

### 4.12 Severe Wind and Tornadoes

#### 4.12.1 Description

FEMA defines a tornado as “a violently rotating column of air extending from a thunderstorm to the ground.” Tornadoes can generate wind speeds of greater than 250 MPH. Tornado paths can be as large as one mile wide and 50 miles long. Nationally, there is an average of 800 tornadoes reported annually across all 50 states.

In general, the midsection of the United States experiences a higher rate of tornadoes than other parts of the country because of the recurrent collision of moist, warm air moving north from the Gulf of Mexico with colder fronts moving east from the Rocky Mountains. Supercells, which form from rotating thunderstorms, are the most destructive variety of tornado.

Tornado Warnings are issued by the Wilmington NWS Forecast Office when a tornado is indicated by the WSR-88D radar or sighted in person by spotters. The WSR-88D radar is an advanced Weather Surveillance Doppler Radar utilized by the NWS to generate a radar image. Once a warning has been issued, people in the warning area should seek shelter immediately. Warnings will include the location of the tornado, as well as what communities will be in its path. A tornado warning can be issued without a tornado watch, and they are typically issued for 30 minutes at a time. If the thunderstorm responsible for the formation of the tornado is also producing large volumes of rain, the tornado warning may be combined with a Flash Flood Warning. The NWS Office will follow up any Tornado Warnings with Severe Weather Statements to provide up-to-date information on the tornado and inform the public when the warning is no longer in effect (Source: NWS).

This section also takes severe wind events, as they can be as destructive as some tornadoes. The NWS can issue various types of wind advisories and warnings. A **wind advisory** is issued when sustained winds of 31 to 39 MPH are reached for an hour or more and/or if there are wind gusts of 46 to 57 MPH for any duration. A **High Wind Watch** indicates that sustained, strong winds are possible and outdoor items should be secured. People should modify plans so they are not caught outside. Additionally, a **High Wind Warning** indicates that sustained, strong winds (40 MPH or greater) with even stronger gusts (greater than 58 MPH) are happening. People should seek shelter, and those driving should keep both hands on the wheel and slow down. An **extreme wind warning** is issued for surface winds of 115 MPH or greater associated with non-convective, downslope, derecho (not associated with a tornado), or sustained hurricane winds that are expected to occur within one hour.

#### 4.12.2 Location

Tornadoes can occur anywhere in Clinton County. All areas and jurisdictions should be considered at risk for a tornado.

#### 4.12.3 Extent

Tornadoes are measured by damage scale for their winds with greater damage equating greater wind speed. The original Fujita Tornado Damage Scale (F-scale) was developed in 1971 without much consideration to a structure’s integrity or condition as it relates to the wind speed required to damage it. The Enhanced Fujita-scale (EF-Scale) took effect on February 1, 2007. This scale starts with the original F-scale’s F0-F5 ratings and classifies tornado damage across 28 different types of damage indicators. These indicators mostly involve building/structure type and are assessed at eight damage levels from 1-8. Therefore, construction types and their relative strengths and weaknesses are incorporated into the EF classification given to a particular tornado. The most intense damage

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within the tornado path will generally determine the EF scale given the tornado. **Table 4.12.1** lists the classifications under the EF- and F-scale. It should be noted that the wind speeds listed in this table are estimates based on damage rather than measurements.

There are no plans by the National Oceanic Atmospheric Administration (NOAA) or the National Weather Service to re-evaluate the historical tornado data using the enhanced scale. Therefore, this Plan and subsequent plans will reference both scales until a complete switchover is deemed necessary.

**Figure 4.12.1**, simulates an extremely destructive, worst-case scenario EF5 tornado and its impacts on Clinton County assets and infrastructure. The worst-case scenario is simulated by running the EF5 tornado on a straight path through the most populated areas of the County. This theoretical scenario is performed to determine maximum potential damage within the County. The damages associated with this theoretical scenario are used to identify the County’s potential vulnerability to tornadoes (**Table 4.12.2**).

