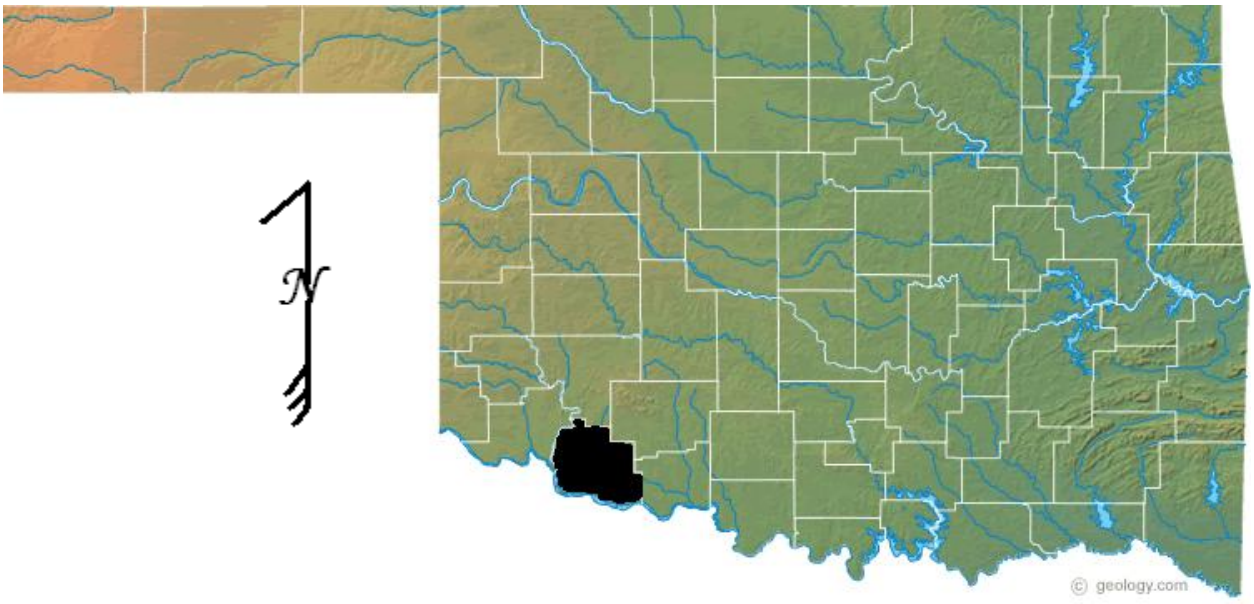
NATURAL HAZARD MITIGATION PLAN TILLMAN COUNTY, OKLAHOMA



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CHAPTER ONE - THE PLANNING PROCESS.

1.1. Introduction.

Floods, tornadoes, winter storms, drought, and other hazardous events are a part of our world and their natural occurrence is inevitable and cannot be controlled. It is when these natural events intersect the man-made environment that "disasters" occur. Natural hazards cannot be prevented, but actions can be taken to reduce their impact upon the human environment so that a disaster is less likely to result.

This natural hazard mitigation plan is focused on unincorporated areas of Tillman County. Incorporated areas are not included within the scope of this plan. It should also be noted that Indian Tribes have lands located within the County and, as separate sovereign entities, are treated like municipalities and are not included in this plan. Tillman County has an Emergency Operating Plan. The Tillman County Conservation District develops a long term plan in conjunction with the USDA-Natural Resources Conservation Service. These plans were reviewed, and where appropriate, used in the Tillman County hazard mitigation plan. No other plans, studies or reports were available at the County level and therefore were not included in this plan.

This Tillman County Natural Hazard Mitigation Plan will discuss the planning process, provide background information, a hazard and risk assessment for Tillman County, describe mitigation strategies, their implementation, and plan maintenance procedures.

1.2. Plan Adoption.

The plan will be reviewed and revised within a five-year cycle with the possibility of updating it into a multi-jurisdictional plan, should Tillman County municipal governments request this. Municipalities must provide appropriate information for inclusion and be willing to adopt the updated or revised plan. Otherwise, this plan is intended to be used in coordination with any efforts that the municipalities may undertake in the area of natural hazard mitigation planning.

I Figure: Formal Adoption by Local Jurisdictions

RESOLUTION #992

TILLMAN COUNTY NATURAL HAZARD MITIGATION PLAN

BE IT REMEMBERED, that on the 18th day of May, 2009, during the regular session of the Board of County Commissioners of Tillman County, the following resolution was presented and adopted:

WHEREAS, motion was made by Commissioner Jimmie C. Smith to approve the Natural Hazard Mitigation Plan for Tillman County, Oklahoma be adopted. Commissioners Joe Don Dickey, Kent Smith and Jimmie C. Smith voted aye.

ADOPTED by the County Commissioners of Tillman County, Oklahoma, this 18th day of May, 2009.

BOARD OF COUNTY COMMISSIONERS
TILLMAN COUNTY

Joe Don Dickey, Chairman

Kent Smith, Vice-Chairman

Jimmie C. Smith, Member

ATTEST:

Jerri Boyd, County Clerk

1.3. The Hazard Mitigation Planning Process.

Hazard mitigation involves recognizing and adapting to natural forces, and is defined by the Federal Emergency Management Agency (FEMA) as “any sustained action taken to reduce long-term risk to human life and property from natural hazards.” Mitigation is the component of emergency management that has the potential to break the cycle of damage and reconstruction that can occur when a community, is subjected to repeated natural hazards and therefore should be a high priority.

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5165, enacted under Section 104 of the DMA 2K, P.L. 106-390 establishes new requirements for local hazard mitigation plans. Local governments are required to have a FEMA-approved local hazard mitigation plan in order to be eligible to receive federal funding through FEMA’s Hazard Mitigation Grant Program (HMGP).

This plan was developed by the Association South Central Oklahoma Governments (ASCOG) through a contract with the Tillman County Commissioners. Funding for this plan was provided in part through a grant from FEMA.

1.3.1. Development Process.

a. Planning Process. An open public involvement process was established for the public, neighboring communities, regional agencies, businesses, academia, etc; to comment on the plan in the drafting stage as well as prior to plan approval.
b. A comprehensive Tillman County approach was taken in developing the plan. In addition, the review and incorporation of appropriate existing plans studies, reports and technical information into the plan during its drafting.

Perform a Risk Assessment.

An assessment of the hazards apparent to Tillman County and the risks on the current or future built environment was established. The assessment includes the following:

a. The type, location and extent of all hazards that affect the jurisdiction, both historically and in the future.
b. Description of the jurisdictions vulnerability to those hazards including types and numbers of existing and future buildings, infrastructure and critical facilities in identified hazard areas.
c. Estimate potential dollar losses of those structures considered vulnerable.
d. General description of land uses and development trends for future land use decisions.

Develop a Mitigation Strategy.
Development of a blueprint for reducing the potential losses identified in the risk assessment, this will include:

a. A description of mitigation goals meant to avoid or reduce long-term vulnerabilities
b. Identification and analysis of a comprehensive or range of mitigation actions and projects
c. Action Plan describing how the mitigation actions and projects will be prioritized, implemented and administered.

Develop a Plan Maintenance Schedule.
Plans must be monitored, evaluated and updated on a five-year cycle, including a review on incorporating the mitigation plan into comprehensive or capital improvement plans.

Adoption by a Governing Body.
A formal adoption by the appropriate governing body of the authoring jurisdiction to codify the mitigation plan.

Approval.
The plan is submitted to the State Emergency Management Agency for review and coordination. Once accepted, it is forwarded to the FEMA regional office for formal review and approval.

1.3.2. Purpose of the Plan: Hazard mitigation planning is a long-term, on-going process.

The primary purpose of this plan is to establish and document such a process for areas and assets within the jurisdiction of Tillman County and, in doing so, fulfill the requirements of the Robert T. Stafford Act and FEMA. The plan will address natural hazards that occur within Tillman County. Tillman County hopes to lessen its vulnerability to disasters caused by natural hazards. The plan is intended to serve as a guide for Tillman County in coordinating and implementing hazard mitigation policies, programs and projects.

1.3.3. The Intent of the Tillman County Mitigation Planning Process. Through this planning process, Tillman County hopes to achieve the following.

1. **Reduce** any repetitive losses from natural hazards in Tillman County.
2. **Facilitate** responsible development in Tillman County so as to reduce or eliminate the potential impacts of natural hazards.
3. **Enhance** public awareness and understanding of natural hazard preparedness.
4. **Develop** mitigation measures for specific hazards.

1.3.4. Hazard Mitigation Planning Committee.

Broad counsel was gained from a planning committee chaired by Jeff Rector (Tillman County Emergency Management Director). The planning committee was composed of County residents, some of whom serve as professional advisors and others that serve as volunteers in local organizations.

They participated in open public meetings in which they identified hazards (Meeting 1), identified goals and action items (Meeting 2), and prioritized and compiled the action items into an action plan (Meeting 3)

The Tillman County Hazard Mitigation Planning Committee was formed to provide guidance during the preparation of this plan. Committee members, along with their affiliation, are listed in Table II. This committee was comprised of private citizens and others from various local organizations, as well as representatives from local governments, businesses and emergency response personnel. Representation was solicited upon recommendations from the Tillman County Commissioners; however, no one wishing to participate was excluded from doing so. Contacted persons were encouraged to bring interested citizens. The Committee meetings were open to the public. The planning process and contacts for plan development were also established. Three public meetings were held during the development of this plan.

II. Table: Tillman County Hazard Mitigation Planning Committee Members.

Name	Affiliation
Kent Smith	Tillman County Commissioner
Jimmy Smith	Tillman County Commissioner
Joe Don Dickey	Tillman County Commissioner
Jerri Boyd	Tillman County Clerk
Buddy Mealor	Frederick Fire chief
Jeff Rector	Tillman County Civil Emergency Management
Billy Manchek	Manitou Fire Chief
Leslie Crosby	Citizen
Bobby Blair	Mayor of Tipton
Stan Rice	Association of South Central Oklahoma Governments

1.3.5. Public Involvement in the Planning Process: Structured public involvement was accomplished through the County committee described above and discussion at regularly scheduled County commissioner meetings.

1. Opportunities for the public to comment on the plan during the drafting stage and prior to plan approval were created in order to reduce the chance that any concerns would be overlooked. Public comment was sought by publication of notices of meetings, during which the progress of the plan was publicized, in newspaper articles, telephone contact, direct mailings, a calendar and area wide newsletters. Draft copies of the hazard mitigation plan were offered for public comment by posting on the ASCOG internet site and by copies placed in the County Commissioner office. This offer was made public through newspaper articles and area wide newsletters. In the County Commissioner's office a form summarizing the natural hazard threats in Tillman County, asking for their opinion of the action items then under consideration, and then requesting additional action items was provided along with the draft copy of the hazard mitigation plan. Supporting documentation and added detail of opportunities for public comment have been placed in attachments.

2. All meeting participants received the handout, "Hazard Mitigation Planning for Local Governments Fact Sheet, FEMA dated September 2002." All meeting attendees were encouraged to share their experiences and suggestions for future mitigation activities.

1.3.6. Additional Public Involvement Information in the Planning Process. (See Appendix A – Supporting Documents.)

1. Newsletters.
2. News Coverage.
3. Agendas.
4. Meeting Minutes.
5. Sign In Sheets and Statements of Attendance.

1.3.7. Other Interested Party Involvement in the Planning Process.

There are many public agencies, private organizations and businesses that contend with natural hazards. Tillman County's contractor, ASCOG, contacted them to collect information on the hazards and determine how their programs could best support Tillman County's mitigation program. Copies of the hazard mitigation plan were offered for public comment by posting on the ASCOG internet site and by copies placed in the Tillman County Commissioner's office. This offer was made to neighboring communities through area wide newsletters and direct mailings.

Among the organizations and agencies contacted were the following: (Each was asked to contribute information on past and potential hazard threats and comment on the planning process and content.)

Federal:

1. Federal Emergency Management Agency (FEMA)
2. US Environmental Protection Agency
3. US Army Corps of Engineers
4. US Department of Agriculture
5. Department of Interior-Bureau of Indian Affairs
6. National Weather Service (NWS)
7. Natural Resource Conservation Service (NRCS)
8. US Fish and Wildlife Service
9. US Geological Survey

National Non-Profit:

1. American Red Cross

State:

1. Oklahoma Department of Civil Emergency Management
2. Oklahoma Water Resources Board
3. Oklahoma Science and Rivers Commission
4. Oklahoma Department of Environmental Quality
5. Oklahoma Department of Commerce
6. Oklahoma Conservation Commission
7. Oklahoma Department of Wildlife Conservation
8. Oklahoma Geological Survey
9. Cameron University

Regional:

1. Association of South Central Oklahoma Governments
2. Area Agency on Aging

County:

1. Tillman County Commissioners
2. Tillman Conservation District
3. Tillman County Health Department
4. Tillman County Rural Fire Departments
5. Tillman County Police Departments and Sheriff
6. Southwestern Rural Electric Association

Other Communities:

All Tillman County communities were invited to participate in the planning process for the unincorporated areas.

1. Davidson
2. Frederick
3. Grandfield
4. Hollister
5. Manitou

6. Tipton
7. Loveland

A draft of the plan was prepared, reviewed and edited by the Tillman County Commissioners and other committee members. Once edits were accepted and incorporated into the plan, the draft was discussed and adopted by the County Commissioners at their regularly scheduled meeting held in compliance of the Oklahoma Public Meeting Act. Once adopted, this draft was submitted to the Oklahoma Department of Emergency Management for State approval.

1.3.8. Review of Existing Plans.

The following plans were reviewed, and where appropriate, incorporated into the Tillman County Hazard Mitigation Plan.

Capital Improvement Plan.
Tillman County is developing a CIP. All physical property and transportation units are being listed. Roads and bridges are classified as to needs and repair schedule. This information was used to support action items.

Emergency Operations Plan.
Tillman County has an Emergency Operations Plan (EOP). The EOP is a response planning manual developed by the County and County emergency management director. The EOP is useful post disaster as a guide to emergency response and recovery and is used in analysis and location of shelters and critical facilities.

Permitting.
Tillman County does not currently have a permitting system in the rural areas.

NFIP.
Tillman County has begun the process of participation in the National Flood Insurance Program.

Conservation District.
The Tillman County Conservation District, and the USDA-Natural Resource Conservation Service, develops a joint long-range plan that specifically addresses drought, flood protection and other natural resources. This information was used in the Tillman County Hazard Mitigation Plan, especially for flooding, drought and rural fires.

CHAPTER TWO – HAZARD ASSESSMENT.

2.1. Identifying Hazards.

a. The first step in developing a hazard mitigation plan is to identify and describe all the natural hazards capable of occurring within Tillman County. Next is to list Tillman County's vulnerabilities to each hazard so that appropriate action can be taken to mitigate the impact of the hazards, minimize the losses and recover as quickly as possible. It is recognized that all the demands of a disaster situation cannot be anticipated but, by being aware of the areas, major facilities and persons who may be vulnerable to each type of hazard, preventive measures as well as emergency response can be planned.

b. The National Climatic Data Center (NCDC) maintains records regarding weather events since 1950. This database, along with information obtained from Tillman County's hazard mitigation meetings, was used to prepare profiles, which assess each of the natural hazards capable of occurring within the County. Several natural hazards were identified by the Hazard Mitigation Planning Committee members and addressed in this plan. Table III lists these natural hazards and explains how and why each was identified as a hazard to Tillman County.

Details of each natural hazard and its impact on Tillman County are given in separate profiles for each hazard.

III. Table: Summary of Natural Hazards.

Hazard	How Identified	Why Identified
Dam Failure	• Review past disaster declarations • OWRB database • Local input • Risk Assessment	• Population and buildings below dam are very vulnerable in event of release or dam failure
Drought	• Review past disaster declarations • Drought databases • Review NCDC database • Input from County • Public Input	• Drought is common in County • Drought was one of the most costly past disasters
Earthquake	• USGS Database • Earthquake databases • Review NCDC database • Input from County • Public Input • HAZUS 99	• The largest earthquake in the continental US centered just east of Oklahoma • Major faults run through Oklahoma
Expansive Soils	• Soil databases • Utility data - recollections • Input from County • Public Input	• Common to area

Extreme Heat	• Review past disaster declarations • Heat databases • Review NCDC database • Input from County • Public Input	• Prolonged temperatures over 100 degrees Fahrenheit are common in summer months • Heat affects people, animals and crops
Flood	• Review of FIRMS • Input from County • Risk Assessments • Public Input • Review of past disaster declarations • Identification of NFIP repetitive loss properties in the County	• The County contains many rivers and streams • Flash Flooding is common
Hailstorm	• Review past disaster declarations • Hail databases • Review NCDC database • Input from County • Public Input	• Hail is a major economic hazard to this agricultural region • Hail occurs each year
Severe Winter Storms	• Review past disaster declarations • Winter Storm databases • Review NCDC database • Input from County • Public Input	• People can be stranded in isolated areas • Damages to public and private sector caused by heavy snows, etc • Can result in death • Humans and property are not prepared for extended periods of cold in this area • Damages to public and private sector caused by freezing lines • Ice Storms recently caused extensive damages to area • Many populations were without power for extended periods • Damages to public and private sector property
Tornado & Wind	• Review past disaster declaration • Tornado databases • National Weather Service data • Review NCDC database • Input from County • Public Input	• Common to State • Public Concern • Past damages • Damages to public and private sector
Wild Fire	• Review past disaster declarations • Fire databases • Review NCDC database • Input from County • Public Input	• Common to area • Can occur in conjunction with drought and/or lightning • Damages to public and private sector
Thunderstorms & Lightning	• Review past disaster declarations • Wind Storm databases • Review NCDC database • Input from County • Public Input	• Flat terrain allows high velocity winds to occur • Damages to public and private sector • Define “Wind” vs. “Tornado” in public mind

2.2 Natural Hazard Assessments.

The profiles found later in this chapter were prepared for each identified natural hazard and assess the hazard per the following eight categories:

1. Description.
Explains what the hazard is, how and where it originates.

2. Location.
The geographic area affected by the natural hazard.

3. Extent.
This describes the hazard's impact in terms of how severe of an event the particular hazard is capable of inflicting upon Tillman County. Due to the limited amount of County-specific documentation, the analysis for determining potential severity is limited to obtaining available documented information and personal recollection of past events from residents, emergency responders and Tillman County Emergency Management.

4. Previous Occurrences.
The description of the hazard's past episodes and the extent of impact.

5. Probability of Future Events.
Probability of future events describes the probability that the hazard will occur within Tillman County. Each hazard is assigned a probability of future events rating based on the criteria and methods described below

The Probability of Future Events rating was based on the following definitions

1. Highly likely = event probable in next year (1 event per year; 1/1=1.00)
2. Likely = event probable in next 3 years (1 event per 3 years; 1/3=0.33)
3. Occasional = event probable in next 5 years (1 event per 5 years; 1/5=0.20)
4. Unlikely = event probable in next 10 years (1 event per 10 years; 1/10=0.10)

This results in the following ranges of Probability of Future Events
1. Highly likely = greater than 0.33
2. Likely = greater than .020, but less than or equal to 0.33
3. Occasional = greater than 0.10, but less than or equal to 0.20
4. Unlikely = 0.10 or less

Example: Tillman County has had 61 tornadoes recorded in the last 53 years.
61 / 53 = 1.15 average per year, which would make tornadoes "Highly Likely" to occur within the County.

6. Vulnerability.
Vulnerability describes how exposed or susceptible to damage Tillman County is in terms of why and where the hazard can occur within the County.

7. Secondary Hazards.
Lists other hazards often triggered by the identified natural hazard event. Some natural disasters set off other types of catastrophes in a cascade of effects that lead to a highly complex situation. Secondary hazards can be events such as transportation and

communications disruptions, fire, hazardous materials dispersion, power outages and other utilities disruptions. These secondary events are identified along with the associated primary hazard due to how they can dictate the amount of impact a natural hazard event can have on Tillman County.

8. Overall Summary of Vulnerability and Impacts.
This section summarizes the vulnerability of Tillman County, and the possible impacts of the natural disaster.

2.3. HAZARD PROFILE - Dam Failure.

2.3.1. Description.

Dams can fail by several different means. Three general failure models include:

a. Natural disaster related failure, such as when the dam is overtopped by flood waters, which creates a breach through the embankment.

b. Intrinsic structural failure, (including foundation problems) either under sunny-day circumstances or during high reservoir levels.

c. Failure resulting from an act of terrorism or sabotage.

2.3.2. Location.

Thirty six dams exist in Tillman County. None are classified as significant or high hazard. Inundation zones identified but because of low hazard dams information is not available. There are not any previous occurrences of dam failure and no other extent is available.

Feature	Type	County	USGS Topo Map	Elevation	Lat	Long
Burts Lake Dam	Dam	Tillman	Frederick	1325 feet	34.408ºN	99.042ºW
Deep Red Run-Coffin Creek Site 1 Dam	Dam	Tillman	Manitou	1204 feet	34.512ºN	98.890ºW
Deep Red Run-Coffin Creek Site 2 Dam	Dam	Tillman	Manitou	1174 feet	34.510ºN	98.900ºW
Jack Creek Site 1 Dam	Dam	Tillman	Chattanooga	1099 feet	34.420ºN	98.694ºW
Jack Creek Site 2 Dam	Dam	Tillman	Chattanooga	1118 feet	34.437ºN	98.705ºW
Jack Creek Site 2a Dam	Dam	Tillman	Chattanooga	1164 feet	34.470ºN	98.715ºW
Jack Creek Site 2b Dam	Dam	Tillman	Chattanooga	1168 feet	34.473ºN	98.704ºW

Jack Creek Site 3 Dam	Dam	Tillman	Chattanooga	1181 feet	34.480ºN	98.747ºW
Jack Creek Site 4 Dam	Dam	Tillman	Faxon	1063 feet	34.422ºN	98.504ºW
Jack Creek Site 5 Dam	Dam	Tillman	Chattanooga SW	1073 feet	34.367ºN	98.734ºW
Jack Creek Site 7 Dam	Dam	Tillman	Chattanooga SW	1073 feet	34.352ºN	98.714ºW
Jack Creek Site 8 Dam	Dam	Tillman	Chattanooga	1112 feet	34.413ºN	98.719ºW
Jack Creek Site 9 Dam	Dam	Tillman	Chattanooga	1109 feet	34.412ºN	98.690ºW
Murray Dam and Lake	Dam	Tillman	Frederick	1263 feet	34.378ºN	99.040ºW
Oknoname 141001 Dam	Dam	Tillman	Hackberry Flat	1168 feet	34.368ºN	98.927ºW
Oknoname 141002 Dam	Dam	Tillman	Tipton SE	1315 feet	34.538ºN	99.007ºW
Oknoname 141003 Dam	Dam	Tillman	Tipton SE	1358 feet	34.553ºN	99.005ºW
Oknoname 141004 Dam	Dam	Tillman	Manitou	1361 feet	34.560ºN	98.999ºW
Oknoname 141005 Dam	Dam	Tillman	Manitou	1342 feet	34.555ºN	98.984ºW
Oknoname 141006 Dam	Dam	Tillman	Indiahoma	1191 feet	34.505ºN	98.762ºW
Oknoname 141007 Dam	Dam	Tillman	Manitou	1289 feet	34.563ºN	98.954ºW
Oknoname 141008 Dam	Dam	Tillman	Hollister NW	1207 feet	34.497ºN	98.940ºW
Oknoname 141009 Dam	Dam	Tillman	Hollister NW	1168 feet	34.417ºN	98.912ºW
Oknoname 141010 Dam	Dam	Tillman	Hollister NW	1161 feet	34.457ºN	98.877ºW
Oknoname 141011 Dam	Dam	Tillman	Hollister NW	1145 feet	34.458ºN	98.875ºW
Oknoname 141012 Dam	Dam	Tillman	Hollister NE	1135 feet	34.443ºN	98.854ºW
Oknoname 141013 Dam	Dam	Tillman	Hollister NE	1161 feet	34.465ºN	98.825ºW

Oknoname 141014 Dam	Dam	Tillman	Hollister NE	1181 feet	34.480ºN	98.849ºW
Oknoname 141015 Dam	Dam	Tillman	Walters NE	1036 feet	34.497ºN	98.339ºW
Oknoname 141016 Dam	Dam	Tillman	Hollister NE	1217 feet	34.495ºN	98.779ºW
Oknoname 141017 Dam	Dam	Tillman	Hollister NE	1174 feet	34.480ºN	98.805ºW
Oknoname 141018 Dam	Dam	Tillman	Hollister NE	1178 feet	34.467ºN	98.787ºW
Oknoname 141019 Dam	Dam	Tillman	Manitou	1227 feet	34.525ºN	98.897ºW
Oknoname 141020 Dam	Dam	Tillman	Hackberry Flat	1151 feet	34.272ºN	98.879ºW
Oknoname 141021 Dam	Dam	Tillman	Tipton SE	1322 feet	34.545ºN	99.004ºW
Redeker Lake Dam	Dam	Tillman	Frederick	1289 feet	34.395ºN	99.045ºW

2.3.3. Extent.

Dam failures have not occurred in any years between 1950 and 2007. Damages to personal property is zero.

The Tillman County rating on the OWRB scale below is Low.

Hazard classifications used by the Oklahoma Water Resources Board (OWRB) to identify dams are based upon their location and the population density located downstream from the structures.

Hazard	Loss of Life	Economic Loss (property)
Low	None (no probable future development)	Minimal (undeveloped, occasional structure or agriculture)
Significant	None (potential for future development exists)	Appreciable (notable agriculture, industrial or structural)
High	Yes (dam failure would likely result in loss of life)	Excessive (extensive community, industrial or agriculture)

The OWRB coordinates the Oklahoma Dam Safety Program to ensure the safety of all dams in Tillman County, especially those that could impact downstream life and property.

The program requires inspections every five years for low hazard classification**.** The OWRB uses criteria established by The Ad Hoc Interagency committee on Dam Safety for Science, Engineering and Technology. The guidelines were prepared in response to a Presidential Memorandum of April 23, 1977 and were published on June 25, 1979. Reference: National Engineering Manual (Part 503, subpart D - Dam Safety).

Because many of these dams are old structures and, as a result, require periodic repair. The OWRB requires submittal and subsequent approval of plans and specifications prior to dam modifications. Staff also coordinates periodic training sessions and workshops on dam safety issues and regulations for dam owners and engineers. The NRCS offers technical assistance in the construction of small farm ponds and related structures.

2.3.4. Previous Occurrences.
There are no previous occurrences of dam failure in Tillman County.

2.3.5. Probability of Future Events.
Since no dam breaks have occurred within the County, probability of a dam break is rated as unlikely. The Tillman County Hazard Mitigation Planning Committee has determined dam failures do not present a severe threat to the County and therefore decided not to adapt any action items for the hazard.

2.3.6. Vulnerability.
As long as dams exist so does the chance for failure. Resources in the flood zones include agricultural, roads, bridges and public utility infrastructure.

2.3.7. Secondary Hazards.
Secondary hazards can include transportation utilities and emergency services Disruption, and possible dispersion of contaminants. Although hazardous materials and other contaminants are not identified in the area, this may need to be addressed in updates to this plan.

2.3.8. Overall Summary of Vulnerability and Impacts.
There is no record of dam failure in the history of Tillman County.
The vulnerability of a dam failure in Tillman County would be to the roads, bridges and utilities that are downstream of the dam and potential loss of life if vehicles were involved. Damage to or loss of these roads, bridges and utilities would impact the citizens and Tillman County through the loss of communication infrastructure, mail, school busses, access for emergency vehicles and utilities such as electrical power. There would be the added expense of taking alternate routes and the cost of repairing the roads and bridges.

