

THUNDERSTORM

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Hazard Description

Severe storms are generally considered a common occurrence in the GBRA Basin. Typical thunderstorms are 15 miles in diameter and lasts an average of 30 minutes. Despite the short time span, thunderstorms can be extremely dangerous as they are often strong and fast in their approach and can be accompanied by flash flooding, lightning, hail, tornadoes, and high winds.



Lightning damage can result in electrocution of humans and animals; vaporization of materials along the path of the strike; fire caused by the high temperature produced by the strike; and sudden power surges that can damage electrical and electronic equipment. Millions of dollars of direct and indirect damages result from lightning strikes on electric utility substations and distribution lines. While property damage is the major hazard associated with lightning, it should be noted that

lightning strikes kill nearly 100 people each year in the United States¹.

Location

Thunderstorms occur randomly, and therefore it is impossible to predict where they will strike within the City. Thus, it is assumed that the GBRA Basin is uniformly exposed to the threat of thunderstorms.

¹ National Weather Service

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Extent

A severe thunderstorm is measured in terms of intensity based on the strength of the wind speeds or significant winds associated with the thunderstorm event. Table 7-1 depicts intensity for thunderstorms according to wind magnitude published by the World Meteorological Organization (WMO).

Table 7-1. Beaufort Wind Scale

FORCE	WIND (KNOTS)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-18	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	19-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-31	Strong Breeze	Larger tree branches moving, whistling in wires
7	32-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Whole trees in motion, resistance felt walking against wind
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-72	Violent Storm	If experienced on land, widespread damage
12	73+	Hurricane	Violence and destruction

A severe thunderstorm event is typically defined by the NCDC based on the intensity and magnitude of wind events associated with the thunderstorm, which can affect the planning area randomly. Because the magnitude of a severe thunderstorm does not take into account wind speeds from a hurricane or tornado (for specific information on hurricanes and tornado, see Sections 6 and 9, respectively), but specifically significant winds, the extent to which it can affect the planning area is a range from a Force 9 to a Force 12. On average, an intense wind event to be mitigated for each of the jurisdictions could have wind speeds ranging from 50 miles per hour, a Force 9 from the Beaufort Wind Scale. Since the greatest

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wind speed recorded for the area is 95 knots (See Table 7-2), in preparation for a severe thunderstorm, the extent to be mitigated is a Force 12.

Historical Occurrences

Table 7-2 lists previous thunderstorm events as compiled by the National Climatic Data Center (NCDC). It is important to note that only thunderstorm events that have been reported have been factored into this risk assessment, and in most cases NCDC data is limited to severe thunderstorm events that are noteworthy for specific reasons (high winds, deaths, injuries, property or crop damages, lightning strikes). It is likely that a high number of thunderstorm occurrences have gone unreported over the past 50+ years.

Table 7-2. Historical Thunderstorm Events by Jurisdiction (NCDC, 1950-2009)

JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM WIND SPEED RECORDED (KNOTS)	DEATHS	INJURIES	REPORTED PROPERTY DAMAGE (2009 DOLLARS)	REPORTED CROP DAMAGE (2009 DOLLARS)
Caldwell County	26	70	0	0	\$1,069,849	\$148,322
Lockhart	8	80	0	0	\$1,027,518	\$75,724
Luling	7	60	0	0	\$1,105,746	\$80,013
Martindale	7	95	0	0	\$15,777,482	Negligible
Calhoun County	30	87	1	0	\$7,365	Negligible
Point Comfort	0	N/A	0	0	Negligible	Negligible
Port Lavaca	5	53	0	0	Negligible	Negligible
Seadrift	2	61	0	0	\$7,572	Negligible
DeWitt County	30	62	0	0	\$9,365,893	\$930,024
Cuero	13	70	0	0	\$612,371	\$29,302
Nordheim	1	0	0	0	\$98,390	\$36,896
Yoakum	0	N/A	0	0	Negligible	Negligible
Yorktown	6	60	0	0	\$220,575	\$70,487
Gonzales County	15	90	0	0	\$288,265	Negligible
Gonzales	10	60	0	0	\$1,074,856	\$75,724
Nixon	2	50	0	0	\$7,148	Negligible
Waelder	0	N/A	0	0	Negligible	Negligible
Cibolo (Guadalupe County)	4	0	0	0	\$94,074	Negligible
Kendall County	15	75	0	1	\$405,919	Negligible

