Special Topics

Seminole County Disaster Resiliency Assessment

The purpose of this section is to assess at the county level key components of disaster resiliency. Housing location and quality as well as planning activities can help reduce impacts from disaster events and allow for faster recovery. Disasters can include tornadoes, extreme weather, high winds, as well as man-made events. These events may largely be inevitable, but the ability to reduce damage and casualties as well recovery can be improved with good planning.

C.0 Comprehensive Plans & Hazard Mitigation Plans

There are 9 cities and towns within the county. The three key cities within the county are Seminole, Wewoka, and Konawa.

Comprehensive plans are the guiding documents for cities of various sizes to address key aspects of their community from land use, transportation, environment, housing, and economic development. The City of Seminole has an adopted comprehensive plan.

The following is language in the plans that addresses land use decisions that reduce placing housing and businesses within historical areas of risk (e.g. flooding) and other supporting actions to increase disaster resiliency.

City of Seminole Comprehensive Plan Elements addressing housing and community resiliency:

- Seminole 2030 Community Assessment: Flood hazard areas have been identified by the Federal Emergency Management Agency (FEMA) to assist in developing sound plain management measures. Ares having one percent chance of being flooded in any given ear, commonly referred to as the 100-year flood, are the base flood for instituting such measures. Seminole is bisected by Magnolia Creek and its adjacent floodplains which limits development but creates opportunities for passive recreation areas and natural resource protection. Flood Insurance Rate Maps (FIRMs) identify the floodplains and floodways in Seminole.

- Emergency Management Services are jointly provided to the City of Seminole and Seminole County from the Seminole County Local Emergency Planning Committee (LEPC).

- Seminole participates in the National Flood Insurance Program (NFIP) and has adopted the 2009 Flood Insurance Rate Map (FIRMs) from the Federal Emergency Management Agency (FEMA).

- Objective LU2.3- Ensure that development around Magnolia Creek, Wewoka Creek, and Sportsman Lake protects that natural environment while serving as a destination and tourism attraction through utilization of buffering and Low Impact Development techniques.

- Objective LU3.3- As part of stormwater management initiatives, protect wetlands through a local wetland ordinance and consideration of wetlands through requiring master plans, zoning ordinances, subdivision and site plan review.

- Objective LU3.5- Develop stormwater management strategies and policies to protect water supplies and reduce the risk of flooding including allowances and incentives for Low Impact Development (LID)

- Objective LU3.11- As part of stormwater management strategies, new parking lots should dedicate 5% of total area to low impact development landscaping and existing parking lots should be retrofitted over the next ten year period or when the use changes, whichever comes first.

- Plan identifies that key challenges for infrastructure are reducing stormwater runoff and that Seminole does not have a plan for managing stormwater.

- Objective IS2.4 -Adopt a stormwater management ordinance that minimizes the amount of sediment and pollutants leaving construction sites.

- Objective IS2.5- Adopt Low Impact Development standards for stormwater management.

- Short Term Work Table Project: Develop a Stormwater Management Plan 2015-2017. Cost Estimated to be $100K.

Based on the review of the existing and available comprehensive plans for the area, it is recommended that any future comprehensive planning work done include coordination and goals to address disaster resiliency.

The other key plan for a city to manage, mitigate and plan for recovery related to disasters is a **Hazard Mitigation Plan** (or Emergency Management Plan). Often in low density counties, the Hazard Mitigation Plan is done at the county level, though some cities may augment the county plan with a city plan.

The City of Seminole does have their own Emergency Manager and operates their own Hazard Mitigation Plan. Though the current HMP has expired, a new draft of the HMP has been completed, has been sent to the state, and is awaiting adoption. Upon state acceptance, the document will be sent to FEMA for approval.

Seminole County also has their own Hazard Mitigation Plan that is operated by the County Emergency Manager. Though the current HMP has expired, the county has hired an external party to update the HMP for state and FEMA approval. The plan is still in the development stages and has not been submitted to the state for approval.

C.2.1.1. Historical Data on Natural Disasters and Other Hazards

Data on historical damages and casualties is typically collected as part of a **Hazard Mitigation Plan** preparation to determine the appropriate planning measures and actions to take before and after an event.

For the City of Seminole the Hazard Mitigation Plan contains the following historic data on disasters and damages in the city and county:

- ☐ Locations and dates of disaster events were listed for all natural hazards relevant to the City of Seminole including: drought, earthquakes, extreme heat/cold, flood, hail, high winds, lighting, tornado, wildfire, and winter storms. This also includes information on all FEMA declared disasters for Seminole County. The city has experienced 22 natural disasters since 1970.
- ☐ Property damages. Data for damages and financial loss was not available for all hazards, but was available for flooding ($2.5 Million for years 2007, 2008, and 2015), high hinds ($150K in 2012

and $5K in 2005), winter storms ($80K in property damages for 2007), and wildfires (5,161 acres burned from 2009-2015).

- ☐ Casualties were not listed.

The Seminole County Emergency Manager was not aware of whether the new HMP (currently in development stage by external parties) would include historical data of previous disasters, property damages, or fatalities.

The proposed HMP for the City of Seminole (2015-2020) has four key goals with objectives:

Goal 1: Protect life and property
Goal 2: Support emergency services to improve the ability to respond to events and assist in the recovery of the community.
Goal 3: Promote public awareness through partnerships of shared resources and information throughout the community.
Goal 4: Encourage the development and implementation of long-term, cost-effective and environmentally sound mitigation projects that increases the protection on life and property in the City of Seminole.