There was not an inventory of Tribal, or Trust Lands, potentially affected by dam failure since these lands are not in the jurisdiction of Tillman County. However,

Tillman County is responsible for the roads, bridges in the area and also the safety of its citizens.

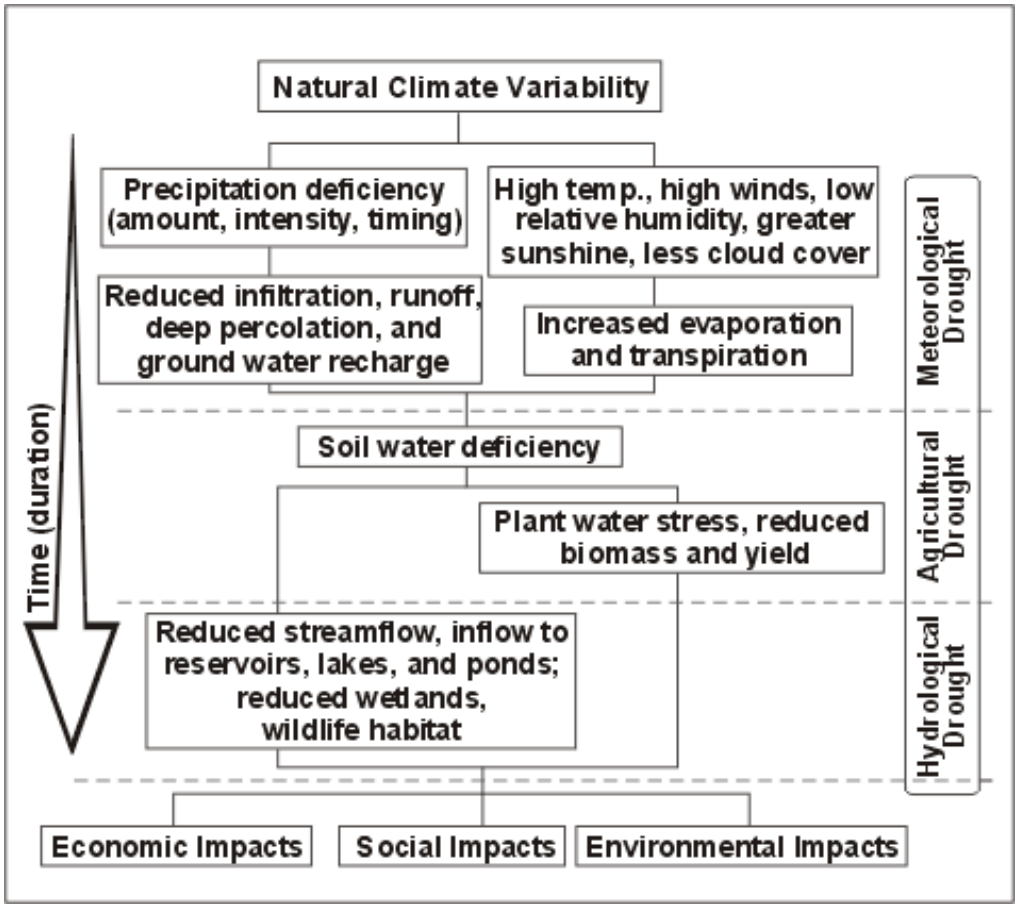
2.4. HAZARD PROFILE – Drought.

2.4.1. Description.

A drought is a period of abnormally dry weather which persists long enough to produce a serious hydrologic imbalance. There are four ways that drought can be defined:

1. **Meteorological**. A measure of departure of precipitation from normal.
2. **Agricultural**. Refers to a situation when the amount of moisture in the soil no longer meets the needs of a particular crop.
3. **Hydrological**. Occurs when surface and subsurface water are below normal.
4. **Socioeconomic**. The situation that occurs when physical water shortage begins to affect people.

IV. Figure: Diagram of Drought.



2.4.2. Location.
All areas of Tillman County are equally susceptible to drought.

2.4.3. Extent.
Drought impacts in a number of ways, spanning all regions, and is capable of affecting the economy as well as the environment. Specific impacts can include:

1. Reduced crop, rangeland.
2. Increased livestock and wildlife mortality rates.
3. Reduced income for farmers and agribusiness.
4. Increased fire hazard.
5. Reduced water supplies for municipal/industrial, agricultural and power uses.
6. Damage to fish and wildlife habitat.
7. Increased consumer prices for food.
8. Reduced tourism and recreational activities.
9. Unemployment.
10. Reduced tax revenues because of reduced expenditures.
11. Foreclosures on bank loans to farmers and businesses.

The most direct impact of drought is economic rather than loss of life or immediate destruction of property. While drought impacts in Tillman County are numerous and often dependent upon the timing and length of individual drought episodes, the greatest impacts of drought are usually experienced in the agricultural community. In addition to the obvious direct losses of both crop and livestock production due to a lack of surface and subsurface water, drought is frequently associated with increases in insect infestations, plant disease and wind erosion.

One of the most significant potential impacts of drought relates to public water supply. In metropolitan areas, there may be a need to stop washing cars, cease watering the grass and take other water conservation steps. In smaller communities, reduced flow in rivers and streams can have a significant effect on the water amount allowed for municipal use. Hot weather during the summer increases demand and subsequent use of supplies, as well as evaporation. In turn, increased water demand can stress many smaller and/or antiquated delivery and treatment facilities to the point of collapse. Prolonged drought has a much greater impact on rural communities, which usually rely on relatively small watersheds and are especially vulnerable during such periods.

Water shortages can also affect fire fighting capabilities in both urban and rural settings through reduced water flows and pressures. Most droughts dramatically increase the danger of fires on wild land. When wild lands are destroyed by fire, the resulting erosion can cause heavy silting of streams, rivers, and reservoirs. Serious damage to aquatic life, irrigation and power production then occurs. Although drought can have serious impact during winter months, it is most often

associated with extreme heat. Wildlife, pets, livestock, crops and humans are vulnerable to the high heat that can accompany drought. When temperatures reach 90 degrees and above, people and animals are more likely to suffer sunstroke, heat cramps and heat exhaustion.

V. Figure: U.S. Drought Monitor.

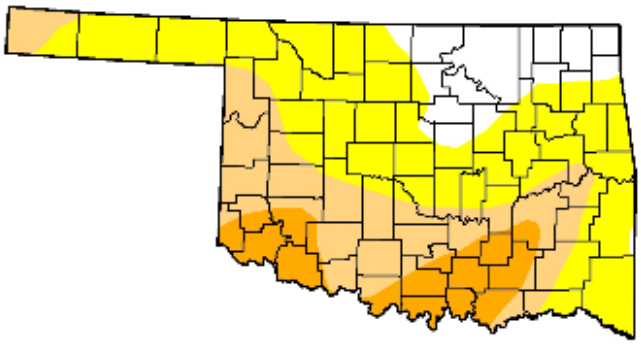
U.S. Drought Monitor

Oklahoma

January 27, 2009
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	13.8	86.2	38.8	12.4	0.0	0.0
Last Week (01/20/2009 map)	29.3	70.7	27.7	4.5	0.0	0.0
3 Months Ago (11/04/2008 map)	45.1	54.9	9.7	0.0	0.0	0.0
Start of Calendar Year (01/06/2009 map)	41.6	58.4	12.0	3.4	0.0	0.0
Start of Water Year (10/07/2008 map)	84.4	15.6	5.0	3.5	0.0	0.0
One Year Ago (01/29/2008 map)	48.5	51.5	8.5	0.0	0.0	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

Released Thursday, January 29, 2009
Author: Eric Luebehusen, U.S. Department of Agriculture

Drought: Palmer Index.
Palmer Drought Severity Index (PDSI)

In 1965, Palmer developed an index to "measure the departure of the moisture supply". Palmer based his index on the supply-and-demand concept of the water balance equation, taking into account more than only the precipitation deficit at specific locations. The objective of the Palmer Drought Severity Index (PDSI), as this index is now called, was to provide a measurement of moisture conditions that were "standardized" so that comparisons using the index could be made between locations and between months.

The Palmer Drought Index is based on precipitation and temperature. The Palmer index can therefore be applied to any site for which sufficient precipitation and temperature data is available.

The Palmer Index varies roughly between -4.0 and +4.0. Tillman County may experience these values. Weekly Palmer Index values are calculated for the climate divisions during every growing season and are on the World Wide Web from the Climate Prediction Center.

VI. Figure: PDSI Classifications.

PDSI Classifications for Dry and Wet Periods

4.00 or more	Extremely wet
3.00 to 3.99	Very wet
2.00 to 2.99	Moderately wet
1.00 to 1.99	Slightly wet
0.50 to 0.99	Incipient wet spell
0.49 to -0.49	Near normal
-0.50 to -0.99	Incipient dry spell
-1.00 to -1.99	Mild drought
-2.00 to -2.99	Moderate drought
-3.00 to -3.99	Severe drought
-4.00 or less	Extreme drought

Source: http://drought.unl.edu/whatis/indices.htm

2.4.4. Previous Occurrences.

There are four major statewide droughts based on U.S. Geological Survey, Water Supply Paper 2375. The drought years involved include the periods of 1929-1941; 1951-1957; 1961-1972; and 1975-1982. These were determined from stream flow records. Tillman County had eight additional events recorded by the National Climatic Data Center (NCDC).

12 DROUGHT event(s) were reported in **Tillman County, Oklahoma** between **01/01/1950** and **10/31/2008**.

*Click on **Location or County** to display Details.*

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Oklahoma

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 OKZ004>048 - 050>052	08/01/2000	12:00 AM	Drought	N/A	0	0	0	399.8M
2 OKZ004>048 - 050>052	07/04/2001	12:00 AM	Drought	N/A	0	0	0	0

3 OKZ019>020 - 023>032 - 035>048 - 050>052	12/01/2005	12:00 AM	Drought	N/A	0	0	10.0M	500K
4 OKZ004>048 - 050>052	01/01/2006	12:00 AM	Drought	N/A	0	0	15.0M	750K
5 OKZ004>048 - 050>052	02/01/2006	12:00 AM	Drought	N/A	0	0	25K	500K
6 OKZ004>048 - 050>052	03/01/2006	12:00 AM	Drought	N/A	0	0	5.0M	500K
7 OKZ004>048 - 050>052	04/01/2006	12:00 AM	Drought	N/A	0	0	1.5M	750K
8 OKZ004>048 - 050>052	05/01/2006	12:00 AM	Drought	N/A	0	0	0	500K
9 OKZ004>048 - 050>052	06/01/2006	12:00 AM	Drought	N/A	0	0	0	151.0M
10 OKZ004>048 - 050>052	07/01/2006	12:00 AM	Drought	N/A	0	0	50K	750K
11 OKZ004>048 - 050>052	08/01/2006	12:00 AM	Drought	N/A	0	4	100K	2.0M
12 OKZ033>038	09/01/2006	12:00 AM	Drought	N/A	0	0	20K	250K
				TOTALS:	0	4	31.695M	557.340M

2.4.5. Probability of Future Events.

Given that 12 drought events have occurred in Tillman County, from the time period of 1929-1982, one may conclude that Tillman County can expect a drought every decade and that we can expect droughts to occur more frequently here than in the United States as a whole. However, long-term forecasts of droughts are difficult and inexact. The U.S. Corps of Engineers (USACE) is preparing the *National Drought Atlas* to provide information on the magnitude and frequency of minimum precipitation and stream flow for the contiguous United States. On average the July-to-January period is the lowest six month period of stream flow throughout the U.S. and is used to characterize drought. The mean monthly flow from July to January has a once-in-20 year's chance of falling below a level that would classify it as a drought. In other words, the average occurrence of drought is once every 4 years, with an occurrence most likely lasting for years. In Tillman County, the risk for drought is likely.

2.4.6. Vulnerability.

Tillman County is located in the south central United States. The primary air masses that bring moisture to the state originate in the Gulf of Mexico. Air masses that come into the state from the west are usually stripped of moisture by the Rocky Mountains, and as a result, mean annual precipitation increases from west to east.

2.4.7. Secondary Hazards.

Drought is considered a secondary hazard brought about by extreme heat and low precipitation. Other hazards associated with drought are wild fire and expansive soils.

2.4.8. Overall Summary of Vulnerability and Impacts.

It is difficult to predict drought probabilities for the near future because of the nature and complexity of the hazard. Drought evolves over time, as certain conditions are met, and are spread over a large geographical area. Drought severity in Tillman County depends on its duration, intensity, geographic extent and the regional water supply demands made by human activities and vegetation. The impact of hazards such as extreme heat, expansive soils and wildfires can be intensified during times of drought. Otherwise, the most direct impact of drought is economic rather than loss of life or immediate destruction of property.

Drought impacts Tillman County in a number of ways, spanning all regions, and is capable of affecting the economy as well as the environment. Specific impacts can include:

1. Reduced crop, rangeland.
2. Increased livestock and wildlife mortality rates.
3. Reduced income for farmers and agribusiness.
4. Increased fire hazard.
5. Reduced water supplies for municipal/industrial, agricultural and power uses.
6. Damage to fish and wildlife habitat.
7. Increased consumer prices for food.
8. Reduced tourism and recreational activities.
9. Unemployment.
10. Reduced tax revenues because of reduced expenditures.
11. Foreclosures on bank loans to farmers and businesses.

2.5. HAZARD PROFILE – Earthquake.

2.5.1. Description.

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth surface. This sudden motion or trembling is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

2.5.2. Location.

All of Tillman County is equally susceptible to earthquake. Earthquake is not limited to certain areas of the County or certain communities. It is regional in nature, covering vast expanses of the country. An extremely devastating earthquake begun several states away could affect Tillman County. With this characteristic in mind, all buildings and structures are equally susceptible to earthquake and its destruction.

2.5.3. Extent.

Tillman County has numerous pipelines, producing oil and gas wells and large buildings that are not constructed to earthquake codes. This creates the possibility of a major catastrophe in the event of a major earthquake.

Tillman County may experiences earthquakes measured from I to III on the Richter Scale.

VII. Figure: Earthquake: Richter Scale, Mercalli Scale.

Mercalli/Richter Scale Comparison

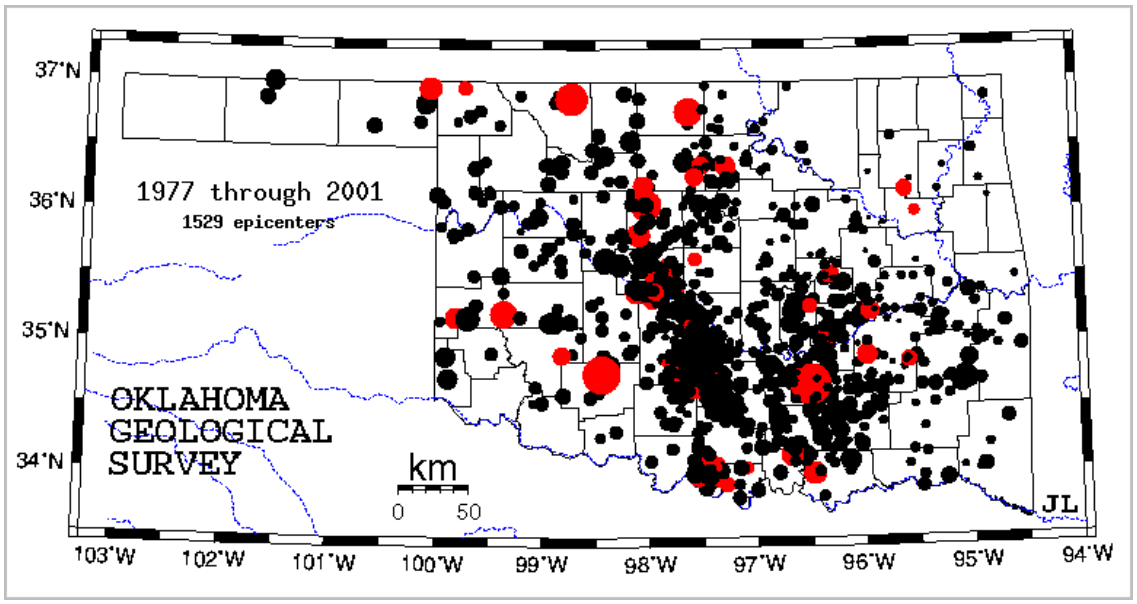
Mercalli Scale	Richter Scale	Full Description
I.	**0 – 1.9**	Not felt. Marginal and long period effects of large earthquakes.
II.	**2.0 -2.9**	Felt by persons at rest, on upper floors, or favorably placed.
III.	**3.0 – 3.9**	Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV.	**4.0 - 4.3**	Hanging objects swing. Vibration like passing of heavy trucks. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink the upper range of IV, wooden walls and frame creak.
V.	**4.4 - 4.8**	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Pendulum clocks stop, start.
VI.	**4.9 - 5.4**	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Books, etc., off shelves. Pictures off walls. Furniture moved. Weak plaster and masonry D cracked. Small bells ring. Trees, bushes shaken.
VII.	**5.5 - 6.1**	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices. Some cracks in masonry C. Waves on ponds. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
VIII.	**6.2 - 6.5**	Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
IX.	**6.6 - 6.9**	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas sand and mud ejected, earthquake fountains, sand craters.
X.	**7.0 - 7.3**	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
XI.	**.7.4 - 8.1**	Rails bent greatly. Underground pipelines completely out of service.
XII.	**> 8.1**	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Masonry A: Good workmanship, mortar, and design; reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.
Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.
Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.
Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.
Source: http://www.abag.ca.gov/bayarea/eqmaps/doc/mmigif/m10.html

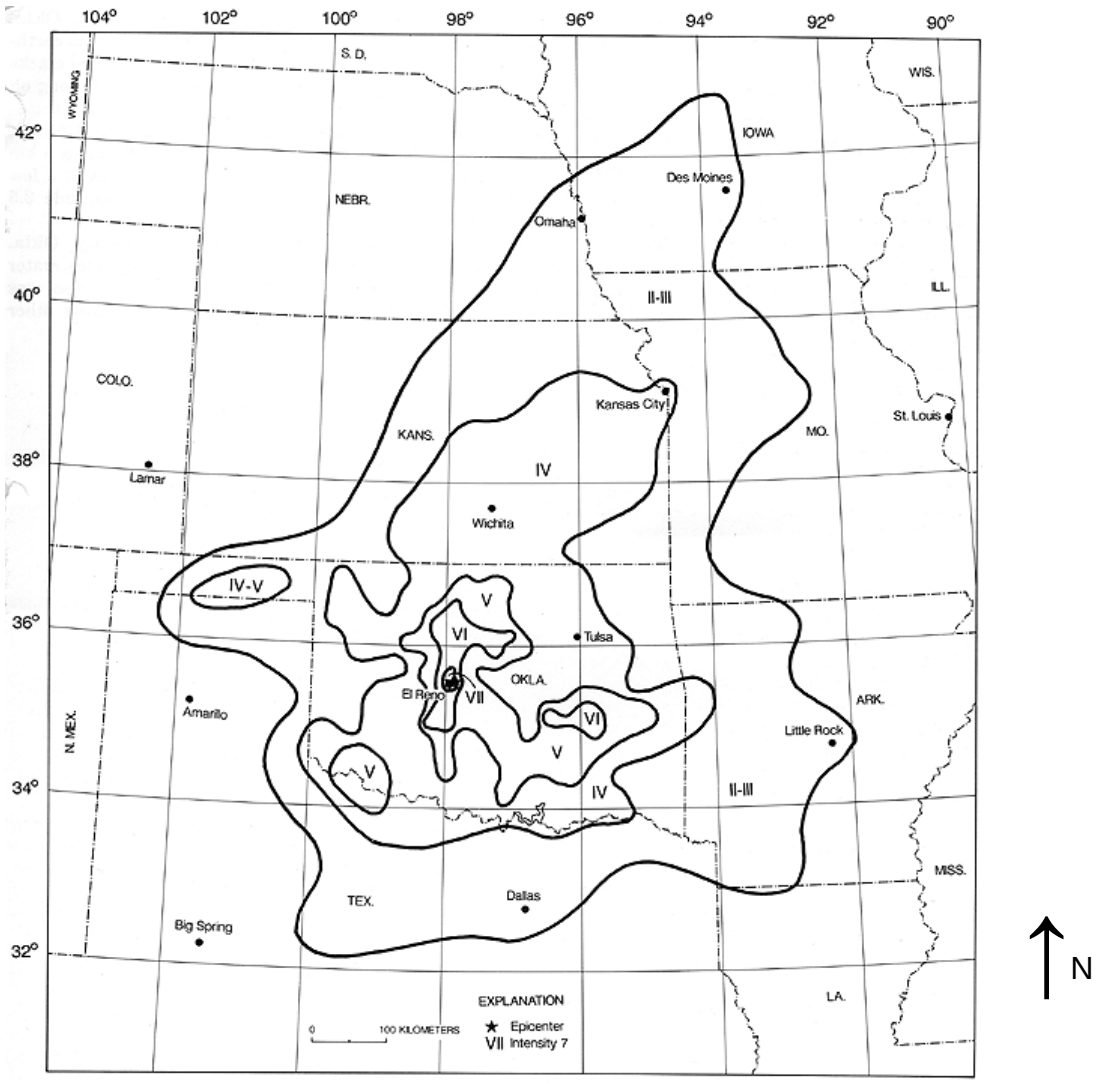
2.5.4. Previous Occurrences.

Earthquakes centered within Tillman County are rare. The few events that have been recorded are largely unfelt and are seismically rated at or below a level 2. Records maintained by the Oklahoma Geological Survey and dating back to 1897 indicate that six occurrences of seismic activity have been recorded in Tillman County. On April 9, 1952, a large earthquake centered near El Reno (in Canadian County) affected most of Oklahoma and extending as far north as Iowa.

VIII. Figure: Seismographic History of Oklahoma 1977 – 2001.



IX. Figure: Diagram of 1952 El Reno Earthquake.

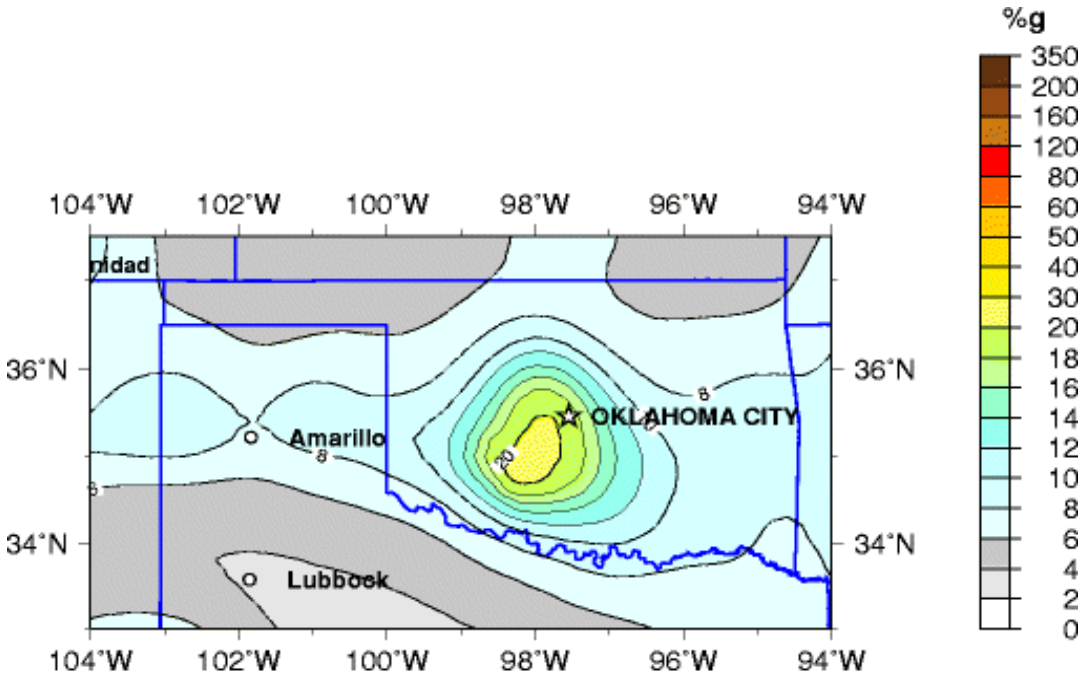


2.5.5. Probability of Future Events.

The County has a Peak Ground Acceleration (PGA) value between 3.5% - 5% probability of expedience in 50 years. This earthquake measure indicates that there is a probability (10% chance in 50 years) of an earthquake at the severity level of 3.5 - 5 occurring within the County. With this rating, and since records dating back to 1897 indicate that six occurrences of seismic activity have been recorded, the probability of an earthquake occurring within Tillman County is unlikely.

The Tillman County Hazard Mitigation Planning Committee has determined earthquakes do not present a severe threat to Tillman County and therefore decided not to adapt any action item for this hazard.

X. Figure: Probability of Exceedance in 50 Years.



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

2.5.6. Vulnerability.

Tillman County has beneath its surface the Nemaha Ridge which connects with the New Madrid fault, one of the nation's most seismic active zones. The installation of a statewide earthquake-station network of seismograph stations greatly improved earthquake detection and location. Oklahoma has experienced, on average, 50 earthquakes each year since the Oklahoma Geological Survey has kept records. Most of these earthquakes are so small that people do not feel them. However, according to Kathleen Shingledecker, earthquake project manager with the Oklahoma Department of Emergency Management, these unfelt earthquakes could adversely affect the integrity of the infrastructure and lifelines within the impacted areas.

2.5.7. Secondary Hazards.

Secondary hazards can include fire explosions collapse or structural failure of bridges, overpasses, roads and disruption of economic activity across the region. Dispersion of contaminants could also occur. Hazardous materials and other contaminants were not identified in the area, but may need to be addressed in updates of this plan.

Ground movement during an earthquake is seldom the direct cause of death or injury. Most earthquake-related injuries result from collapsing walls, flying glass

and falling objects as a result of the ground shaking, or people trying to move more than a few feet during the shaking.

2.5.8. Overall Summary of Vulnerability and Impacts.

As the Earth's crust moves and bends, stresses are built up, sometimes for years before suddenly breaking or slipping. This abrupt release of accumulated tension can be devastating to human communities. The destructiveness of an earthquake depends upon the magnitude of the tremor, direction of the fault, distance from the epicenter, regional geology, local soils and the design characteristics of buildings and infrastructure. Earthquakes centered in Tillman County are rare and the few events that have occurred were largely unfelt. There is concern as to what the long term affects of the unfelt earthquakes have on the integrity and infrastructure of the numerous pipelines associated with the oil and gas industries located within Tillman County.

The vulnerability for earthquake is the damage to or failure of homes and other structures. Structural failure of bridges, overpasses, roads, pipe lines and utilities would also be at risk or vulnerable to earthquakes. The impact from this would be displacement of people from their homes, loss of water and utilities and the disruption to the infrastructure of Tillman County.

