Section 14. Flooding

Contents

Contents 14-1
Why Floods are a Threat 14-1
Hazard Profile 14-4
Location of Hazardous Areas 14-5
History of Flooding 14-7
National Flood Insurance Program Participation 14-21
People and Property at Risk 14-23

Why Floods are a Threat

Flooding is defined as the accumulation of water within a water body and the overflow of excess water onto adjacent floodplain lands. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding.

According to *American Hazardscapes: The Regionalization of Hazards and Disasters* published by the National Academy Press, Texas, because of its size and location, consistently outranks other states in deaths and damage from floods. Texas is second in casualties and damage from hurricanes and tropical storms.

The State's vulnerability is the result of several factors: its miles of Gulf of Mexico coastline; its proximity to the Pacific Ocean off the west coast of Mexico; its geographical location near the Rocky Mountains of Colorado and Arizona and the high-altitude jet stream; and its nearness to the unique West Texas "dry line," a shifting, invisible atmospheric separation of dry desert air from the moist Gulf air. These factors create a breeding ground for the big storms of spring and fall that spawn tornadoes and suck up Gulf or Pacific moisture that feed the heavy rains that cause flash flooding. All these geographic factors cause Texas to experience extensive, annual storms. Figure 14-1 shows the State's vulnerability to damaging storms.

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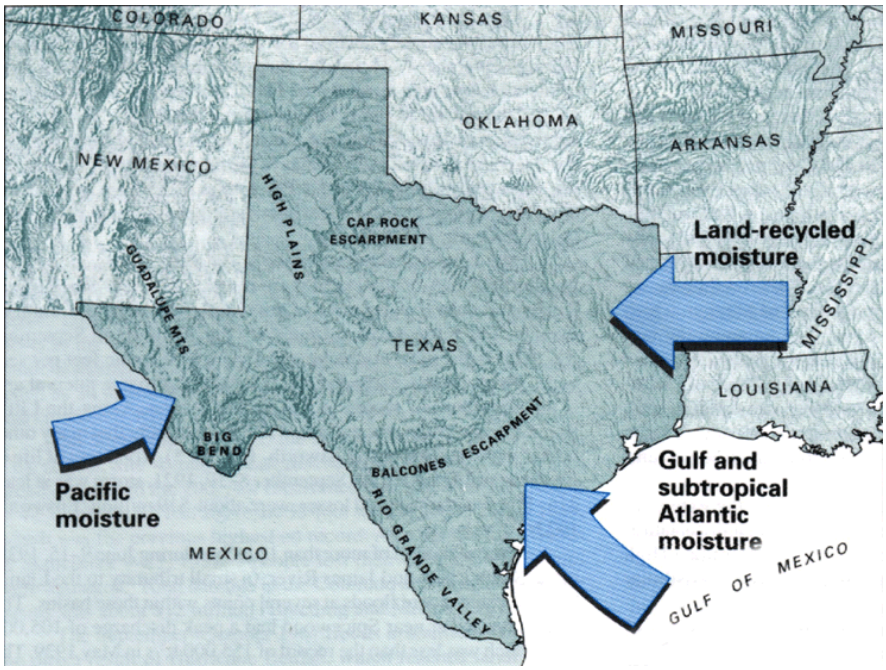

Figure 14-1. Texas Sources of Moisture

According to the Federal Interagency Floodplain Management Task Force, flooding in the United States can be separated into several types:

Hazard Identification: *Riverine Flooding*

Includes overflow from a river channel, flash floods, alluvial fan floods, and ice jam floods. Overbank flooding of rivers and streams is the most common type of flood event. Flooding in large rivers usually results from large-scale weather systems generating prolonged rainfall over wide areas. These same weather systems can cause flooding in smaller basins that drain to major rivers.

Hazard Identification: *Flash Floods*

Are characterized by a rapid rise in water level, high velocity and large amounts of debris. Major factors in flash flooding are the intensity and duration of rainfall and the steepness of watershed and stream gradients. The amount of watershed vegetation, the natural and artificial flood storage areas and the configuration of the streambed and floodplain are also factors.

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Urban flooding in Houston after Tropical Storm Allison.

Flash floods may also result from the failure of a dam or the sudden breakup of an ice jam. They are capable of tearing out trees, undermining buildings and bridges and scouring new channels.

WHAT IS A 100-YEAR FLOOD?

Floods are random, variable events. Hydrologists characterize them as 50-year, 100-year, or 500-year floods. What exactly is a "100-year flood"? It is a flood that has a one-percent chance of being equaled or exceeded in any given year.

A young Missouri farmer has provided an ingenious explanation of the possibility of experiencing a 100-year flood. He described a bag full of 100 marbles with 99 clear marbles and one black marble. Every time you pull one of those marbles out and it's black, you've got a 100-year flood. After each draw, you put the marble back in the bag and shake it up. It's possible, although not likely, that you could pull the black one out two or even three times in a row.

A 100-year flood has a 26 percent chance of occurring over the life of a 30-year mortgage and a 63 percent chance of occurring over the next 100 years. No one, especially those living in high-risk floodplains, should be misled into believing that a 100-year flood occurs only once in a century. In addition, although the 100-year flood is usually the only type people hear about, flood events of all sizes can also occur.

As commonly applied, the concept of a 100-year floodplain can be misleading. Technically, only the outer edge of a 100-year floodplain has a risk of one percent of being flooded in any given year. The risk rises for sites closer to the river, and also at lower elevations, yet many people think of the entire area between the water body and the outer edge of the 100-year floodplain as subject to the same risk. This risk variability is not usually shown on floodplain maps. It should be kept in mind that mapping floodplain boundaries is at best an imperfect science.