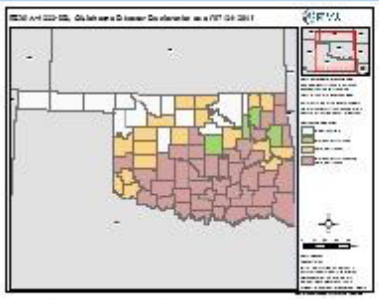
TABLE 2-1

Natural Hazards for the City of Seminole		
Hazard	**How reviewed**	**Why identified**
Drought	• Oklahoma Climatological Survey • National Climatic Data Center • Public Input Survey	Temperatures in Oklahoma can easily reach over 100 degrees & persist for many days and weeks.
Earthquake	• United States Geological Survey • Oklahoma Geological Survey • Past Historical Records	Past history, existing fault lines around and near the City of Seminole.
Extreme Heat/Cold	• National Weather Service • Oklahoma Climatological Survey • Public Input Survey	The City of Seminole has prolonged periods of high temperatures and is prone to wide swings of temperature.
Flood	• Local Emergency Management Records • Public Input Survey • National Climatic Data Center • National Flood Insurance Program	There is often flooding in the City of Seminole due to heavy rains.
Hail	• National Weather Service • National Climate Data Center • Oklahoma Climatological Survey • Public Input Survey	The City of Seminole experiences hailstorms during severe thunderstorms sometimes causes severe damage.
High Winds	• National Climatic Data Center • Public Input Survey • Oklahoma Climatological Survey • National Weather Service-Norman	The City of Seminole experiences high winds usually during severe thunderstorms although sometimes occurring without thunderstorm activity.
Lightning	• National Climatic Data Center • Public Input Survey • Oklahoma Climatological Survey • National Weather Service-Norman • National Lightning Safety Institute	The City of Seminole is susceptible to lightning every year associated with thunderstorms.
Tornado	• Local Emergency Management Records • Public Input Survey • FEMA Declarations • National Weather Service	Oklahoma has a distinction as the epicenter of Tornado Alley. The City of Seminole experienced 9 tornadoes since 1954.
Wildfire	• Local Emergency Management Records • City of Seminole Fire Dept. Records • Public Input Survey	Local fire department records reflect a particularly heavy wildfire season in 2011-2012.
	• FEMA Declarations	
Winter Storm	• National Weather Service • National Climate Data Center • FEMA Declarations • Sperry-Piltz Utility Ice Damage Index	Severe winter storms occur regularly in the City of Seminole.

Data on historical damages and casualties is typically collected as part of a **Hazard Mitigation Plan** preparation to determine the appropriate planning measures and actions to take before and after an event.

Historical natural disasters in for Seminole County are documented in the *proposed* City of Seminole Hazard Mitigation Plan (2015-2020). Twenty-six natural disasters have occurred and since 1970 have been formally declared disaster area by FEMA. Typical hazard disasters in the region include flooding, severe storms, tornadoes, and severe winter storms. (*Proposed* Hazard Mitigation Plan for the City of Seminole 2015-2020)

TABLE 2-2

Seminole County Declared Emergency/Disaster History (Excludes Fire Management Assistance History)				
Incident Date	**Nature of Disaster**	**FEMA # Declared Date**	**Area Affected**	**Declared Area**
May 5-June 22, 2015	Severe Storms, Flooding, Tornadoes	4222 **Declared:** May 26, 2015	Statewide	
May 18-June 2, 2013	Severe Storms and Tornadoes	4117 **Declared:** May 20, 2013	Statewide	
Jan 31-Feb 5, 2011	Severe Winter Storm	3316 **Declared:** Feb 2, 2011	Statewide	No Map Available
May 10-13, 2010	Severe Storms, Tornados, and Straight-Line Winds	1917 **Declared:** May 24, 2010	County wide and surrounding counties	No Map Available
Jan 28-30, 2010	Severe Winter Storm	1883 **Declared:** Mar 5, 2010	County wide and surrounding counties	No Map Available
Dec 24-25, 2009	Severe Winter Storm	1876 **Declared:** Feb 25, 2010	County wide and surrounding counties	No Map Available

Jan 28-30, 2010	Severe Winter Storm	3308 **Declared:** Jan 30, 2010	Statewide	No Map Available
April 9, 2008-April 28, 2008	Severe Storms, Tornadoes, and Flooding	1754 **Declared:** May 9, 2008	County wide and surrounding counties	No Map Available
Dec 8, 2007-Jan 3, 2008	Severe Winter Storm	1735 **Declared:** Dec 18, 2007	County wide and surrounding counties	No Map Available
Dec 8, 2007-Jan 3, 2008	Severe Winter Storm	3280 **Declared:** Dec 10, 2007	Statewide	No Map Available
May 24-June 1, 2007	Severe Storms, Flooding, and Tornadoes	1723 **Declared:** Aug. 31, 2007	Statewide	No Map Available
Aug 18-Sept 12, 2007	Severe Storms, Tornados, and Flooding	1718 **Declared:** Aug 24, 2007	County wide and surrounding counties	No Map Available
June 10- July 25, 2007	Severe Storms, Flooding, and Tornados	1712 **Declared:** July 7, 2007	County wide and surrounding counties	No Map Available
May 4-11, 2007	Severe Storms, Tornados, and Flooding	1707 **Declared:** June 7, 2007	County wide and surrounding counties	No Map Available
Jan 12-26, 2007	Severe Winter Storms	1678 **Declared:** Feb 1, 2007	County wide and surrounding counties	No Map Available
Jan 12-26, 2007	Severe Winter Storm and Flooding	EM-3272 **Declared:** Jan 15, 2007	Statewide	No Map Available
Nov 27, 2005-Mar 31, 2006	Severe Wildfire Threat	DR-1623 **Declared:** Jan 10, 2006	Statewide	No Map Available
Aug. 29-Oct. 1, 2005	Hurricane Katrina Evacuation	EM-3219 **Declared:** Sept. 5, 2005	Statewide	No Map Available
May 8-May 30, 2003	Severe Storms and Tornadoes	DR-1465 **Declared:** May 10, 2003	Statewide	No Map Available