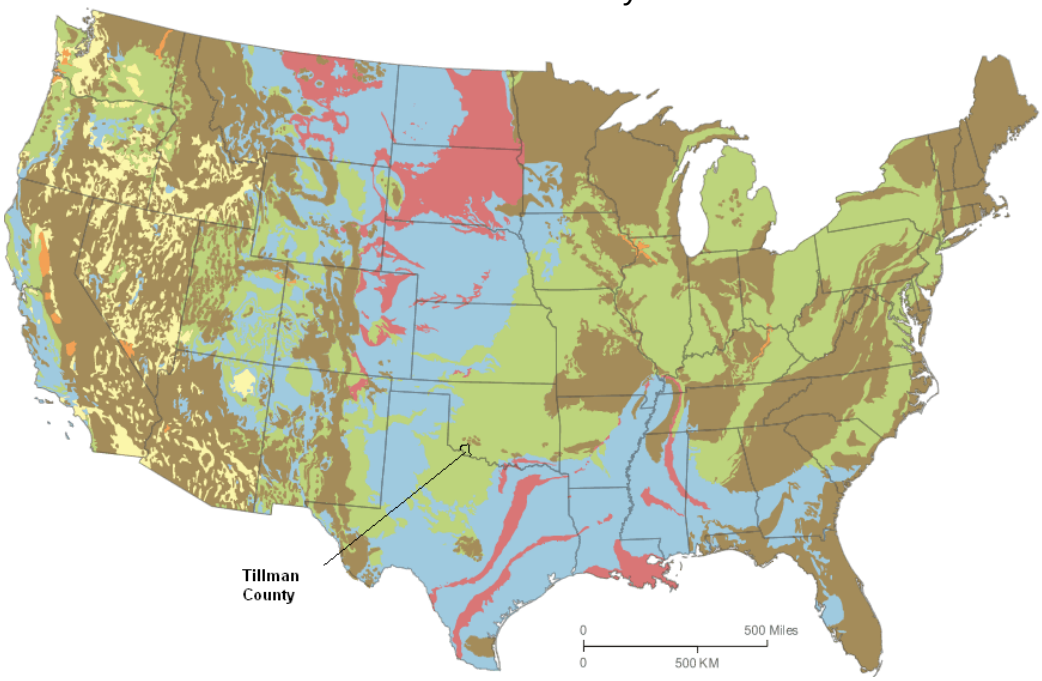
2.6. HAZARD PROFILE - Expansive Soils.

2.6.1. Description.

Expansive soils are soils with relatively high percentages of clay colloids that are subject to volumetric changes as water is present or absent. These volume changes can impact the integrity of structures built on, or within, the surface of such soils. Expansive soils present no problem in their natural state.

2.6.2. Location.

Expansive soils in Tillman County have shale as the parent material and are generally in central and eastern Tillman County. The expansive soil area amounts to about 20% of Tillman County.



Over 50 percent of these areas are underlain by soils with abundant clays of high swelling potential.

Less than 50 percent of these areas are underlain by soils with clays of high swelling potential.

Over 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.

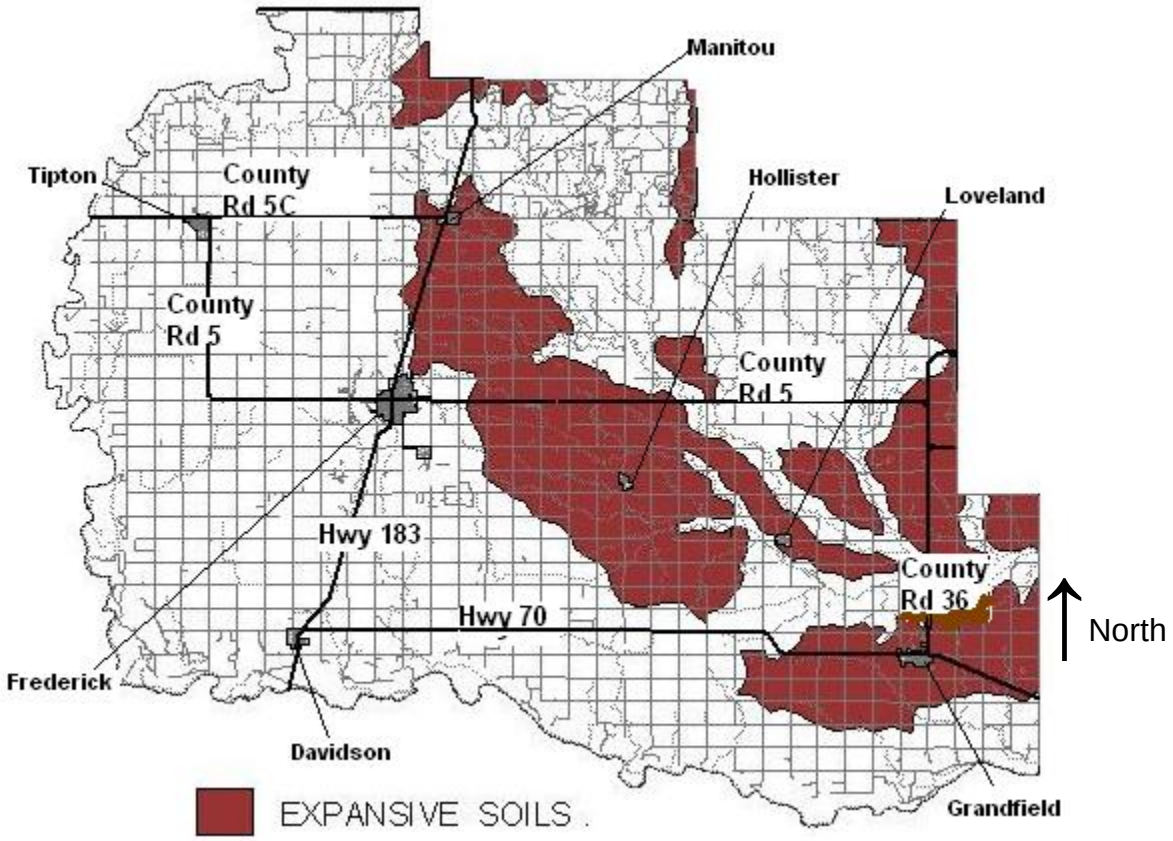
Less than 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.

These areas are underlain by soils with little to no clays with swelling potential.

Data insufficient to indicate the clay content or the swelling potential of soils.

Source: Geology.com The map above is based upon "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider and R. Schuster. It was published in 1989 as Map I-1940 in the USGS Miscellaneous Investigations Series.
Land areas were assigned to map soil categories based upon the type of bedrock that exists beneath them as shown on a geologic map. In most areas, where soils are produced "in situ", this method of assignment was reasonable. However, some areas are underlain by soils which have been transported by wind, water or ice. The map soil categories would not apply for these locations.

X.I Figure: Expansive Soils



2.6.3. Extent.

Extensive damage from expansive soils can occur to highways and streets. Homes, buildings and other structures can have damage resulting in sticking doors, uneven floors and cracks in the foundation, floors, walls and ceilings. The greatest damage occurs when structures are constructed when clays are dry (such as during a drought) and then subsequent soaking rains swell the clay. Damage can become so severe that the cost of repair can exceed the value of the building.

Both public and private structures can develop extreme foundation problems during times of shrink-swell events. The most common signs of damage are cracks in foundations, brick exteriors, drywall interiors, sidewalks and other concrete structures within the building.

Sewer and water lines are also affected by shrink-swell soils. The action of the movement of the soils can damage water and sewer lines, producing a minimum of social discomfort and a maximum of a serious health and welfare risk.

The expansive tendency of a soil is a function of its shrink-swell potential. NRCS sorts this shrink-swell potential soil property into five categories; very low, low, moderate, high and very high. This is the range of magnitude of an expansive soils hazard. Shrink-swell potential categories are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The categories are very low, a change of less than 1%; low, 1 -3%; moderate, 3 -6%; high, 6 -9%; and very high, greater than 9%. Soils in the low to moderate category may be modified using lime to stabilize the soil. High to very high expansive soils not only are treated with lime but, structures must be built in such a way to resist damage from the high shrink-swell soils. For this reason few homes are built in this area of Tillman County and many roads are gravel. Approximately 20% of Tillman County is in some way affected by expansive soils.

2.6.4. Previous Occurrences.

Since this hazard develops gradually and seldom presents a threat to life, problems may not be recognized as being related to expansive soils or may be considered only nuisances and therefore never reported. No records of specific incidences of structure loss due to expansive soils in Tillman County were found.

2.6.5 Probability of Future Events.

Since no records of specific incidences of loss associated with expansive soils were found, no future event losses were calculated. The Tillman County Hazard Mitigation Planning Committee has determined expansive soils do not present a severe threat to Tillman County and therefore decided not to adapt any action items for the hazard.

2.6.6. Vulnerability.

The effects of expansive soils are most prevalent in regions of moderate to high precipitation subject to prolonged periods of drought. Other cases of damage result from increases in moisture volume from such sources as broken or leaking water and sewer lines. Areas capable of these changes in soil volume present a hazard to buildings, roads and other structures built over them and to the pipelines buried in them. Houses and one-story commercial buildings are more apt to be damaged by the expansion of swelling clays than are multi-story buildings which, because of expense, have mitigation measures taken before construction starts. No incidences of expansive soils have been recorded in Tillman County.

2.6.7. Secondary Hazards.

Depending on the use of the pipeline, contamination of soils and groundwater could occur should buried pipelines become damaged by expansive soils.

2.6.8. Overall Summary of Vulnerability and Impacts.

Changes in soil volume present a hazard to structures built on top of expansive soils. Damages occur as clay moisture content expands or shrinks the soil volume causing the structure to move. There are no records of specific incidences of loss within Tillman County due to expansive soils. For large areas of the United States, little information is reported other than field observations of the physical characteristics of clay in a particular stratigraphic unit. As a result, fixed criteria for determining the swelling potential have not been devised. The impact is financial in that foundations shift and can require extensive and costly repairs

2.7. HAZARD PROFILE - Extreme Heat.

2.7.1. Description.

Temperatures that hover ten degrees or more above the average high temperature for the region, and last for several weeks, are defined as extreme heat. Humid or muggy conditions, which add to the discomfort of high temperature, occur when a “dome” of high atmospheric pressure traps hazy, damp air near the ground.

2.7.2. Location.

Extreme heat events are regional in nature. The entire County is equally affected by extreme heat.

2.7.3. Extent.

The severity of the extreme heat is dependent on a combination of temperature and humidity. High temperatures, when combined with high humidity can put an area in the “extreme danger” category on the National Weather Service Heat Index scale. When extreme heat is combined with drought, results can include not only excessively dry hot conditions that contribute to a high risk of life-

threatening heat related illnesses, but can also provoke dust storms with low visibility.

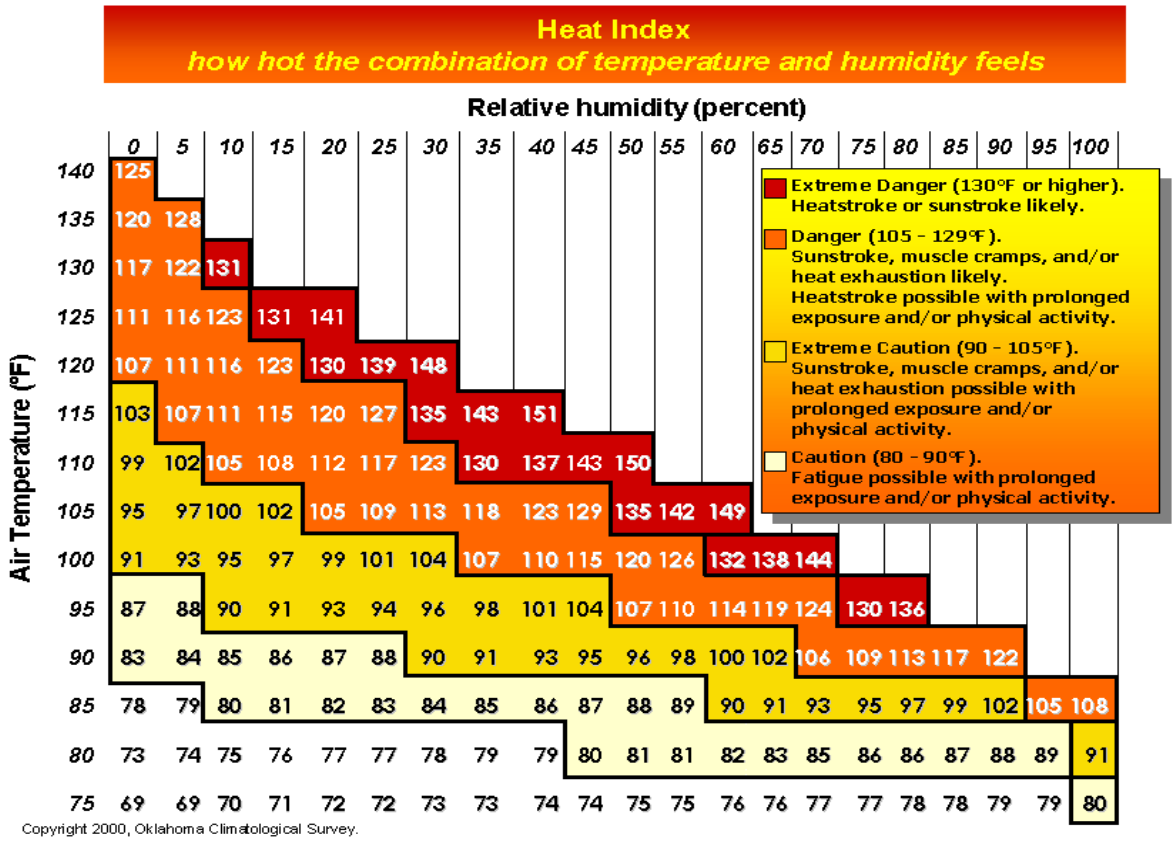
Heat kills by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature.

Most heat disorders occur because the victim has been overexposed to heat or has over exercised for his or her age and physical condition. Other conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality.

Prolonged extreme heat can have a serious economic impact on a community. Increased demand for water and electricity may result in shortages of resources. Moreover, food shortages may occur if agricultural production is damaged or destroyed by a loss of crops or livestock.

Tillman County may experience readings on the heat index scale ranging from 107 to 106.

XII. Figure: Heat Index.



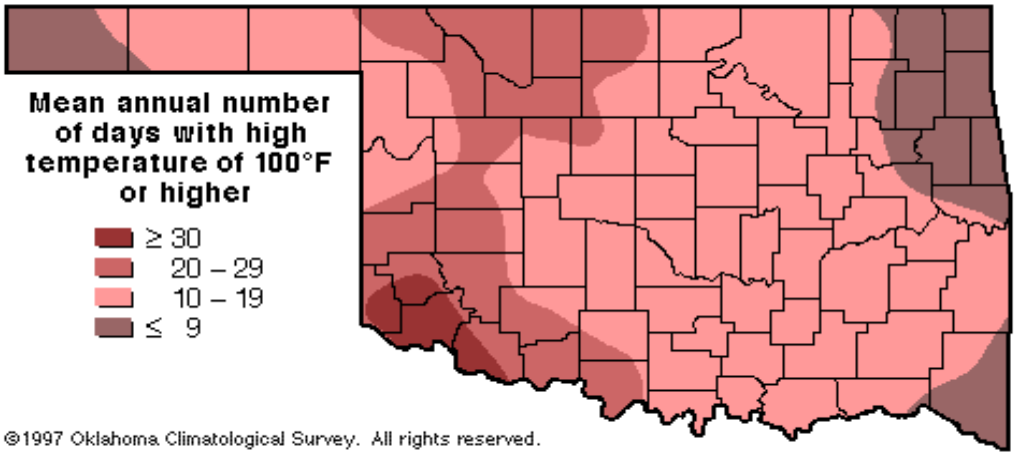
2.7.4. Previous Occurrences.

In a normal year, approximately 175 Americans die from extreme heat. Between 1936 and 1975, nearly 20,000 people succumbed to the effects of heat and solar radiation. From 1979-1999, excessive heat exposure caused 8,015 deaths in the United States. On average, approximately 400 people die each year from exposure to heat. In Oklahoma, July is generally the hottest month of the year, followed by August. On June 27, 1994 a temperature of 120º was recorded at Tipton in western Tillman County, tying a state record.

2.7.5. Probability of Future Events.

According to the Oklahoma Climatological Survey, Tillman County averages 30 days per year of daytime high temperatures greater than 100° F. Therefore extreme temperatures are highly likely to occur within Tillman County.

XIII. Figure: High Heat Days for Oklahoma.



2.7.6. Vulnerability.

In Tillman County young children, elderly people and those who are sick or overweight are more likely to become victims to extreme heat. Other conditions that can limit the ability to regulate temperature include fever, dehydration, heart disease, mental illness, poor circulation, sunburn, prescription drug use and alcohol use. Another segment of the population at risk is those whose jobs consist of strenuous labor outside. Livestock and crops can also become stressed, decreasing in quality or in production during times of extreme heat.

2.7.7. Secondary Hazards.

Extreme high temperatures can cause water shortages, increase fire danger and prompt excessive demands for energy. Another secondary hazard is air pollution in summer months resulting from consistent high temperatures and reduced airflows.

2.7.8. Overall Summary of Vulnerability and Impacts.

Tillman County can expect to experience extreme heat every summer which is most likely to occur during the months of July and August. The severity of the extreme heat is dependent on temperature and humidity. High temperatures and high humidity can result in dangerous conditions that expose people to an increased risk of heat stroke and other heat related illnesses. The most vulnerable population is the elderly, young children and those who are sick, overweight, or who work outside. Extreme heat can also cause stress on livestock and other agricultural productions. With periods of extended extreme heat, water supplies are exhausted, roads are damaged and crops fail. The impact of extreme heat ranges from increased medical problems and loss of life to loss of income for farmers and ranchers and increased expense to Tillman County for additional road and bridge repairs.

2.8. HAZARD PROFILE – Flood.

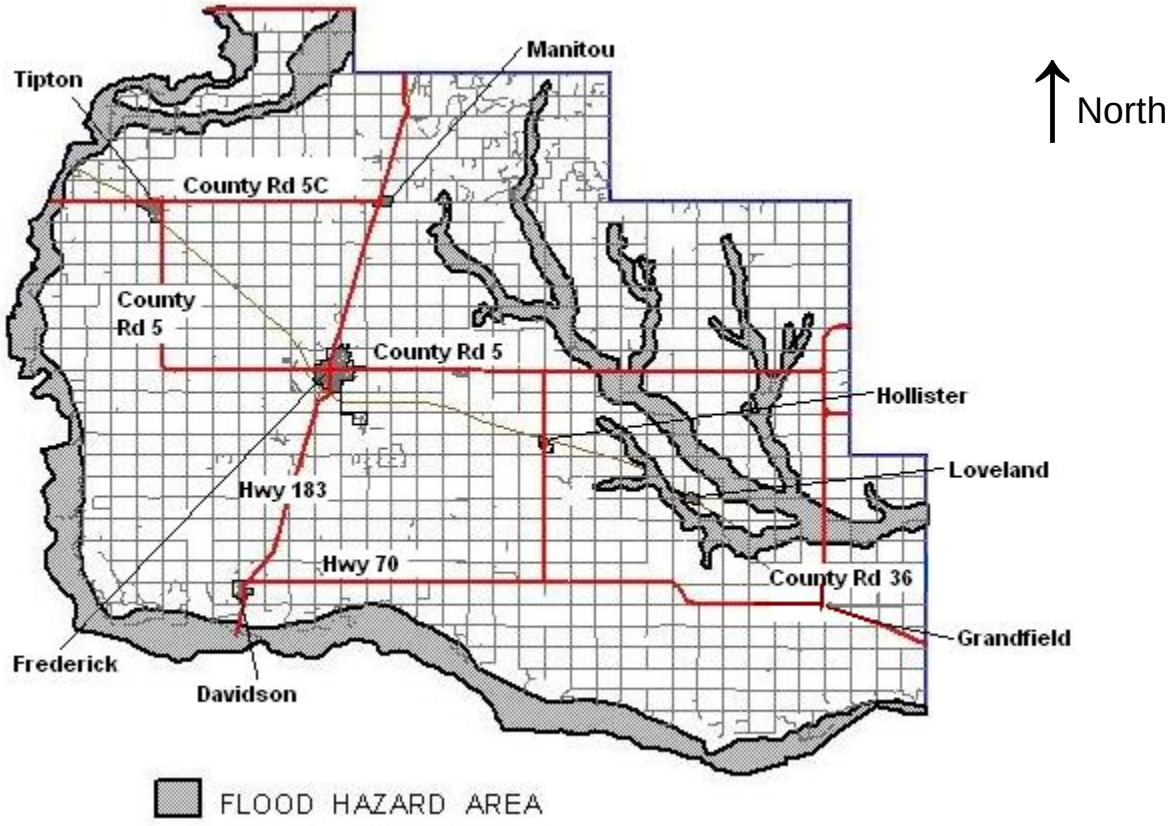
2.8.1. Description.

Flooding is the most prevalent and costly disaster in the United States. Flooding occurs any time dams fail, rains or melting snows exceed the capacity the flow capacity of rivers, streams or drainage ways. At the point the water concentration exceeds the capacity of the floodway, the water enters the floodplain.

There are two types of floods, both which can occur in Tillman County. First, flash floods, which result from localized heavy rain falls. Flash floods occur rapidly with little warning. Dam failures are a unique form of flash flood. Flash flooding is the most common cause of death by natural disaster in the United States. Second, riverine floods occur after extended periods of rain over several days or weeks. Riverine floods generally can be forecast in advance and proper precautions taken to save lives and mitigate some, though certainly not all, property losses.

2.8.2. Location.

XIV. Figure: Flood Zones of Tillman County.



2.8.3. Extent.

Severity of flooding is determined by several factors including rainfall intensity, duration and location. Flash floods are most dangerous since they can occur suddenly and begin before the rain stops. Tillman County anticipates that a minimum severity flash flood will occur with 1 inch or less rainfall in one hour. Tillman County anticipates that a 6 inch rainfall or greater in one hour will create a major severity flash flood. A maximum flood threat could result if soils are saturated and wide spread heavy rains begin to fall. Such an event could cause all streams and rivers within Tillman County to rise above flood stage. The extent scale below will apply to the FIRM maps when FEMA creates them as result of Tillman County joining NFIP.

Flood Zones		
Zone A	The 100-year or Base Floodplain. There are six types of A zones:	
	A	The base floodplain mapped by approximate methods, i.e., BFEs are not determined. This is often called an unnumbered A zone or an approximate A zone.
	A1-30	These are known as numbered A zones (e.g., A7 or A14). This is the base floodplain where the firm shows a BFE (old format).
	AE	The base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
	AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
	AH	Shallow flooding base floodplain. BFE's are provided.
	A99	Area to be protected from base flood by levees or Federal flood protection systems under construction. BFEs are not determined.
	AR	The base floodplain that results from the de-certification of a previously accredited flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection
Zone V and VE	**V**	The coastal area subject to velocity hazard (wave action) where BFEs are not determined on the FIRM.
	VE	The coastal area subject to velocity hazard (wave action) where BFEs are provided on the FIRM.
Zone B and Zone X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and the 500-year floods. B zones are also used to designate base floodplains or lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	

Zone C and Zone X (unshaded)	Area of minimal flood hazard, usually depiction FIRMs as exceeding the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood.
Zone D	Area of undetermined but possible flood hazards.
Source: Understanding Your Risks, identifying hazards and estimating losses, FEMA 386-2	

2.8.4. Previous Occurrences.

National Climatic Data Center storm event statistics record 12 flooding events in Tillman County during 1995-2007. The reported damage totaled $1.262 million.

Previous Occurrences of Flooding.

- September 22, 1997 - After 9.5 inches of rain fell in less than 24 hours, with most of the rain falling in a four hour period from 21:30 CST on the 22nd to 01:30 CST on the 23rd, streets of Tipton looked more like rivers than roads. Water up to five feet deep flowed down Main Street in downtown Tipton. At least 19 residences, four businesses, a post office, and a church were flooded. Highway 5 near town was also impassable. Damage was reported at $125,000.
- May 27, 1999 - Several houses were reported to be flooded in Frederick in Tillman County, and two homes needed to be evacuated. Portions of State Route 36, and State Route 5 in Tillman County were also reported to be covered by water. Damage was reported at $60,000.
- June 10, 1999 - In Frederick in Tillman County, flooding was reported on S. Main St.
- October 22, 2000 – Railroad tracks north of Frederick were washed out due to rushing water. Highway 183 was closed between Frederick and Manitou, while State Highway 5c was closed between Manitou and Tipton. No damage amount was reported.
  October 22, 2000 – In the city of Tipton in Tillman County, six homes were flooded and several streets were covered with a half foot of water. A couple was rescued from their home three miles east of Manitou in Tillman County, while a family was rescued from their home one mile east of Frederick in Tillman County, both due to high water. A vehicle traveling on Red River Gin Road, three miles south of Frederick in Tillman County, was swept off the road and into a creek. Both occupants were rescued by boat and treated for injuries, one for a broken leg and the other for lacerations. Many roads, including large segments of Highway 183, were closed during this time. Damage was reported at $75,000.

2.8.5. Probability of Future Events.

Tillman County receives abundant rainfall mainly in the spring and fall. Consequently, rivers and creeks overflow their banks during these seasons.

Many of these floods are of small consequence; however, the number of major floods in the last 20 years warrants a highly likely probability rating.

2.8.6. Vulnerability.

The boundary of a 100-year frequency flood was digitized into an ArcView map layer. That map layer was superimposed over newest available aerial photographs of Tillman County. The resulting map was visually searched for homes**.** This search found located zero homes.

From County assessor records a list of 37 rural non-home land parcels with "improvements" was identified. The locations were digitized into an Arc View map layer. The 100-year flood frequency map layer was superimposed to identify any of these 'improvements" in flood hazard. There were none in the flood hazard area. Since Tillman County has not previously had a flood insurance program there are no repetitive loss structures.

2.8.7. Secondary Hazards.

Secondary hazards include transportation disruptions, dam failure, and dispersion of contaminants and threatened water supplies. Hazardous materials (and other possible sources of contaminants) are not identified in the area but may need to be addressed in updates to this plan.

2.8.8. Overall Summary of Vulnerability and Impacts.

In Tillman County spring and fall rains can result in a rise in Tillman County's rivers and creeks resulting in floods that vary in intensity. Severity of flooding is determined by several factors including rainfall intensity, duration and location. Flash floods are most likely to close small roads and some major highways within Tillman County. Tillman County has no structures that are designated as repetitive loss structures. Tillman County's roadways, bridges, and some farmland remain most vulnerable to floods. The impact is during times of flooding and inundation, roads become impassible and emergency response becomes very limited. Roads that become impassible create a financial and time hardship to citizens; school districts and others in that they must find alternate routes around flooded areas.

2.9. HAZARD PROFILE – Hailstorm.

2.9.1. Description.

Due to Oklahoma's rapidly changing climate, large-scale hailstorms are especially prevalent. Hail is formed by actions of wind and rain at freezing temperatures, which cause water particles to become frozen and condense into particles ranging from very small to grapefruit size. Hailstones may be spherical, conical or irregular in shape. The size and shape of hailstones is determined by the strength of wind within the storm cell. Each lifting, falling, recoating cycle produces a larger hailstone until finally the weight of the stone causes it to fall to earth.

Hail is associated with severe thunderstorms. Powerful updrafts produce cumulonimbus clouds that tower tens of thousands of feet above the ground. Air temperature in the upper levels of these clouds may be -50°F or below. Hailstones grow as ice pellets, are lifted by updrafts and collect super cooled water droplets. As they grow, hailstones become heavier and begin to fall. Sometimes, they are caught by successively stronger updrafts and are circulated through the cloud again and again; growing larger each time the cycle is repeated. Eventually, the updrafts can no longer support the weight of the hailstones. As hailstones fall to the ground, they produce a hail streak that may be more than a mile wide and a few miles long. A single thunderstorm can produce several hail streaks.

