Section 10. Severe Winter/Ice Storms

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Why Severe Winter/Ice Storms Are a Threat

Winter storms originate as mid-latitude depressions or cyclonic weather systems, sometimes following the path of the jet stream. A winter storm, or blizzard, combines heavy snowfall, high winds, extreme cold and ice storms. Many winter depressions give rise to exceptionally heavy rain and widespread flooding and conditions worsen if the precipitation falls in the form of snow. The winter storm season varies widely, depending on latitude, altitude and proximity to moderating influences.

The occurrence of large snowstorms, ice storms and severe blizzards can have a substantial impact on communities, utilities and transportation systems, often resulting in the loss of life due to accidents of hypothermia. Heavily populated areas are at high risk because the severe weather can cause communication and power lines to go down. High levels of snow can accumulate, building faster than it can be cleared and heavy icing can impact utility systems and transportation routes. Damage to buildings often occurs in areas where the normally anticipated snowfall depths are not considered in building codes. Roof collapses damage residential, commercial and industrial structures.

The degree of exposure to severe winter storms depends on the normal severity of the region's winter weather. Nearly the entire United States, with the exception of the extreme southern states, Hawaii and the U.S, territories can be affected by severe winter storms. Alaska, the Upper Midwestern and Northeastern states tend to be more susceptible than others, but generally these

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regions are better prepared for severe winter weather. The regions where extreme winter weather is less common tend to experience more damage and disruption when the storms hit.

Areas along the Gulf Coast and Southeast regions of the United States are generally unaccustomed to snow, ice, and freezing temperatures. Once in a while, cold air penetrates south across Texas and Florida, into the Gulf of Mexico. Temperatures fall below freezing, killing tender vegetation, such as flowering plants and the citrus fruit crop. Wet snow and ice rapidly accumulate on trees with leaves, causing the branches to snap under the load. Motorists are generally unaccustomed to driving on slick roads and traffic accidents increase. Some buildings are poorly insulated or lack heat altogether. Local municipalities may not have available snow removal equipment or treatments, such as sand or salt, for icy roads.

Hazard Profile

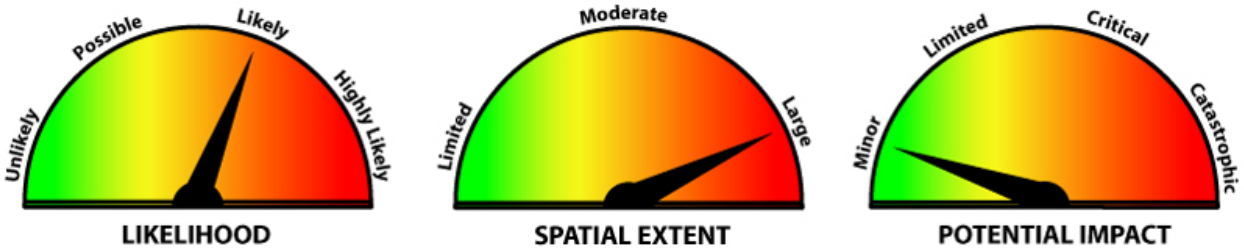

Figure 10-1. Severe Winter/Ice Storm Hazard Profile Summary for the City of Plano

The frequency, or likelihood, of a severe winter/ice storm in the City of Plano is "Likely", with an event probable in the next two to three years. Warning time for severe winter/ice storms is minimal.

The spatial extent of a severe winter/ice storm event is "Large," expected to affect more than 50% of property the City of Plano. The potential impact of severe winter/ice storm is "Minor," resulting in few, if any, injuries. There is only minor property damage and minimal disruption to the quality of life. Shutdown of facilities is temporary.

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Magnitude and Distribution of Severe Winter/Ice Storm Events

Winter ice storms occur in North Central Texas when precipitation occurs during the winter and the temperature is near or below freezing. For this study, a combination of precipitation and minimum temperatures were used as a surrogate for winter ice storms or as a measure of potential winter ice storms. Daily precipitation and daily minimum temperature are measured and recorded at NWS first order climatic stations and are archived at the National Data Climatic Center (NCDC) in Asheville, North Carolina as part of the Daily Surface Data. Six climatic stations in Dallas and Tarrant Counties have at least 20 years of data. These stations and their periods of record are given in Table 10-1. The locations of these stations are shown in Figure 10-2.