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JURISDICTION	NUMBER OF REPORTED EVENTS	MAXIMUM WIND SPEED RECORDED (KNOTS)	DEATHS	INJURIES	REPORTED PROPERTY DAMAGE (2009 DOLLARS)	REPORTED CROP DAMAGE (2009 DOLLARS)
Boerne	8	60	0	0	\$331,224	Negligible
Refugio County	9	60	0	0	Negligible	Negligible
Austwell	0	N/A	0	0	Negligible	Negligible
Bayside	1	50	0	0	Negligible	Negligible
Refugio	7	60	0	0	\$7,572	\$7,572
Woodsboro	1	N/A	0	0	Negligible	Negligible
Victoria County	60	87	0	0	\$7,572	\$9,126
Victoria	32	65	0	0	\$100,614	\$27,576
TOTALS FOR STUDY AREA²	299	95	1	1	\$31,610,005	\$1,490,766

Probability of Future Events

The probability of occurrence for future thunderstorms in the GBRA Basin is highly probable, meaning there is greater than a 75 percent chance of a storm occurring in any given year. According to the NCDC reported historical occurrences, areas within the Basin experiences a severe storm twice a year. Given this regular frequency of occurrence, it can be expected that future thunderstorms will continue to threaten life and cause minor³ property damages throughout the Basin area.

Impact and Vulnerability

According to the available data for previous occurrences, high winds are common to the GBRA area when accompanied by thunderstorms. If another Beaufort event of 10 or higher were to occur, the Basin would be susceptible to structural damage to structural facilities, especially roofs and windows. Injuries may also occur as a result of debris that is carried by strong gusts or twigs and branches that are broken off from the force of the wind. Traffic disruptions may also occur as traffic lights could be damaged or flying debris could cause accidents on the road. This would hinder the ability of critical services staff to travel to and from work.

² Totals for the study area may include values less than \$5,000 for dollar amounts that are classified as “Negligible” in the table.

³ Minor damages mean the potential to destroy or substantially damage more than ten percent of property or shutdown facilities for one week.

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To estimate thunderstorm losses, NOAA historical thunderstorm loss data was used to develop a thunderstorm stochastic model. In this model, losses were scaled to account for inflation and expected annualized losses were calculated through a non-linear regression of historical data. Table 7-3 shows potential annualized losses by jurisdiction. “Negligible” indicates that the annualized expected property losses are less than \$5,000.

Table 7-3. Potential Annualized Losses by County (Thunderstorm)

JURISDICTION	TOTAL EXPOSURE	ANNUALIZED LOSS (AL)	ANNUALIZED LOSS RATIO (ALR)
Caldwell County	\$605,797,000	\$20,303	0.00%
Lockhart	\$618,183,000	\$18,387	0.00%
Luling	\$264,373,000	\$19,763	0.01%
Martindale	\$40,522,000	\$262,958	0.65%
Calhoun County	\$609,016,000	Negligible	0.00%
Point Comfort	\$80,897,000	Negligible	0.00%
Port Lavaca	\$651,340,000	Negligible	0.00%
Seadrift	\$62,036,000	Negligible	0.00%
DeWitt County	\$469,085,000	\$171,599	0.04%
Cuero	\$412,893,000	\$10,695	0.00%
Nordheim	\$25,111,000	Negligible	0.00%
Yoakum	\$370,136,000	Negligible	0.00%
Yorktown	\$127,049,000	Negligible	0.00%
Gonzales County	\$457,255,000	Negligible	0.00%
Gonzales	\$401,785,000	\$19,176	0.00%
Nixon	\$94,690,000	Negligible	0.00%
Waelder	\$37,972,000	Negligible	0.00%
Cibolo (Guadalupe County)	\$221,273,000	\$13,938	0.01%
Kendall County	\$1,181,519,000	\$6,765	0.00%
Boerne	\$494,789,000	\$5,520	0.00%
Refugio County	\$ 149,487,000	Negligible	0.00%
Austwell	\$28,397,000	Negligible	0.00%
Bayside	\$26,026,000	Negligible	0.00%
Refugio	\$186,843,000	Negligible	0.00%

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JURISDICTION	TOTAL EXPOSURE	ANNUALIZED LOSS (AL)	ANNUALIZED LOSS RATIO (ALR)
Woodsboro	\$78,606,000	Negligible	0.00%
Victoria County	\$1,174,737,000	Negligible	0.00%
Victoria	\$3,942,383,000	Negligible	0.00%
TOTALS FOR STUDY AREA⁴	\$12,812,200,000	\$530,717	0.06%

Source: HAZUS-MH MR4 (exposure values) and NCDC (property losses)

⁴ Totals for the study area may include values less than \$5,000 for amounts that are classified as “Negligible” in the table.