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Hazard Identification: *Localized Urban Drainage Problems*

Can be caused by heavy local precipitation flooding areas other than delineated floodplains or along recognizable drainage channels. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems. Flooding of this nature generally occurs in areas with flat gradients and generally increases with urbanization, which speeds the accumulation of floodwaters because of impervious areas.

The statistical meaning of terms like "25-year storm" and "100-year flood" can be confusing. Simply stated, a floodplain can be located anywhere; it just depends on how large and how often a flood event occurs. Floodplains are those areas that are subject to inundation from flooding. Floods and the floodplains associated with them are often described in terms of the percent chance of a flood event happening in any given year. As a community management or planning term, "floodplain" most often refers to an area that is subject to inundation by a flood that has a one percent chance of occurring in any given year (commonly and incorrectly referred to as the 100-year floodplain).

Hazard Profile

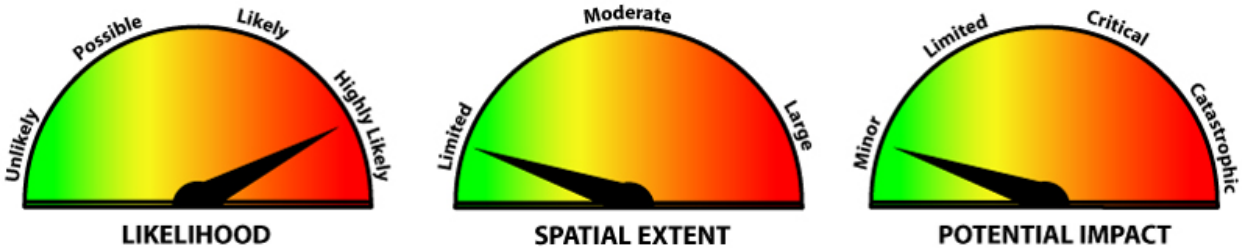

Figure 14-2. Flood Hazard Profile Summary for the City of Plano

The frequency of occurrence of flooding in the City of Plano is highly likely. The annual probability of observing a 100-year flood is one-percent. The annual probability of observing a 500-year flood event is 0.2 percent.

Because of the City's previous efforts to mitigate flood damage, the spatial extent of flooding in the City of Plano is limited, with ten percent of property potentially affected by the hazard. Major flooding and flash flooding events would have a minor severity of impact, with few injuries.

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Flooding in Plano would result in only minor property damage and minimal disruption of the quality of life and temporary shutdown of facilities.

Flooding occurs in seasonal patterns. Thunderstorms form when warm, moist air collides with cooler, drier air. Since these masses tend to come together during the transition from summer to winter, most thunderstorms and resulting flooding occur during the spring (April, May and June) and fall (October, November, and December).

Location of Hazardous Areas

Flood-hazard areas are determined using statistical analyses of records of riverflow, storm tides, and rainfall; information obtained through consultation with communities; floodplain topographic surveys; and hydrological and hydraulic analyses. FEMA's Flood Insurance Rate Maps (FIRMs) identify areas subject to flood hazard. These include Special Flood Hazard Areas, which are defined as areas that will be inundated by a flood event having a one-percent chance of being equaled or exceeded in any given year. The one-percent-annual-chance flood is also referred to as the base flood or 100-year flood. Moderate flood-hazard areas are also shown on the FIRM, and are the areas between the limits of the base flood and the two-tenths of a percent-annual-chance (or 500-year) flood. Figure 14-3 depicts the flood zones where there is potential for damage to property and loss of life in the City of Plano. The effective date of the FEMA FIRM for the City of Plano is dated 12-19-97. (Community number 480140).

FEMA also encourages the identification of critical facilities that currently lie in flood hazard areas. Figure 14-4 depicts Plano's essential facilities located in 100- and 500-year Q3 Flood Zones. (NOTE: Gerri in Plano GIS Department is to correct Figures 14-3 and 14-4 to show Q3 not Q2; also, the flood zones need to be better delineated)