Table 10-1. Summary of National Weather Service Climatic Stations in Dallas and Tarrant Counties with 20 or More Years of Daily Precipitation and Minimum Temperature Data

COUNTY	STATION NAME	Beginning Year	Ending Year
Dallas	Dallas Love Field	1948	2000
Dallas	Dallas Hensley Field Nas	1945	1997
Tarrant	Benbrook Dam	1953	2003
Tarrant	Dallas-Fort Worth Intl Ap	1974	2003
Tarrant	Eagle Mountain Lake	1978	2002
Tarrant	Grapevine Dam	1953	2003

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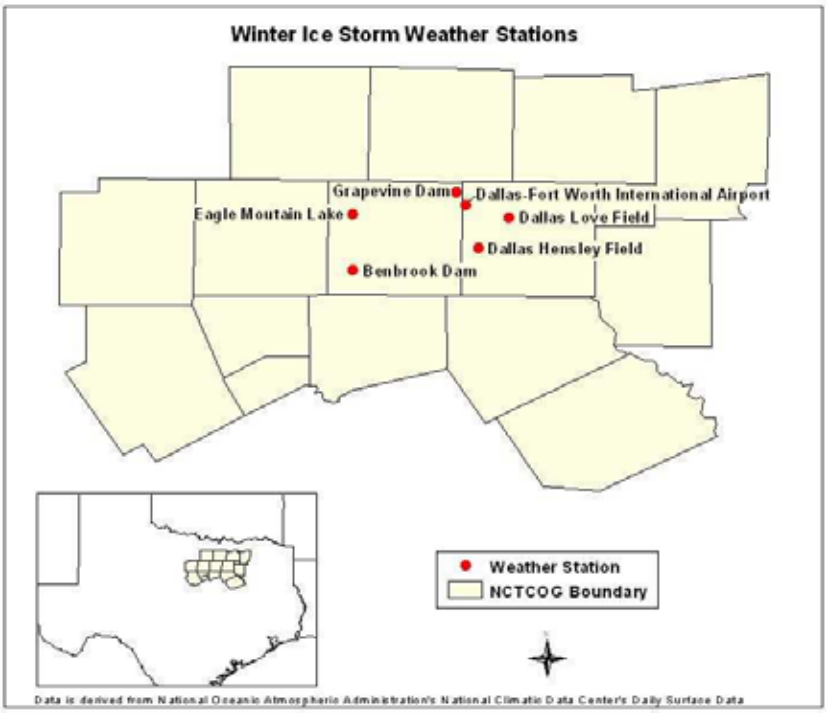

Figure 10-2. Locations of the Six Climatic Stations in Dallas and Tarrant Counties with 20 or More Years of Daily Precipitation and Minimum Temperature Data

Daily precipitation data were used in the analysis if the precipitation equaled or exceeded 0.25 inches and the minimum temperature for that day and the previous day were below 33 degrees Fahrenheit. The assumption is that if the minimum temperatures were below 33 degrees for the previous and current day, then precipitation would likely occur as ice or freezing rain resulting in a winter ice storm.

The 2-, 10-, 50-, and 100-year precipitation values were estimated using both the Weibull and Cunnane plotting position formulas. Plotting position formulas can be used to determine the recurrence intervals of climatic and hydrologic data.

The data series of daily precipitation represents peaks above a threshold since only events in excess of 0.25 inches were selected where the minimum daily temperature was below 33 degrees for the previous and current day. For some years there were multiple events and there were no events for some years.

The frequency estimates based on the Cunnane plotting position were provided at all six climatic stations. Results from two of the locations – Dallas Hensley Field and Dallas Love Field – are provided in Figures 10-3 and 10-4, respectively.

