

HAZARD IDENTIFICATION AND VULNERABILITY ANALYSIS (HIVA)

Walla Walla County, Washington

TORNADO

Hazard Overview

A tornado is “a violently rotating column of air, pendant from a cumuliform cloud or under a cumuliform cloud, and often but not always visible as a funnel cloud.”¹ The vortex must be connected to both the cloud and the ground to be classified as a tornado. Tornadoes are an extremely difficult hazard to classify and define. Not all of them have a visible funnel, it is nearly impossible to pinpoint at what wind speed of the cloud-to-ground ground vortex becomes a tornado, and the difference between a strong mesocyclone (parent thunderstorm circulation) on the ground and a large, weak tornado is difficult to differentiate.

Since there are so many degrees to which a tornado can exist, Dr. T. Theodore Fujita developed a damage scale for tornado winds relates the degree of damage to the intensity of the wind. This scale, the Fujita Scale shown below in Figure One, is the only widely used tornado rating method. This scale, however, is somewhat arbitrary because it is so hard to define wind speeds and to determine how much wind may be needed to cause a certain amount of damage.² Tornadoes are labeled “significant” if they do damage of F2 or greater on the Fujita Scale.

Figure One³
The Fujita Scale

Maximum Wind Speeds	Equivalent Saffir-Simpson Scale	Typical Effects
F0 Category Tornado		
40-72 mph (35-62 kt)	NA	Gale Tornado. Light Damage: Some damage to chimneys; breaks twigs and branches off trees; pushes over shallow-rooted trees; damages signboards; some windows broken; hurricane wind speed begins at 73 mph.
F1 Category Tornado		
73-112 mph	Cat 1/2/3	Moderate Tornado. Moderate damage: Peels

¹ *Glossary of Meteorology* (AMS 2000).

² The Online Tornado FAQ Page, Robert Edwards, Storm Prediction Center

³ NCDC Satellite Events Art Gallery, NCDC Website

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Maximum Wind Speeds	Equivalent Saffir-Simpson Scale	Typical Effects
(63-97 kt)		surfaces off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.
<i>F2 Category Tornado</i>		
113-157 mph (98-136 kt)	Cat 3/4/5	Significant Tornado. Considerable damage: Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
<i>F3 Category Tornado</i>		
158-206 mph (137-179 kt)	Cat 5	Severe Tornado. Severe damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.
<i>F4 Category Tornado</i>		
207-260 mph (180-226 kt)	Cat 5?	Devastating Tornado. Devastating damage: Well constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees in forest uprooted and carried some distance away.
<i>F5 Category Tornado</i>		
261-318 mph (227-276 kt)	NA	Incredible Tornado. Incredible damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 ft (100 m); trees debarked; incredible phenomena will occur.
<i>F6-F12 Category Tornadoes</i>		
Gtr than 319 mph	NA	The maximum wind speeds of tornadoes are not expected to reach the F6 wind speeds.

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Maximum Wind Speeds	Equivalent Saffir-Simpson Scale	Typical Effects
(277 kt)		

Figures one through three below show examples of Tornadoes that caused F0, F2, and F4 damage on the Fujita Scale.⁴

Figure 2: An F0 Tornado near Erick OK, 1989



Figure 1: An F2 Tornado in El Reno OK, April 1978



Figure 3: An F4 Tornado in Binger OK, May 1981



⁴ NOAA Public Domain Tornado Images, NOAA Website

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History and Probability of Occurrence

From 1880 through 2002 Walla Walla County has experienced seven recorded tornados and three reported funnel clouds. Funnel clouds are twisting clusters of air and clouds that form the beginning of a tornado. They may lower slightly below the cloud line, but do not make contact with the ground. In Walla Walla County these tornados have rated between F0 and F2. The most damaging tornados recorded in Washington State occurred in Clark, King, and Lincoln counties, all rating an F3. However, with a total of seven tornados, Walla Walla County is among the top three counties in Washington State to have experienced the most tornados since 1880.

The seven tornados in Walla Walla County occurred in June of 1916, September of 1936, April of 1958, June of 1958, May of 1964, August of 1982, and August of 1987. The beginning and end locations of these tornados is unknown. Figure Four below shows the date each tornado took place, its length and width, its magnitude, and the amount of property damage that was caused. None of these tornados caused any injuries, fatalities or crop damage, but two of them did cause property damage.⁵

Figure Four⁶

History of Tornados in Walla Walla County, 1880 – 2002

Date	Hour	Length/Width	Magnitude	Amt Prop. Damage
Jun 1916	---	NA	F2	NA
Sep 1936	1750	NA	F0	NA
Apr 1958	1515	45 mi/17 yds	F0	\$0.0K
Jun 1958	1800	0 mi/50 yds	F0	\$25.0K
May 1964	1419	11 mi/7 yds	F0	\$0.0K
Aug 1982	1625	0 mi/10 yds	F0	\$0.0K
Aug 1987	1700	0 mi/10 yds	F0	\$2.5K

Two of the documented funnel clouds occurred near the Walla Walla Airport, and one was spotted near Waitsburg. They took place in March of 1999, May of 2000, and April of 2001. None of them caused any fatalities, injuries or property damage, and one was associated with a thunderstorm that brought pea-sized hail to the city of Walla Walla.