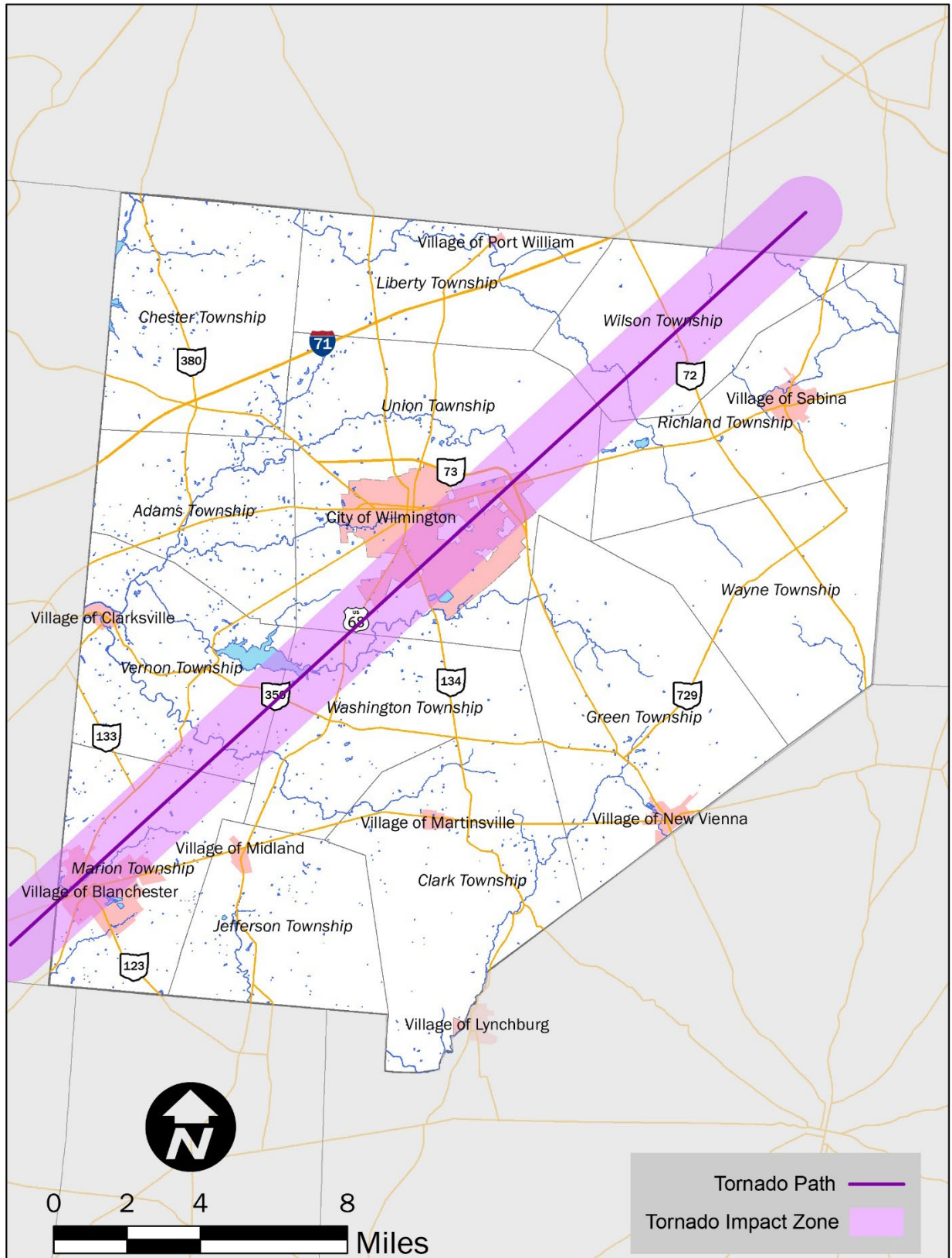
**Table 4.12.1 Fujita and Enhanced Fujita Scale Classifications**

Fujita Scale 3-Second Wind Gust (MPH)		Damage Levels	Enhanced Fujita Scale 3-Second Wind Gust (MPH)	
F0	45-78	<b>Light Damage:</b> Tree branches down.	EF-0	65-85
F1	79-117	<b>Moderate damage:</b> Roof damage.	EF-1	86-110
F2	118-161	<b>Considerable damage:</b> Houses damaged.	EF-2	111-135
F3	162-209	<b>Severe damage:</b> Buildings damaged.	EF-3	136-165
F4	210-261	<b>Devastating damage:</b> Structures leveled.	EF-4	166-200
F5	262-317	<b>Incredible damage:</b> Whole towns destroyed.	EF-5	Over 200

Source: SOHMP

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Figure 4.12.1: Worst-Case Tornado Scenario



### 4.12.4 History

There have been 36 severe wind or tornado events in Clinton County between April 1961 and June 2020 resulting in a total of \$13.417 million in property damage and \$16,000 in crop damage. These events were responsible for two deaths and 19 injuries. Ten of these events occurred in the last ten years. Annualized damages average to approximately \$227,407 in property damages and \$271 in crop damages. Events with the highest recorded property damages, injuries, and fatalities are described below. Additionally, one event resulted in a Disaster Declaration. This is also described below.