Dec. 25, 2000-Jan. 10, 2001	Severe Winter Storm	DR-1355 **Declared:** Jan. 5, 2001	Statewide	No Map Available
Feb. 27-May 31, 1996	Fire Emergency	EM-3158 **Declared:** Feb. 27, 1996	Statewide	No Map Available
May 26-June 11, 1995	Flooding, Severe Storm, Tornado	DR-1058 **Declared:** June 26, 1995	Statewide	No Map Available
April 14-June 1, 1990	Flooding, Severe Storm, Tornado	DR-866 **Declared:** May 18, 1990	Unknown	No Map Available
June 10, 1974	Severe Storms and Flooding	DR-441 **Declared:** June 10, 1974	Unknown	No Map Available
Dec. 19,1973	Severe Storms and Flooding	DR-409 **Declared:** Dec. 10, 1973	Unknown	No Map Available
Oct. 14, 1970	Heavy Rains, Tornadoes, Flooding	DR-297 **Declared:** Oct. 14, 1970	Unknown	No Map Available

Drought

Historical Context: **"**Drought has cyclically been a problem for the state. Drought is often followed by potential for severe flooding due to absorption rates for soils. The City of Seminole is subject to all levels of drought conditions. Although water supplies are pumped from well sites and not a lake, the City of Seminole can be impacted by agricultural losses which severely impact the local economy during times of drought." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

Table 2-3

City of Seminole Drought Events 2004-2014 Data from the National Climatic Data Center (NCDC)		
Date	Description	Crop Damage
May 2014-July 2014	While several rainfall events occurred throughout the month, drought conditions remained mostly unchanged across Oklahoma. Despite, several rainfall events, D2 (severe) drought persisted across the city.	Unknown
September 2013	Rainfall ranged from somewhat below to somewhat above average during September in Oklahoma. The northern half of the state generally saw a marginal improvement in drought conditions, while the southern half saw marginal worsening with less rainfall. No drought was present at the beginning of the month, but persistent dry conditions allowed the development of D0 (abnormally dry) drought by the end of the month.	Unknown
July 2012-April 2013	The drought conditions that had affected the City of Seminole earlier in the year returned in late June and early July as little precipitation fell and excessive days of temperatures over 100 degrees dried out vegetation and water levels from lakes and ponds dropped. Numerous grass fires were reported causing fire department resources to spread out across the county. At the end of August all of the City of Seminole was in a D3 (Extreme) drought and had been for over a month.	Unknown
Jan 2011-Mar 2012	Several months of below normal precipitation continued to wreak havoc on Oklahoma's agriculture. Summer	Unknown

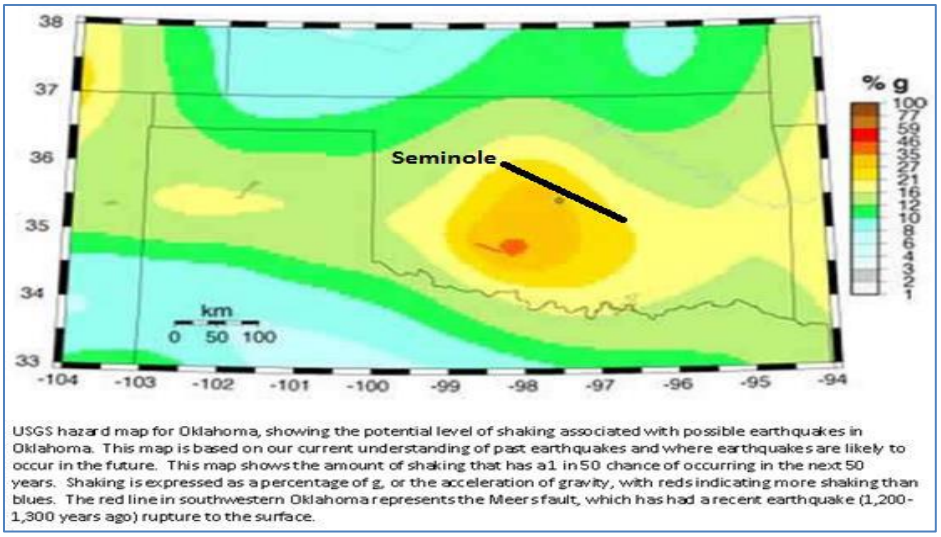
	and fall crops, hay forages, and alfalfa were hit hard by the lack of any significant precipitation. Beginning in February and throughout the year, numerous grass fires were reported each month due to the exceptionally dry conditions and very hot temperatures. The effects of the drought lasted until the early months of 2012 when substantial precipitation assisted in relieving the City of Seminole from drought conditions.	
Oct 2006-Jan 2007	Despite some rainfall the drought continued across much of western and central Oklahoma during October. The area was under severe to exceptional (D2-D4) drought conditions throughout the month. The worst conditions were in south central and southeast Oklahoma where drought conditions were in the extreme to exceptional (D3-D4) drought categories. Participation in January improved areas of the state and the moisture that saturated the ground ended the drought effects.	Unknown