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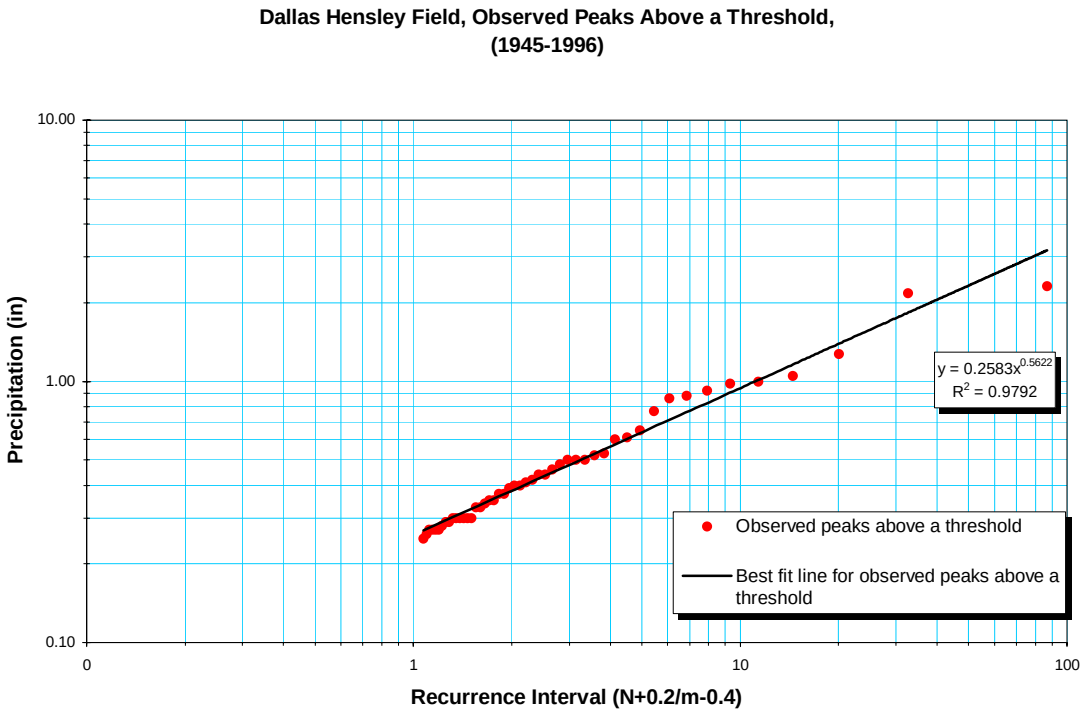

Figure 10-3. Frequency Curve Based on the Cunnane Plotting Position of Precipitation Values Above a Threshold for Dallas Hensley Field for the Period 1945 to 1996

As Figure 10-3 demonstrates, it is expected that within a one year recurrence interval, or "window of time," it is expected that Dallas Hensley Field will experience a freezing precipitation of almost 0.30 inches. It is expected that within a 90-year recurrence interval, or "window of time," Dallas Hensley Field will experience a freezing precipitation of approximately 3.0 inches.