#### ***Disaster Declaration FEMA-1805-DR on October 14, 2008 | Windstorms on September 14, 2008***

On October 14, 2008, Governor Ted Strickland requested a major disaster declaration due to a severe windstorm associated with Tropical Depression Ike on September 14, 2008. The Governor requested a Declaration for public assistance for 33 counties and Hazard Mitigation for all counties. During the period of October 6-10, 2008, joint Federal, State, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties and are summarized below. PDAs estimate damage immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the State and the affected local governments, and that Federal assistance is necessary.

On October 24, 2008, President Bush declared that a major disaster exists in the State of Ohio. This declaration made Public Assistance requested by the Governor available to State and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe windstorm associated with Tropical Depression Ike in Ashland, Brown, Butler, Carroll, Champaign, Clark, Clermont, Clinton, Coshocton, Delaware, Fairfield, Franklin, Greene, Guernsey, Hamilton, Harrison, Highland, Hocking, Holmes, Knox, Licking, Madison, Miami, Montgomery, Morrow, Perry, Pickaway, Preble, Shelby, Summit, Tuscarawas, Union, and Warren Counties. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.

In total, the County reported \$5.1 million in property damages associated with this event. Clinton County had a per capita impact of \$10.76, which is more than twice the statewide per capita impact of \$4.75. (Source: FEMA)

#### ***Tornado on September 14, 1990***

An F2 tornado caused \$2.5 million in property damage, as well as two injuries. The tornado was approximately 200 yards wide and tracked 22.5 miles. Two mobile homes were destroyed, as well as seven barns and outbuildings. (Source: NCEI)

#### ***Tornado on March 10, 1986***

An F2 tornado caused ten injuries and \$2.5 million in property damage on March 10, 1986. The tornado was measured to be 50 yards wide and tracked 8.8 miles across the County. The tornado touched down in western Wilmington and tracked northeast, traveling through the northern part of the City. Two permanent homes were destroyed, and six permanent homes were badly damaged. Five business buildings were also seriously damaged. In one trailer park, 30 mobile homes were overturned. The tornado was 73 yards wide and tracked for 6 miles.

#### ***Tornado on April 23, 1968***

An F4 tornado caused two injuries and \$2.5 million in property damage on April 23, 1968. The tornado was measured to be 33 yards wide and tracked 6.1 miles across the County.

**Tornado on April 25, 1961**

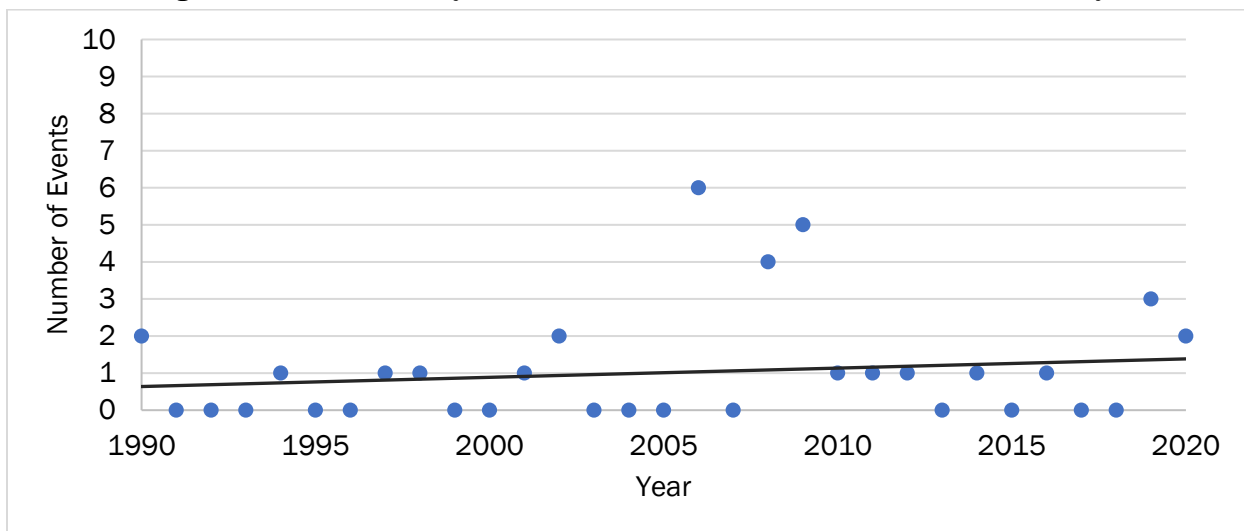
An F2 tornado caused two fatalities, four injuries, and \$250,000 in property damage on April 25, 1961. The tornado was measured to be 50 yards wide and tracked 8.8 miles across the County.

