980 to 2020)**

| *Total Events* | *Areas Affected* | *Area w/ Most Events* | *Avg. Events / Year* | *Hail Size* | | *Injuries* | *Fatalities* | *Damages* | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Avg.* | *Largest* | | | *Property* | *Crop* |
| 51 | 26 | Marietta (33%) | 1.28 | 1” | 1.75” | 0 | 0 | $57,000 | $0 |
| Most hail events in one year = 4 in 1998 | | | | | | | | | |

**LIGHTNING (1996 to 2020)**

| *Total Events* | *Areas Affected* | *Area w/ Most Events* | *Avg. Events / Year* | *Injuries* | *Fatalities* | *Damages* | |
|---|---|---|---|---|---|---|---|
| | | | | | | *Property* | *Crop* |
| 6 | 5 | Marietta (50%) | 0.29 | 2 | 0 | $189,000 | $0 |
| Most lightning events in one year = 2 in 1996 | | | | | | | |

**HEAVY SNOW (1996 to 2020)**

| *Total Events* | *Areas Affected* | *Area w/ Most Events* | *Avg. Events / Year* | *Snow Depth* | | *Injuries* | *Fatalities* | *Damages* | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Avg.* | *Highest* | | | *Property* | *Crop* |
| 21 | CW | Newport | 0.84 | 7” | 18” | 0 | 0 | $25,000 | $0 |
| Most heavy snow events in one year = 3 in 2002 and 2015 | | | | | | | | | |

**WINTER STORM (1999 to 2020)**

| *Total Events* | *Areas Affected* | *Month w/ Most Events* | *Avg. Events / Year* | *Injuries* | *Fatalities* | *Damages* | |
|---|---|---|---|---|---|---|---|
| | | | | | | *Property* | *Crop* |
| 11 | CW | January | 0.5 | 0 | 0 | $10,000 | $0 |
| Most winter storm events in one year = 2 in 2014 | | | | | | | |

**EXTREME COLD (2000 to 2020)**

| *Total Events* | *Areas Affected* | *Month w/ Most Events* | *Avg. Events / Year* | *Temperatures* | | *Injuries* | *Fatalities* | *Damages* | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *Avg.* | *Lowest* | | | *Property* | *Crop* |
| 7 | CW | January | 0.33 | -7 | -18 | 0 | 0 | $215,000 | $0 |
| Most extreme cold events in one year = 3 in 2000 | | | | | | | | | |
| 205 | N/A | N/A | N/A | N/A | | 5 | 0 | $6.33M | $50K |

**Source:** NCEI Storm Event Database



***Bartlett Hailstorm – April, 2002***

A late day thunderstorm formed along a cold front, large hail was common with this storm. The largest hail was across the community of Bartlett, measuring approximately 1.75" in diameter. Several vehicles were dented, and roof and window damage also occurred to residential homes in the area.

***Newport Lighting Strike – May, 1994***

On May 25, 1994 in the community of Newport; lightning struck an oil tank at a storage facility causing a spectacular fire. The fire burned for about three hours and caused $500,000 in damages.

***Poterfield Lighting Strike – June, 2002***

In June of 2002, lightning caused $100,000 in damages to an area five (5) miles north west of Poterfield. A ridge top church on Route 3 in Decaturville was struck by lightning and subsequently destroyed by fire. The *Marietta Times* reported that the Full Gospel Temple was a total loss. Fire fighters from four (4) local departments were able to salvage only an organ and a few keepsakes from the church. The *Marietta Times* also reported that this same storm with winds up to 60 mph caused thousands in the county to lose power and downed many trees.

***Countywide Winter Storms – February and March, 1994***

Two severe winter storms struck Washington County in the winter of 1994. The first occurred on February 11, the *Marietta Times* reported that heavy freezing rain accumulated one and a half inches, and in many areas two inches of snow fell before the freezing rain. Power lines and tress were downed causing many residents to loose electrical power for several days. A number of roads became virtually impassable triggering numerous traffic accidents. A Washington County Highway Department dump truck attempting to plow was turned on its side on State Route 7. Total damages from this storm included $5 million in property damages, $500,000 in crop damage, and 26 people sustained injuries. On March 9, 1994, another storm blanketed the county and much of southeastern Ohio with a mixture of snow, sleet, and freezing rain. Trees and power lines were again downed by the ice and snow, some severely damaging homes and automobiles. This storm resulted in $5 million in property damage and 14 people were injured.