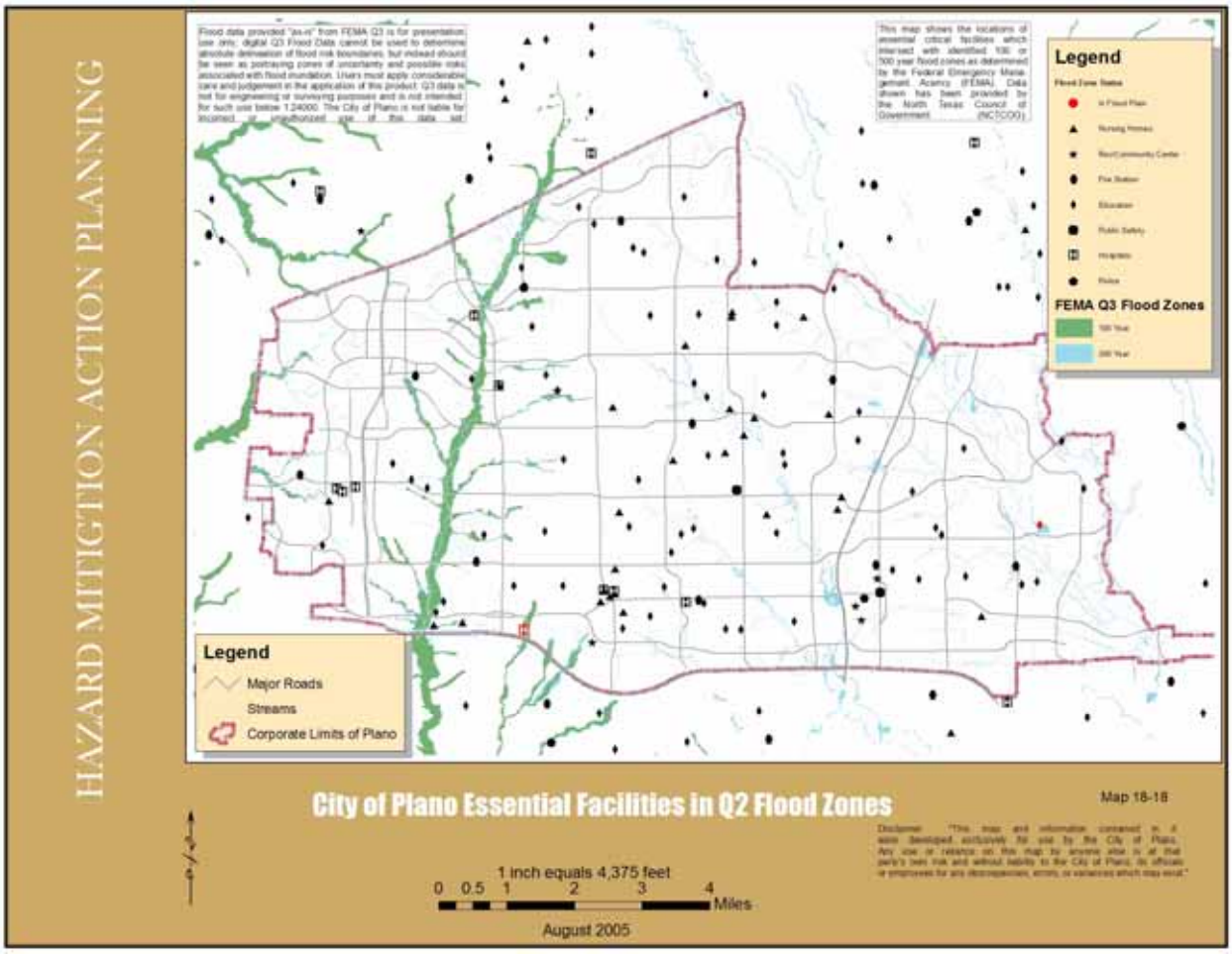

Figure 14-3. City of Plano 100- and 500-Year Q3 Flood Zones

Figure 14-4. City of Plano Essential Facilities in Q3 Flood Zones

History of Flooding

Flooding occurs in all 50 States. FEMA indicates that the States with the most land area subject to flooding are Texas, Louisiana, Florida, and Arkansas. Since 1965, 30 Presidential Disaster Declarations have been declared in Texas. Of these 30 declarations, 5 have been declared in the NCTCOG area.

In any given year, damaging floods are likely to occur on at least one major river or stream in Texas, affecting thousands of homes and businesses, and often resulting in the loss of life. Floods in Texas killed more people between 1989 and 1998 than in any other state—145 out of a national total of 957 people killed in floods. On the average, Texas suffers $254 million in losses (direct crop and

property damage) each year from flooding. According to the National Oceanic and Atmospheric Administration, there have been 17 flood events reported in the City of Plano or in Collin County, Texas between January 1, 1950 and April 30, 2005.

Table 14-1. Reported Flood 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	Injuries	Property Damage	Crop Damage
Collin County						
Flash Flood	Collin	07/14/1994	-	-	-	-
Flash Flood	Collin	11/14/1994	-	-	-	-
Flash Flood	Collin	03/13/1995	-	-	-	-
Flash Flood	Collin	05/24/1995	-	-	-	-
Flash Flood	Collin	05/25/1995	-	-	-	-
Flood	Collin	08/02/1995	-	-	-	-
Flash Flood	Collin	02/16/2001	-	-	-	-
Flash Flood	Collin	02/16/2001	-	-	-	-
City of Plano						
Flash Flood	Plano	05/05/1995	-	-	-	-
Flash Flood	Plano	02/19/1997	-	-	-	-
Flash Flood	Plano	05/19/1997	-	-	-	-
Flash Flood	Plano	05/19/1997	-	-	$10,000	-
Flash Flood	Plano	05/19/1997	-	-	-	-
Flash Flood	Plano	06/09/1997	-	-	-	-
Flash Flood	Plano	12/20/1997	-	-	-	-
Flash Flood	Plano	06/08/1999	-	-	-	-
Flash Flood	Plano	12/30/2002	-	-	-	-

Table 14-2 below provides a description of major flooding events throughout North Central Texas since 1884 according to the U.S. Geological Survey.

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Table 14-2. Flood Event History for North Central Texas Since 1884, according to the U.S. Geological Survey (Open File Report 03-193):

North-Central, Texas	
May 20 to 21, 1884	
Substantial rainfall caused the Trinity River at Fort Worth to overflow, inundating the bottomlands for a mile on either side and washing away a few cabins. The crest was the highest known since 1866. At Waco, the Brazos River crested at 32 feet as recorded by the USGS.	
Deaths and Damage:	Unknown
Max. Precipitation:	13.00 in.
Severity:	Major Storm
Storm Center(s):	**Parker Co., Weatherford**
References:	None

North and Central Texas	
May 22 to 25, 1908	
As much as 9 in. of rainfall caused flooding throughout much of North and Central Texas.	
Deaths and Damage:	Eleven lives were lost and property damage exceeded $5 million in the Dallas area.
Max. Precipitation:	9.20 in.
Severity:	Major Storm
Storm Center(s):	**Uvalde Co., Sabinal** **Dallas Co.**
References:	Dallas Morning News, 1999

North-Central Texas	
November 5 to 9, 1918	
The largest amounts of rainfall occurred in Erath and Bosque Counties. In a 24-hour period from the 7th to the 8th, the city of Kopperl in Bosque County recorded 7.6 in.	
Deaths and Damage:	Unknown
Max. Precipitation:	16.21 in. (Erath Co.) 11.59 in. (Erath Co.)
Severity:	Major Storm
Storm Center(s):	**Erath Co., Stephenville** **Erath Co., Dublin**
References:	U.S. Army Corps of Engineers, unpublished. data