**4.12.5 Probability**

There have been 36 severe wind or tornado events in Clinton County between April 1961 and June 2020 resulting in a total of \$13.417 million in property damage and \$16,000 in crop damage. As such, tornadoes are likely to occur within Clinton County and result in an average of \$227,678 in property and crop damages annually. In the last ten years, there have been ten tornado or severe wind events.

The annual rate for tornadoes and severe wind events in Clinton County is 0.61 events per year, which amounts to approximately one event every one to two years. However, when conditions are right, there may be multiple tornadoes in one year. This rate is displayed in **Figure 4.12.2** below, which shows the number of tornado or severe wind events each year since 1990. The slope is slightly positive, which means the frequency of severe wind and tornado events has increased since 1990.

**Figure 4.12.2: Probability of Severe Wind or Tornado Events in Clinton County**



**4.12.6 Vulnerability Assessment**

**Infrastructure Impact**

Above-ground infrastructure can be damaged by severe winds and tornadoes. Debris caught in the high winds as well as fallen trees can also cause damage to buildings and infrastructure including road closure (**Figure 4.12.3**). Above ground utility infrastructure can be damaged or destroyed, which can cause service outages.

**Population Impact**

Tornadoes are random in nature and have the potential to occur anywhere in the County. Everyone within the County should be prepared for a tornado and severe wind events. Residents in mobile home parks are particularly vulnerable and should have a plan in place.



**Property Damage**

Tornadoes can cause significant damage to buildings and properties. There have been 36 tornadoes in Clinton County which have caused more than \$13.4 million in property and crop damage. Annually, this amounts to \$227,678 in damages. **Table 4.12.2** details the structural vulnerability from the worst-case scenario tornado for Clinton County, which is demonstrated in **Figure 4.12.1**.

**Figure 4.12.3: A fallen tree blocks road outside Wilmington during a Tornado**



**Loss of Life**

At least two lives have been lost as a result of a tornado in Clinton County. There is potential for loss of life during any tornado event.

**Economic Losses**

Tornadoes and severe winds can cause major damage to structures and roads. Higher severity tornadoes have the potential to destroy structures. Debris also has the potential to cause damage to structures by breaking windows, damaging walls, or falling directly onto buildings and above-ground infrastructure.

Damages to utilities and roadways may also cause economic damage due to business closures, destruction of goods that require electricity, and halting economic activity. The following table projects the vulnerability to structures in Clinton County based on the worst-case scenario tornado depicted in **Figure 4.12.1**. This modeling is completed only to demonstrate potential damages associated with a EF-5 tornado that tracks through the most populated areas of the County.

**Table 4.12.2: Structure Vulnerability from Tornadoes**

Structure Type	Number of Properties Exposed	Value of Vulnerable Structures		
		Land	Building	Total
Residential	3,183	\$16,248,790	\$58,535,050	\$74,783,840
Non-Residential	1,683	\$98,058,860	\$121,132,340	\$219,191,200
Critical Facilities	19	\$4,534,400	\$21,011,560	\$25,545,960
<b>Total</b>	<b>4,866</b>	<b>\$114,307,650</b>	<b>\$179,667,390</b>	<b>\$293,975,040</b>

*\*Note: Critical Facilities are non-residential structures and their value is incorporated into the non-residential totals as well. Calculated totals are determined by summing the residential and non-residential values.*

**4.12.7 Land Use and Development Trends**

Tornadoes can occur anywhere. Any development that has occurred since that previous plan and any future development has the potential to be impacted by tornadoes.