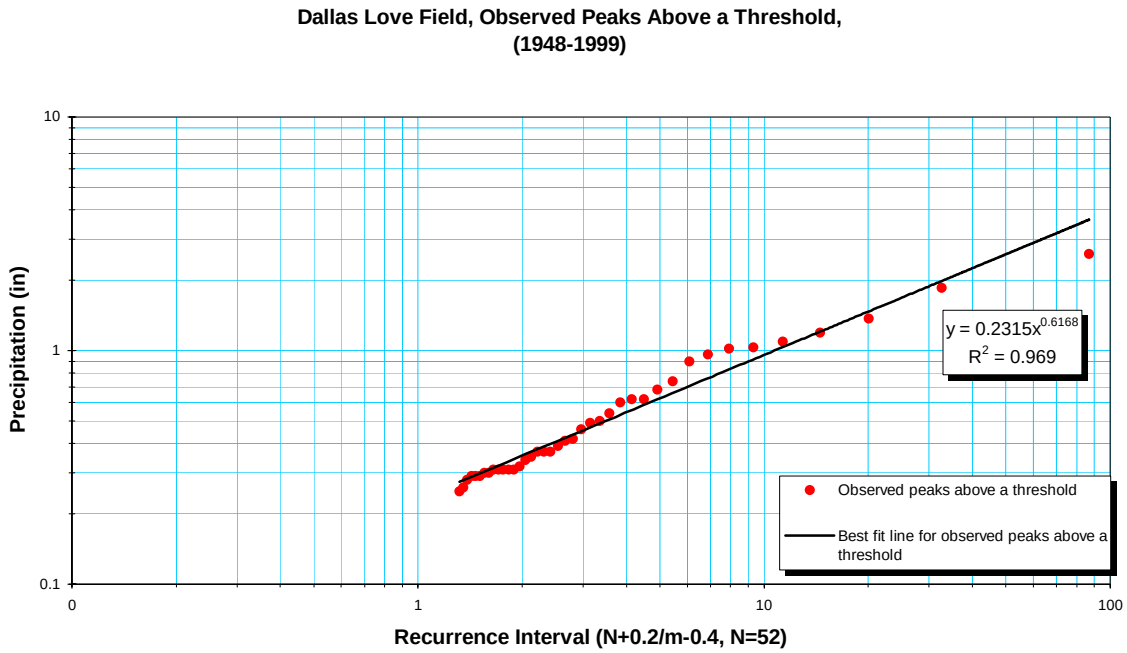

Figure 10-4. Frequency Curve Based on the Cunnane Plotting Position of Precipitation Values Above a Threshold for Dallas Love Field for the Period 1948 to 1999

As Figure 10-4 demonstrates, it is expected that within a one- and a-half year recurrence interval, or "window of time," it is expected that Dallas Love Field will experience a freezing precipitation of almost 0.30 inches. It is expected that within a 90-year recurrence interval, or "window of time," Dallas Love Field will experience a freezing precipitation of approximately 4.0 inches.

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Table 10-2. Summary of Frequency Estimates for Two Plotting Positions for the Six Climatic Stations Based on the Precipitation Data Above a Threshold

	2-year estimate (inches)		10-year estimate (inches)		50-year estimate (inches)		100-year estimate (inches)	
Distribution:	**Weibull**	**Cunnane**	**Weibull**	**Cunnane**	**Weibull**	**Cunnane**	**Weibull**	**Cunnane**
Dallas Love Field (52)	0.35	0.35	1.04	0.96	3.05	2.59	4.86	3.96
Dallas Hensley Field (52)	0.38	0.38	1.01	0.94	2.67	2.33	4.07	3.44
Grapevine Dam (49)	0.48	0.48	1.07	1.04	1.67	1.60	1.93	1.84
Dallas-Fort Worth Int'l AP (28)	0.31	0.31	0.76	0.70	1.89	1.58	2.80	2.25
Eagle Mountain Lake (24)	0.33	0.33	1.01	0.89	3.12	2.41	5.06	3.69
Benbrook Dam (49)	0.45	0.45	0.85	0.82	1.24	1.19	1.42	1.35

The values are also given in Table 10-2 above. For example, using the Cunnane plotting formula, within any given two-year period of time, it is expected that Dallas Love Field will experience 0.35 inches of freezing precipitation. Using the same formula, within any given 100-year period, Dallas Love Field is expected to experience 3.96 inches of freezing precipitation.

The regional distribution of the 10-year event based on the Cunnane plotting position is shown in Figure 10-5.