Tornados are infrequent west of the Rockies per unit area. Walla Walla County has only had seven reported tornados since 1880, so the probability of another occurrence within the next twenty-five years is very low. The possibility that a tornado could hit any given square mile of land is about every thousand years on

⁵ NCDC Storm Events – Tornados by State, www.tornadoproject.com

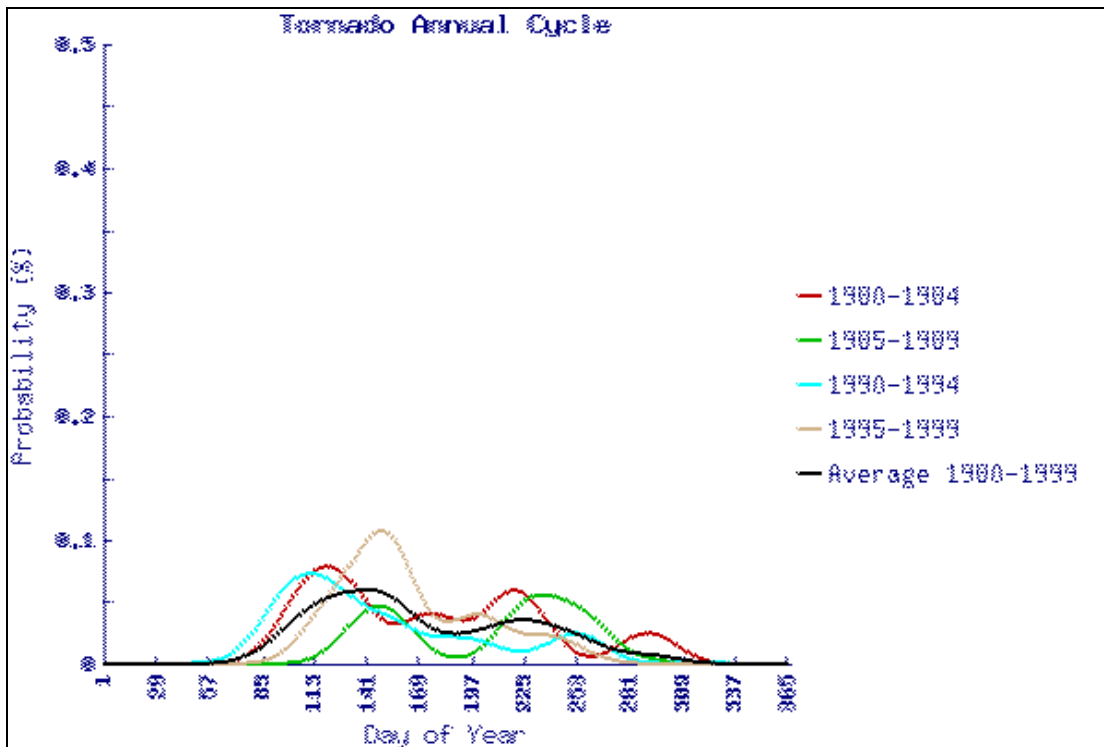
⁶ I.B.I.D.

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average, but this probability varies across the United States dependant on terrain, climate and time of year. This estimate is not an exact number because there is not a long and accurate enough record of tornadoes to make more statistically sound calculations. The probability of a tornado also varies during the year and across the country. Figure Five is a graph that shows the probability of any tornado occurring on any given day for the Walla Walla County area. The y value indicates the percentage chance of receiving tornados on the date indicated by the x-axis value. Figure six shows the probability of a significant tornado event occurring on any given day of the year in the Walla Walla County area. Taking into account these probabilities, along with the history of Tornados in Walla Walla County, the probability of an occurrence within the next twenty-five years in Walla Walla County is LOW.

Figure Five⁷

Probability of any tornado event during any given period of the year within the Walla Walla County area