Note, that although hail is associated with thunderstorms, this plan profiles hail equal to or larger than 1.50" in diameter as a separate natural hazard event. Based on previous occurrences, when hail gets this large, it can be particularly damaging to cars, roofs and windows but can also hurt people.

2.9.2. Location.
All parts of Tillman County are equally vulnerable to hailstorms.

2.9.3. Extent.
The severity of damage caused by hailstorms depends on the hailstone sizes (average and maximum), number of hailstones per unit area, and associated winds. Storms that produce high winds in addition to hail are most damaging and can result in numerous broken windows and damaged siding. Hailstorms can cause extensive property damage affecting both urban and rural landscapes. Fortunately, most hailstorms produce marble-size or smaller hailstones. These can cause damage to crops, but they normally do not damage buildings or automobiles. Larger hailstones can destroy crops, livestock and wildlife and can cause extensive damage to buildings, including roofs, windows and outside walls. Vehicles can be total losses. When hail breaks windows, water damage from accompanying rains can also be significant. A major hailstorm can easily cause damage running into the millions of dollars.

Nationwide, hail is responsible for over $1 billion in property and crop damages per year.

XV. Figure: Hail: NWS/TORRO Hail Scale.

Combined NOAA/TORRO Hailstorm Intensity Scales

Size Code	Intensity Category	Typical Hail Diameter (inches)	Approximate Size	Typical Damage Impacts
H0	Hard Hail	up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33-0.60	Marble or Mothball	Slight damage to plants, crops
H2	Potentially Damaging	0.60-0.80	Dime or grape	Significant damage to fruit, crops, vegetation
H3	Severe	0.80-1.20	Nickel to Quarter	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2-1.6	Half Dollar to Ping Pong Ball	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.6-2.0	Silver dollar to Golf Ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	2.0-2.4	Lime or Egg	Aircraft bodywork dented, brick walls pitted
H7	Very destructive	2.4-3.0	Tennis ball	Severe roof damage, risk of serious injuries
H8	Very destructive	3.0-3.5	Baseball to Orange	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	4+	Softball and up	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Sources: www.noaa.gov and www.torro.org

2.9.4. Previous Occurrences.

National Climatic Data Center documented a total of 263 hail events occurring in Tillman County between 1955 and 2006. Of these events it is estimated 85 were large hail (>1.5 inch diameter) storms. There were no reported deaths from hail events within the County.

Hail events have been documented in every year from 1950 to 2007. Damages to personal property are usually insured losses, therefore not reported publicly. All structures are equally acceptable to hail damage. Crops are especially vulnerable to hail damage.

XVI. Figure: Hail Events.

97 HAIL event(s) were reported in **Tillman County, Oklahoma** between **01/01/1997** and **03/31/2007**.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Oklahoma

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Tipton	05/08/1997	04:31 PM	Hail	1.75 in.	0	0	0	0
2 Frederick	05/08/1997	04:38 PM	Hail	1.75 in.	0	0	0	0
3 Frederick	05/08/1997	04:45 PM	Hail	1.00 in.	0	0	0	0
4 Grandfield	05/08/1997	05:34 PM	Hail	0.88 in.	0	0	0	0
5 Hollister	05/30/1997	01:30 AM	Hail	1.00 in.	0	0	0	0
6 Frederick	05/30/1997	12:55 AM	Hail	1.00 in.	0	0	0	0
7 Grandfield	04/06/1998	05:37 PM	Hail	0.88 in.	0	0	0	0
8 Grandfield	04/06/1998	05:41 PM	Hail	1.00 in.	0	0	0	0
9 Grandfield	04/06/1998	05:43 PM	Hail	0.75 in.	0	0	0	0
10 Grandfield	04/06/1998	06:00 PM	Hail	1.00 in.	0	0	0	0
11 Grandfield	04/14/1998	04:55 PM	Hail	1.00 in.	0	0	0	0
12 Grandfield	04/26/1998	12:50 PM	Hail	0.75 in.	0	0	0	0
13 Tipton	06/09/1998	07:40 PM	Hail	1.00 in.	0	0	0	0
14 Tipton	06/09/1998	07:50 PM	Hail	1.00 in.	0	0	0	0
15 Frederick	06/09/1998	08:15 PM	Hail	0.88 in.	0	0	0	0
16 Davidson	06/19/1998	05:13 PM	Hail	0.88 in.	0	0	0	0

17 Tipton	04/21/1999	04:45 PM	Hail	0.88 in.	0	0	0	0
18 Manitou	04/21/1999	04:58 PM	Hail	1.00 in.	0	0	0	0
19 Frederick	05/03/1999	09:10 PM	Hail	0.88 in.	0	0	0	0
20 Frederick	05/25/1999	07:37 PM	Hail	1.25 in.	0	0	0	0
21 Frederick	05/25/1999	07:45 PM	Hail	0.75 in.	0	0	0	0
22 Frederick	05/31/1999	07:07 PM	Hail	1.75 in.	0	0	0	0
23 Manitou	05/31/1999	07:20 PM	Hail	1.00 in.	0	0	0	0
24 Frederick	05/31/1999	07:26 PM	Hail	1.00 in.	0	0	0	0
25 Grandfield	06/06/1999	08:36 AM	Hail	1.00 in.	0	0	0	0
26 Loveland	09/12/1999	12:27 AM	Hail	1.00 in.	0	0	0	0
27 Loveland	09/12/1999	12:42 AM	Hail	1.00 in.	0	0	0	0
28 Tipton	10/29/1999	08:19 PM	Hail	0.75 in.	0	0	0	0
29 Frederick	12/02/1999	05:50 PM	Hail	0.75 in.	0	0	0	0
30 Hollister	12/02/1999	05:50 PM	Hail	1.75 in.	0	0	0	0
31 Grandfield	12/09/1999	01:23 AM	Hail	0.75 in.	0	0	0	0
32 Tipton	02/22/2000	04:20 PM	Hail	2.75 in.	0	0	0	0
33 Tipton	02/22/2000	04:34 PM	Hail	2.75 in.	0	0	0	0
34 Manitou	02/22/2000	04:40 PM	Hail	1.25 in.	0	0	0	0
35 Tipton	02/22/2000	04:42 PM	Hail	1.50 in.	0	0	0	0
36 Manitou	02/22/2000	04:44 PM	Hail	2.75 in.	0	0	0	0
37 Manitou	02/22/2000	04:55 PM	Hail	2.75 in.	0	0	1K	0
38 Grandfield	04/01/2000	08:15 AM	Hail	0.75 in.	0	0	0	0
39 Davidson	04/15/2000	06:20 PM	Hail	0.75 in.	0	0	0	0
40 Grandfield	04/15/2000	06:55	Hail	0.75 in.	0	0	0	0

		PM						
41 Grandfield	04/30/2000	05:21 PM	Hail	0.88 in.	0	0	0	0
42 Tipton	05/26/2000	06:30 PM	Hail	1.00 in.	0	0	0	0
43 Frederick	05/27/2001	11:00 PM	Hail	1.00 in.	0	0	0	0
44 Frederick	05/27/2001	11:00 PM	Hail	1.00 in.	0	0	0	0
45 Frederick	05/29/2001	10:50 PM	Hail	0.75 in.	0	0	0	0
46 Grandfield	05/29/2001	11:33 PM	Hail	1.00 in.	0	0	0	0
47 Davidson	06/28/2001	03:46 PM	Hail	1.75 in.	0	0	0	0
48 Davidson	06/28/2001	03:55 PM	Hail	1.75 in.	0	0	1K	0
49 Frederick	04/13/2002	06:00 AM	Hail	1.00 in.	0	0	0	0
50 Hollister	04/13/2002	06:00 AM	Hail	1.00 in.	0	0	0	0
51 Grandfield	04/13/2002	06:30 AM	Hail	3.00 in.	0	0	100K	0
52 Tipton	04/19/2003	01:20 AM	Hail	2.75 in.	0	0	0	0
53 Frederick	04/19/2003	01:27 AM	Hail	1.75 in.	0	0	0	0
54 Frederick	04/19/2003	01:30 AM	Hail	4.50 in.	0	0	0	0
55 Manitou	04/19/2003	01:32 AM	Hail	1.00 in.	0	0	0	0
56 Frederick	04/19/2003	01:35 AM	Hail	1.00 in.	0	0	0	0
57 Tipton	04/29/2003	07:05 PM	Hail	1.75 in.	0	0	0	0
58 Frederick	05/07/2003	09:30 PM	Hail	1.00 in.	0	0	0	0
59 Tipton	05/07/2003	09:40 PM	Hail	0.88 in.	0	0	0	0
60 Frederick	05/07/2003	09:45 PM	Hail	1.00 in.	0	0	0	0
61 Davidson	05/23/2003	11:02 PM	Hail	0.88 in.	0	0	0	0
62 Tipton	05/23/2003	11:02 PM	Hail	0.88 in.	0	0	0	0
63 Grandfield	06/04/2003	11:00 PM	Hail	1.75 in.	0	0	0	0

64 Frederick	06/13/2003	03:08 AM	Hail	0.75 in.	0	0	0	0
65 Manitou	06/13/2003	03:17 AM	Hail	0.75 in.	0	0	0	0
66 Grandfield	06/13/2003	12:45 AM	Hail	0.75 in.	0	0	0	0
67 Davidson	04/23/2004	01:00 PM	Hail	0.75 in.	0	0	0	0
68 Davidson	04/23/2004	01:30 PM	Hail	0.88 in.	0	0	0	0
69 Hollister	04/23/2004	01:36 PM	Hail	1.00 in.	0	0	0	0
70 Loveland	04/23/2004	02:00 PM	Hail	0.88 in.	0	0	0	0
71 Grandfield	04/29/2004	09:15 PM	Hail	1.00 in.	0	0	0	0
72 Grandfield	04/29/2004	09:20 PM	Hail	1.75 in.	0	0	0	0
73 Grandfield	05/13/2004	12:48 PM	Hail	0.75 in.	0	0	0	0
74 Manitou	05/24/2004	05:43 PM	Hail	1.00 in.	0	0	0	0
75 Manitou	05/24/2004	06:02 PM	Hail	4.50 in.	0	0	0	0
76 Manitou	05/24/2004	06:45 PM	Hail	1.75 in.	0	0	0	0
77 Manitou	05/24/2004	06:50 PM	Hail	2.50 in.	0	0	0	0
78 Manitou	05/24/2004	06:58 PM	Hail	1.75 in.	0	0	0	0
79 Grandfield	05/24/2004	07:35 PM	Hail	1.75 in.	0	0	0	0
80 Frederick	06/02/2004	06:58 PM	Hail	0.75 in.	0	0	0	0
81 Davidson	11/01/2004	05:10 PM	Hail	1.00 in.	0	0	0	0
82 Davidson	11/01/2004	05:11 PM	Hail	1.00 in.	0	0	0	0
83 Frederick	05/13/2005	07:59 PM	Hail	0.75 in.	0	0	0	0
84 Frederick	05/13/2005	07:59 PM	Hail	1.00 in.	0	0	0	0
85 Tipton	05/31/2005	05:22 PM	Hail	0.88 in.	0	0	0	0
86 Manitou	06/05/2005	08:18 PM	Hail	0.88 in.	0	0	0	0
87 Manitou	04/01/2006	07:39	Hail	1.00 in.	0	0	0	0

		PM						
88 Frederick	04/24/2006	05:05 PM	Hail	1.25 in.	0	0	0	0
89 Hollister	04/24/2006	05:15 PM	Hail	1.00 in.	0	0	0	0
90 Manitou	04/24/2006	05:21 PM	Hail	1.00 in.	0	0	0	0
91 Hollister	04/24/2006	05:30 PM	Hail	0.88 in.	0	0	0	0
92 Grandfield	04/24/2006	06:05 PM	Hail	1.00 in.	0	0	0	0
93 Grandfield	04/24/2006	06:27 PM	Hail	1.25 in.	0	0	0	0
94 Frederick	05/10/2006	03:39 AM	Hail	0.88 in.	0	0	0	0
95 Grandfield	05/10/2006	03:50 AM	Hail	1.00 in.	0	0	0	0
96 Grandfield	05/10/2006	04:00 AM	Hail	0.88 in.	0	0	0	0
97 Davidson	06/17/2006	01:39 PM	Hail	0.75 in.	0	0	0	0
				TOTALS:	0	0	101K	0

2.9.5. Probability of Future Events.

Based on the previous occurrences of 23 large-hail events recorded in the last 50 years, an average of 0.46 events occurs per year. Therefore, the probability of large-hail (equal to or greater than 1.50“in diameter) occurring within Tillman County each year is highly likely.

2.9.6. Vulnerability.

Vulnerability is difficult to evaluate since hail occurs in random locations and creates relatively narrow paths of destruction. Hail is capable of causing considerable damage to crops, buildings, and vehicles, and occasionally death to farm animals. Hail can also strip leaves and small limbs from trees. While large hail poses a threat to people caught outside in a storm, it seldom causes loss of human life.

1. Costs and losses to agricultural and livestock producers.
2. Reduced yields and crop loss.
3. Injuries or loss of livestock.
4. Damage to barns and other farm buildings.
5. Damage to farm machinery.
6. Damage to wood fences.
7. Loss from timber production.
8. Damage to trees resulting in increased susceptibility to disease.
9. Urban, residential, and commercial.

10. Damage to and destruction of buildings.
11. Roofs.
12. Windows.
13. Siding, stucco, brick, and other exterior building materials.
14. Loss of trees and landscaping.
15. Damage to automobiles, trucks, trains, airplanes, etc.
16. Disruptions to local utilities and services.
17. Power.
18. Communications.
19. Transportation.
20. Health.
21. Injuries.
22. Fatalities.
23. Mental and physical stress.
24. General economic effects.
25. Revenue loss from lost production in business and industry.
26. Negative impact of economic multipliers.
27. Environmental Impacts.
28. Damage to trees and bushes resulting in increased susceptibility to disease.
29. Losses of wildlife, with particular emphasis on birds.

2.9.7. Secondary Hazards.

Deep hail can easily worsen a flash flood situation by clogging drainage-ways, culverts and bridges.

2.9.8. Overall Summary of Vulnerability and Impacts.

Hail can occur in any strong thunderstorm. However, the size of the hailstones is a direct function of the severity and size of the storm. Hail, larger than 1.5", can cause serious damage to cars, roofs, walls, windows, and inflict serious bodily injury as well. All of Tillman County has a significant exposure to hailstorms, and virtually all buildings and automobiles are at risk. Crops are also at risk since the peak periods for hailstorms occur during early spring and late fall, which coincide with critical agricultural seasons.

The impact of hail is mainly financial resulting in repairs to cars, roofs, walls, and windows. The loss of crops and livestock can be devastating to farmers and the economy in lost revenues.

2.10. HAZARD PROFILE – Severe Winter Storm.

2.10.1. Description.

This plan defines a winter storm as a single or combination of the following winter weather types occurring over a wide area of Tillman County.

1. **Ice storm.** Described by the National Weather Service (NWS), as an occasion when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations are usually accumulations of 0.25 inches or greater.
2. **Heavy snow.** Defined as either a snowfall accumulating to four inches in depth in 12 hours or less, or snowfall accumulation to six inches or more in depth in 24 hours or less.
3. **Freezing rain or freezing drizzle.** An occasion when rain or drizzle freezes on surfaces such as trees, power lines, highways, etc.
4. **Extreme Cold.** Cold temperatures for extended periods of time.

2.10.2. Location.
All parts of Tillman County are susceptible to severe winter storms.

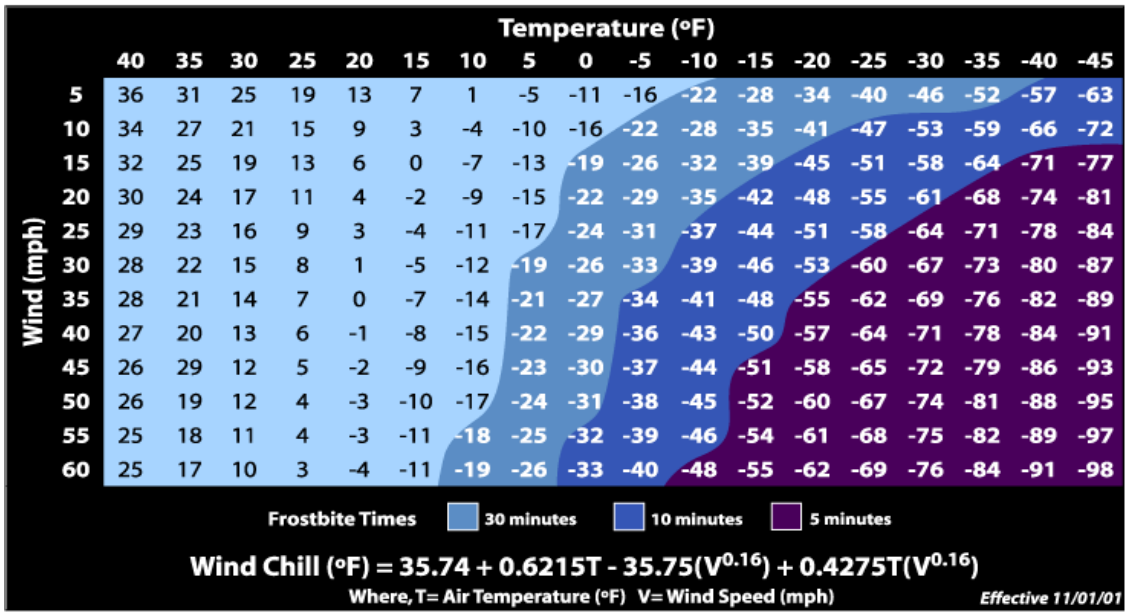
2.10.3. Extent.
Based on past occurrence, Tillman County winter storms have not been shown to have significant impact on agricultural and loss of life, but there has been property and economic damage.

Winter storms such as blizzards can strike unexpectedly and can create hazardous travel conditions and utility outages. Dangerous driving conditions can play roles in community, economic and social hardships. Fortunately, Tillman County is not affected by blizzard as often as other parts of the state. Damages usually occur in loss of water due to frozen water lines and loss in agricultural revenue due to loss of livestock. During times of more than average accumulation structures can collapse due to the added weight of snow and ice. Ice dams can cause additional roof damage.

Extremely cold temperatures can cause property damages and death. Tillman County is not well equipped for extended periods of below freezing and colder temperatures. Water pipes can freeze and crack. Individuals may not be prepared with proper clothing. These individuals can underestimate the wind chill or can become trapped in cold temperatures due to car failure or other unexpected events.

XVII. Figure: Winter Storm: Wind Chill (extreme cold), Volume of Ice, and Volume of Snow.

The Wind Chill temperature you have undoubtedly heard of is simply a measure of how cold the wind makes real air temperature feel to the human body. Since wind can dramatically accelerate heat loss from the body, a blustery 30° day would feel just as cold as a calm day with 0° temperatures. The index was created in 1870, and on November 1, 2001, the National Weather Service released a more scientifically accurate equation, which we use today. Here is a chart for calculating wind chill. (Please note that it is not applicable in calm winds or when the temperature is over 50°.)



Source: National Weather Service and NOAA

2.10.4. Previous Occurrences.

Over the past 20 years (1984 - 2003), the National Climatic Data Center has recorded that Tillman County has experienced five significant winter storm events. Some examples of past winter storm events in Tillman County include the following;

January 5-7, 1988 - Significant snowfall amounts were reported across Oklahoma. The storm totals exceeded six inches over virtually the entire state, except a few areas near the Red River and the far western Oklahoma Panhandle.

November 24, 1996 - Ice accumulated up to one half inch thick mainly southeast of a line from Shawnee in Pottawatomie to Chickasha, in Grady County to Frederick in Tillman County. Power was out to a large portion of the area due to icing of power lines and tree limbs. It took as long as three days to restore power to some customers.

December 20, 1998 - Light-freezing rain produced a thin layer of ice on most roads. Across the entire state, there were 13 fatal traffic accidents and 100 injury-related traffic accidents.

January 30, 2002 - Ice accumulations of one to two inches. The worst damage occurred in a 60-mile wide band, extending from near Ponca City, in Kay County southwestward toward Anadarko in Caddo County and Hobart in Kiowa County. Dozens of towns were left completely without power for days, with some residents without power for weeks. The damage was catastrophic in places, with thousands of utility poles, along with thousands of trees, brought down by the weight of the ice.

December 4, 2002 - A winter storm affected the northwest half of Oklahoma during the afternoon and evening of the 3rd and early morning of the 4th. The precipitation started as freezing rain and sleet across portions of west central and northwest Oklahoma, including Harper, Ellis, Woodward, Woods, Alfalfa and Major Counties, and then quickly changed to snow. Total accumulations were between four and eight inches. The highest totals were nine inches in Arnett (Ellis County), eight inches in Mutual (Woodward County) and eight inches in Buffalo (Harper County). Southeast of this area, a mixture of freezing rain, sleet and snow fell, with ice accumulations ranging from a trace to one half inch, and snow accumulations between two and three inches. The greatest amount of ice fell from about Stillwater (Payne County), southwestward to about Guthrie (Logan County), Bethany (Oklahoma County), Weatherford (Custer County), and Elk City (Beckham County). Nearly 50,000 residences were without power during the peak of the winter storm.

2.10.5. Probability of Future Events.

Based on previous occurrences, some 16 snows and/or ice events have occurred in the last 57 years. This would indicate that the probability of a winter storm occurring within Tillman County is likely.

2.10.6. Vulnerability.

Cold waves pose a variety of threats to individuals and communities. These threats are sometimes compounded by accumulations of ice or snow. The delivery of public services and maintenance of infrastructure are often disrupted by cold waves. Frozen and burst water lines are a common problem. Increased consumption of heating fuel can lead to energy shortages and higher prices. People and animals are subject to health risks from extended exposure to cold air. The list below summarizes some of the most common impacts of cold waves.

Costs and losses to livestock producers.

1. Loss of livestock due to exposure.
2. Greater mortality due to increased vulnerability to disease.
3. Increased feed costs.
4. Reduced milk production.

5. Cost of supplemental water for livestock if onsite ponds and streams are frozen.
6. Machinery and farm vehicles that will not operate in cold weather.
7. Urban, residential, and commercial impacts.
8. Availability of water for municipal use due to frozen and burst water lines.
9. Homes with alternative energy sources.
10. House fires from overburdened chimneys. Carbon monoxide poisoning from exhaust produced by heaters and generators.
11. Vehicles that will not operate in cold weather. Cost of keeping transportation lines clear of ice and snow.

Health:

1. Mental and physical stress in the form of "cabin fever".
2. Frostbite and hypothermia.
3. Disruption of services.
4. Government offices and schools closed .
5. Garbage collection halted.

General economic effects:

1. Revenue loss from lost production in business and industry.
2. Negative impact of economic multipliers.
3. Higher energy costs.
4. Damage to animal species.
5. Loss of wildlife, particularly if cold wave is coupled with prolonged snow cover that makes sources of food unavailable.
6. Greater mortality due to increased vulnerability to disease.
7. Loss of trees and woody shrubs that is not hardy enough to survive prolonged exposure to cold temperatures, especially when soil moisture is low.
8. Pollution from increased energy production.

A major winter storm can be lethal. Preparing for cold weather conditions and responding to them effectively can reduce the dangers caused by winter storms.

Mitigating ice storm damage to power lines must be a joint effort by Tillman County and city workers, private landowners and utility companies. Regular trimming by all levels of participants can substantially reduce the damage caused by future episodes.

2.10.7. Secondary Hazards.

Secondary hazards can include traffic accidents due to snow and ice covered roads, and death from hypothermia due to prolonged exposure to cold. Wind-driven snow can result in “whiteout” conditions that can also make driving extremely dangerous. House fires and resulting deaths tend to occur more frequently from increased and improper use of alternate heating sources. Fires

during winter storms also present a greater danger because water supplies may freeze and impede firefighting efforts.

2.10.8. Overall Summary of Vulnerability and Impacts.

A winter storm can range from accumulating snow and/or ice over a few hours to blizzard conditions with blinding, wind-driven snow lasting several days. In latitudes like Tillman County's, where moist Gulf air collides with arctic temperatures from the north, winter storms - particularly ice storms - have the potential to cause significant property damage, transportation problems and utility service failure over large areas of the state. The aftermath of a winter storm can continue to impact a region for weeks and even months. Houses, roads, electrical poles and lines, water systems, people and cattle are all vulnerable to severe winter storms. Houses are damaged from the weight of the ice, roads buckle and or become slick and hazardous, electrical poles and lines break, and people loose electricity and heat, water lines freeze and burst due to the cold weather and people and livestock have no water. People and livestock are susceptible to frostbite and death from exposure.

2.11. HAZARD PROFILE – Tornado – High Winds.

2.11.1. Description.

Tornadoes and high winds are combined in profile because of similarities in potential damage and mitigation measures.

A tornado is a violent whirling wind, characteristically accompanied by a funnel-shaped cloud. Tornadoes are the result of great instability in the atmosphere and are often associated with severe thunderstorms or in advance of cold fronts. Note that although tornadoes and high winds are associated with thunderstorms, tornadoes and high winds are profiled in this plan as a separate event.

High Winds.

Wind is defined as the motion of air relative to the earth's surface. High winds can result from thunderstorm inflow and outflow, or downburst winds when the storm cloud collapses, and can result from strong frontal systems, or gradient winds (high or low pressure systems) moving across Oklahoma. High winds are speeds reaching 50 mph or greater, either sustaining or gusting. Downdraft winds are from a strong thunderstorm downburst that causes damaging winds on or near the ground, and can extend to as little as 2½ miles or extend over a hundred miles. These speeds can range from light breezes to sustained speeds of 80 to 100 mph:

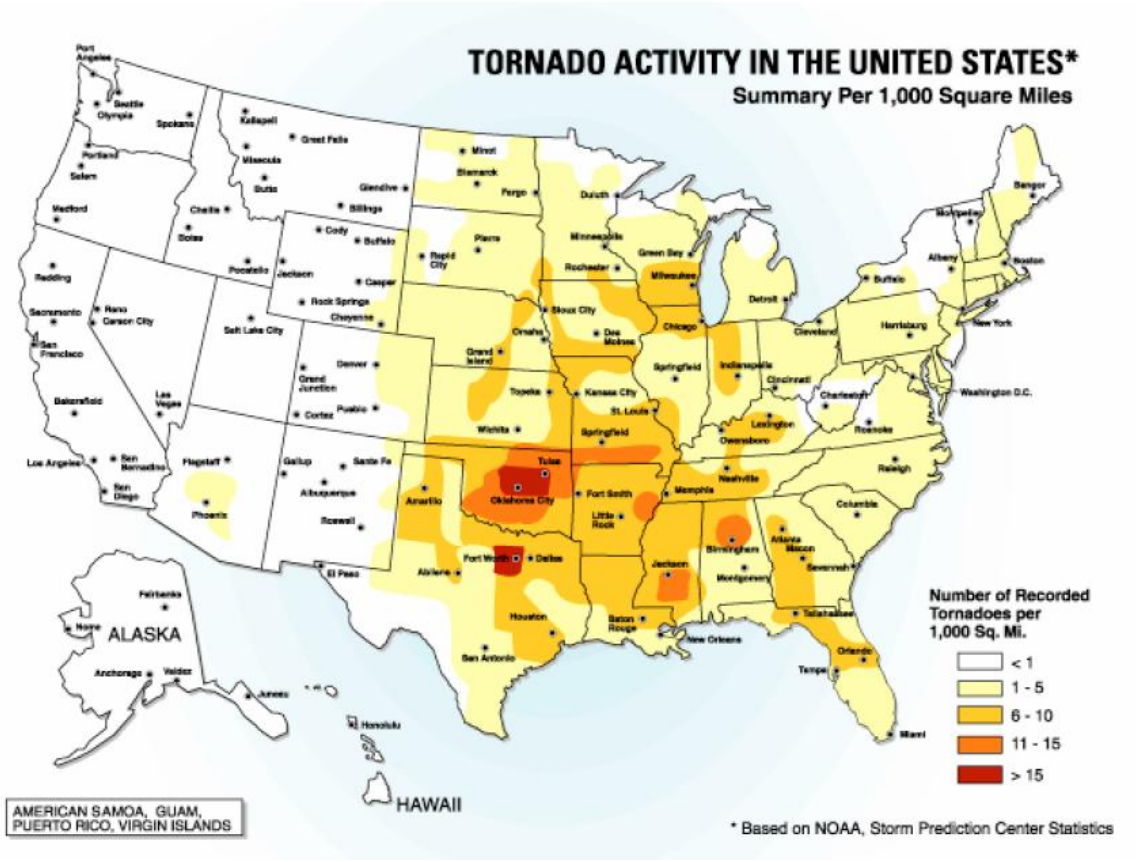
High winds in Tillman County can be caused by thunderstorms, but high winds can also occur without a thunderstorm event, such as a severe pressure gradient.