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Northeast Texas	
October 21 to 24, 1919	
The largest amounts of rainfall occurred in Fannin and Denton Counties. The city of Bonham in Fannin County measured 9.4 in.	
Deaths and Damage:	Unknown
Max. Precipitation:	9.40 in. (Fannin Co.) 6.75 in. (Denton Co.)
Severity:	Major Storm
Storm Center(s):	**Fannin Co., Bonham** **Denton Co., Denton**
References:	U.S. Army Corps of Engineers, unpublished. data

North-Central Texas	
April 23 to 25, 1922	
Rainfall moved from the Panhandle to north-central and east Texas.	
Deaths and Damage:	Flooding in Fort Worth claimed 11 lives and about $1 million in property damage.
Max. Precipitation:	Unknown
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Fort Worth**
References:	Dallas Morning News, 1999; U.S. Army Corps of Engineers, unpublished. data

Central and East Texas	
April 24 to 27, 1922	
This large storm covered much of Central and East Texas. The maximum rainfall depths were about 12 in. in the Weatherford area.	
Deaths and Damage:	Unknown
Max. Precipitation:	11.40 in. (Parker Co.) 9.30 in. (Nacogdoches Co.)
Severity:	Major Storm
Storm Center(s):	**Parker Co., Weatherford** **Nacogdoches Co., Nacogdoches**
References:	U.S. Army Corps of Engineers, unpublished. data

North-Central Texas	
April 5 to 30, 1942	
The largest amounts of rainfall occurred in Tarrant and Cooke Counties. Tarrant County had nearly 17 in. of rain while Cooke County had about 16.5 in. The highest daily total, 5.7 in., occurred in Cooke County on the 25th.	
Deaths and Damage:	Unknown
Max. Precipitation:	17.00 in. (Tarrant Co.) 16.50 in. (Cooke Co.)
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Ft. Worth** **Cooke Co., Gainesville**
References:	U.S. Army Corps of Engineers, unpublishedlished. data

White Rock Creek in Dallas	
April 19 to 20, 1942	
According to long-time area residents, this was the greatest flood since at least 1886. The rain produced historically significant peak discharges at several streamflow-gaging stations. Although official rainfall stations adjacent to the watershed did not receive extraordinary rainfall, there were unofficial reports of as much as 12 in. on the upper watershed. Two days of general thunderstorm activity in the area prior to this storm contributed to a higher-than-normal rate of flood runoff.	
Deaths and Damage:	Unknown
Max. Precipitation:	12.00 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas**
References:	Asquith and Slade, 1995; Gilbert, 1963

Southeast Texas	
July 2 to 6, 1942	
Rainfall of 10-14 in. along the entire Gulf coast caused flooding throughout much of southeast Texas.	
Deaths and Damage:	Unknown
Max. Precipitation:	13.00 in. (Navarro Co.) 12.90 in. (Guadalupe Co.) 12.10 in. (Victoria Co.)
Severity:	Major Storm
Storm Center(s):	**Navarro Co., Eureka** **Guadalupe Co., Seguin** **Victoria Co., Victoria Air Base**
References:	U.S. Army Corps of Engineers, 1954

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North-Central Texas	
May 16 to 17, 1949	
Excessive rain ranging from 2 to 10 in. in the upper Trinity River Basin on May 16th and 17th produced the flood of record in Fort Worth with extensive flooding of business and residential areas and leaving residents without city water for about 3 days. Dallas had the second highest flood of record with severe flooding along lowlands outside of the levee district, and several sections of south Dallas, unprotected by levees. The same excessive precipitation that caused the Fort Worth-Dallas flood also caused moderate flooding along the Brazos River from Granbury to Waco on the 17th and extended into the Sulphur and Sabine River Basins.	
Deaths and Damage:	Unknown
Max. Precipitation:	12.00 in.
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Kennedale**
References:	U.S. Army Corps of Engineers, unpublished. data

Fort Worth	
May 17, 1949	
Maximum recorded rainfall was 12 in. on Village Creek in the West Fork Trinity River Basin southeast of Fort Worth.	
Deaths and Damage:	Ten lives were lost, and damage was $15 million in Fort Worth and vicinity.
Max. Precipitation:	12.00 in.
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Fort Worth**
References:	Breeding, 1949

North-Central Texas	
June 13 to 14, 1949	
From 2 to 10 in. of rain fell in the upper Trinity River Basin on the 13th and 14th centered near Richardson, Garland, and Carrollton. Most of the rain fell during the night. Streets in Carrollton were reported knee deep in water, and all highways leading north of Dallas were blocked by floodwaters at 12:30 a.m. on the 14th.	
Deaths and Damage:	Unknown
Max. Precipitation:	10.00 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Richardson**
References:	U.S. Army Corps of Engineers, unpublished. data

Bosque River Watershed	
May 18 to 19, 1955	
Rainfall began about 7:30 p.m. May 18 and continued for 5.5 hours. A gage 9 mi west of Stephenville in the Green Creek watershed recorded 2.00 in. during one 30-minute period. Bucket surveys indicated that higher intensities were near the center of the storm. Maximum recorded rainfall was 12.0 in. 5 mi east of Lingleville.	
Deaths and Damage:	Damage was estimated at $680,000.
Max. Precipitation:	12.00 in.
Severity:	Major Storm
Storm Center(s):	**Erath Co., Lingleville**
References:	Soil Conservation Service, 1955b