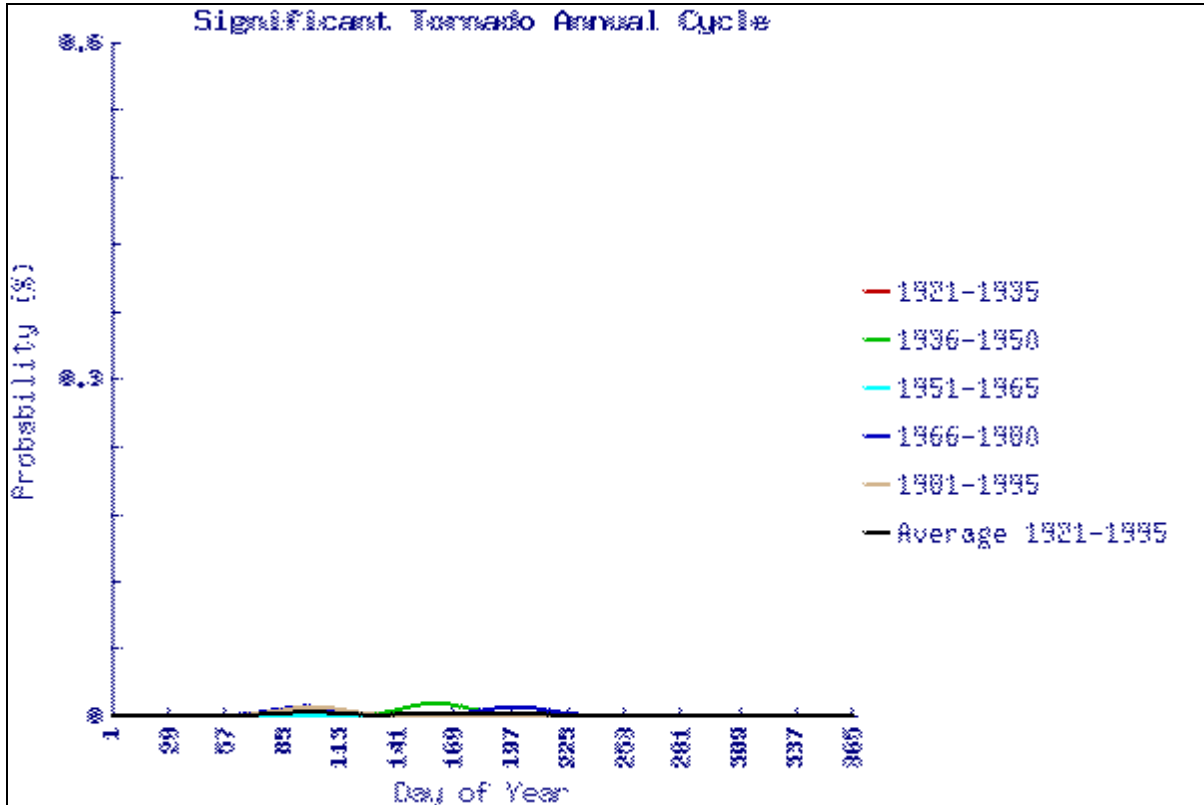


⁷ NOAA National Severe Storms Laboratory, NOAA Website

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Figure Six⁸

Probability of a significant tornado occurrence during any given period of the year within the Walla Walla County area



Vulnerability

All of Walla Walla County is vulnerable to the effects of a tornado. High winds can cause widespread damage to trees and power lines and interrupt transportation, communications, and power distribution. A tornado touchdown also has the potential to cause multiple injuries and fatalities, including people who are on the ground and in the air at the time of the occurrence.

There are numerous other hazards that are associated with tornados. With the increasing amount of hazardous materials being transported within Walla Walla County, the chances that a tornado would cause a hazardous material incident are high. However, the probability of a tornado incident still remains low. The Washington Public Power Supply System's nuclear reactor is built to withstand a tornado's winds, and communications between the reactor, meteorologists, the Hanford Weather Station, Hanford Patrol and other key officials is well organized and has been successfully utilized in the past.

⁸ I.B.I.D.

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The relative isolation of many cities within Walla Walla County also contributes to its vulnerability to prolonged effects of tornado damage. Isolated residents without power are more likely to use wood fires to stay warm or to cook, possibly resulting in an increase in the number of structural fires, and residents without food or water may attempt to use impassable roads and thereby increase the number of potential rescues.⁹ While Walla Walla County has had little occurrence of tornados, the costs associated with a destructive storm could very well be significant.

Tornado forecasting is virtually impossible – forecasting for today or tomorrow is quite difficult, and specific severe weather forecasting more than days in advance is almost random. This is the reason that there is no such thing as a long-range severe storm or tornado forecast. There are simply too many small-scale variables involved which cannot be reliably measured or modeled, so scientific forecasters do not even attempt them.¹⁰ The chances that a tornado would hit a major downtown are quite low – not for any meteorological reason, but simply because downtowns are small targets. Even when tornados hit metro areas, the odds of it hitting downtown are small out of space considerations alone.¹¹

Additionally, there is no nationwide requirement for tornado sirens. The National Weather Service issues tornado watches and warnings, but it is primarily up to local governments to create preparedness and response plans. The two most common reasons for a lack of sirens are low budgets and the perception that tornados are uncommon and cannot happen in the government's respective area. The latter is obviously incorrect, and despite the fact that history shows little chance of a tornado in Walla Walla County, both of these factors combined with the above mentioned issues warrant a MEDIUM vulnerability rating for cities within the county if a tornado *were* to occur.

Risk Rating

Despite the moderate vulnerability rating, storm history suggests such a low probability of a tornado occurrence that a LOW risk rating is assigned. There is little potential for a tornado disaster during the next 25 years. The threat is such as to warrant little special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the county's emergency management training and exercise program except as generally dealt with during hazard awareness training.

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⁹ Thurston County Severe Storms HIVA.

¹⁰ The Online Tornado FAQ Page.

¹¹ I.B.I.D.

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