According to the proposed HMP for the City of Seminole, based on past recent history and the seasonal drought outlook from NOAA, the probability of future drought events in the City of Seminole is "LIKELY". (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

Mitigation Strategy / Recommendations from HMP: "Drought is a concern for the City of Seminole due to the major agricultural activity and low water availability. The most vulnerable population in the City of Seminole, in addition to agricultural and drinking water, are those that might require large volumes of water, such as industries, landscapers, fire fighters, and the people dependent upon them." The HMP Action Projects 34, 35, and 38 (wells, additional water capacity, and xeriscaping) were identified as threes approachs to aid in drought mitigation.

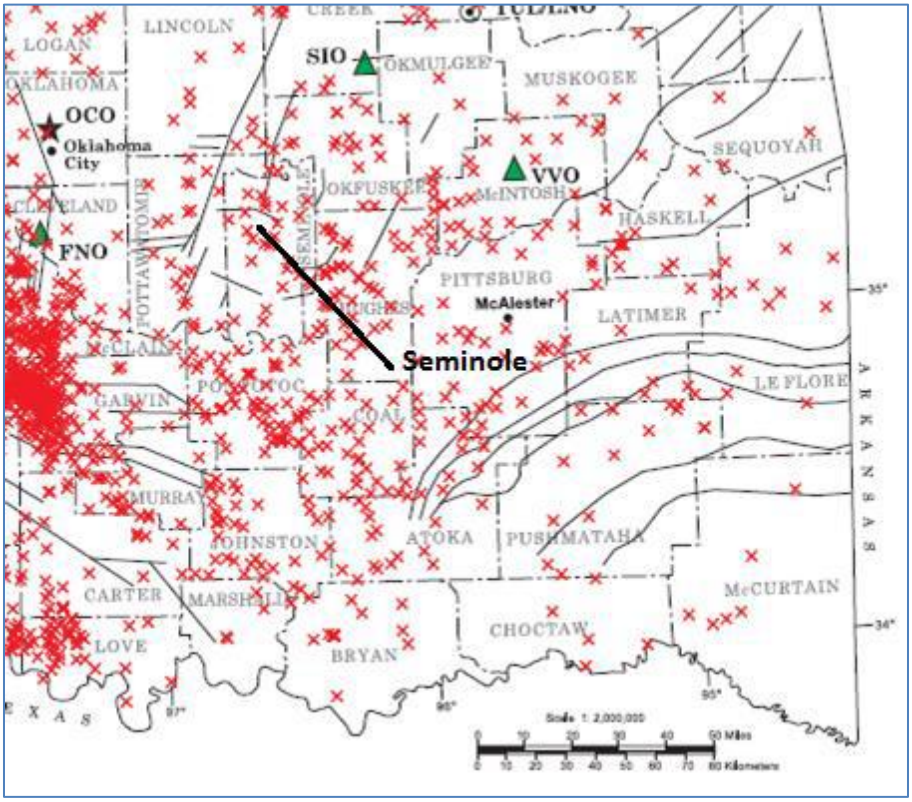
Earthquake

Historical Context: Oklahoma is at a moderate risk for an earthquake, as a result of the State's proximity to the New Madrid Seismic Zone. Past earthquakes near or in the City of Seminole have been slight, with minor to moderate damage to structures in the city. The Oklahoma Geographical Survey Observatory provides a brief history of earthquake activity affecting the City of Seminole. Although listed, the effects of these earthquakes may or may not have been felt in the City of Seminole.



USGS hazard map for Oklahoma, showing the potential level of shaking associated with possible earthquakes in Oklahoma. This map is based on our current understanding of past earthquakes and where earthquakes are likely to occur in the future. This map shows the amount of shaking that has a 1 in 50 chance of occurring in the next 50 years. Shaking is expressed as a percentage of g, or the acceleration of gravity, with reds indicating more shaking than blues. The red line in southwestern Oklahoma represents the Meers fault, which has had a recent earthquake (1,200-1,300 years ago) rupture to the surface.

(*Proposed* City of Seminole Hazard Mitigation Plan 2015-2020)



(*Proposed* City of Seminole Hazard Mitigation Plan 2015-2020)