2.11.2. Location.

All of Tillman County is equally susceptible to tornado and high wind damages. Due to the County wide probability every structure has equal probability to be struck by a tornado or high wind.

According to NOAA data, this area of the United States is the most tornado prone in the country. The area has a reported concentration of more than 11 tornadoes per 1000 square miles.

XVIII. Figure: Tornado Activity in the United States.



2.11.3. Extent.

The most severe impact by a tornado would be the result of an F5 tornado moving through Tillman County and hitting several communities.

Tornadoes which drop in areas of low development cause little damage. Conversely, tornadoes, which drop in heavily populated areas, can cause extreme loss of property and loss of human life. Winds of such velocity can lift even the most solidly build structure. Mature trees can be uprooted and flung across fields or into homes or businesses. Automobiles can be lifted and projected into other structures. Smaller projectiles made of glass shards,

splintered lumber or metal have been documented to pierce trees, homes and other property. Death can result from any debris at this speed.

XIX. Figure: Tornado: Fujita scale, Enhanced Fujita Scale.

Fujita Scale

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object Missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies

FUJITA SCALE			DERIVED EF SCALE		OPERATIONAL EF SCALE	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)	**EF Number**	**3 Second Gust (mph)**
0	40-72	45-78	0	65-85	**0**	**65-85**
1	73-112	79-117	1	86-109	**1**	**86-110**
2	113-157	118-161	2	110-137	**2**	**111-135**
3	158-207	162-209	3	138-167	**3**	**136-165**
4	208-260	210-261	4	168-199	**4**	**166-200**
5	261-318	262-317	5	200-234	**5**	**Over 200**

On February 1, 2007, the Fujita scale was decommissioned in favor of the more accurate Enhanced Fujita Scale, which replaces it. None of the tornadoes recorded on or before January 31, 2007 will be re-categorized. Therefore maintaining the Fujita scale will be necessary when referring to previous events.
Source: http://en.wikipedia.org/wiki/Fujita_scale

2.11.4. Previous Occurrences.

Oklahoma, Texas and Kansas are the most common area for tornado formation, although they can occur anywhere on the world. The Unites States as a whole has more large and intense tornadoes than any other country. Tornadoes have occurred in every state of the union. Nearly 900 occur each year. In the last fifty years nine thousand deaths were caused by tornadoes.

XX. Figure: Tornados Reported.

61 TORNADO(s) were reported in **Tillman County, Oklahoma** between **01/01/1951 and 03/31/2007**.

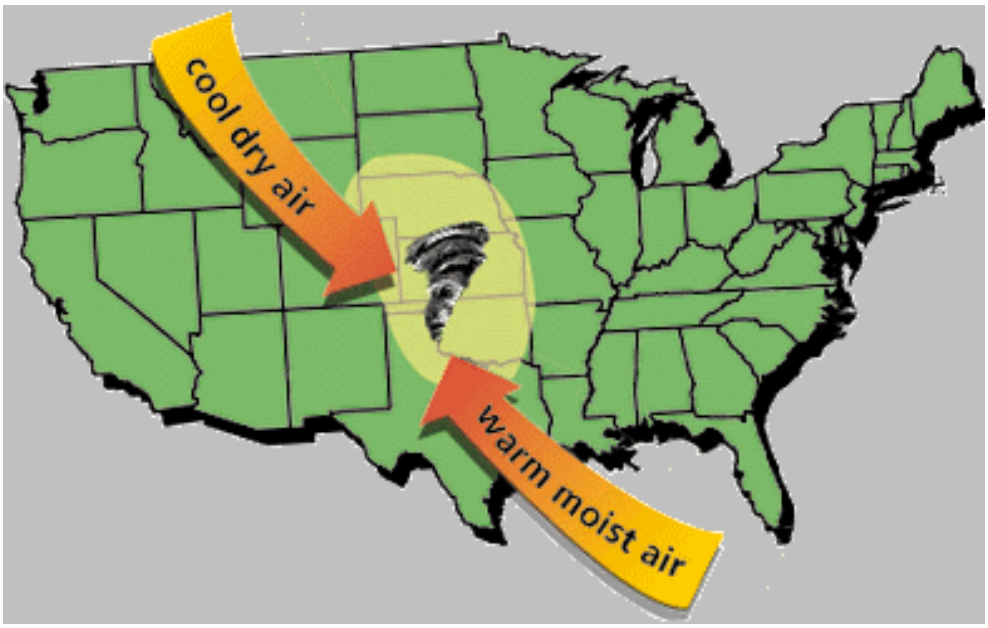
Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Oklahoma

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 TILLMAN	06/07/1951	1700	Tornado	F2	0	0	25K	0
2 TILLMAN	06/08/1951	1915	Tornado	F1	0	0	3K	0
3 TILLMAN	06/29/1952	1630	Tornado	F2	0	1	3K	0
4 TILLMAN	05/01/1954	1416	Tornado	F4	0	0	3K	0
5 TILLMAN	05/01/1954	1530	Tornado	F2	0	0	25K	0
6 TILLMAN	05/01/1954	1600	Tornado	F3	0	0	250K	0
7 TILLMAN	08/30/1954	1330	Tornado	F1	0	0	0K	0
8 TILLMAN	06/17/1955	2220	Tornado	F2	0	0	25K	0
9 TILLMAN	08/05/1955	1430	Tornado	F1	0	0	3K	0
10 TILLMAN	05/10/1957	0216	Tornado	F0	0	0	0K	0
11 TILLMAN	05/24/1957	1630	Tornado	F1	0	0	25K	0
12 TILLMAN	07/27/1958	1845	Tornado	F1	0	0	25K	0
13 TILLMAN	05/04/1960	1740	Tornado	F1	0	0	3K	0
14 TILLMAN	05/04/1960	1740	Tornado	F1	0	0	3K	0
15 TILLMAN	05/05/1960	1338	Tornado	F	0	0	0K	0
16 TILLMAN	05/16/1961	1930	Tornado	F	0	0	0K	0
17 TILLMAN	05/16/1961	1930	Tornado	F	0	0	0K	0
18 TILLMAN	06/02/1961	2300	Tornado	F1	0	0	3K	0
19 TILLMAN	05/20/1962	1936	Tornado	F0	0	0	0K	0
20 TILLMAN	05/24/1962	1932	Tornado	F0	0	0	0K	0
21 TILLMAN	05/24/1962	1932	Tornado	F0	0	0	0K	0
22 TILLMAN	03/04/1963	0525	Tornado	F1	0	0	250K	0
23 TILLMAN	04/07/1965	1930	Tornado	F1	0	0	25K	0
24 TILLMAN	04/09/1967	1520	Tornado	F1	0	0	25K	0
25 TILLMAN	05/22/1973	2130	Tornado	F1	0	0	250K	0
26 TILLMAN	06/18/1973	1750	Tornado	F1	0	0	0K	0
27 TILLMAN	06/18/1973	1750	Tornado	F2	0	0	0K	0
28 TILLMAN	06/18/1973	1815	Tornado	F3	0	29	250K	0
29 TILLMAN	06/18/1973	1825	Tornado	F0	0	29	2.5M	0
30 TILLMAN	04/19/1977	2300	Tornado	F2	0	0	3K	0

31 TILLMAN	05/20/1977	1738	Tornado	F3	0	0	250K	0
32 TILLMAN	05/27/1978	1815	Tornado	F1	0	0	25K	0
33 TILLMAN	04/10/1979	1545	Tornado	F4	0	1	250K	0
34 TILLMAN	04/10/1979	1605	Tornado	F2	0	1	250K	0
35 TILLMAN	04/10/1979	1625	Tornado	F2	0	3	2.5M	0
36 TILLMAN	08/21/1979	2100	Tornado	F0	0	0	0K	0
37 TILLMAN	04/25/1980	1412	Tornado	F	0	0	0K	0
38 TILLMAN	05/27/1982	1835	Tornado	F2	0	0	2.5M	0
39 TILLMAN	05/13/1983	1430	Tornado	F1	0	0	25K	0
40 TILLMAN	06/13/1983	1815	Tornado	F0	0	0	0K	0
41 TILLMAN	05/20/1985	1545	Tornado	F0	0	0	0K	0
42 TILLMAN	05/08/1986	1608	Tornado	F0	0	0	0K	0
43 TILLMAN	05/14/1986	1505	Tornado	F1	0	0	250K	0
44 TILLMAN	05/16/1986	2200	Tornado	F0	0	0	25K	0
45 TILLMAN	07/17/1987	1530	Tornado	F0	0	0	0K	0
46 TILLMAN	10/29/1989	1732	Tornado	F0	0	0	0K	0
47 Grandfield	03/29/1993	1929	Tornado	F0	0	0	0	0
48 Tipton	04/16/1995	1440	Tornado	F0	0	0	0	0
49 Grandfield	04/17/1995	1615	Tornado	F0	0	0	0	0
50 Frederick	06/03/1995	2257	Tornado	F0	0	0	0	0
51 Frederick	06/03/1995	2316	Tornado	F0	0	0	0	0
52 Grandfield	06/09/1995	1830	Tornado	F0	0	0	0	0
53 Manitou	05/25/1999	07:16 PM	Tornado	F0	0	0	0	0
54 Grandfield	05/04/2001	03:05 PM	Tornado	F1	0	1	250K	0
55 Hollister	04/06/2004	06:10 PM	Tornado	F0	0	0	0	0
56 Grandfield	04/23/2004	01:59 PM	Tornado	F0	0	0	0	0
57 Manitou	05/24/2004	06:21 PM	Tornado	F0	0	0	0	0
58 Manitou	05/24/2004	06:27 PM	Tornado	F0	0	0	1K	0
59 Manitou	05/24/2004	06:29 PM	Tornado	F0	0	0	1K	0
60 Frederick	05/24/2004	06:32 PM	Tornado	F0	0	0	0	0
61 Frederick	05/24/2004	06:58 PM	Tornado	F0	0	0	0	0
				TOTALS:	0	65	10.023M	0

XXI. Figure: Tornado Alley.



Tornadoes are most common on the Great Plains and in the part of the United States often called *Tornado Alley.* According to NOAA data, this area of the United States is the most tornado prone in the country. The area has a reported concentration of more than 11 tornadoes per 1000 square miles.

In Oklahoma, Tillman County is located within this area and tornadoes have a history of development and destruction throughout the County. Tornadoes occur most often in spring during the late afternoon or early evening. Based on records kept by the National Climatic Data Center (NCDC) since 1951, a total of 61 tornadoes were recorded.

May to August is the predominate tornado season, though again, they can occur any time of year. Over 80% of tornadoes occur between noon and midnight, one quarter from 4:00PM. to 6:00 PM. Tornadoes within Tillman County have varied in intensity from F0 to F4 on the Fujita Scale. Out of the 61 total, none were rated F5, two were rated as F4, three as F3, five were rated as F2, and 51 were F1 or F0 on the Fujita Scale.

Examples of other tornado events are listed in the following table.

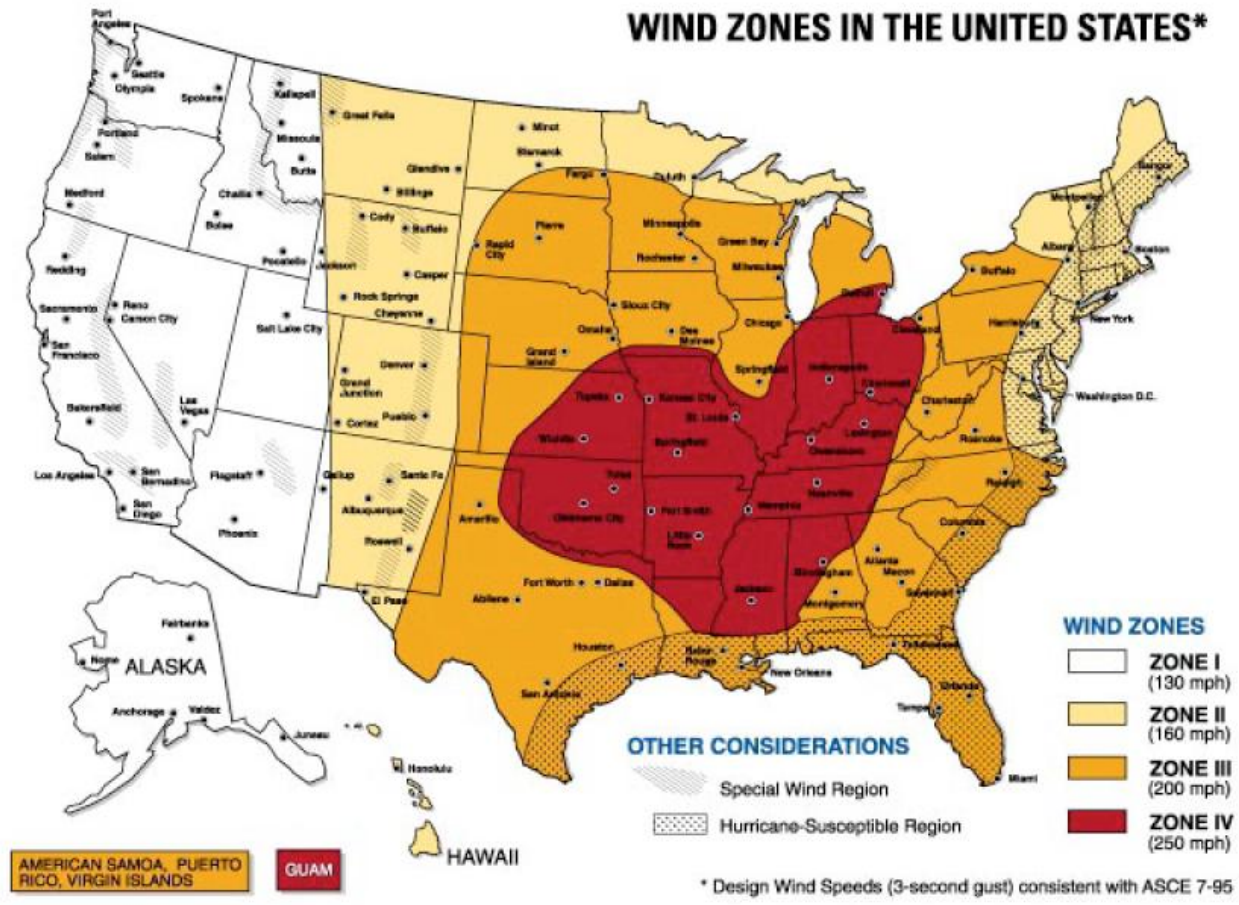
May 25, 1999 -- A tornado was observed by a reserve deputy in Manitou in Tillman County, touching down west of Manitou with no known damage.

May 4, 2001 -- This brief tornado formed on the west side of Grandfield in Tillman County near Highway 70 and tracked northward for approximately one half mile, covering a distance of five to six blocks. Two grain storage bins were destroyed. The wall of a garage was blown out. Power poles were snapped, and large trees were pulled

out of the ground and laid within 50 feet of their original location. In addition, stadium bleachers were blown over, and a chain-linked fence was destroyed. One man was injured when he was blown out of a barn. The amount of reported damage was $250,000.

April 6, 2004 – Seven miles west of Hollister -- A brief, pencil-like tornado was observed in open country. No damage was reported.

XXI. Figure: Wind Zones in the United States.



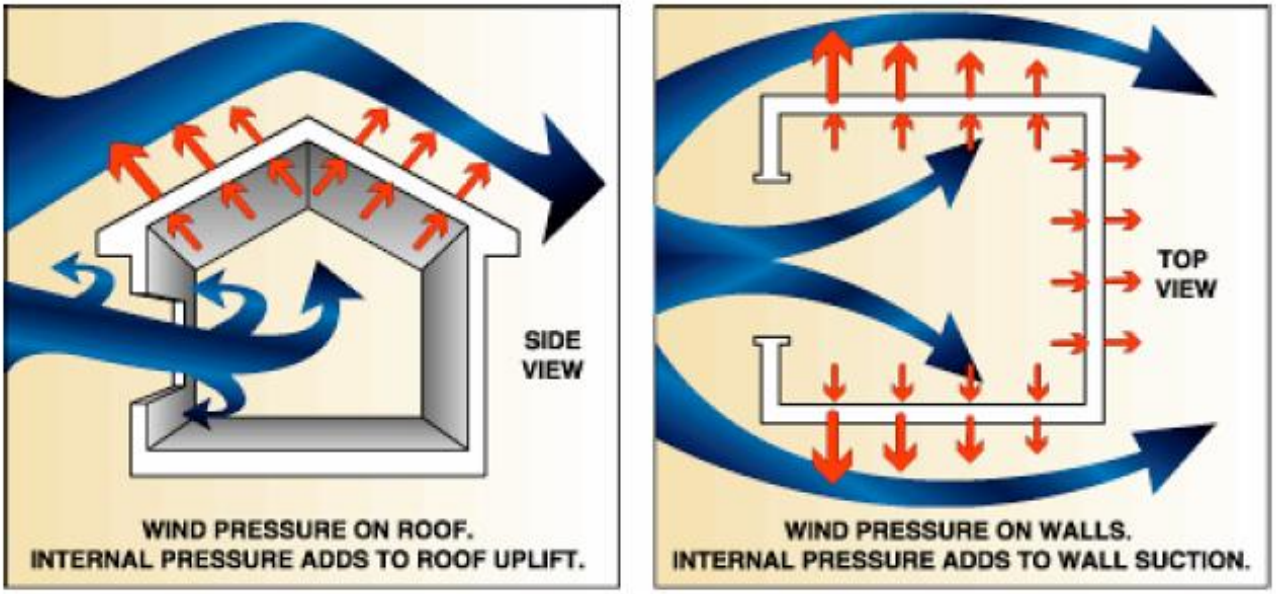
2.11.5. Extent of damaging winds.

A worst-case scenario involving thunderstorms would be a solid or redeveloping line, of severe thunderstorms that move through the entire County. These storms can result in heavy rains causing wide spread flooding and road closures. Large economic loss to agriculture and/or major damage to buildings and other property can result if such storms are accompanied by hail and high winds. High winds and lightning associated with such storms can also down trees and highline poles and result in power outages capable of affecting large areas of Tillman County.

Extreme winds can cause several kinds of damage to a building. Figure XXII below shows how extreme winds affect a building and helps explain why these winds cause buildings to fail.

Wind speeds, even in these extreme wind events, rapidly increase and decrease. An obstruction, such as a house, in the path of the wind causes the wind to change direction. This change in wind direction increases pressure on parts of the house. The combination of increased pressures and fluctuating wind speeds creates stress on the house that frequently causes connections between building components to fail. For example, the roof or siding can be pulled off or the windows can be pushed in.

XXIII. Figure: Diagram of Windstorm Effects.



Buildings that fail under the effects of extreme winds often appear to have exploded, giving rise to the misconception that the damage is caused by unequal wind pressures inside and outside the building. This misconception has led to the myth that during an extreme wind event, the windows and doors in a building should be opened to equalize the pressure. In fact, opening a window or door allows wind to enter a building and increases the risk of building failure.

Damage can also be caused by flying debris (referred to as windborne missiles). If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, walls, or the roof. For example, an object such as a 2” x 4” wood stud weighing 15 pounds, when carried by a 250-mph wind, can have a horizontal speed of 100 mph and enough force to penetrate most common building materials used in houses today. Even a reinforced masonry wall will be penetrated unless it has been designed and constructed to resist debris impact during extreme winds. Because

missiles can severely damage and even penetrate walls and roofs, they threaten not only buildings but the occupants as well.

XXIV. Figure: Beaufort Scale.

Beaufort Scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

2.11.6. Previous Occurrences.

Since 1955 the National Climatic Data Center (NCDC) recorded 217 high wind events in Tillman County. Due to the rural nature of the County, most reports of thunderstorms and any associated damage are from cities and towns.

XXV. Figure: High Wind Events.

113 THUNDERSTORM & HIGH WINDS event(s) were reported in **Tillman County, Oklahoma** between **01/01/1997** and **03/31/2007**.

Mag: Magnitude
Dth: Deaths
Inj: Injuries
PrD: Property Damage
CrD: Crop Damage

Oklahoma

Location or County	Date	Time	Type	Mag	Dth	Inj	PrD	CrD
1 Tipton	05/07/1997	04:25 PM	Tstm Wind	53 kts.	0	0	0	0
2 Tipton	05/08/1997	04:25 PM	Tstm Wind	53 kts.	0	0	0	0
3 Davidson	06/14/1997	08:40 PM	Tstm Wind	52 kts.	0	0	0	0
4 Frederick	06/14/1997	09:10 PM	Tstm Wind	52 kts.	0	0	0	0
5 Tipton	06/16/1997	08:00 PM	Tstm Wind	52 kts.	0	0	0	0
6 Davidson	06/16/1997	08:17 PM	Tstm Wind	65 kts.	0	0	0	0
7 Grandfield	06/16/1997	08:35 PM	Tstm Wind	50 kts.	0	0	0	0
8 Grandfield	06/16/1997	08:50 PM	Tstm Wind	54 kts.	0	0	0	0
9 Manitou	08/10/1997	10:20 PM	Tstm Wind	0 kts.	0	0	1K	0
10 Grandfield	08/22/1997	05:30 AM	Tstm Wind	0 kts.	0	0	0K	0
11 Grandfield	04/14/1998	05:00 PM	Tstm Wind	50 kts.	0	0	0	0
12 Tipton	05/15/1998	02:27 AM	Tstm Wind	0 kts.	0	0	1K	0
13 Tipton	06/21/1998	09:40 PM	Tstm Wind	54 kts.	0	0	0	0
14 Grandfield	07/13/1998	05:30 PM	Tstm Wind	0 kts.	0	0	1K	0
15 Frederick	11/09/1998	07:53 PM	Tstm Wind	58 kts.	0	0	0	0
16 OKZ004>048 - 050>052	02/11/1999	07:00 AM	High Wind	0 kts.	0	0	2K	0
17 OKZ018>020 - 022>031 - 033>042 - 044>046 - 050	03/02/1999	12:00 PM	High Wind	0 kts.	0	0	0	0
18 OKZ004>031 - 033>038 - 044	03/08/1999	02:00 PM	High Wind	0 kts.	0	0	16K	0

19 OKZ004>040 - 042 - 044>045 - 052	04/14/1999	05:00 PM	High Wind	64 kts.	0	0	57K	0
20 Frederick	05/03/1999	09:08 PM	Tstm Wind	60 kts.	0	0	0	0
21 Frederick	05/03/1999	09:08 PM	Tstm Wind	60 kts.	0	0	0	0
22 Grandfield	05/03/1999	09:50 PM	Tstm Wind	59 kts.	0	0	0	0
23 Grandfield	05/03/1999	09:50 PM	Tstm Wind	59 kts.	0	0	0	0
24 Tipton	05/09/1999	07:25 PM	Tstm Wind	59 kts.	0	0	0	0
25 Grandfield	05/09/1999	08:55 PM	Tstm Wind	59 kts.	0	0	0	0
26 Frederick	05/16/1999	08:45 PM	Tstm Wind	0 kts.	0	0	2K	0
27 Hollister	05/16/1999	08:55 PM	Tstm Wind	52 kts.	0	0	0	0
28 Tipton	05/25/1999	07:30 PM	Tstm Wind	57 kts.	0	0	0	0
29 Frederick	05/25/1999	07:45 PM	Tstm Wind	52 kts.	0	0	0	0
30 Grandfield	08/23/1999	07:30 PM	Tstm Wind	0 kts.	0	0	1K	0
31 Tipton	10/29/1999	07:45 PM	Tstm Wind	58 kts.	0	0	0	0
32 Tipton	10/29/1999	07:50 PM	Tstm Wind	55 kts.	0	0	0	0
33 Tipton	10/29/1999	08:19 PM	Tstm Wind	64 kts.	0	0	2K	0
34 Grandfield	05/26/2000	03:45 AM	Tstm Wind	60 kts.	0	0	0	0
35 Grandfield	05/26/2000	03:50 AM	Tstm Wind	0 kts.	0	0	3K	0
36 Frederick	02/08/2001	11:20 PM	Tstm Wind	56 kts.	0	0	2K	0
37 Grandfield	02/08/2001	11:30 PM	Tstm Wind	58 kts.	0	0	0	0
38 Grandfield	02/08/2001	11:39 PM	Tstm Wind	56 kts.	0	0	0	0
39 OKZ004>006 - 009>011 - 014>017 - 022>023 - 033>038	03/15/2001	09:40 AM	High Wind	50 kts.	0	0	101K	0
40 OKZ004>006 - 009>011 - 015>017 - 020>023 - 033>038 - 044	04/06/2001	06:00 PM	High Wind	52 kts.	0	0	20K	0
41OKZ005>008 - 010>048	04/10/2001	09:00	High Wind	44	0	0	33K	0

- 050>052		PM		kts.				
42 Frederick	05/18/2001	01:04 AM	Tstm Wind	73 kts.	0	0	5K	0
43 Grandfield	05/18/2001	01:20 AM	Tstm Wind	58 kts.	0	0	0	0
44 Frederick	05/18/2001	12:55 AM	Tstm Wind	63 kts.	0	0	30K	0
45 Tipton	05/18/2001	12:55 AM	Tstm Wind	51 kts.	0	0	0	0
46 Grandfield	05/27/2001	10:20 PM	Tstm Wind	51 kts.	0	0	0	0
47 Grandfield	05/29/2001	11:31 PM	Tstm Wind	61 kts.	0	0	0	0
48 OKZ004>005 - 008>048 - 050>052	03/08/2002	07:00 PM	High Wind	45 kts.	0	0	0	0
49 OKZ004>042 - 044>046	04/02/2002	08:00 AM	Strong Winds	N/A	0	0	0	0
50 Manitou	04/13/2002	07:42 AM	Tstm Wind	56 kts.	0	0	0	0
51 OKZ024 - 027 - 036>039 - 044>045	05/08/2002	10:50 PM	High Wind	56 kts.	0	0	0	0
52 OKZ037 - 037	06/12/2002	10:25 PM	High Wind	57 kts.	0	0	0	0
53 Tipton	06/15/2002	08:25 PM	Tstm Wind	50 kts.	0	0	0	0
54 Tipton	06/15/2002	08:35 PM	Tstm Wind	50 kts.	0	0	0	0
55 Grandfield	06/15/2002	08:45 PM	Tstm Wind	62 kts.	0	0	0	0
56 Grandfield	06/15/2002	08:50 PM	Tstm Wind	73 kts.	0	0	0	0
57 Grandfield	06/15/2002	09:00 PM	Tstm Wind	0 kts.	0	0	10K	0
58 Frederick	08/27/2002	02:26 AM	Tstm Wind	66 kts.	0	0	0	0
59 Frederick	04/19/2003	01:27 AM	Tstm Wind	61 kts.	0	0	0	0
60 Davidson	05/16/2003	12:12 AM	Tstm Wind	56 kts.	0	0	5K	0
61 Davidson	05/16/2003	12:19 AM	Tstm Wind	61 kts.	0	0	2K	0
62 Grandfield	05/16/2003	12:20 AM	Tstm Wind	51 kts.	0	0	0	0
63 Frederick	06/01/2003	08:30 PM	Tstm Wind	65 kts.	0	0	1K	0
64 Frederick	06/01/2003	08:31 PM	Tstm Wind	56 kts.	0	0	0	0