Green Creek Watershed	
April 29 to May 3, 1956	
Maximum recorded precipitation was 14.54 in. in the upper North Bosque River Basin. In Erath County 3 mi northeast of Stephenville, 11.57 in. was measured during the period, with a maximum intensity of 3 in. during 45 minutes Apr. 30. As much as 8 in. of rain was reported in that area during 2.5 hours Apr. 30.	
Deaths and Damage:	There was no loss of life. Damage was estimated at $80,000.
Max. Precipitation:	14.54 in.
Severity:	Major Storm
Storm Center(s):	**Erath Co., Stephenville**
References:	Hendricks, 1964a, p. 26-28; Soil Conservation Service, 1956a

Texas and Adjacent States	
April to June 1957	
Total rainfall on much of the eastern two-thirds of Texas for the 3-month period exceeded that normally recorded for a 12-month period. These rains effectively broke the infamous 1950s drought.	
Deaths and Damage:	Unknown
Max. Precipitation:	19.32 in.
Severity:	Catastrophic
Storm Center(s):	**Palo Pinto Co., Brazos**
References:	Yost, 1963, p. 5-9

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Trinity, Brazos, Colorado, Guadalupe, Nueces River Basins	
September 28 to October 4, 1959	
As much as 12 in. of rain caused extensive flooding in the upper Trinity River Basin on Big Fossil, Big Sandy, Chambers, and Richland Creeks and produced historically significant peak discharges at several streamflow-gaging stations. In the middle Brazos River Basin, floods (exceeding all previously known) on North Bosque River and Cowhouse Creek followed rain totaling more than 14 in. at some places. Spring Creek in the middle Colorado River Basin reached its highest stage since 1882 following rainfall that exceeded 10 in. Johnson Creek, in the headwaters of the Guadalupe River, recorded the second highest flood known since at least 1852. Flash flooding on the upper Nueces River Basin followed heavy rain Oct. 3-4. Unofficial totals of as much as 16 in. of rain were reported.	
Deaths and Damage:	One person drowned during the flood. Big Fossil Creek flooded parts of Richland Hills, a suburb of Fort Worth, causing an estimated $300,000 in damage. Damage to agricultural interests and rural public properties was estimated at $700,000 by the U.S. Weather Bureau.
Max. Precipitation:	16.00 in.
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Fort Worth**
References:	Asquith and Slade, 1995; Hendricks, 1964b, p. 70-74

Fort Worth Vicinity	
June 24 to 25, 1961	
A small-area storm of high intensity caused flash flooding in Richland Hills near Fort Worth. Three rain gages in the area recorded rainfalls of 3.64-4.71 in. A bucket survey was conducted on upper Big Fossil Creek where 7.7, 8.0, and 8.7 in. of rain were recorded.	
Deaths and Damage:	Unknown
Max. Precipitation:	8.70 in.
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Fort Worth**
References:	Rostvedt, 1965b, p. 57

Mineral Wells Vicinity	
July 25 to 27, 1962	
Heavy rain of 5-17 in. fell within a 40-mi radius of Mineral Wells July 25-27. The area upstream from Greenville Ave. in Dallas had an average rainfall of 6.2 in. July 27. That same area recorded 2 in. the previous day.	
Deaths and Damage:	Property damage exceeded $1.5 million.
Max. Precipitation:	6.20 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas**
References:	Rostvedt and others, 1968a, p. 97

Near Crandall	
July 26 to 27, 1962	
A flood-producing storm began about midnight July 26 and continued intermittently until about noon July 27. Crandall recorded 11.4 in. during the 6-hour period midnight to 6:00 a.m. July 27.	
Deaths and Damage:	There was no loss of life. Crop and pasture damage from the floodwaters was estimated at $26,000.
Max. Precipitation:	11.40 in.
Severity:	Major Storm
Storm Center(s):	**Kaufman Co., Crandall**
References:	Soil Conservation Service, 1962

Haltom City near Fort Worth	
September 6 to 7, 1962	
As much as 11 in. of rain fell Sept. 7 on upper Big Fossil Creek Basin. During the afternoon Sept. 7, the recording rain gage near Justin, about 13 mi northeast of Big Fossil Creek Basin, measured 5 in. during 1 hour and 2 in. more the following hour.	
Deaths and Damage:	Unknown
Max. Precipitation:	11.00 in.
Severity:	Major Storm
Storm Center(s):	**Tarrant Co., Fort Worth**
References:	Rostvedt and others, 1968a, p. 99-101

White Rock Creek Basin	
October 8, 1962	
During early morning Oct. 8, an intense storm of short duration centered over Cottonwood Creek in the upper White Rock Creek Basin. An average 4.6 in. of rain fell on the basin during about 3 hours. Rainfall on Cottonwood Creek Basin ranged from about 4 in. on the upper basin to 7 in. on the lower basin.	
Deaths and Damage:	Unknown
Max. Precipitation:	4.60 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas**
References:	Rostvedt and others, 1968a, p. 99

South-Central and Northeast Texas	
September 15 to 30, 1964	
The rain produced historically significant peak discharges at two streamflow-gaging stations. As much as 12.5 in. of rain fell during the night Sept. 15 in Dimmit County between Carrizo Springs and Encinal. As much as 15 in. fell on the Devils River Basin during 24 hours, and as much as 17 in. fell on the upper Nueces River Basin. As much as 20.33 in. was measured Sept. 15-30. During the first 8 hours of Sept. 21, more than 12 in. fell in northeastern Tarrant County, eastward over Dallas, and in Collin County. The heaviest rain fell on an area north of Dallas.	
Deaths and Damage:	Unknown
Max. Precipitation:	20.33 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas**
References:	Rostvedt and others, 1970a, p. 82-90