Table 2-4

City of Seminole Earthquake Events October 24, 2005-October 24, 2015 Information provided by the Oklahoma Climatological Survey					
Date	Time (UTC)	Depth (km)	Magnitude	Latitude	Longitude
08/09/2015	02:56:18	6.9	3.6	35.439°N	97.109°W
06/12/2015	22:35:38	6.5	3.5	35.558°N	97.125°W
11/30/2014	06:59:56	6.9	3.6	35.538°N	96.771°W
11/13/2014	01:28:31	3.1	3.6	35.350°N	96.539°W
10/20/2014	20:34:16	4.8	3.5	35.417°N	96.558°W
08/18/2014	02:50:09	5.0	3.5	35.372°N	96.487°W
01/09/2014	03:26:53	3.2	3.8	35.542°N	96.773°W
07/24/2013	11:52:05	8.6	3.5	35.373°N	96.481°W
01/04/2013	01:59:20	5.0	3.5	35.380°N	96.515°W
05/10/2012	21:14:31	5.0	3.8	35.510°N	96.781°W
04/16/2012	08:12:00	4.4	3.8	35.530°N	96.759°W
12/31/2011	08:07:17	5.0	3.6	35.391°N	96.520°W
12/25/2011	14:10:41	5.0	3.6	35.398°N	96.530°W
11/08/2011	19:05:18	3.0	3.5	35.526°N	96.770°W
11/08/2011	02:46:57	5.0	4.8	35.531°N	96.788°W
11/06/2011	15:07:07	5.0	3.8	35.484°N	96.856°W
11/06/2011	10:52:35	3.1	3.6	35.537°N	96.779°W
11/06/2011	09:39:57	5.0	3.7	35.469°N	96.865°W
11/06/2011	09:22:04	5.0	3.5	35.485°N	96.844°W
11/06/2011	07:38:31	5.0	3.6	35.517°N	96.834°W
11/06/2011	06:31:11	5.0	3.7	35.479°N	96.859°W
11/06/2011	04:31:50	5.0	3.9	35.522°N	96.776°W
11/06/2011	04:03:42	5.0	4.0	35.521°N	96.771°W
11/06/2011	03:53:10	5.2	5.6	35.532°N	96.765°W
11/05/2011	14:36:30	5.0	3.6	35.518°N	96.778°W
11/05/2011	07:12:45	3.1	4.8	35.550°N	96.764°W
03/22/2010	02:37:18	8.0	3.7	35.556°N	96.750°W
02/27/2010	22:22:27	5.0	4.1	35.553°N	96.752°W

Mitigation Strategy / Recommendations from HMP: "Based on available information, the potential impact of earthquakes to the City of Seminole is moderate. Futures felt earthquakes in and around the City of Seminole are likely. Based upon public input and data from the USGS, the potential of damaging earthquakes in the City of Seminole is "Possible." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020) Many action projects were recommended to address earthquake related risks and hazards including: construction standards, earthquake resistant utilities, etc.

Expansive Soils

Historical Context: Expansive soils are one of the nation's most prevalent causes of damage to buildings and construction. The City of Seminole is located in the cobby loam soil texture of Oklahoma. Residents and city officials my notice cracked foundations, floors, and basement walls which are typical of expansive soils. There is apparent expansive soils damage to buildings in the City of Seminole." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020).

Mitigation Strategy / Recommendations from HMP: "The State of Oklahoma does not have disaster information on expansive soils because a disaster declaration has never been declared for an event. The expansive soil hazard develops gradually and is difficult to attribute to a particular damage or issues. No history is available for the City of Seminole as well, although members of the CSHMPT expressed individual knowledge of problems with cracking walls and foundations due to expansive soil conditions. Based upon public input and local construction reports, the potential of expansive soil in the City of Seminole is "LIKELY". It is possible to build successfully and safely on expansive soils if stable moisture content can be maintained or if the building can be insulated from any soil volume change that occurs." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

Extreme Heat

Historical Context: The City of Seminole and the State of Oklahoma are at risk for extreme heat, although temperatures experienced in the City of Seminole do not compare with western Oklahoma that experience 35 – 40 days of temperatures over 100 degrees.

TABLE 2-5

City of Seminole Extreme Heat History
2010-2015
Data provided by the Oklahoma Climatological Survey

Year	Days above 90 degrees	Days above 100 degrees	City of Seminole	
			Fatalities	Injuries
2012	93	34	Unknown	Unknown
2011	109	63	Unknown	Unknown
Average High for July: 93.1 degrees Average Number of Days above 90 degrees: 76				

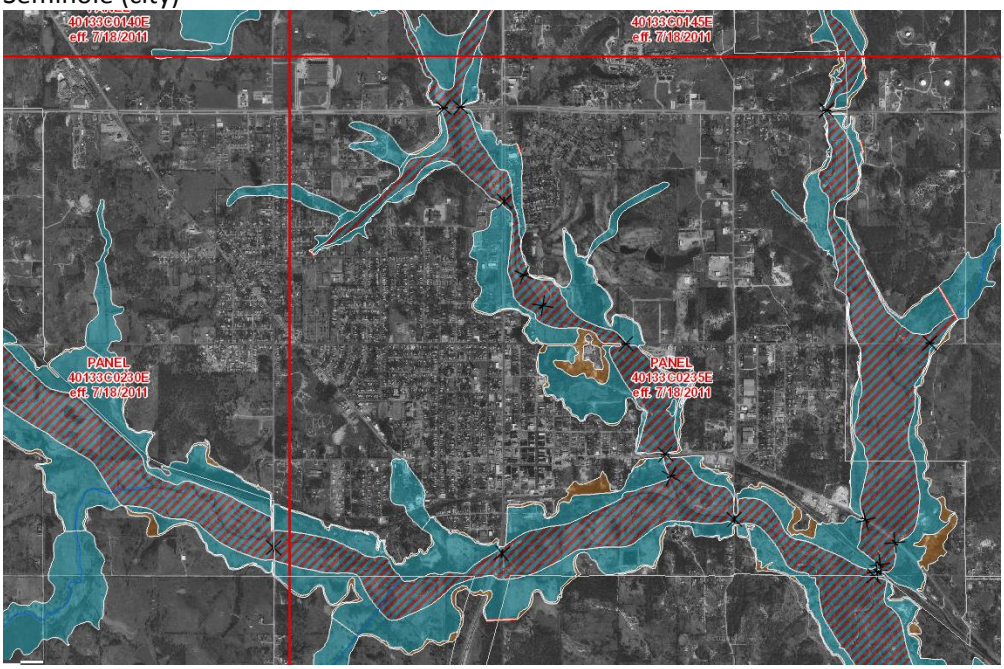
Mitigation Strategy / Recommendations from HMP: "The entire state of Oklahoma is at risk for extreme heat. Based on history and public input, the probability of a future extreme heat event in the City of Seminole is "HIGHLY LIKELY. Extreme heat deaths are usually from that group of citizens, although handicapped and very young can sometimes be victims of extreme heat also. In the City of Seminole, various groups will volunteer fans and air conditioners free of charge for people who can't afford them." The HMP action projects include measures to address this hazard.(Proposed City of Seminole Hazard Mitigation Plan 2015-2020).