65 Frederick	06/01/2003	08:36 PM	Tstm Wind	66 kts.	0	0	0	0
66 Frederick	06/01/2003	08:45 PM	Tstm Wind	52 kts.	0	0	0	0
67 Grandfield	06/01/2003	08:45 PM	Tstm Wind	55 kts.	0	0	0	0
68 Tipton	06/01/2003	08:45 PM	Tstm Wind	63 kts.	0	0	0	0
69 Tipton	06/21/2003	12:00 AM	Tstm Wind	52 kts.	0	0	0	0
70 Frederick	03/04/2004	01:35 PM	Tstm Wind	74 kts.	0	0	35K	0
71 Grandfield	03/04/2004	01:35 PM	Tstm Wind	52 kts.	0	0	0	0
72 Grandfield	03/04/2004	01:35 PM	Tstm Wind	65 kts.	0	0	4K	0
73 Grandfield	03/04/2004	01:36 PM	Tstm Wind	69 kts.	0	0	20K	0
74 Grandfield	03/04/2004	01:37 PM	Tstm Wind	61 kts.	0	0	200K	0
75 Grandfield	04/23/2004	02:03 PM	Tstm Wind	52 kts.	0	0	0	0
76 Frederick	04/25/2004	05:54 PM	Tstm Wind	52 kts.	0	0	0	0
77 Davidson	04/29/2004	06:00 PM	Tstm Wind	52 kts.	0	0	0	0
78 Grandfield	04/29/2004	06:35PM	TstmWind	53kts.	0	0	0	0
79 Frederick	06/02/2004	06:58 PM	Tstm Wind	52 kts.	0	0	0	0
80 OKZ037	06/12/2004	11:20 PM	High Wind	52 kts.	0	0	0	0
81 Tipton	07/03/2004	01:10 AM	Tstm Wind	64 kts.	0	0	0	0
82 Frederick	07/03/2004	01:22 AM	Tstm Wind	56 kts.	0	0	0	0
83 Frederick	07/03/2004	01:29 AM	Tstm Wind	56 kts.	0	0	0	0
84 Grandfield	07/03/2004	01:40 AM	Tstm Wind	52 kts.	0	0	0	0
85 Tipton	08/04/2004	01:50 PM	Tstm Wind	61 kts.	0	0	5K	0
86 Frederick	08/04/2004	02:05 PM	Tstm Wind	56 kts.	0	0	0	0
87 OKZ036>037	06/03/2005	10:10 AM	High Wind	56 kts.	0	0	20K	0
88 Tipton	06/05/2005	08:25 PM	Tstm Wind	51 kts.	0	0	0	0

89 Frederick	06/05/2005	08:36 PM	Tstm Wind	64 kts.	0	0	0	0
90 Frederick	06/05/2005	08:40 PM	Tstm Wind	65 kts.	0	0	0	0
91 Frederick	06/05/2005	08:40 PM	Tstm Wind	69 kts.	0	0	10K	0
92 Grandfield	06/05/2005	09:15 PM	Tstm Wind	61 kts.	0	0	2K	0
93 Grandfield	06/05/2005	09:17 PM	Tstm Wind	61 kts.	0	0	0	0
94 Tipton	09/14/2005	02:20 AM	Tstm Wind	61 kts.	0	0	50K	0
95 Tipton	09/14/2005	06:45 PM	Tstm Wind	51 kts.	0	0	0	0
96 OKZ023 - 037>038 - 042 - 045>047	03/20/2006	03:30 PM	High Wind	61 kts.	0	0	60K	0
97 Tipton	04/01/2006	08:20 PM	Tstm Wind	53 kts.	0	0	0	0
98 Frederick Arpt	04/01/2006	08:25 PM	Tstm Wind	64 kts.	0	0	0	0
99 Frederick Arpt	04/01/2006	08:45 PM	Tstm Wind	52 kts.	0	0	0	0
100 OKZ015 - 025 - 033 - 035 - 037	04/06/2006	01:30 PM	High Wind	55 kts.	0	0	3K	0
101 Grandfield	05/02/2006	07:30 PM	Tstm Wind	56 kts.	0	0	0	0
102 Grandfield	05/10/2006	03:50 AM	Tstm Wind	56 kts.	0	0	0K	0
103 Grandfield	05/10/2006	03:55 AM	Tstm Wind	63 kts.	0	0	0	0
104 Grandfield	05/10/2006	04:00 AM	Tstm Wind	61 kts.	0	0	1K	0
105 Davidson	08/16/2006	06:15 PM	Tstm Wind	61 kts.	0	0	0	0
106 Tipton	08/16/2006	06:30 PM	Tstm Wind	50 kts.	0	0	0	0
107 Tipton	08/16/2006	06:35 PM	Tstm Wind	55 kts.	0	0	0	0
108 Tipton	08/16/2006	06:40 PM	Tstm Wind	66 kts.	0	0	0	0
109 Tipton	08/16/2006	06:45 PM	Tstm Wind	50 kts.	0	0	0	0
110 Grandfield	08/21/2006	07:55 PM	Tstm Wind	51 kts.	0	0	0	0
111 OKZ037	10/30/2006	08:28 PM	High Wind	57 kts.	0	0	0K	0K
112 OKZ004>005 -	11/15/2006	12:35	High Wind	59	0	0	195K	0K

009>010 - 012 - 014>016 - 021>022 - 025 - 027 - 029>030 - 033>039		AM		kts.				
113 OKZ004 - 008 - 014 - 017 - 025 - 029>030 - 033>039 - 041>042 - 045>047 - 050>052	02/24/2007	11:55 AM	High Wind	55 kts.	0	0	389K	0K
				TOTALS:	0	0	1.284M	0

2.11.7. Probability of Future Events.

In the last 53 years Tillman County had 61 tornadoes and 217 high wind events and, resulting in an average of 1.15 tornadoes and 4.09 high wind events per year. Therefore the probability of a tornado or high wind occurring within Tillman County each year is highly likely.

2.11.8. Vulnerability.

Located in the central part of Oklahoma, Tillman County is in an active part of tornado alley and has a designated wind speed rating of a Zone IV. Zone IV is associated with 250 mph wind speeds. Historically the average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since tornadoes form at different strengths, in random locations and create relatively narrow paths of destruction. Residents most vulnerable to tornadoes and high winds are those living in mobile homes.

Education about and preparedness for this threat is a perpetual process and many Tillman County residents are aware that they live in tornado alley and take appropriate precautions during tornado and high wind warnings. Warning systems, as well as trained spotters, exist in all areas of Tillman County. As a result, there is a low casualty rate. With peak tornado season in the spring there is a slight risk of crop loss in the tornado path.

Advances in meteorology and the use of Doppler radar allow efficient prediction of tornado formation before they occur. Networks of storm watchers attempt to identify funnel clouds and report to various networks to alert the population. Even though these advances have significantly improved the available response time, tornadoes can still occur unexpectedly and without warning. The use of better building techniques and the availability of affordable home storm shelters have helped to mitigate losses in Tillman County.

2.11.9. Secondary Hazards.

Secondary hazards in Tillman County can include fire, power outages, communications disruption and failure of municipal services. Peripheral damages can occur caused by the accompanying thunder/rain storm activity. Lighting can cause fire. Rain can cause flooding. Tornadoes often affect areas not directly struck by the tornadic event. Loss of power and telephone service

due to downed lines within the system can lead to a wide range of problems. Debris can cause damage ranging from minor inconvenience to major transportation problems. The resulting “building rush” following a major event can lead to material shortages and price increases.

2.11.10. Overall Summary of Vulnerability and Impacts.

Located in “Tornado Alley”, Oklahoma is hit by more tornadoes each year, on average, than any other state except Texas. Texas has twice as many tornadoes, but it also is more than twice the size of Oklahoma.

Oklahoma has experienced an average of 60 tornadoes per year over the past 50 years. They are most likely to occur between March and June within the afternoon hours of 3:00PM. to 7:00PM. A tornado can generate winds exceeding 300 mph. The path width of a tornado is generally less than a half-mile, but path length can vary from a few hundred yards to dozens of miles. Therefore the impact on human life and property can be substantial. Based on wind speed and type of damage done, tornado intensity is rated using the Fujita Scale of F0 to F5. In the last 53 years Tillman County has experienced tornadoes of various intensities, with 56 tornadoes rated as an F2 or under and five tornadoes rated as F3 or F4. Tornado’s damage and destroy houses and other structures often displacing people from their homes and sometimes causing businesses to close (whether permanent or temporary) costing lost revenues and incomes. Less common with today’s early warning systems but sometimes loss of life occurs.

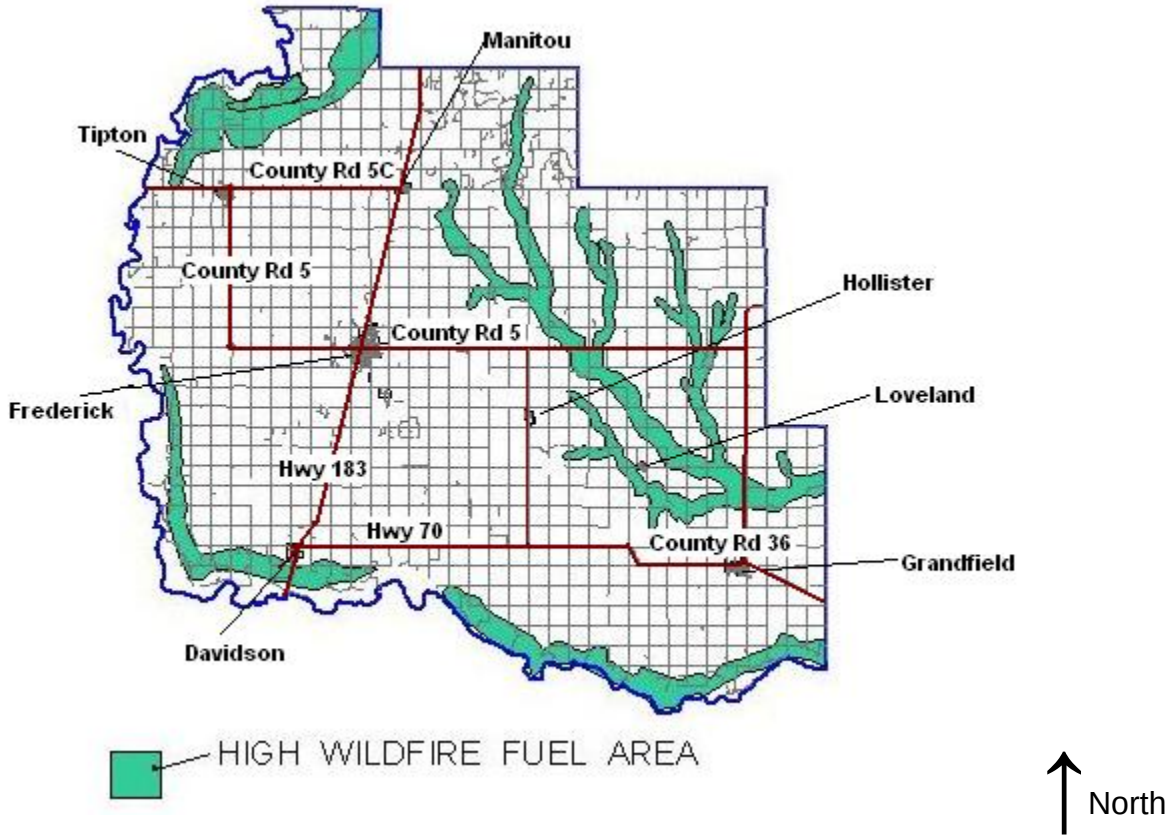
Damage from high wind created by a thunderstorm, frontal passage or microburst is similar to damages from a tornado. Straight line winds can, and do, reach speeds in excess of 100 mph. This would correspond to an F1 tornado. High winds, especially those associated with a frontal passage, often cause severe wind erosion to exposed soil creating a safety and health problem due to visibility and particulate matter. This is in addition to crop losses and long term damage to the soil.

2.12. HAZARD PROFILE – Wildfire.

2.12.1. Description.

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed and spread quickly and are usually signaled by dense smoke that fills the air for miles around. A “Wild Land” fire is a fire in an area in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities. An “Urban-Wild Land Interface” fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wild land or vegetative fuels.

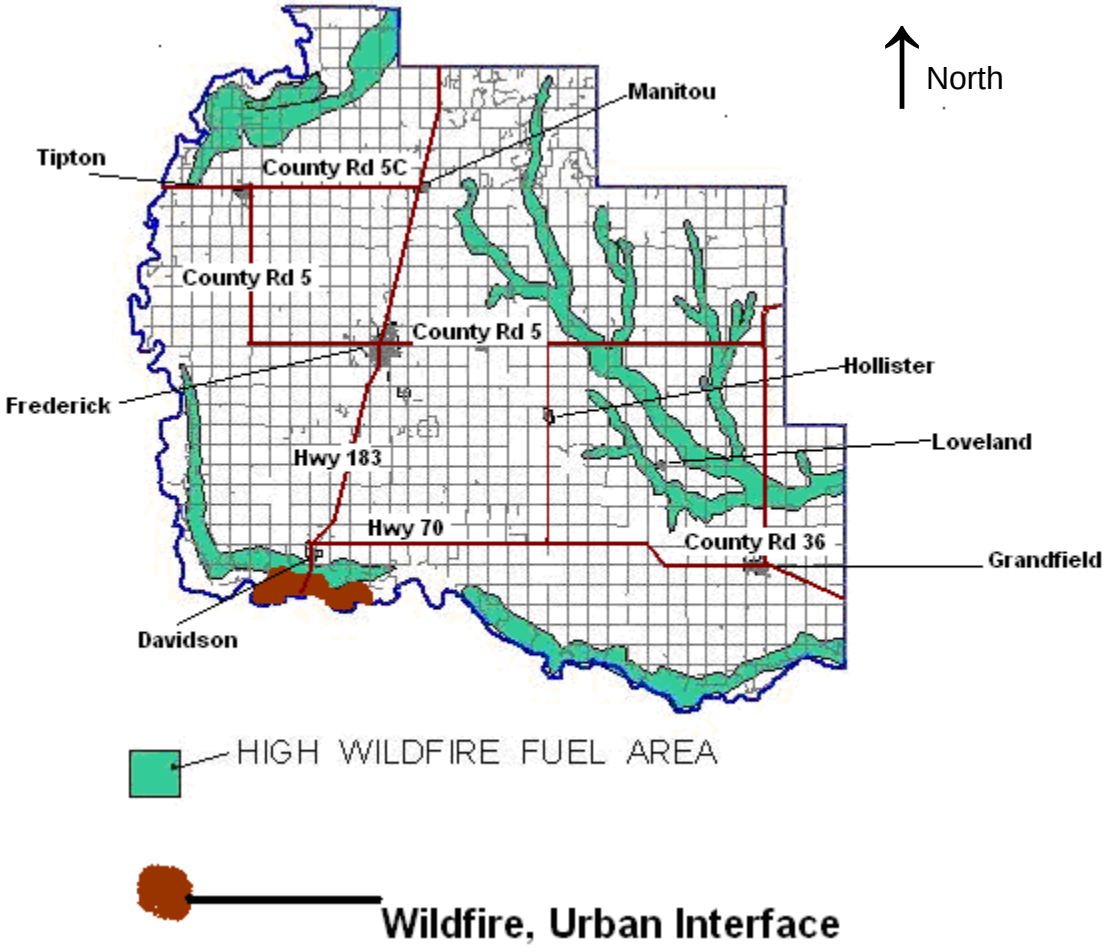
XXVI. Figure: High Wildfire Fuel Area.



2.12.2. Location.

Wild fires can occur anywhere throughout Tillman County but will occur most often in the wild land urban interface areas due to the combination of dry burnable ground cover and lightning storms. See the Wild land /Urban interface map below.

XXVII. Figure: Wild land Urban Interface Map.



2.12.3. Extent.

Dry conditions, high temperatures, low humidity and high winds can increase the potential and severity of a wildfire. In such conditions, wildfires can spread quickly, affecting large areas in a short amount of time. A worst-case scenario would be multiple wildfires started simultaneously by lightning during dry thunderstorms that move across an area experiencing drought conditions.

On average, fires kill nearly 5,500 Americans each year. Over 30,000 people are injured in fires annually. In the United States, someone dies in a fire every 40 minutes. Most often, victims are children or the elderly. Children playing with fire start 25 percent of the fires that kill young children. Approximately 1,300 senior citizens die in fires annually. Approximately three-quarters of all fire fatalities occur in residential dwellings.

Each year in the US, fire causes over $2 billion worth of damage to homes.

XXVIII. Figure: Fire.

Keetch-Byram Drought Index, fire danger rating system, acres burned, fuel load.

The Keetch-Byram Drought Index (KBDI) is basically a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. This system was originally developed for the southeastern United States and is based primarily on recent rainfall patterns.

The KBDI is the most widely used drought index system by fire managers in the south. It is also one of the only drought index systems specifically developed to equate the effects of drought with potential fire activities.

The result of this system is a drought index number ranging from 0 to 800 that accurately describes the amount of moisture that is missing. A rating of zero defines the point where there is no moisture deficiency and 800 is the maximum drought possible.

These numbers correlate with potential fire behavior as follows:

0 - 200 Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.

200 - 400 Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Also, expect smoldering and the resulting smoke to carry into and possibly through the night.

400 - 600 Fire intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.

600 - 800 Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn thorough the night and heavier fuels will actively burn and contribute to fire intensity.

Source: http://www.wfas.us/content/view/32/49/

XXIX. Figure: Fire Danger.

Fire Danger Rating System		
rating	**basic description**	**detailed description**
CLASS 1: Low Danger (L) COLOR CODE: **Green**	fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open or cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
CLASS 2: Moderate Danger (M) COLOR CODE: **Blue**	fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Woods fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel – especially draped fuel - - may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
CLASS 3: High Danger (H) COLOR CODE: **Yellow**	fires start easily and spread at a rapid rate	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
CLASS 4: Very High Danger (VH) COLOR CODE: **Orange**	fires start very easily and spread at a vary fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics - such as long-distance spotting - and fire whirlwinds, when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
CLASS 5: Extreme (E) COLOR CODE: **Red**	fire situation is explosive and can result in extensive property damage	Fires under extreme conditions start quickly, spread furiously and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger class (4). Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.
source: http://www.wfas.net/content/view/34/51/		

2.12.4. Previous Occurrences: Wild Fires Occur Every Year.

People start more than four out of every five wildfires, usually as debris burns, arson or carelessness. Lightning strikes are another cause of wildfires. Other sources of ignition include railroads, catalytic converters on automobiles and spontaneous ignition of hay bales. Wildfires that do not encounter a human population are difficult to calculate damages. Homes and businesses that are burned in naturally occurring fires are usually privately owned. No data exists for structural losses on the non-incorporated Tillman County level.

2.12.5. Probability of Future Events.

There are wildfires in Tillman County every year. There are seasonal maximums of wildfires during late winter and late summer when fuel and weather conditions are best for fire propagation. According to data collected by the state fire marshal, rural and small town fire departments made an average of 785 fire runs per year. Sampling of fire run reports of these fire departments show that 75% of their fire runs are to suppress wild land fires and 50% are in mutual aid of

another fire department for the same fire. Applying the 75% and 50% factor yields 294 fire runs to suppress wild land fires per year. Wildfires are highly likely in Tillman County.

2.12.6. Vulnerability.

Periods of drought, dry conditions, high temperatures, wind and low humidity set the stage for wildfires in Tillman County. Areas along railroads and people whose homes are in woodland settings in rural areas have an increased risk of wildfire. The sparsely populated tall grass rangelands are capable of experiencing large sweeping fires. Ironically, fire suppression is capable of creating larger fire hazards, because live and dead vegetation is allowed to accumulate in areas where fire has been excluded.

2.12.7. Secondary Hazards.

The loss of groundcover from fire makes areas more susceptible to soil erosion from rainstorms. Water quality can also deteriorate as runoff from burned areas carries mud, agriculture-related chemicals and other debris onto roadways, clog bridges and impair waterways.

2.12.8. Overall Summary of Vulnerability and Impacts.

Arson, debris burns, lightning strikes, railroads, catalytic converters on autos and carelessness can cause wildfires. Fire can increase erosion and result in a deterioration of watercourses, disrupt transportation and affect soil and water quality. Houses and other structures that are amongst the wild land/urban interface are vulnerable to wild fire. The impact from houses burning is people being displaced from their homes.

2.13. HAZARD PROFILE – Thunderstorms/Lightning.

2.13.1. Description.

Produced by a cumulonimbus cloud, a thunderstorm is an atmospheric disturbance with lightning and thunder. Lightning is generated by the buildup of charged ions in a thundercloud. When that buildup interacts with the best conducting object or surface on the ground, the result is a discharge of a lightning bolt. Thunder is the sound of the shock wave produced by the rapid heating and cooling of the air near the lightning bolt. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes and may also be accompanied by high winds, rain and hail. A thunderstorm is considered severe if it produces hail at least ¾ inch in diameter, or high damaging winds 58 mph or greater. The high winds may be in the form of straight-line winds or microburst's. While thunderstorms are capable of producing tornados, high winds, hail and rain causing floods, this Hazard Mitigation plan profiles these events as separate natural hazards.

2.13.2. Location.

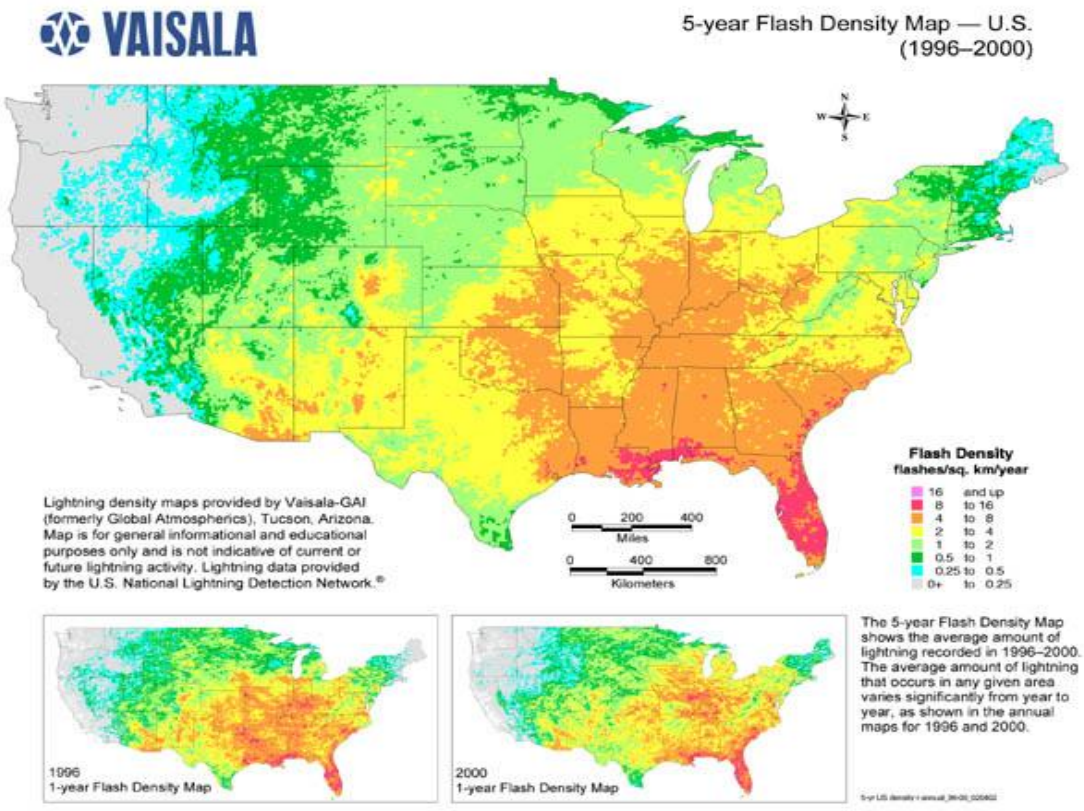
All parts of Tillman County are at risk for thunderstorms.

2.13.3. Extent.
Lightning killed 98 people and injured 243 in Oklahoma during the 1959-2003. Secondary effects from lightning include fires, power disruption and damage to objects struck by the flash. Lightning data provided by the U.S. National Lightning Detection Network show the average amount of lightening recorded during 1996-2000 in Tillman County to be 4-flashes/square kilometer/year. A lightning strike within 10 yards of a building may cause damage.

NOAA Technical Memorandum NWS SR-193 reports concerning insurance covered lightning losses. “Those losses were paid for insurance claims by homeowners and some small businesses. Over a third of the insurance losses were between $251 and $1000, and a few were over $5000.”

Each thunderstorm is capable of generating multiple cloud-to-ground lightning strikes. While the onset of a particular lightning strike is instantaneous, a thunderstorm cloud is always present. Usually a storm with cloud to ground lightning can be seen approaching.

Figure: XXX. Flash Density Map.



2.13.4. Previous Occurrences.

August 13, 1993 – Three miles south of Frederick in Tillman County -- A lightning strike resulted in a fire at an oil storage tank 2.5 miles south of Frederick. The amount of reported damage was $5,000.

April 26, 1996 -- A storm spotter was standing next to his pick-up videotaping a thunderstorm, when he was struck by lightning. He was released from a local hospital within a few hours. No damage amount was reported.

June 14, 1997 -- Lightning struck the main substation, knocking out electrical power across most of Frederick in Tillman County. Power was out in most areas through Sunday morning, June 15. No damage amount was reported.

2.13.5. Probability of Future Events.

Considering the previous occurrences and the high number of recorded thunderstorm events, the probability that at least one severe thunderstorm event will occur within Tillman County each year is highly likely.

2.13.6. Vulnerability.

Vulnerability is difficult to evaluate since thunderstorms can occur at different levels of strength, in random locations, and create relatively narrow paths of destruction. Due to the randomness of this event, the entire population of Tillman County remains vulnerable to possible injury and/or property loss from lightning. Lightning can strike ten miles out from the rain column, enabling injurious lightning strikes to people to occur under a clear sky ahead of the storm, as they tend to wait to seek shelter until the last minute.

2.13.7. Secondary Hazards.

Secondary hazards can include fires and power failures. Hail, flooding and high winds/tornadoes, although associated with thunderstorms, are profiled as separate events with their own secondary hazards.