Collin, Grayson, Dallas, and Tarrant Counties	
September 20 to 21, 1964	
The storm began about midnight Sept. 20 and continued until about 8:00 a.m. Sept. 21. McKinney in Collin County reported 12.10 in. of rain from 1:15 to 7:00 a.m. on Sept. 21. Flooding was severe in McKinney, Fort Worth, and north Dallas.	
Deaths and Damage:	Two drownings occurred, and property damage was about $3 million.
Max. Precipitation:	12.10 in.
Severity:	Major Storm
Storm Center(s):	**Collin Co., McKinney**
References:	Soil Conservation Service, 1964

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Navarro, Hill, Ellis, and Johnson Counties	
April 20 to May 2, 1966	
A series of flood-producing rains of 8-15 in. fell on Chambers Creek watershed Apr. 20-May 2. Rainfall of 7.91-14.75 in. was recorded. Unofficial reports of rainfall indicate that isolated areas of the watershed had as much as 17 in. The greatest rainfall was reported for the area immediately west of Corsicana.	
Deaths and Damage:	Storm damage was estimated at $441,000.
Max. Precipitation:	17.00 in.
Severity:	Major Storm
Storm Center(s):	**Navarro Co., Corsicana**
References:	Soil Conservation Service, 1966a

North Dallas	
April 28, 1966	
As much as 6.7 in. fell during a 6-hour period; 4.9 in. fell during 1 hour. Almost 8 in. of rain had fallen during the preceding 2 weeks, resulting in a well-saturated basin in which all storage areas were full.	
Deaths and Damage:	Flooding resulted in 14 deaths and damage estimated at $15 million.
Max. Precipitation:	6.70 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas**
References:	Mills and Schroeder, 1969

Central and East Texas	
June 23 to 28, 1968	
During the afternoon June 23, Tropical Storm Candy moved inland over the middle Texas coast. The storm weakened slowly as it moved north toward the Dallas-Fort Worth area. Rainfall totals of 3-4 in. were common throughout central and eastern Texas, with numerous locations reporting 5 in. or more.	
Deaths and Damage:	No deaths or injuries resulted from this storm; however, estimates placed crop losses at $2.1 million and property losses at $625,000.
Max. Precipitation:	5.00 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas** **Tarrant Co., Ft. Worth**
References:	Rostvedt and others, 1972, p. 42

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Cleburne	
May 6 to 7, 1969	
Rainfall exceeded 8 in. during the storm. Most of this rain fell during the evening of May 6th and early morning May 7th.	
Deaths and Damage:	Damage in Johnson County was estimated at $400,000.
Max. Precipitation:	8.00 in.
Severity:	Major Storm
Storm Center(s):	**Johnson Co., Cleburne**
References:	Reid and others, 1975

North-Central Texas	
March 27, 1977	
Heavy rain fell in Tarrant, Somervell, and Dallas Counties.	
Deaths and Damage:	There were 5 drownings and $1 million in property damages.
Max. Precipitation:	Unknown
Severity:	Major Storm
Storm Center(s):	**Tarrant Co.** **Somervell Co.** **Dallas Co.**
References:	Dallas Morning News, 1999

North-Central Texas and Oklahoma	
October 10 to 14, 1981	
The storm extended in a southwest-to-northeast direction from near Abilene to near McAlester, Okla. Maximum recorded rainfall was 23 in. during 34 hours about 5 mi north of Clyde, Tex. Numerous areas reported rains exceeding 10 in.	
Deaths and Damage:	Six lives were lost, and damage was about $115 million.
Max. Precipitation:	23.00 in.
Severity:	Catastrophic
Storm Center(s):	Callahan Co., Clyde
References:	Buckner and Kurklin, 1984

North and East Texas	
May 11 to 14, 1982	
Rainfall totals for a 24-hour period ending May 13 were 13.02 in. at Trenton in Fannin County, 13.00 in. at Pilot Point in Denton County, and 12.60 in. at Bonham in Fannin County.	
Deaths and Damage:	Millions of dollars in damage were sustained.
Max. Precipitation:	13.00 in. (Denton Co.) 12.60 in. (Fannin Co.)
Severity:	Major Storm
Storm Center(s):	**Denton Co., Pilot Point** **Fannin Co., Bonham**
References:	Bomar, 1983b, p. 24

North Texas	
April 27 to 28, 1985	
Intense thunderstorms covered most of North Texas during the late evening Apr. 27 and early morning Apr. 28. About 10 in. of rain fell 9:00 to 11:00 p.m. near Rockwall in Rockwall County.	
Deaths and Damage:	Eight people drowned as a result of driving into high waters.
Max. Precipitation:	10.00 in.
Severity:	Major Storm
Storm Center(s):	**Rockwall Co., Rockwall**
References:	Moody and others, 1986

Fort Worth	
May 24, 1986	
The storm produced winds as strong as 95 miles per hour, hail as large as 3-in. in diameter, and about 4 in. of rain during an hour.	
Deaths and Damage:	Two people drowned when swept from their car after driving into a flooded underpass. Wind, rain, and flood damages were estimated at about $2 million.
Max. Precipitation:	4.77 in.
Severity:	Major Storm
Storm Center(s):	**Wise Co., Bridgeport**
References:	Moody and others, 1988, p. 22

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Upper Coast and North Texas	
May 16 to 19, 1989	
Houston Intercontinental Airport recorded 10.28 in. May 17-18. Spring recorded more than 15 in. during a 24-hour period May 17-18.	
Deaths and Damage:	Widespread rains caused flooding that resulted in five deaths and total damages of about $50 million.
Max. Precipitation:	15.00 in. (Harris Co.) 10.28 in. (Harris Co.)
Severity:	Catastrophic
Storm Center(s):	Harris Co., Spring Harris Co., Houston Intercontinental Airport
References:	Griffiths and others, 1990, p. 38-40