Flood

Historical Context: "The City of Seminole is susceptible to severe flooding primarily due to flash flooding affecting primarily low-lying areas throughout the city, although riverine flooding from the Wewoka Big Cree is also possible especially in the central parts of the city." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

There are areas where development in Seminole has encroached on the floodplain and this should be avoided for new housing and development.

Seminole (city)



FEMA's National Flood Hazard Layer http://fema.maps.arcgis.com/

Flood Hazard Zones

1% Annual Chance Flood Hazard

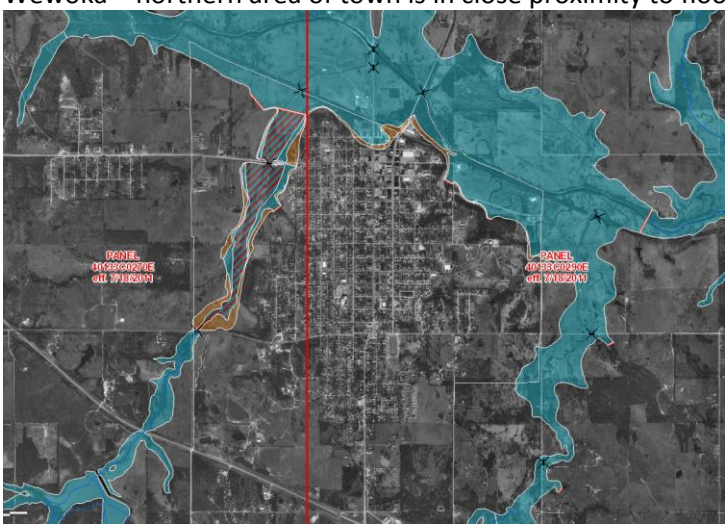
Bowlegs – town is predominantly outside of prime floodplain risk areas

FEMA's National Flood Hazard Layer http://fema.maps.arcgis.com/

Flood Hazard Zones

1% Annual Chance Flood Hazard

Wewoka – northern area of town is in close proximity to floodplain.



FEMA's National Flood Hazard Layer http://fema.maps.arcgis.com/

Flood Hazard Zones

1% Annual Chance Flood Hazard

TABLE 2-6

City of Seminole Flood Events 1996-2015 Information provided by the National Climatic Data Center (NCDC)		
Date	**Location**	**Description**
08 May 2015	Seminole	**Flash Flood**-Numerous roads flooded and impassable. No damage reported.
19 Aug 2007	Seminole	**Flash Flood**-Tropical Storm Erin, the fifth named storm of the 2007 Atlantic Hurricane season, developed quickly over the northeast Gulf of Mexico on the 15th, before moving onshore during the morning hours of the 16th. Erin maintained her depression status as it then began to move northeast into southwest Oklahoma between Hollis and Erick during the afternoon hours of Saturday, August 18th. A very tropical airmass was in place along and east of this feature, extending into western and central Oklahoma. Heavy rainfall developed along and east of the center, which moved slowly to the northeast. Three

		to four feet of water accumulated at the Seminole Ford/Mercury car dealership. Numerous city and county roads were closed due to the high water. A 67-year old woman drowned as her car was washed off the roadway into Magnolia Creek.
20 June 2007	Seminole	**Flash Flood**-A widespread severe thunderstorm event occurred over much of Oklahoma from the 19th into the 20th. A weakly capped airmass, combined with a surface trough oriented northwest to southeast over Oklahoma, and afternoon heating allowed for another round of strong to severe thunderstorms to develop. Several roads were closed due to high water. John's Park was completely flooded.
22 June 2004	Seminole	**Flood**-The most significant heavy rainfall and flooding event of June occurred on June 19-24. Rainfall totals for the 72-hour period ending at 7:00 am CDT on June 22 reached 2 to 3 inches in a wide swath that included most of northwest, west central, north central, and central Oklahoma. The subsequent heavy runoff produced by these rains generated flash flooding and riverine flooding in northwestern and central Oklahoma.
03 Mar 2004	Seminole	**Flood**-No damage or injuries reported.
29 June 1999	Seminole	**Flood**-Periods of heavy rain, amounting to between 3 and 5 inches, fell across much of Seminole County for a 24-hour period from mid-day of the 29th through mid-day of the 30th. Flooding waters damaged several bridges, including the Sandcreek Bridge, washed out 2 roads, and severely damaged 2 others.
23 April 1999	Seminole	**Flood**-Five to 7 inches of rain fell across portions of central Oklahoma from the 24th through the 26th. In Seminole County Highway 9 was reported to be covered by high water from the Salt Creek 6 miles southwest of Bowlegs, and Sportsman Lake Road near Sportsman Lake in Wewoka was also flooded. Magnolia Creek in Seminole overflowed its banks as well flooding Seminole Municipal Park.
26 April 1998	Seminole	**Flash Flood**-Widespread 24-hour rainfall totals of 3 to 4 inches caused flash flooding in many areas. Particularly hard-hit were Garvin, Jefferson, Carter, and Seminole Counties. Several streets in northeast Seminole were barricaded due to high water. Several cars were stalled in the high water around town.
13 July 1996	Seminole	**Flash Flood**-Heavy rains flooded the Seminole Municipal Park, completely submerging the baseball fields and drainage ditches. An old oil storage tank was washed away by flash flood waters into a swollen creek.
11 July 1996	Seminole	**Flash Flood**-Portions of HWY 3E were under water between Seminole and Bowlegs; numerous streets were closed in Seminole.