2.13.8. Overall Summary of Vulnerability and Impacts.

All of Tillman County has a significant exposure to thunderstorms. In addition to lightning, thunderstorms are capable of producing tornadoes, hail and rain causing floods. This plan profile lightning with thunderstorms. Overall, lightning is the most constant and widespread threat to people and property during the thunderstorm season. The impact or result could be people displaced from their homes, financial loss due to wildfire and electronic equipment damaged.

CHAPTER THREE – ASSESSING VULNERABILITY.

3.1. Hazard Summary.

This summary identifies the major natural hazards that could occur, and includes previous occurrences and probability of future events of them occurring, within Tillman County.

XXXI. Table: Hazard Summary.

Hazard	Previous Occurrences	Probability of Future Events
Dam Failure	No record of this occurring.	Unlikely
Drought	12 previous occurrences in 50 years.	Likely
Earthquake	6 recorded since 1897.	Unlikely
Expansive Soils (1)	Due to limited or non-existent data, no specific occurrences could be found documented.	unlikely
Extreme Heat	Annually	Highly Likely
Flood	12 events from 1995 to 2007.	Highly Likely
Hailstorm	85 large-hail events recorded since 1955.	Highly Likely
Severe Winter Storm	16 snow and/or ice events since 1950.	Likely
Tornado/high winds	61 tornado and 217 wind events recorded since 1955.	Highly Likely
Wildfire	294 wild land fire responses per year.	Highly Likely
Thunderstorm/Lightning	263 severe thunderstorm events recorded since 1955.	Highly Likely

The Tillman County Hazard Mitigation Planning Committee has determined Expansive Soils, Dam failures and Earthquakes do not present a severe threat to the County and therefore decided not to adapt any action items for the hazard.

3.2. Types and Numbers of Existing Structures Affected by the Flood Hazard.

Table XXXI attempts to estimate the proportion and value of structures that are located in a 100 year flood plain.

XXXII. Table: Types and Numbers of Existing Structures Affected by Flood Hazard.

Existing Assets Vulnerable to Flood Damage			
Asset	Number	Unit Valuation	Vulnerable Asset Valuation
Buildings – Housing Units	0	-	0
Buildings - Commercial	0	-	$0
Critical Facility – Courthouse	0	-	$0
Critical Facility – County Barns	0	-	$0
Infrastructure – County Bridges	53	1696ft@$2500/ft.	$4,240,000
TOTALS	53	-.	$4,240,000

There are no planned developments in the flood hazard area in rural Tillman County. Other County assets affected by floods are roads and bridges. Roads and bridges throughout Tillman County may require cleanup and repairs after flood events. Total costs associated with the cleanup and repairs were not available. However, Tillman County intends to include specific road and bridge projects as mitigation actions in updates to the County's Hazard Mitigation plan. At that time the projects will be prioritized and costs associated with the repairs/cleanup versus the cost of the mitigation action will be compared.

3.3. Types and Numbers of Existing Structures Affected-All Other Hazards-100% Susceptible.

Table XXXII estimates the proportion and values of buildings and the population that are located in areas affected by all other hazards, which is the entire Tillman County area. Table XXXII is an inventory of specific critical facilities identified in this plan that can be damaged by all hazards mentioned except flood. Total unincorporated areas population of Tillman County in the according to the 2000 US Census is 1,106.

XXXIII. Table: Types and Numbers of Existing Structures Affected by All Other Hazards – 100% Susceptibility.

Existing Assets Vulnerable to all Hazards except Floods			
Asset	Number	Unit Valuation	Vulnerable Asset Valuation
Buildings – Housing Units	487	$ 48,500 ea.	$23,619,500
Buildings - Commercial	37	$122,000	$4,514,000
Critical Facility – Courthouse	1	$10,000,000	$10,000,000
Critical Facility – County Barns	3	$600,000	$1,800,000

TOTALS	528		$39,933,500

3.4. Identifying Assets.

The Tillman County Hazard Mitigation plan identifies critical facilities located within Tillman County and the hazards to which these facilities are susceptible. A critical facility is defined as a facility that provides essential products or services to the general public and is necessary to the preservation of the welfare and quality of life in Tillman County. In this initial County plan, the Hazard Mitigation Planning Committee agreed that the following basic facilities should be considered critical: courthouse, County maintenance barns and County maintained bridges. In future updates of this plan, other facilities may be added.

Committee members and others helped locate the facilities. GIS software was used to map the facilities and determine which are most likely to be affected by hazards. According to the guidelines in the FEMA document "Understanding Your Risks Identifying Hazards and Estimating Losses," the use of a truncated inventory with cost estimates of critical facilities and residential properties is sufficient for providing a very broad picture of the potential extent of damage likely from a hazard event. According to information provided by the Tillman County Assessor Tables XXXI and XXXII were prepared to estimate the proportion of buildings, the value of buildings that are located in hazard areas of the unincorporated area of Tillman County.

3.5. Estimating Potential Dollar Loss.

Potential dollar loss was estimated for each hazard based on losses recorded from previous natural hazard events. The total recorded loss was divided by the number of events to obtain an average potential dollar loss per event. An attempt was made to estimate losses for all hazards profiled in this plan, however due to limited resources, detailed data for estimating County-specific potential dollar loss for some of the natural hazards were not available. Where specific Tillman County data was available benefit-cost ratios were developed for each action item using the frequency damage method. B-C estimates were made using specific hazard occurrence frequency and past damage estimates.

3.5.1. Potential Dollar Loss and Vulnerability for Each Hazard.

Expansive Soil.

There is no recorded damages caused by expansive soils; therefore the planning committee decided not to include any action items for expansive soils.

Dam Failure.

There is no record of dam failure occurring within Tillman County. It has been decided by the Tillman County Planning Committee to not include any action Items for dam failures.

Drought.
In the State of Oklahoma, four severe drought events have been recorded. Any estimates of dollar losses cannot reflect total loss since damages resulting from drought are not fully compensated. Potential losses are not static due to drought severity and commodity value fluctuation, therefore potential dollar loss is impossible to estimate.

Earthquake.
There have been no significant historical damages recorded; potential dollar loss was not estimated. This hazard was not included in the action items.

Extreme Heat.
County-specific data pertaining to dollar loss resulting from Extreme Heat was not found. Therefore, estimates for potential loss could not be derived. Such loss is likely to include livestock and crop damage, but it is most likely to be associated with drought, rather than extreme heat.

Flood.
According to the National Climatic Data Center (NCDC), Tillman County experienced 14 flood events that resulted in approximately $1,262,000 in flood damages since 1993. Therefore the average potential dollar loss is estimated at $90,143 per event. Dollar loss specific to flood damages experienced in Tillman County *outside municipalities* was not found.

Hail.
According to the NCDC, Tillman County experienced 85 large-hail events since 1955. Since most hail losses are insured or go unreported, no loss figures are estimated for those events. Potential dollar loss estimates may be made by assuming the same hail storm frequency in the future as in the past and estimating the amount of damage to structures in the unincorporated area.

Estimates of Dollar Losses Due to Hail:
To make a 10-year potential loss estimate from a hailstorm these assumptions or factors were used:

- The average damage to a housing unit from a hailstorm is $3,500.
- The average damage to commercial buildings and County barns from a hail is $14,000.
- The damage to the courthouse from a hailstorm is $140,000.All buildings are equally likely to experience hail.
- The probability of hail damage in a decade is 5%.

Thunderstorms/Lightning.
It was found documented that Tillman County had 217 thunderstorm recorded with damages totaling $3,421,400. Although this dollar loss recorded by NCDC includes damages that resulted in loss occurring within municipalities, these values were used to estimate loss for Tillman County. Therefore, based on these

values, it is concluded that the County can experience an estimated potential dollar loss of $15,766 for each thunderstorm event that includes high wind, hail and/or lightning.

Tornadoes/High Winds.
Overall, in the State of Oklahoma, the average cost in tornado damages per year is $23,221,264. According to the National Climatic Data Center, Tillman County and its communities have experienced 61 tornado events that resulted in approximately $10,023,000,000 in damages in the last 53 years. Therefore the average potential dollar loss per event is estimated to be approximately $164,311,147 dollars per event.

Tillman County averages 4.09 high wind events per year. At an average loss of $15,766 per thunderstorm-wind event, an annual loss of $64,482 can be expected.

Since this plan covers only the rural, unincorporated areas of the County, a tornado scenario is not appropriate. Most damage caused by tornadoes is incurred when their paths intersect a densely populated area. Tornadoes setting down in unincorporated Tillman County would have a relatively small monetary impact.

Wildfire.
According the 2002 annual report by the Oklahoma State Fire Marshall, in the State of Oklahoma, there were a total of 1,427 wild land fires reported, which burned approximately 25,804 acres and resulted in total estimated dollar losses of $25,804,000. No costs estimates are available for Tillman County.

Winter Storms.
Tillman County has experienced many winter storms of varied intensities that consisted of snow and/or ice. Snow - blocked and ice - covered roads not only make travel dangerous, but the removal and clearing of snow and ice can be costly. Downed electrical lines and the resulting loss of power to homes, businesses and water systems not only increase hardships and hinder recovery, but can also increase potential dollar losses during and after winter storm events.

In late December 2000, a winter storm caused an estimated $74,250,000 in damages in Tillman County and surrounding areas. Therefore, based on past damages, potential dollar loss per event can be substantial.

3.6. Development Trends.
The State of Oklahoma has not granted to counties broad regulatory powers to enact and enforce building codes, building inspections, subdivision regulations and growth management initiatives. Tillman County does have power to regulate all platting of land, all construction of dwelling units or commercial or industrial structures, and all future

development within a delineated floodplain area, except land held in trust by the United States for Native Americans.

At this time, there is no planned housing or commercial developments, County critical facility expansions or County infrastructure changes in the unincorporated area of Tillman County other than those required to meet immediate County transportation needs. Existing substandard County bridges are to be rebuilt to higher standards as funding allows. Extrapolating the change of the decade of the 1990s and present outlook, there will be a zero net gain of houses in the unincorporated areas of Tillman County during the next decade. Also no new commercial growth is expected. Awareness of natural hazards in Tillman County and acceptable mitigation measures will be made available to home owners and builders.

CHAPTER FOUR – MITIGATION STRATEGY.

4.1. Hazard Mitigation Goals.

Goal 1. Protection from loss of life and personal injury.
Goal 2. Protection of critical facilities and infrastructure.
Goal 3. Protection of personal property and reduction of economic injury due to hazards.
Goal 4. Minimize the costs of disaster response.

These goals were developed by Tillman County's Hazard Mitigation Planning team through public input and in consultation with County Commissioners and emergency response personnel.

4.2. Comprehensive Range of Mitigation Actions and Cost-Benefit Ratios.

To meet Tillman County's overall goals the following actions as they relate to specific natural hazards were developed through discussions and a consensus reached at the public meetings that included the Hazard Mitigation Committee members and any other interested party. Cost-benefit ratios were made using the frequency-damage method by known occurrences compared to past damages. Those mitigating the effects of more than one hazard are analyzed only once. Some of the actions being considered are so inter-related that the analysis of one duplicates the analysis of another.

These identified actions and projects not only address reducing the effects of hazards on new and existing buildings, but also infrastructure as well.

HAZARD: Drought, Extreme Heat, Flood, Hailstorm, Severe Winter Storm, Tornado/High Winds, Wildfire, Thunderstorm/Lightning.

Action Item #1: Educating the Public about Various Dangers Associated with Natural Hazards. This Item is general in nature and addresses all hazards. It is intended to be re-occurring on an annual basis.

1. Comments: People are sometimes injured because of lack of knowledge of the danger of natural hazards.
2. Action: Educate the public about various dangers associated with natural hazards. Education can be accomplished by sponsoring professional programs, school poster contests, essays and other activities through workshops, public meetings and various support groups (child care, senior citizens centers, public schools, 4-H, etc).
3. Participating Jurisdiction: Tillman County.
4. Lead Agency: Tillman County Emergency Management.
5. Estimated Cost: $1,000 per year for 5 years.
6. Funding: County budget and grants.
7. Implementation Timeline: Annually for five years.

8. Cost - Benefit Ratio: Potential life saving. Implementation of this item would also have a great impact on not only educating the public and but will provide ideas for future action items. Cost-benefit ratio greater than 1: 1.

Action Item #2: Develop a database to gather historical data on Drought, Extreme Heat, Flood, Hailstorm, Severe Winter Storm, Tornado/High Winds, Wildfire, Thunderstorm/Lightning.

1. Comments: Develop a database that would allow the tracking of hazardous events occurring in Tillman County.
2. Action: Work to develop a database that would track each hazardous event. The database would include a map showing the location of those at risk residents so that the appropriate action will be achieved to ensure their safety or evacuation if so required.
3. Participating Jurisdiction: Tillman County.
4. Lead Agency: Tillman County Emergency Management.
5. Estimated Cost: $135,000.
6. Funding: County budget and grants.
7. Implementation Timeline: 12 months.
8. Cost - Benefit Ratio: Good public support. Potential life saving. The use of volunteers could save costs.

HAZARD: Drought.

Action Item # DR 1: Drill Additional Water Wells.

1. Comments: Long periods of drought tax the water supply in Tillman County.
2. Action: Drill additional water wells ensuring that an adequate water supply is available for residents of Tillman County.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Conservation District - USDA /NRCS.
5. Estimated Cost: $210,000.
6. Funding Sources: County Budget, Water Resources Board, USDA.
7. Implementation Timeline: 36 months.
8. Cost - Benefit Ratio: Thought to be of high benefit to cost ratio. Good public support.

Action Item # DR 2: Build Reservoirs.

1. Comments: Expansion of water reserves is required to provide for fire protection, wildlife and livestock.
2. Action: Build reservoirs to contain rain and runoff water for agricultural use.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County.
5. Estimated Cost: $150,000.
6. Funding Sources: USDA-NRCS, Conservation District, Tillman County.
7. Implementation Timeline: 48 months.
8. Cost - Benefit Ratio: 1:1 benefit to cost ratio. Good public support.

HAZARD: Extreme Heat

Action Item # EH 1: Public Education of Dangers Associated With Extreme Temperature Events.

1. **Comments:** Many citizens die each year from extreme heat.
2. Action: Work with Tillman County on developing and implementing a public education campaign informing Citizens of the dangers associated with extreme temperature events such as heat exhaustion and heat stroke, etc.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Fredrick Hospital.
5. Estimated Cost: $7,000.
6. Funding Sources: County budget.
7. Implementation Timeline: 24 months.
8. Cost Benefit Ratio: Benefits thought to be quite high compared to cost. Great public support.

Action Item # EH 2: Protective Film on windows in all County buildings.

1. Comments: This action item is also listed as Hail Storm Item #3. The protective film will be Low-E, tinted film to lower heat gain in the buildings.
2. Action: Install on all County building office space.
3. Participating Jurisdictions: Tillman County.
4. Lead Agency: Tillman County emergency management.
5. Estimated Cost: $25,000.
6. Funding Sources: County budget, HMG Grant.
7. Implementation Timeline: 12 months.
8. Cost-Benefit Ratio: Greater than 1:1.

HAZARD: Flooding

Action Item # F 1: Implement NFIP Program and provide continual administration to insure NFIP compliance.

1. Comments: NFIP participation is necessary to fully participate in the Hazard Mitigation process.
2. Action: Implement NFIP Program and provide continual administration to insure NFIP compliance is maintained on an annual basis.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $100,000.
6. Funding Sources: County budget, HMG grants.
7. Implementation Timeline: 36 months.
8. Cost - Benefit Ratio: Benefits would be high compared to costs.

Action Item # F2: Elevate 3 County roads and bridges to provide flood protection and safe corridors for the public and emergency vehicles during floods.

1. Comments: Three segments of County roads are impassable during floods.
2. Action: Raise roadbed and construct new bridges and approaches.
3. Participating Jurisdiction: Tillman County.
4. Lead Agency: Tillman County, Flood Plain Management.
5. Costs: $3,000,000.
6. Funding Source: Tillman County budget, FEMA.
7. Implementation Timeline: 2009-2012.
8. Costs - Benefit Ratio: Multiple benefits and great public support. Long term cost-benefits thought to greater than 1:1.

HAZARD: Hail Storms.

Action Item # HS 1: Building Material Awareness - Insurance Agents, Contractors and Citizens.

1. Comments: Homes and businesses are damaged by hail storms causing large financial loss to members of the community.
2. Action: Public education - Promote the use of hail resistant shingles and building materials for retrofit or new construction to the public (Insurance agents, homeowners associations, contractors, and citizens), using brochures and the media.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $6,000.
6. Funding Sources: Grants, Tillman County budget.
7. Implementation Timeline: 18 months.
8. Cost - Benefit Ratio: The benefit to cost thought to be quite high since the mitigation would lower insurance rates. This action would affect both new and existing structures.

Action Item # HS 2: Provide new shelters for County owned vehicles to protect from hail damage.

1. Comments: Vehicles parked in uncovered areas are subject to hail damage causing additional expense for repairs.
2. Action: Provide new shelters for County owned vehicles to protect from hail damage.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $600,000.
6. Funding Sources: Tillman County budget, HMG Grants.
7. Implementation Timeline: 24 months.
8. Cost - Benefit Ratio: Good benefits to cost ratio. Good support from the public. Good protection of critical infrastructure.

Action Item # HS 3: Protective film on windows in all County buildings.

1. Comments: Hail storms cause broken windows and flying glass causes bodily injuries.
2. Action: Install protective film on windows in all County buildings
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $25,000.
6. Funding Sources: County budget, HMG Grant.
7. Implementation Timeline: 12 months.
8. Cost - Benefit Ratio: Thought to have favorable benefit-cost ratio.

HAZARD: THUNDERSTORMS/LIGHTNING.

Action Item # L 1: Purchase Lightning Prediction Systems for Tillman County Critical Facilities.

1. Hazard: Lightning.
2. Comments: Lightning causes death, injury and property damage.
3. Action: Provide lightning detection systems for Tillman County critical facilities.
4. Participating Jurisdictions: Tillman County.
5. Lead Agencies: Tillman County Emergency Management.
6. Estimated Cost: $16,000.
7. Funding Sources: Grants, County Budget.
8. Implementation Timeline: 30 months.
9. Cost - Benefit Review: Thought to have good benefits to cost ratio. There should be strong public support. Potential life saving.

Action Item # L 2: Lightning Suppression Systems at Critical Facilities.

1. Comments: Lighting protection and suppression systems protecting radios and other essential equipment at existing and new critical facilities throughout the County would be beneficial.
2. Action: Install lighting protection and suppression systems protecting radios and other essential equipment at critical facilities throughout the County.
3. Participating Jurisdictions: Tillman County
4. Lead Agencies: Tillman County Emergency Management
5. Estimated Cost: $45,000
6. Funding Sources: Hazard Mitigation grand program, County budget
7. Implementation Timeline: 24 months
8. Cost - Benefit Ratio: Thought to have benefit to cost ratio greater than 1:1.

HAZARD: Tornado-High Winds.

Action Item # T-HW 1: Develop Emergency Operation Plan for Tornadoes.

1. Comments: This plan would reduce the chances of loss of life and lower property damage.
2. Action: Develop emergency operation plan to implement mitigation, response and recovery phases of an event. This plan would reduce the chances of loss of life and lower property damage.
3. Participating Jurisdictions: Tillman County.
4. Lead Agency: Tillman County Emergency Management.
5. Estimated Cost: $3,500.
6. Funding: County budget, FEMA Grants.
7. Implementation Timeline: 24 months.
8. Cost - Benefit Ratio: The Countywide Emergency Operation Plan is a response and recovery plan mandated to the County. Additional actions for natural hazards would be of great benefit at a low cost.

Action Item # T-HW 2: Educate the public in the benefits of installing residential and commercial storm shelters and safe rooms.

1. Comments: The public must be encouraged to install safe rooms to reduce the loss of life.
2. Action: Educate the public through public meetings and media outlets.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $2,500 per year.
6. Funding Sources: County budget, Grants.
7. Implementation Timeline: 24 months.
8. Cost – Benefit Ratio: Thought to have favorable cost -benefit ratio. Potential life saving measure.

Action Item # T-HW 3: Mobile Communications System.

1. Comments: Storm spotters need a common communications system.
2. Action: Obtaining mobile communications equipment for spotters and emergency response teams.
3. Participating Jurisdictions: Tillman County.
4. Lead Agency: Tillman County Emergency Management.
5. Estimated Cost: $18,000.
6. Funding Sources: Grants, County budget.
7. Implementation Timeline: Ongoing.
8. Cost - Benefit Ratio: Great public support. Potential life saving.

Action Item # T-HW 4: Installation of NOAA Receivers in Public Facilities.

1. Comments: The public must have timely warnings of severe weather events.
2. Action: Purchase and install NOAA Weather Radio receivers in schools, hospital Nursing homes and other public facilities.
3. Participating Jurisdictions: Tillman County.
4. Lead Agency: Tillman County Emergency Management.
5. Estimated Cost: $2,000.
6. Funding Sources: Tillman County budget, Hazard Mitigation grant program.
7. Implementation Timeline: Ongoing.
8. Cost - Benefit Ratio: Extremely low cost for the benefit received.

Action Item # T-HW 5: Install residential and commercial storm shelters.

1. Comments: Tornadoes and high winds take lives unless people have adequate protection.
2. Action: 10 new Storm Shelters installed to reduce the loss of life.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $500,000.
6. Funding Sources: County Budget and Grants.
7. Implementation Timeline: 2009.
8. Cost - Benefit Ratio: Demand from the public will be great. Potential life saving.

Action Item # T-HW 6: Tie-Down – Mobile Homes & Other Structures Education Program.

1. Comments: Mobil homes and other buildings suffer wind damage.
2. Action: Promote the benefits of tie downs and hurricane clips to secure existing and future mobile homes and other structures helping reduce damage from high winds or tornados. This action will be implemented through public information meetings and information packets developed, or obtained, by the County Emergency Manager.
3. Participating Jurisdiction: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $5,000.
6. Funding Sources: Tillman County Budget, Hazard Mitigation Grant.
7. Implementation Timeline: 12 months.
8. Cost - Benefit Ratio: Important to participants. Potential life saving.

Action Item # T- HW 7: Review the Tillman County Severe Weather Response Plan and Warning System on an Annual Basis.

1. Comments: An outdated plan can increase the risk of damage and injury.
2. Action: Reviewing the Tillman County severe weather plan and warning system will promote readiness and will change with the needs of Tillman County as new businesses and infrastructure are developed.

3. Participating Jurisdiction: Tillman County.
4. Lead Agency: Tillman County Emergency Management.
5. Estimated Cost: $500.
6. Funding: County Budget and Grants.
7. Implementation Timeline: 12 months.
8. Cost - Benefit Ratio: Important action for the cost.

HAZARD: Wildfires.

Action Item # WF 1: Purchase of Tanker Fire Trucks – Wildfire Protection.

1. Comments: Wildfires are a serious hazard in Tillman County.
2. Action: Purchase of two tanker fire trucks to protect structures in Tillman County from wildfires.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $100,000.
6. Funding Sources: Grants, County Budget .
7. Implementation Timeline: 36 months.
8. Cost Benefit Ratio: Great public support. Potential is high for both property and life saving benefits. Thought to have high benefit-cost ratio.

Action Item # WF 2: Provide Dry Hydrants for Wildfire Protection.

1. Comments: Wildfires are a serious hazard in Tillman County.
2. Action: Provide 10 Dry Hydrants for Wildfire Protection.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $50,000.
6. Funding Sources: Grants, County Budget.
7. Implementation Timeline: 36 months.
8. Cost - Benefit Ratio: Public support is high and the cost is low compared to the benefit.

Action Item # WF 3: Implement the Fire Wise program to provide Wildfire Protection by making the public aware of the need for defensible spaces.

1. Comments: Wildfires are a serious hazard in Tillman County.
2. Action: Create an awareness program to inform the public of the dangers of wild fires and the need to provide defensible spaces around structures.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $50,000.
6. Funding Sources: Grants, County Budget .
7. Implementation Timeline: 36 months.
8. Cost Benefit Ratio: Good public support. High benefit for the cost.

HAZARD: Winter Storms.

Action Item # WS 1: Purchase and Installation of Generators to Power Critical Facilities.

1. Comments: Ice storms break power lines, leaving areas without electricity.
2. Action: Purchase and install generators for critical facilities in Tillman County such as the Court House, County Barns, rural water districts, sewer systems, public shelters, nursing home, etc.
3. Participating Jurisdictions: Tillman County.
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $250,000.
6. Funding Sources: Grants, County Budget.
7. Implementation Timeline: 30 months.
8. Cost - Benefit Ratio: Good public support. Favorable cost-benefit ratio.

Action Item # WS 2: Database and Map of Special Needs Population.

1. Comments: Develop a plan to notify citizens with special needs who may be adversely affected by extreme cold events.
2. Action: Work with Tillman County 911 database, senior citizens centers and the public in creating a database of citizens with special needs who may be adversely affected by extreme cold events. The database would include a map showing the location of at risk residents with contact information so their welfare can be verified.
3. Participating Jurisdictions: Tillman County .
4. Lead Agencies: Tillman County Emergency Management.
5. Estimated Cost: $135,000.
6. Funding Sources: Grants, County Budget.
7. Implementation Timeline: 12 months.
8. Cost - Benefit Ratio: Good public support. Could reduce costs using volunteers.

4.3. Implementation of Mitigation Actions.

4.3.1. Prioritization.

The Hazard Mitigation Planning Committee and County residents prioritized each potential action item as to how to implement them in the best interest of the County residents. After careful consideration and with consultation from the Tillman County Commissioners the mitigation items were given a priority ranking in order to expedite their implementation in the order of effectiveness and cost. Effectiveness of the mitigation item takes into consideration the population served, the probability and intensity of the hazard occurring, and the number of hazards mitigated by the action. Since subjective rankings are dynamic as public perception changes, these rankings are subject to be modified as items are implemented, the needs of the County changes, hazards are recognized differently by the public and new technologies dealing with these hazards become available.

The following scales were used for each category:

Cost

Cost was ranked, starting with the value of 1 to indicate the MOST expensive Action Example
1 = Most expensive Action
2 = Next expensive Action
3 = Next…..etc.

Citizens Potentially Served

1 = A few individuals (less than 24%)
2 = A fourth of the County (25%-49%)
3 = Half the County (50%-99%)
4 = Entire County (100%)

Probability of Future Events of Natural Hazard that Requires the Action

1 = Unlikely (1 event per 10 years)
2 = Occasional (1 event per 5 years)
3 = Likely (1 event per 3 years)
4 = Highly likely (1 event per year)

XXXIV. Table: Summary of Categories and Scales Used to Determine Priority Ranking of Mitigation Actions by Cost, Benefits and Citizens Served.

The higher the TOTAL, the higher the PRIORITY.