North Texas	
May 1 to 7, 1990	
Heavy rainfall May 1-4 produced major flooding in North Texas during early May. Rainfall was 5-9 in. on north-central sections of North Texas and 2-5 in. elsewhere.	
Deaths and Damage:	Unknown
Max. Precipitation:	6.91 in. (Dallas Co.) 6.36 in. (Dallas Co.)
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas Naval Air Station** **Dallas Co., Dallas Love Field**
References:	National Oceanic and Atmospheric Administration, 1990

Dallas and Tarrant Counties	
May 5, 1995	
Damage caused by wind speeds up to 70 miles per hour, softball-size hail, and high-intensity rain caused this storm to be deemed the "costliest thunderstorm event in history" by the National Weather Service. The maximum rainfall intensity was almost 3 in. in 30 minutes. 109 people were injured by hail.	
Deaths and Damage:	20 lives were lost, and $2 billion in damage was reported.
Max. Precipitation:	4.96 in.
Severity:	Major Storm
Storm Center(s):	**Dallas Co., Dallas** **Tarrant Co.**
References:	None

National Flood Insurance Program Participation

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the ravages of flooding. There are currently over 390 flood insurance policies in force in the City of Plano with over $98,772,900 in property covered. There have been 44 losses to date with $159,693 in claims payments. There has been only one substantial damage claim since 1978. A substantial damage claim may be made under the NFIP if the community determines that a home or business is damaged by flood to the point that repairs will cost 50 percent or more of the building's pre-damage market value.

Table 14-3. NFIP Status of the City of Plano

NFIP Status	Participating
Current Flood Insurance Rate Map	December 19, 1997
Community Rating System Class	6
Repetitive loss category	B

Table 14-4. NFIP Policies and Claims in the City of Plano

Policies in force	390
Insurance in force	$98,772,900
Number of losses paid	44
Total losses paid since 1969	$159,693
Substantial damage claims since 1978	1

Repetitive Loss Properties

Presently, one of FEMA's highest priorities is to break the cycle of repetitive losses on structures insured by the National Flood Insurance Program (NFIP). Through hazard mitigation planning, FEMA is strongly encouraging local communities to mitigate repetitive loss properties. When the term “repetitive loss” is used, FEMA defines it as those properties insured by the National Flood Insurance Program (NFIP) that have experienced at least 2 paid losses of more than $1,000 each in any 10-year period. At the national level, FEMA has identified over 10,000 high priority repetitive loss properties, out of a total of about 48,000 such properties.

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With six repetitive loss properties in the City of Plano, the community is defined by FEMA as a Repetitive Loss Category B, meaning that the City has between 1 and 10 repetitive loss properties. Category A is a community with no repetitive loss properties; Category C communities have 10 or more repetitive loss properties. Fortunately, the City of Plano has made substantial drainage improvements in the late 1980's to provide a protection from a minimum 25-year flood event. The last flood loss was in 1991 although there could be future flooding of the structures.

The spatial representation of the repetitive loss properties in the City of Plano is shown below.