***Countywide Heavy Snow – March, 2015***

Heavy wet snow quickly accumulated along the Ohio River counties during the late evening, into the morning hours. Total snow accumulations of 10 to 13 inches were common. Marietta reported a snow accumulation of one foot. The following morning it was two below zero in the community of Newport.

**Countywide Heavy Snow – January, 2016**

The most recent major snow event to occur in Washington County, according to NCDC records, was winter storm Jonas. Jonas swept through the area, along with much of the east coast, in late January, 2016. By late morning on January 23rd, Marietta had already accumulated 11 inches of snow (Lane, Rouan & Sutherly, 2016.) The storm put the Washington County Public Schools over their snow removal budget by $2,000 while closing schools for a week. In total there was a reported 23 to 31 inches in various parts of the county (Greene, 2016.)

***Countywide Extreme Cold – February, 2014***

Arctic air poured into southeast Ohio, a clear night with diminishing winds resulted in temperatures mostly in the minus five to minus 20 degree range across southeast Ohio. Marietta reported temperatures of minus 7, and minus 14 was reported in Watertown in Washington County. Unofficial readings of minus 19 along Interstate 77 in northern Washington County were reported. The three day cold wave finally broke as temperatures rose to either side of freezing (32 degrees).



*Loss and Damages*

Severe weather can impact all areas and jurisdictions of Washington County and are typically widespread events. Severe weather events have resulted in $6.33 million in property damages and $50,000 in crop damages in Washington County over the past 46 years. This likely underestimates damages caused to infrastructure and power lines.

For Mitigation Information Portal (MIP) data entry, planners utilized the historical worst-case scenario loss of $5 million. Planners considered the entire building stock as exposed and used the worst-case scenario event to occur in Washington County as the representative historical occurrence for completion of the following table.

| SEVERE WEATHER LOSS ESTIMATE – MIP DATA ENTRY | | |
|---|---|---|
| *Structure Type* | *Number* | *Loss Estimate* |
| Residential | 1 | $471,000 |
| Non-Residential | 1 | $154,000 |
| Critical Facilities | 1 | $25,000 |
| TOTALS | 3 | $650,000 |

*Vulnerability Assessment*

This section summarizes the vulnerability of Washington County to severe weather events. Washington County conducted an online survey for the public to share its thoughts on hazard vulnerabilities. The following table presents the results of that survey regarding severe weather. For the following table, data includes severe thunderstorms and associated hail, and lighting, as well as severe winter storms and associated blizzards, heavy snow, ice and extreme cold, as those hazards appeared combined in the survey.

| PUBLIC SENTIMENT, SEVERE WEATHER – WASHINGTON COUNTY | | | | | |
|---|---|---|---|---|---|
| *Hazard* | *Level of Concern* | | | | *Total Responses* |
| | *Not at All* | *Somewhat* | *Concerned* | *Very* | |
| Severe Weather | 2 (5.56%) | 14 (38.89%) | 15 (41.67%) | 6 (16.67%) | 36 |
| In the past ten years, do you remember this hazard occurring in your community? | | | | 33 (91.67%) | 36 |
| Have you noticed an increase in the occurrences or intensity of this hazard? | | | | 13 (36.11%) | 36 |
| Have you noticed a decrease in the occurrences or intensity of this hazard? | | | | 1 (2.78%) | 36 |



The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's Mitigation Information Portal (MIP) tool.

| SEVERE WEATHER VULNERABILITY SUMMARY | | | |
|---|---|---|---|
| *Category* | *Points* | *Description* | *Notes* |
| Frequency | 5 | Excessive | There have been 205 severe weather events since 1974. Washington County can expect an average of 4.5 severe weather events per year. |
| Response | 3 | One week | The response to most severe weather events typically occurs over the course of one day; however, several do require a minimum of one week. |
| Onset | 2 | 12-24 hours | All types of severe weather can be predicted up to 12 hours in advance. |
| Magnitude | 4 | More than 50% of land area affected | Severe weather events typically affect large portions of the county simultaneously. |
| Business | 1 | Less than 24 hours | Businesses would not typically close for a severe weather event. Damages from a significant storm may cause a short (less than 24 hour) disruption of services. |
| Human | 2 | Low (some injuries) | There have been five injuries, and no deaths reported due to one severe weather. While injury and death are possible, it is unlikely that severe weather would cause significant human injuries. |
| Property | 2 | 10-25% of property affected | Though impacting large land areas, severe weather events often result in minimal property damage (when considering it at a countywide level). |
| Total | 19 | Medium | |