Actions or Projects	Cost	Cost Rank	Citizens Served	Probability of Future Events	# of hazards mitigated	TOTAL	PRIORITY
Educating the public about natural hazards	$5,000	21	4	4	10	39	1
Drill additional water wells	$210,000	5	2	2	1	10	20
Build reservoirs	$150,000	6	2	2	1	11	19
Public education on extreme heat	$7,000	18	4	4	1	27	6
Elevate County roads and bridges	$3,000,000	1	2	2	1	6	21
Implement flood plain board	$120,000	8	1	4	1	14	17
Provide protective storage for County equipment	$600,000	2	4	4	3	13	18
Increase public awareness of concepts such as “survivable space” and “firewise”	$ 50,000	10	4	4	1	19	12
Provide generators needed to power water pumps, sewage systems and emergency communications	$250,000	4	4	4	3	15	16
Installation of NOAA Weather Radios in critical facilities	$2,000	24	1	4	4	33	3
Building material awareness	$6,000	19	2	4	1	26	7
Protective film on windows	$25,000	12	1	4	1	18	13
Lightning detectors	$16,000	15	1	4	1	21	10
Lightning suppression	$45,000	10	4	4	1	19	12

Develop EOP for tornadoes	$3,500	22	4	4	1	31	5
Storm shelter education	$2,500	23	4	4	1	32	4
Storm spotter communication system	$18,000	14	4	4	2	24	8
Storm shelters	$500,000	3	2	4	2	11	18
Structure tie-down and high wind - education program	$5,000	20	1	4	2	27	6
Review weather response plan	$500	25	4	4	4	37	2
Purchase of fire trucks	$100,000	9	3	4	1	17	14
Install dry hydrants	$50,000	13	3	4	1	21	11
Database of special needs population (Winter Storm)	$135,000	7	4	4	1	16	15
Develop Database to track hazards	$135,000	7	4	4	10	25	9

4.3.2. Implementation and Administration.

Following the prioritization of the hazard actions and projects, the committee then determined possible sources of funding and finally initialized an implementation schedule.

XXXV. Table: Summary of selected actions and their priority ranking.

Actions or Projects	Cost	Funding Sources	Who will Implement Action	Schedule	PRIORITY
Educating the public about natural hazards	$5,000	County Funds	County DEM	Annually for five years	1
Review weather response plan	$500	County Funds	County DEM	!2 Months	2
Storm shelter education	$2,500	County Funds	County DEM	24 Months	4
Installation of NOAA Weather Radios in critical facilities	$2,000	County	County DEM	Ongoing	3
Develop EOP for Tornadoes	$3,500	County Funds	County DEM	24 mos.	5
Storm spotter communication system	$18,000	County	County Funds Grants	Ongoing	8
Public education on extreme heat	$7,000	County Funds	County DEM	24 Mos.	6
Building material awareness	$6,000	County Funds Grants	County DEM	18 Mos.	7
Structure tie-down – high wind education program	$5,000	County Funds HMG	County DEM	12 Mos.	6
Lightning detectors	$16,000	Grants County Funds	County DEM	30 Mos.	9
Increase public awareness of concepts such as “survivable space” and “firewise”	$50,000	County Funds Grants	County DEM	36 Mos.	11

Install dry hydrants	$50,000	County DEM Conservation District Rural Fire Dept.	County DEM	36 Mos.	10
Database of special needs population (Winter Storm)	$135,000	County Funds	County DEM	12 Months	14
Purchase of fire trucks	$100,000	County Funds Ok. State Dept. of Agri.	County DEM Rural Fire Depts.	36 Mos.	13
Lightning suppression	$45,000	HMGP County Funds	County DEM	24 Mos.	12
Provide generators needed to power water pumps, sewage systems and emergency communications	$250,000	County Funds Grants	County Commissioners	30 Months	16
Implement flood plain board- NFIP compliance	$100,000	County Funds HMG Grants	County DEM	36 Mos.	17
Build reservoirs	$150,000	County Funds USDA-NRCS-Conservation Districts	County DEM	48 Mos.	11
Provide protective storage for County equipment	$600,000	County Funds HMG Grants	County Commissioners	24 Mos.	18
Drill additional water wells	$210,000	County Funds Grants	County DEM Conservation Districts	36 Mos.	20
Storm shelters	$500,000	County Funds	County DEM	2009	19
Elevate County roads and bridges	$3,000,000	County Funds HMG Grants	County Commissioners	2009-2012	21
Protective Film on Windows	$25,000	County Funds	County DEM	12 Mos.	12
Develop Database to Track Hazards	$135,000	County Funds	County DEM	12 Mos.	15

CHAPTER FIVE - PLAN MAINTENANCE PROCESS.

The plan maintenance section of this document describes the formal process that will insure that the Tillman County Natural Hazard Mitigation Plan remains an active and relevant document with continued public participation. The plan maintenance process includes annual evaluations and revisions or updates, as needed by Tillman County. The plan will be resubmitted for State and Federal review every five years. Tillman County's Department of Emergency Management, along with the Hazard Mitigation Planning Committee, will be responsible for evaluating and updating the plan. Plan updates or revisions will be submitted to the Tillman County Board of Commissioners for adoption.

5.1. Plan Monitoring.

The County Emergency Management director will be responsible for monitoring the plan. A monitoring report will be written and submitted to the County commissioners on a yearly basis. The Commissioners may request a quarterly report following a period of rapid growth or other unexpected event.

The emergency management director will perform any necessary site visits on a monthly basis. The emergency management director will also be the lead contact for phone calls and scheduling meetings.

The Natural Hazard Mitigation Plan will be kept on record in the County clerk's office housed inside the Tillman County Courthouse in Frederick, OK. The County Commissioners will house the official plan at the Tillman County Courthouse. Any interested party may request a copy of the plan via the County clerk or the emergency management director.

The Tillman County Hazard Mitigation Committee has identified hazard mitigation projects to be included in the Hazard Mitigation Plan. The Tillman County Emergency Planning Committee will work with the public and local elected officials to evaluate potential projects. Each project will be judged and ranked according to Tillman County priorities and impact. When necessary, the Committee will also look at past occurrences and historical trends to aid in assigning priority.

5.2. Plan Evaluating.

The Tillman County Emergency Management Director and the County's Hazard Mitigation Planning Committee will evaluate the Natural Hazard Mitigation Plan every year to determine the effectiveness and/or progress of mitigation actions and the implementation of other actions.

Plan evaluation should address the following questions

1. Do actions address current and expected hazardous conditions?
2. Has the nature or magnitude of risks changed?

3. Are the current resources appropriate for implementing mitigation actions?
4. Are there any implementation problems, such as technical, political, legal or coordination issues with other agencies?
5. Did outcome of mitigation actions occur as expected?

The Committee and Emergency Management Director will have three months, from the date of the evaluation meeting, to update the plan with any changes needed. Tillman County will resubmit the plan for State and Federal review every five years.

The Tillman County Commissioners, Emergency Management director and the Hazard Mitigation Committee will evaluate the Natural Hazard Mitigation Plan every year to determine the effectiveness and/or progress of mitigation actions and the implementation of other actions.

Items covered during the evaluation process should include:

1. Evaluate magnitude of risk and determine if it has changed.
2. Evaluate current resources and determine if they are appropriate for implementing mitigation actions.
3. Determine if there were any implementation problems, such as technical, political, legal or coordination issues with other agencies.
4. Evaluate how other agencies and partners have participated.
5. Evaluate mitigation actions and determine if outcome occurred as expected.
    a. Was the intended purpose of the original mitigation action met?
    b. Was the mitigation action met in the proposed timeline?
    c. Did the listed agencies participate in the mitigation action?
    d. Did mitigation action stay within proposed budget?

The evaluation process assesses goals, objectives and current/expected conditions; change in the nature or magnitude of risks; current resources for implementation; mitigation action item outcomes; and whether agencies and other partners participated as originally proposed.

5.3. Plan Updating.

The plan will continue to be evaluated and updated annually during the five-year cycle process and anytime there is a disaster. Beginning on the fourth year, the Tillman County Commissioners, Emergency Management Director and the Hazard Mitigation Committee will make all plan revisions to be finalized and be approved by FEMA before the end of the fifth year so that the jurisdiction will maintain eligibility. The plan will be resubmitted for State and Federal review every five years.

5.4. Incorporation into Existing Planning Mechanisms.

Tillman County will establish resolutions to incorporate the hazard mitigation plan into all other County planning mechanisms. The resolutions will require each plan manager to contact the Hazard Mitigation officer on an annual basis to incorporate the changes and

additions of other plans they administer into the Hazard Mitigation Plan. The County Commissioners will have all divisions of County government implement the hazard mitigation plan into any future projects. Tillman County will continue to work closely with the Tillman County Conservation District in the areas of flood plain management, drought and rural fire protection.

Tillman County currently utilizes the Emergency Operations Plan to guide recovery in the County. After Tillman County officially adopts the Hazard Mitigation Plan, these existing mechanisms will have hazard mitigation strategies integrated into them.

Tillman County currently utilizes capital improvement planning to guide development in the County. After Tillman County officially adopts the Hazard Mitigation Plan, these existing mechanisms, which are updated annually, will have hazard mitigation strategies integrated into them.

After adoption of the Mitigation Plan, Tillman County will suggest that local municipalities address natural hazards in their respective planning processes. Specifically, one of the goals in the Mitigation Plan directs County and local governments to protect life and property from natural disasters and hazards. The County Commissioners office will conduct periodic review of the County's amendments, and provide technical assistance to other local municipalities in implementing these requirements.

Any capital improvement planning that occurs in the future will also contribute to the goals in the Hazard Mitigation Plan. The respective Emergency Management director will work with the capital improvement planners to secure high-hazard areas for low risk uses.

Incorporating goals of other planning activities into the Hazard Mitigation Plan will occur as each of these plans is updated.

The Tillman County Conservation District has a long-range plan that is updated annually and specifically addresses drought, flood protection and other natural resources. This local unit of government has been and will continue to be active advisors to the Hazard Mitigation Planning Committee.

Within six months of the formal adoption of the Mitigation Plan, the policies listed above will be incorporated into the process of existing planning mechanisms.

5.5. Continued Public Participation.

While the Hazard Mitigation Planning Committee represents the public to some extent, the public will be able to directly comment on and provide feedback about the plan. Tillman County is dedicated to generating public interest in the updates of the County Hazard Mitigation Plan. Efforts to do so may include:

1. Distributing information about the existence and purpose of the Hazard Mitigation Plan to community groups, units of County government, and other public gatherings.

2. Questionnaires periodically being made available to the public to collect information on what mitigation activities the citizens would like to see implemented.

3. Posting information about the Hazard Mitigation Plan on the ASCOG Web page, along with an email address for questions and input.

Meeting notices will be posted in accordance with the policies for open meetings at the Tillman County Court House which is located in Frederick, OK. An ad in the local newspapers official (legal notice) will inform the public about the meetings. These meetings will provide the public a forum where residents can express their concerns, opinions or ideas about the Plan. Citizen's comments and concerns will be discussed at the annual evaluation to determine if changes to the plan need to be made.

Listed below is the address and phone number of the County Emergency Management Director who is responsible for keeping track of public comments on the plan. Copies of the plan will be kept at the County Department of Emergency Management and at the County Clerk's office where the public can review the plan. The public will also be invited to, and included in, the Hazard Mitigation Planning Committee's annual evaluation of the plan. This meeting will provide the public with a forum for which they can express their concerns, opinions or ideas about the plan.

Tillman County DEM
Tillman County Courthouse
Frederick, OK

(580) 335-2156

Attachments

Public participation

NOTICE
Hazard Mitigation Meeting

The public is invited to a public participation meeting at the Tillman County Courthouse at 11;00 A.M. on Monday May 10, 2002.
This meeting is for public input on a county-wide Hazard Mitigation plan to be developed by the Tillman County Commissioners.
Discussion items will include floods, wildfires, tornados and other natural hazards.

Summary of Hazards and Their Impact in Tillman County

General Hazard	FLOODING		THUNDERSTORM				WINTER STORM
Specific Hazard	General Rain Flooding	Flash Floods	Tornado	Thunderstorm Winds	Lightning	Hail	Ice Accumulation
How bad can it get?	500 year flood	Roads and buildings flooded	F5 tornado	130 mph wind	Cloud to ground lightning	4.0 in. hail	Ice accumulation of 2 in.
Expected Event	100 year flood	Roads and buildings flooded	F2 tornado	80 mph wind	Cloud to ground lightning	2.0 in. hail	Ice accumulation of 0.5 in.
Where can it occur?	Along rivers	Along any stream or drainage channel	Anywhere in the county	Anywhere in the county	Anywhere in the county	Anywhere in the county	Anywhere in the county
How often is it likely to occur?	Once in 5 years	Every year	33 in 100 years	Every year	During most thunderstorms	Every year	Every year
What is the speed of onset?	Hours and days.	Minutes and hours.	Minutes	Minutes	Instantaneous, in thunderstorm	Instantaneous, in thunderstorms	Hours and days
Harm to Persons	People evacuated	Drowning of motorists	Injuries, infrequent deaths	Infrequent injuries	Death to persons struck	Infrequent injury	
Harm to Structures	Structures flooded	Structures flooded	Considerable damage	Moderate damage	Fire	Moderate damage to roofs & vehicles	Electric lines down
Other affects	Emergency response routes blocked	Emergency response routes blocked	Power outages for hours	Power outages for hours			Power outages for days

General Hazard	WILDFIRE	DROUGHT	EARTHQUAKE	EXPANSIVE SOILS	DAM FAILURE	EXTREME HEAT
Specific Hazard	Wildfire	Hydrologic Drought	Earthquake	Expansive Soils	Dam Failure	Heat Wave
How bad can it get?	Thousands of acres burnt over	1930s dust bowl conditions	M7 earthquake	Structures destroyed	A water supply dam could fail.	30 consecutive days with 100+ degree high temperatures.
Expected Event	Hundreds of acres burnt over	1930s dust bowl conditions	M3 earthquake	Structures damaged	Large farm pond dam failure	10 consecutive days with 100+ degree high temperatures
Where can it occur?	In permanent vegetation areas	Anywhere in the county	Anywhere in the county	On upland clay soils	At any dam	Anywhere in the county
How often is it likely to occur?	Every spring and fall	Once in 50 years	Once in 10 years	At every drought cycle	Once in 200 years	Once in 5 years
What is the speed of onset?	Minutes	Months, realized in retrospect	Instantaneous	Continuous	Hours	Days
Harm to Persons	People evacuated					Frail persons who live alone die
Harm to Structures	Houses, barns and fences burnt			Damage to buildings and infrastructure	Flooding	
Other affects	Livestock forage and animals burnt	Water shortage Dust storm				

Friday May 10, 11:00 A.M. – County Commissioners Office-Tillman County Courthouse
Attendees, see attached.

Meeting was opened by Kent Smith, Chairman Tillman County Commissioners, describing the need for a Natural Hazard Mitigation Plan and how the plan will benefit Tillman County.
Jim Holland and Stan Rice from ASCOG were introduced. Jim handed out copies of the Federal Register and led a discussion as to the requirement of the program.
Stan asked the group to identify potential natural hazards common to Tillman County. A matrix was developed listing all hazards identified. The group discussed all hazards and their impact on the county.
From the participants a four member working group was selected to coordinate all future planning activity. Those members are: Kent Smith, representing the County Commissioners. Owen Fry, citizen. Jeff Rector, Emergency Management. Carolyn McAlexander, Mayor of Hollister. Jeff Rector was appointed Chairperson.

A date of Aug 01, 02 was selected for a workshop to develop goals and action items.

Tillman County Hazard Mitigation

Meeting attendees:
Kent Smith – County Commissioner
Joe Don Dickey – County Commissioner
Leon Wright – County Commissioner
Jeff Rector – Emergency Management Director
Owen Fry – Citizen
Carolyn McAlexander – Mayor of Hollister
Leslie Crosby – County Commissioner Office
Mary Albrecht – County Clerk

Public Notice

Hazard Mitigation Planning Meeting
10:00 A.M.
August 01, 2002
Southwest Bank Civic Room

The purpose is to gain input from the public in order to establish goals and actions for our county-wide Natural Hazard Mitigation Plan.

Your ideas and input are important!

For more information contact: Leslie Crosby or Jeff Rector at the Courthouse.

Natural Hazard Mitigation Meeting
First Bank Community Room
Frederick, Oklahoma

10:00 A.M.

Kent Smith, County Commissioner, opened the meeting by introduction of attendees and stating the purpose of the meeting.

Meeting was turned over to Jim Holland and Stan Rice.

Previously identified natural hazards and the vulnerability to those hazards were reviewed. Each participant was asked to complete a worksheet personally ranking the hazards. Following the exercise each participant was asked to review the action items. These action items were then discussed, modified and new items developed for review by the working group and the board of county commissioners.

12:00 Meeting adjourned

Hazard Mitigation Meeting Aug 01, 2002
Southwest Bank Civic Room
Frederick, Oklahoma

Attendees: Kent Smith, County Commissioner
Owen Fry, Citizen
Jeff Rector, Emergency Manager
Floyd Hughes, Mayor of Davidson
Carolyn McAlexander, Mayor of Hollister
Mary Albrecht, County Clerk
Leslie Crosby, County Commissioner Secretary
Ward Hill, Citizen
Jim Holland, ASCOG
Rodney Love, ASCOG
Stan Rice, ASCOG

Hon. Mayor, Fire Chief------
City/Town of ----

Re: Natural Hazard Mitigation Planning – 10:30 A.M., Monday, Feb.3, '03

Dear

A working meeting to further develop the county-wide natural hazard mitigation plan will be held at 10:30 A.M., Monday, Feb. 3rd in the Co. Commissioner's Office (Tillman County Courthouse). We should be finished by 11:30 A.M.

Several weeks ago, ASCOG staff and county and community representatives met and developed a list of hazards that might affect the Tillman County area. Since that meeting, ASCOG staff have been assessing those identified hazards and their potential impact on the county.

The next step in the process is for county and community representatives to consider the vulnerability in terms of persons, buildings, infrastructure and critical facilities in hazard areas and to estimate potential dollar loss to vulnerable structures.

From that data the group will develop mitigation goals and identify action items necessary to reduce the effects of the hazards.

Your evaluation of the identified hazards and participation in analyzing vulnerability and developing mitigation goals and action items is essential. If you or a representative will be unable to attend, please call me, Jim Holland or Stan Rice at ASCOG.

See you at the meeting.

Sincerely,

Blaine H. Smith, Jr.
Executive Director

Tillman County Natural Hazard Mitigation Workshop
Tillman County Courthouse
Frederick, Ok.
February 3, 2003

10:30 A.M.
The group was welcomed by Leon Wright, County Commissioner. It was noted the meeting was convened as a County Commissioners meeting and the notice was posted in the Tillman County Courthouse as required.
Introductions were made. Attending was Leon Wright, Joe Don Dickey, Kent Smith, Jeri Boyd, Leslie Crosby, Jeff Rector, Stan Rice and Jim Holland.

Worksheets were handed to each participant and the previously selected hazards prioritized by importance. Those results were tabulated and the final list presented to the group. After discussion the list was approved. Goals were finalized.
A list of action items were then reviewed and discussed by the group. Benefit-costs were noted and funding sources identified.
Existing and future development was discussed, especially
buildings and infrastructure most vulnerable to hazards. Action items were developed that impacted the most critical of these developments.

12:00 P.M. Meeting adjourned.

NOTICE
Hazard Mitigation Meeting

The public is invited to a public participation meeting at the Tillman County Courthouse at 10:30 A.M. on Monday Dec. 29, 2003.
This meeting is for public input on the action items to be included in the county-wide Hazard Mitigation plan.

12/29/03
Tillman County Commissioner's meeting room
Frederick, Ok.
10:30 A.M.

The Meeting was called to order by Leon Wright and noted that it was a continuation of the Commissioner's meeting convened at 9:00 A. M.
Present were Leon Wright, Joe Don Dickey, Kent Smith, Tillman County Commissioners. Jeff Rector, Emergency Manager, Bobby Blair, Leslie Crosby, Jerri Boyd, Stan Rice and Jim Holland, ASCOG.

A list of previously developed action items were presented for discussion. A ranking system, with weights for goal, cost-benefit, number of people affected, and likelihood of hazard was tabulated. Action items were then prioritized. Potential funding sources were also discussed. With these final actions in place it was agreed the final draft would be available for review.

11:30 A.M. meeting adjourned

Natural Hazard	Action Item	Don't' Understand	No opinion	Worthless	Good
Multi-hazard Action Items					
Multi-hazard #1	**Hazard mitigation and response committee** Create a committee of county private citizens specifically charged with the responsibility of plan maintenance and solicitation of public input				✓
Multi-Hazard #2	**Generators for emergency electric power** Identify priority locations and secure generators.				✓
Flood Mitigation Action Items					
Flood #1	**Support of County Floodplain Board** Staff and facility support of Tillman County Floodplain Board (This board reviews proposed building sites to determine if the new residential buildings in the Special Flood Hazard Area have their lowest floor at or above the base flood elevation.)		✓		
Flood #2	**Integration of E-911 addressing with floodplain management** In areas served with E-911 use request for an address for a new building to trigger a check of whether that address in the Special Flood Hazard Area.		✓		
Flood #3	**Build baseline of existing development in flood plains.** 1. Obtain higher resolution, color aerial photographs of county 2. Locate buildings and facilities inside 100-year flood boundary using photos with flood boundary overlay 3. Record findings to build baseline of flood plain development. 4. Provide findings and map sheets to flood plain management board		✓		
Flood #4	**Flood warnings, barricades and evacuation** 1. Warn residents in flood areas of impending flood and evacuation if appropriate 2. Temporary barricades of low water crossings during flash floods				✓
Wildfire Mitigation Items					
Wildfire #1	**Rural Fire Department Support** 1. Responding with county equipment during fire emergencies. 2. Helping small fire departments seek and secure sales tax funding and grants. 3. Encouragement of county fire association (This group is to be a forum for after-action review of events at fires using mutual aid.)				✓
Wildfire #2	Controlled burn association 1. Affiliation of landowners for the purpose of conducting controlled burns of brush cover land to reduce improve grazing and reduce fuel load in case of wildfire. 2. Furnish expertise, training and equipment for controlled burns				✓
Dam Safety Items					
Dam Safety #1	**Inspection of conservation district flood control dams** 1. Accomplish annual inspection of flood control dams. 2. Make available annual inspection reports, conducted by the three conservation districts, to Tillman County Emergency Management.			✓	
Dam Safety #2	**OWRB Dam Inspection Program** The program requires inspections every five and three years for low and significant hazard structures, respectively. It requires annual inspection of the state's 165 high-hazard dams, so designated due to the presence of occupied dwellings immediately downstream. The Water Board requires submittal and subsequent approval of plans and specifications prior to dam modifications.			✓	
Earthquake Mitigation Action Items					
Earthquake #1	**Inspection of damage after earthquake** Build list of buildings, road bridges and dams to be inspected for damage immediately after a strong earthquake			✓	
Write-in Action #1	Tornados				
Write-in Action #2	Heat Wave				
Write-in Action #3					

Tillman County Natural Hazard Mitigation Meeting
Tillman County Courthouse
Monday January 29, 2004

The Hazard Mitigation Plan review held as part of the regularly scheduled Commissioners meeting.
Present were: Leon Wright, Kent Smith, Joe Don Dickey, Leslie Crosby, Jeri Boyd, Jeff Rector, with Jim Holland and Stan Rice from ASCOG.

Mitigation action priorities were established by the County Commissioners with assistance from Jim Holland and Stan Rice.

The draft plan was presented to the commissioners by Jim and Stan. It was explained the plan format had not been approved but basic planning elements, goals, action items etc. were not expected to change.
After review and discussion it was decided the plan would be made available for public review with the new action priorities in place.

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Copy of Tillman County Natural Hazard Mitigation Plan available

A draft copy of the Tillman County Natural Hazard Mitigation Plan is available for public review at the County Commissioner's office located in the Tillman County Courthouse. The plan identifies natural hazards that threaten your community such as floods, tornadoes, high winds, ice storms, and wildfires.

Public input is encouraged in the planning process and is especially valued in formulating the action steps necessary to lessen the effect of hazards. The local mitigation plan represents community commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of hazards. For more information, contact your local County Commissioner's office.

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Edition 168
January, 2004

Hazard Mitigation - Opportunity for Public Comment: Copies of Hazard Mitigation Plans are now available on the ASCOG website (www.ascog.org) for all counties except **Grady**. Public comment is invited. Contact **Stan Rice** at ASCOG or e-mail to **rice_st@ascog.org.**

Workforce Investment Act Performance Exceeded: The South Central Oklahoma Workforce Investment Board and area (ASCOG area) exceeded all fifteen performance measures mandated by the Workforce Investment Act. The measures reflect the number of area residents served, the number of people that obtained employment following receipt of services, the number of people who remained employed for a nine-month period following the receipt of services, and a gain in salary of about $6,000 per year following services. Achieving or exceeding performance standards results in the workforce investment area continuing to be viable by the state and receipt of incentive grant funds. ASCOG staff provided the WIB services to area residents on behalf of the South Central Oklahoma Workforce Investment Board.

CDBG Applications Available: The 2004 applications for the Oklahoma Department of Commerce Community Development Block Grants (CDBG) are now available. If you are interested in applying for a project this year, call **Rodney Love**. Deadline for all applications to be submitted to ODOC is Feb. 12, 2004, thus work needs to begin now to be able to complete on time.

Staff Attend Labor Market Information Training Conference. Workforce development division staff attended a two-day conference presented by the Oklahoma Employment Security Commission that focused on occupation, wage, employment, and industry - type and number of employees. Staff can assist in providing information for counties or communities. For additional information, contact **Carl Holden** or **Ray Friedl** at ASCOG.

Brownfields. Proposal applications have been submitted to the U.S. Environmental Protection Agency for continuation of the assessment demonstration pilot program and a revolving loan fund for hazardous substance contamination. Proposals will be evaluated by the Region VI offices in Dallas for priority status and then submitted to Washington, D.C. headquarters for final review. If you have any questions regarding the proposal submittals please contact **Sheri Cathey** at ASCOG.

Copy for News "n" Briefs

Hazard Mitigation Meetings: ASCOG is hosting a series of meetings throughout the area to gain input from the local officials and the public in order to complete the county-wide hazard mitigation plans in Caddo, Comanche, Cotton, McClain, Stephens and Tillman Counties.

At these meetings plans of action will be formulated by which our communities can offset, or lessen, the effects of a natural hazard. Examples could range from educational programs for children on severe thunderstorm safety to lessening the effects of an ice storm. Mayors and Fire Chiefs from communities in these seven counties will be invited by direct mail. Any interested citizen who would like to assist in this planning effort is welcome to attend.

Scheduled dates and locations are:

Comanche County: Feb. 3, 1:00 P.M. Great Plains Tech Center (Lawton), Room 656, Building 600

McClain County: Feb. 4, 1:00 P.M. Mid-America Tech Center (Wayne), Industrial Training Room, Adult Education Department (east side of campus)

Tillman County: Feb.5, 1:00 P.M. Courthouse, Frederick.

Caddo County: Feb. 6, 1:00 P.M. Caddo-Kiowa Tech Center (FT. Cobb) Panther Room (tentative)

Cotton County: Feb.7, 1:00 P.M. Cotton Electric Cooperative Civic Room (Walters)

Jefferson County: Feb.7, 9:30 A.M. Courthouse, Waurika.

Stephens County: Feb. 10, 1:00 P.M. Red River Tech Center (Duncan)

Tillman County Natural Hazard Mitigation Plan Workshop
Feb. 3-2003
Tillman County Courthouse

Attendees: Bobby Blair, Leon Wright, Kent Smith, Joe Don Dickey, Leslie Crosby, Jerri Boyd, Bobby Givins, Blaine Smith, Jim Holland, Robert Johnston, Owen Fry, Billy Manschack, Randy Clark, Jeff Rector, Stan Rice, Floyd Hughes.

Stan Rice from ASCOG moderated the meeting. Discussion centered on action items and the cost benefit of each project. Potential funding sources were also discussed. Prioritization of each hazard was completed using a weighted grading score sheet.

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For Immediate Release

Brenda Biffle
Public Information Director
O: 800.658.1466
H: 580.252.3362

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