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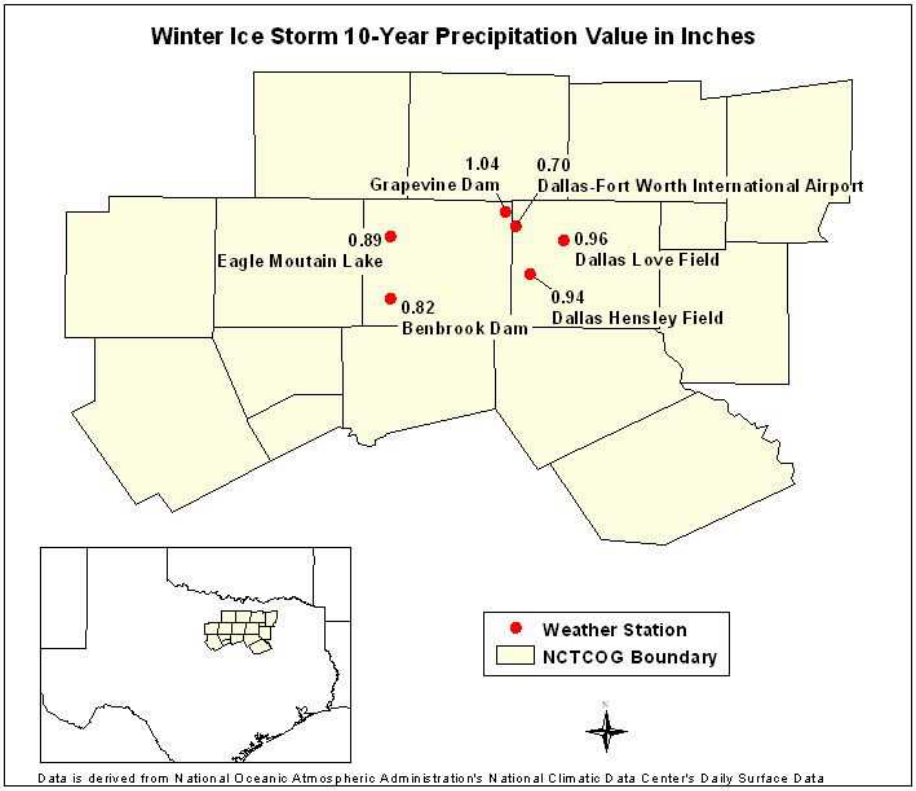

Figure 10-5. Regional Distribution of the 10-year Winter Precipitation Event

Location of Hazardous Areas

There is no distinct geographic boundary to severe winter/ice storms. Severe winter/ice storms can occur in every area of the City and of the North Central Texas region. Figure 10-2 provides a map of reported severe winter ice storm events in the City of Plano as measured by the frequency of ice- or snow-related road condition advisories.

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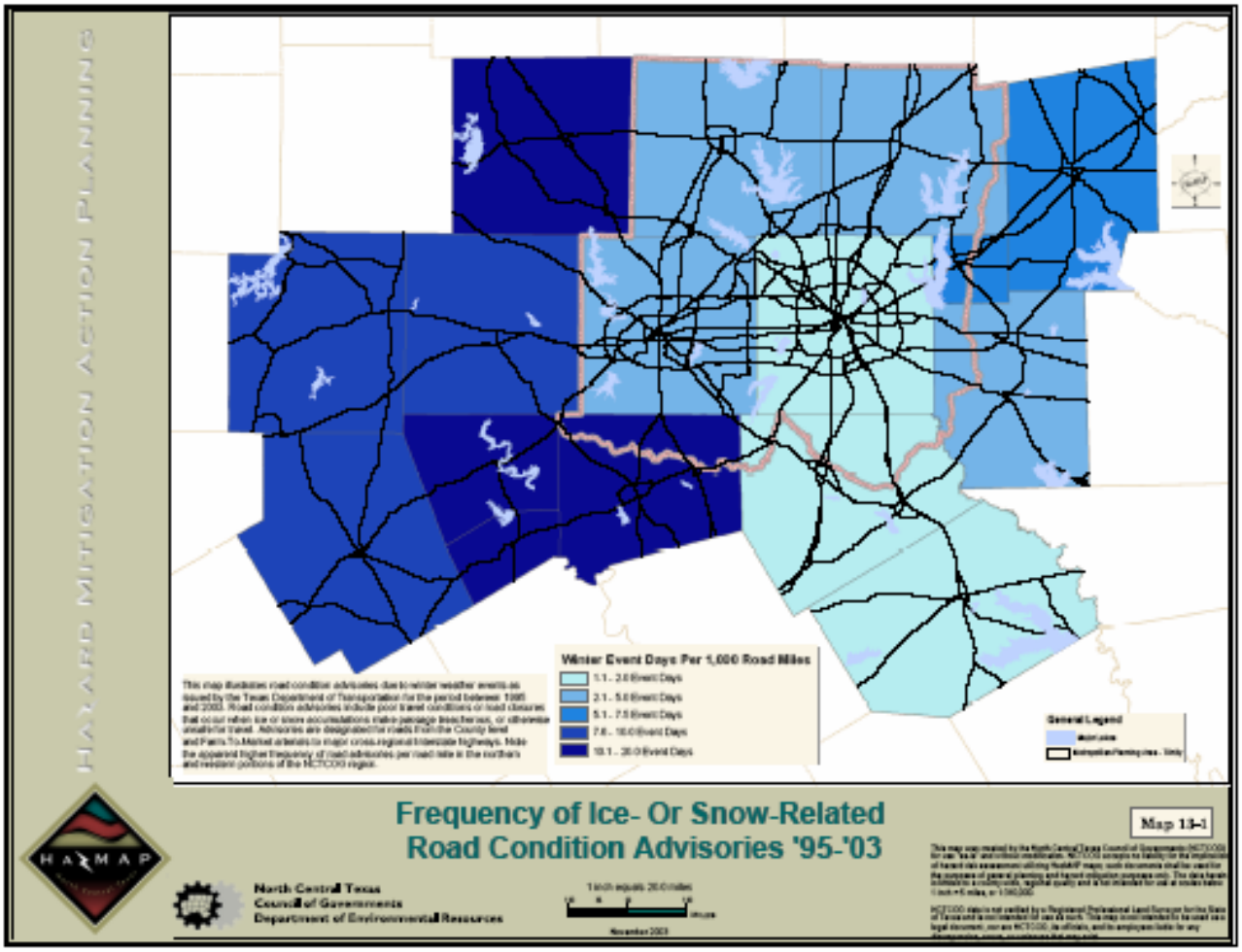