Mitigation Strategy / Recommendations from HMP: Flooding is major concern for the City of Seminole. A major effort the city has identified to address flooding is the development of a storm water management plan. The City of Seminole Comprehensive Plan highlights many objectives to address storm water management. The HMP action projects include measures to address this hazard.

Hail

Historical Context: "The City of Seminole and Seminole Public School District are subject to hail storms. Usually associated with severe thunderstorms, all structures, wildlife, livestock, and the entire population is subject to hail damage." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

TABLE 2-7

City of Seminole Hail Storm History 2005-2015 (Only events with 1 inch hail or greater are profiled)				
Date	Location	Time	Hail Size (inches)	Damage
31 Mar 2015	Seminole	8:10 PM	1.75	Unknown
31 Mar 2015	Seminole	8:04 PM	1.75	Unknown
30 Mar 2013	Seminole	6:30 PM	1.75	Unknown
03 Feb 2012	Seminole	5:10 PM	1.75	Unknown
11 June 2011	Seminole	3:55 PM	1.00	Unknown
12 May 2011	Seminole	5:45 PM	1.00	Unknown
06 April 2010	Seminole	10:55 PM	1.00	Unknown
09 April 2008	Seminole	4:25 PM	1.00	Unknown
09 April 2008	Seminole	4:25 PM	1.00	Unknown
01 April 2006	Seminole	10:49 PM	1.00	Unknown
13 June 2005	Seminole	4:52 PM	1.00	Unknown

Mitigation Strategy / Recommendations from HMP: "Oklahoma and the City of Seminole property and citizens are susceptible to hail storms and will continue to be at risk. The City of Seminole experience several hailstorms a year, some of them causing damage. The entire city is at risk from hail and the probability of future events is "HIGHLY LIKELY". Public information is critical to minimize the effects of hail. An informed public can prevent some damage and in particular injuries or deaths." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020).The HMP action projects include measures to address this hazard.

High Winds

Historical Context: "The City of Seminole experiences high winds exposing virtually all structures, infrastructure, and individuals in the city to their effects. According to the Oklahoma Climatological Survey, the City of Seminole experiences an average of 50 thunderstorm days annually some of which will have warnings issued during the event." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

TABLE 2-8

City of Seminole High Wind Events 2005-2015 Information provided by the National Climatic Data Center (NCDC)			
Date	**Location**	**Description**	**Estimated Damage**
29 May 2012	Seminole	A metal canopy was flipped, causing damage to the main airplane hangar at Seminole airport including minor damage to several planes. Several small trees were blown down along with one power pole. Two portable buildings were also destroyed. Monetary damages are estimated.	$150,000
11 June 2011	Seminole	The front that had waffled over Oklahoma for three four days began slowly lifting north as a warm front. Several areas of showers and thunderstorms developed near and just north of the front. A couple of the storms were able to maintain themselves, developing supercell characteristics, with very large hail and damaging winds.	Unknown
04 July 2005	Seminole	Trees and tree limbs were downed. A few 4th of July fireworks stands were also downed.	$5,000

Mitigation Strategy / Recommendations from HMP: "The City of Seminole will continue to have thunderstorms with high winds, some being severe. There will continue to be damage from thunderstorm high winds. Considering the high winds experienced, the probability of high winds in the City of Seminole is "HIGHLY LIKELY. Oklahoma and the City of Seminole have significant exposure to high wind events. Infrastructure damage most often occurs to transmissions lines and communications facilities; however, occasional damage to structures can arise during downbursts. Unfortunately, early warning for downburst is limited due to the speed in which they develop, although research in ongoing through the National Weather Service (NWS) to increase warning information for the public." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020).The HMP action projects include measures to address this hazard.

Lightning

Historical Context: " The National Weather Service publication, Storm Data, records 100 deaths from lightning strikes in Oklahoma between 1959 and 2012, and ranks the state 17th in the nation. The City of Seminole and Seminole Public Schools are vulnerable to lightning. Hundreds of thunderstorm events take place across Oklahoma each year. Most bring welcome precipitation but the lightning that accompanies them occasionally causes damage, injury, or death. The City of Seminole and Seminole Public Schools consider all thunderstorms that produce lightning to be dangerous." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

Mitigation Strategy / Recommendations from HMP: "Property damage and possibly injuries from lightning are expected in the City of Seminole especially during thunderstorms. The probability of future lightning events is "HIGHLY LIKELY". Schools are most susceptible to

lightning during outdoor activities such as sporting activities which often draw large crowds. Public education is important in lessening the effects of lightning by encouraging residents to remain inside or in their cars during lightning events. Additionally early warning research is ongoing through the National Weather Service (NWS) and private organizations to improve notification and threat information to the public." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

Tornado

Historical Context: "The entire state of Oklahoma is at risk for tornadoes including all of the City of Seminole. Oklahoma and the City of Seminole are located in the center of the infamous Tornado Alley. Oklahoma averages 58 tornados annually. National Weather Service documents that the City of Seminole has experienced 9 tornados since 1956." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