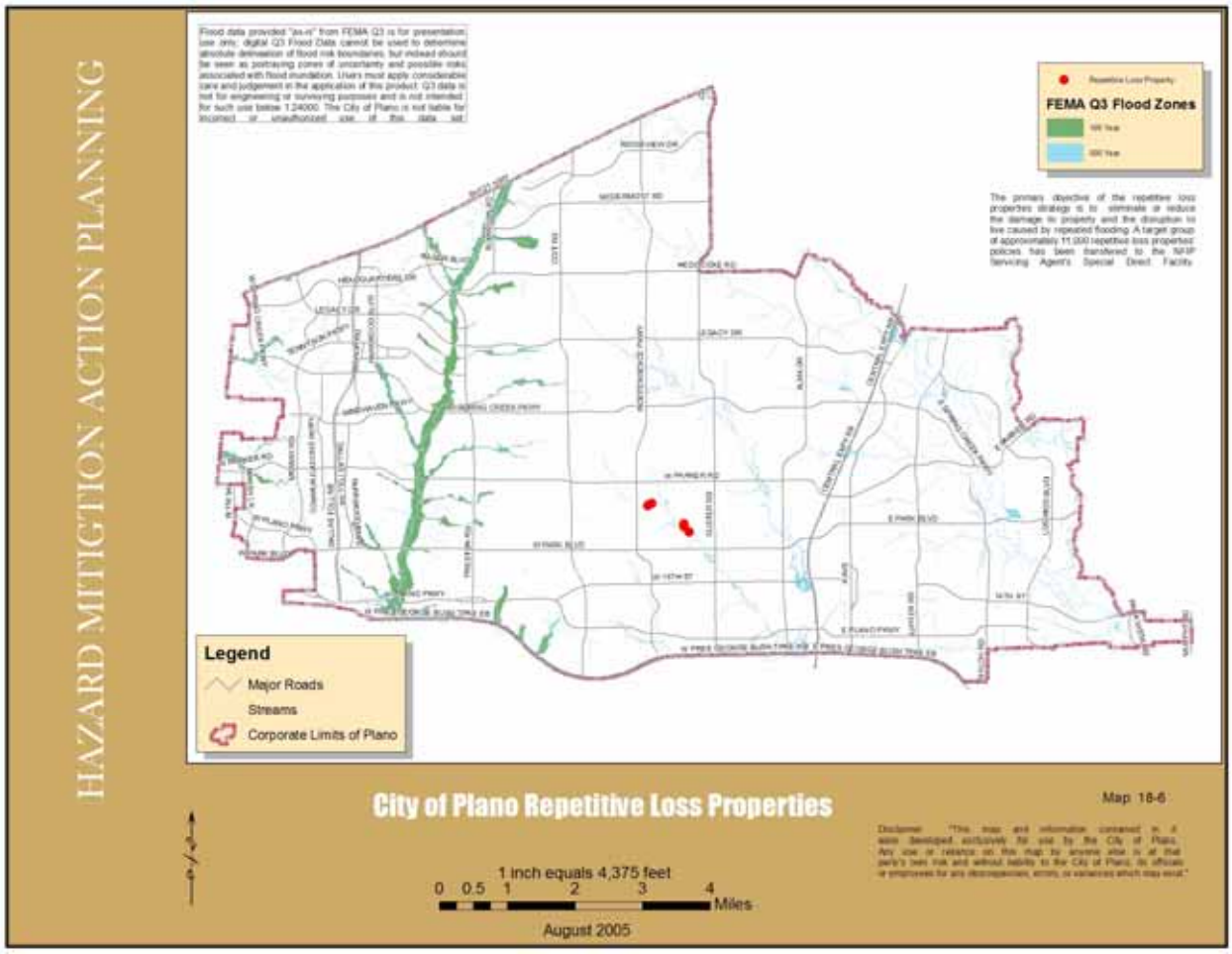

Figure 14-5. City of Plano Repetitive Loss Properties

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Community Assistance Visits

To date, the City of Plano has had one Community Assistance Contact from FEMA, on September 12, 1995. During this Community Assistance contact, FEMA or the State made an inquiry about the status of floodplain management in the City. To date, no FEMA Community Assistance Visits have been made to the City of Plano.

Community Rating System Participation

The City of Plano participats in the NFIP' s Community Rating System (CRS) Program. Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance. Ten CRS classes exist. Class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction. The CRS recognizes 18 creditable activities in the areas of Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness that go well beyond the minimum NFIP requirements. Plano is currently a Class 6 CRS community, enabling residents living in Special Flood Hazard Areas (SFHAs) to obtain a 20% percent reduction in flood insurance premiums, and non –SHFA residents to obtain a 10% percent reduction in flood insurance premiums.

People and Property at Risk

Analysis by the City of Plano indicates that there are approximately 250 residential structures and 15 commercial structures located in Special Flood Hazard Areas (so called 100-year floodplain) – worth about $40 million – in the City of Plano.

Table 14-5. City of Plano Property at Risk of Flooding

Type of Structure	Number of Structures	Average Value of Structure	Total of Structures ($) at Risk of Flooding
Residential	250	$150,000	$37,500,000
Commercial	15	$150,000	$2,250,000

Source: City of Plano Floodplain Administrator

According to the NCTCOG, there are estimated to be 16,488 people and almost $1.6 in property exposed to the flood hazard in Special Flood Hazard Areas within the Collin County.

Table 14-6. People and Property at Risk of Flooding in Collin County

Collin County Flood Loss Estimation						
County	Total Stream Miles*	Total Flood Hazard Area (sq miles)*	Total square footage of structures in flood hazard area*	Total population potentially exposed to flood hazard area*	Total replacement cost for all potentially exposed structures and contents in flood hazard area*	Total annual sales for businesses located within flood hazard area*
Collin	678	138	11,001,337	16,488	$1,586,132,516	$268,723,663

Assumptions and Estimates Adapted from FEMA How-To Guide 386-2:
Residential: Total ReplValue Cost: $88 psf, Contents: $44 psf,
Commercial: TotalReplValue Cost: $97 psf, Contents: $97 psf
Industrial: TotalReplValueCost: $69 psf, Contents: $103.50 psf
Public: TotalReplValueCost: $109.50 psf, Contents: $131 psf
Average Annual Sales: $36.5 per sq ft commercial, $327 per sq ft industrial

* All figures are approximations

Source: North Central Texas Council of Governments

Table 14-7. Approximate Potential Exposure of Population, Businesses and Structures to Flood Hazard Areas in Collin County

Approximate square miles of flood hazard area	138
Approximate total square footage of structures in flood hazard area	11,001,337
Approximate total population potentially exposed to flood hazard area	16,488
Approximate total households potentially exposed to flood hazard area	7,378
Approximate total number of major business locations within flood hazard area (over 100 employees)	1
Approximate total number of employees for major business locations within flood hazard area	0

Approximate total annual sales for business locations within flood hazard area	$268,723,663
Approximate number of unit residential structures potentially exposed to flood hazard area	5,717
Approximate number of commercial structures potentially exposed to flood hazard area	273
Approximate number of industrial structures potentially exposed to flood hazard area	190
Approximate number of public structures potentially exposed to flood hazard area	2
Approximate total cost for potentially exposed residential structures in flood hazard area	$821,714,344
Approximate total cost for potentially exposed commercial structures in flood hazard area	$117,129,925
Approximate total cost for potentially exposed industrial structures in flood hazard area	$47,403,000
Approximate total cost for potentially exposed public structures in flood hazard area	$361,350
Approximate total cost of contents for potentially exposed residential structures in flood hazard area	$410,857,172
Approximate total cost of contents for potentially exposed commercial structures in flood hazard area	$117,129,925
Approximate total cost of contents for potentially exposed industrial structures in flood hazard area	$71,104,500
Approximate total cost of contents for potentially exposed public structures in flood hazard area	$432,300
Approximate total square footage for potentially exposed residential structures in flood hazard area	9,337,663
Approximate total square footage for potentially exposed commercial structures in flood hazard area	1,207,525
Approximate total square footage for potentially exposed industrial structures in flood hazard area	687,000
Approximate total square footage for potentially exposed public structures in flood hazard area	3,300
Approximate total population potentially exposed to flood hazard area in the year 2030	78,062
Note: total cost approximations are derived from appraisal district data	

Source: North Central Texas Council of Governments

While great strides in reducing flood damage have been made and the City of Plano ranks as one of the most advanced cities in the country when it comes to floodplain management. However, continuing growth and development in the City will continue to increase storm water and drainage issues, challenging the City to further stabilize flood risks and minimize future flood losses.

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