Figure 10-6. Frequency of Ice- and Snow-Related Road Condition Advisories, 1995 - 2003

History of Severe Winter/Ice Storms

While snowstorms are not frequent in Texas, ice storms create dangerous driving conditions, may freeze pipes and down power lines. On January 2001, a severe ice storm caused Hunt County to declare a Presidential Disaster Declaration. A north eastern Texas ice storm ending on January 2, 1979, which had lasted 6 days, was said to be the worst ice storm in Texas in 30 years. An eastern Texas ice storm ending on January 1, 1999 caused power outages lasting more than two days.

According to Table 10-3, there have been 20 snow and ice events reported to NOAA in Collin County, Texas between January 1, 1950 and April 30, 2005.

Table 10-3. Reported Severe Winter/Ice Storm Events in Collin County and the City of Plano, According to the National Oceanic and Atmospheric Administration, January 1, 1950 to April 30, 2005

Event	Location	Date	Deaths	Property Damage
Collin County				
Ice Storm	Collin	02/09/1994	0	50.0M
Winter Storm	Collin	11/24/1996	0	0
Ice Storm	Collin	12/20/1997	0	0
Ice Storm	Collin	12/22/1998	6	0
Winter Storm	Collin	01/25/2000	4	0
Winter Storm	Collin	12/12/2000	0	0
Heavy Snow	Collin	12/25/2000	2	40K
Winter Storm	Collin	12/25/2000	0	0
Winter Storm	Collin	12/31/2000	0	0
Heavy Snow	Collin	01/01/2001	0	0
Winter Storm	Collin	01/27/2001	0	0
Ice Storm	Collin	11/27/2001	0	0
Winter Storm	Collin	01/30/2002	0	0
Winter Storm	Collin	02/05/2002	0	0
Heavy Snow	Collin	02/05/2002	0	0
Winter Storm	Collin	03/02/2002	0	0
Winter Storm	Collin	02/24/2003	0	15.0M
Heavy Snow	Collin	02/14/2004	0	0
Winter Weather/mix	Collin	12/22/2004	0	0

People and Property at Risk

There is no defined geographic boundary for severe winter/ice storm events. All population, buildings, critical facilities, infrastructure and lifelines, and hazardous materials facilities are considered exposed to the severe winter/ice storm hazard and could potentially be impacted. As a result, severe winter/ice storms deserve mitigation consideration by the City of Plano.

Based on a qualitative analysis of the impacts from historical severe winter ice storm events and based on a quantitative analysis of the magnitude and frequency of historical severe winter/ice storm events, the risk of a severe winter ice storm in the City of Plano is sufficient enough to merit mitigation consideration.

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