TABLE 2-9

City of Seminole Tornado History		
Category	Date	Fugita Scale
Tornado	06/08/1956	F-2
Tornado	06/16/1967	F-0
Tornado	04/19/1968	F-3
Tornado	05/06/1973	F-2
Tornado	11/01/1984	F-1
Tornado	04/29/1985	F-1
Tornado	06/09/1995	F-2
Tornado	05/06/2007	EF-0
Tornado	05/10/2010	EF-3

Mitigation Strategy / Recommendations from HMP: "Based on the location of Oklahoma between the warm humid air from the Gulf of Mexico, the arid hot air from New Mexico, and the cool air from the Rocky Mountains, conditions are right as proven by the history of tornados in Oklahoma for tornados to continue to threaten the City of Seminole. Public input and review by the City of Seminole Hazard Mitigation Planning Team agree that the potential for future tornados in and around the City of Seminole is POSSIBLE." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

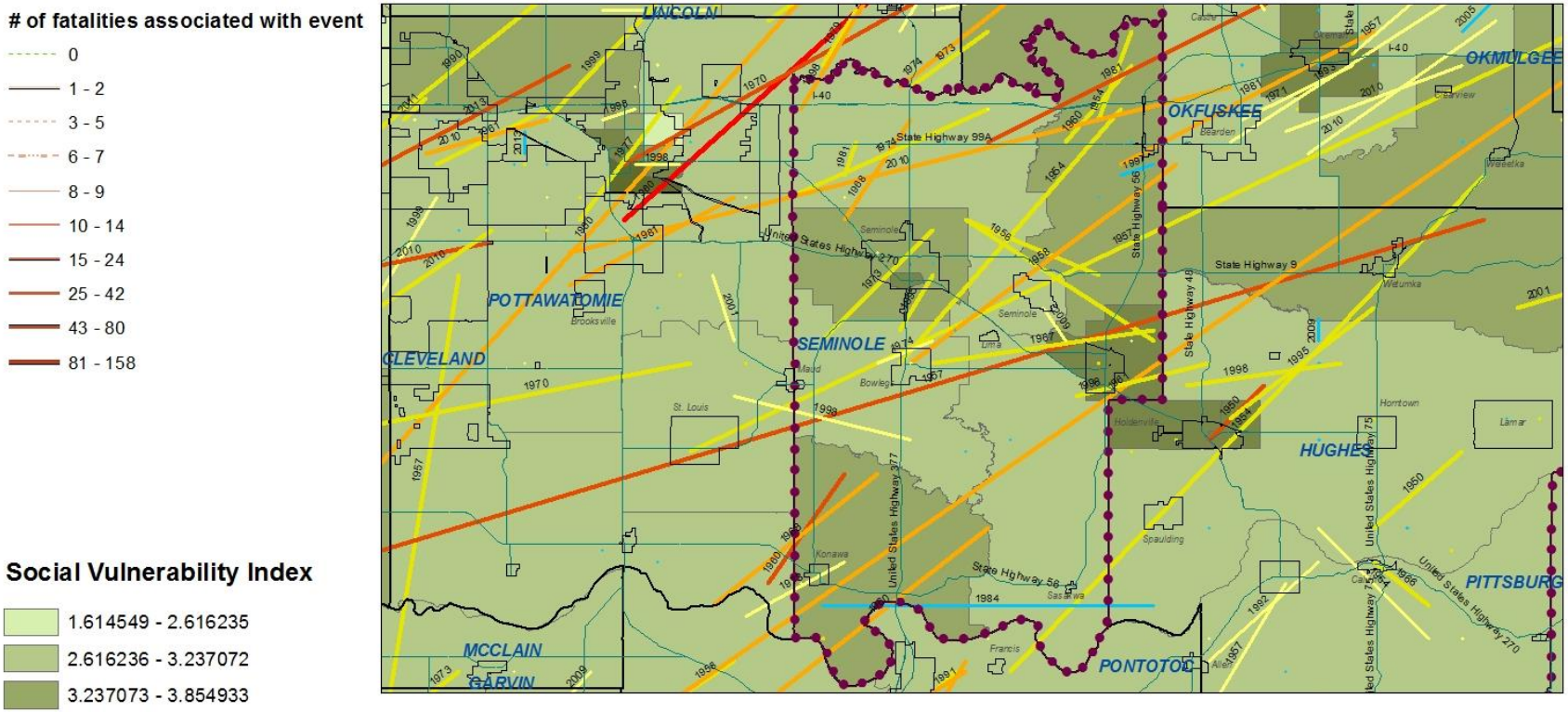
"Fortunately better construction practices can limit the damage potential from all but the most violent tornados. The residences and businesses of today are more likely to withstand the damaging winds of weaker tornados than those structures built fifty years ago; however there are still many older residential structures in the county and even the stronger modern structures are not immune to major tornados. The inclusion of safe rooms, below ground shelters, and hurricane straps in current construction plans have help mitigate the effects of tornados to both life and property. Additionally, the National Weather Service is also taking steps to improve warning time. The next step in NOAA's long-time weather radars is phased array radar. Special

considerations need to be given to all critical facilities important to the survival and response to emergencies in the City of Seminole, as well as highways that might be closed due to debris." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020).The HMP action projects include measures to address this hazard.

Social Vulnerability - Impacts on Housing & Disaster Resiliency

Tornado Events 1950 - 2014

Seminole County

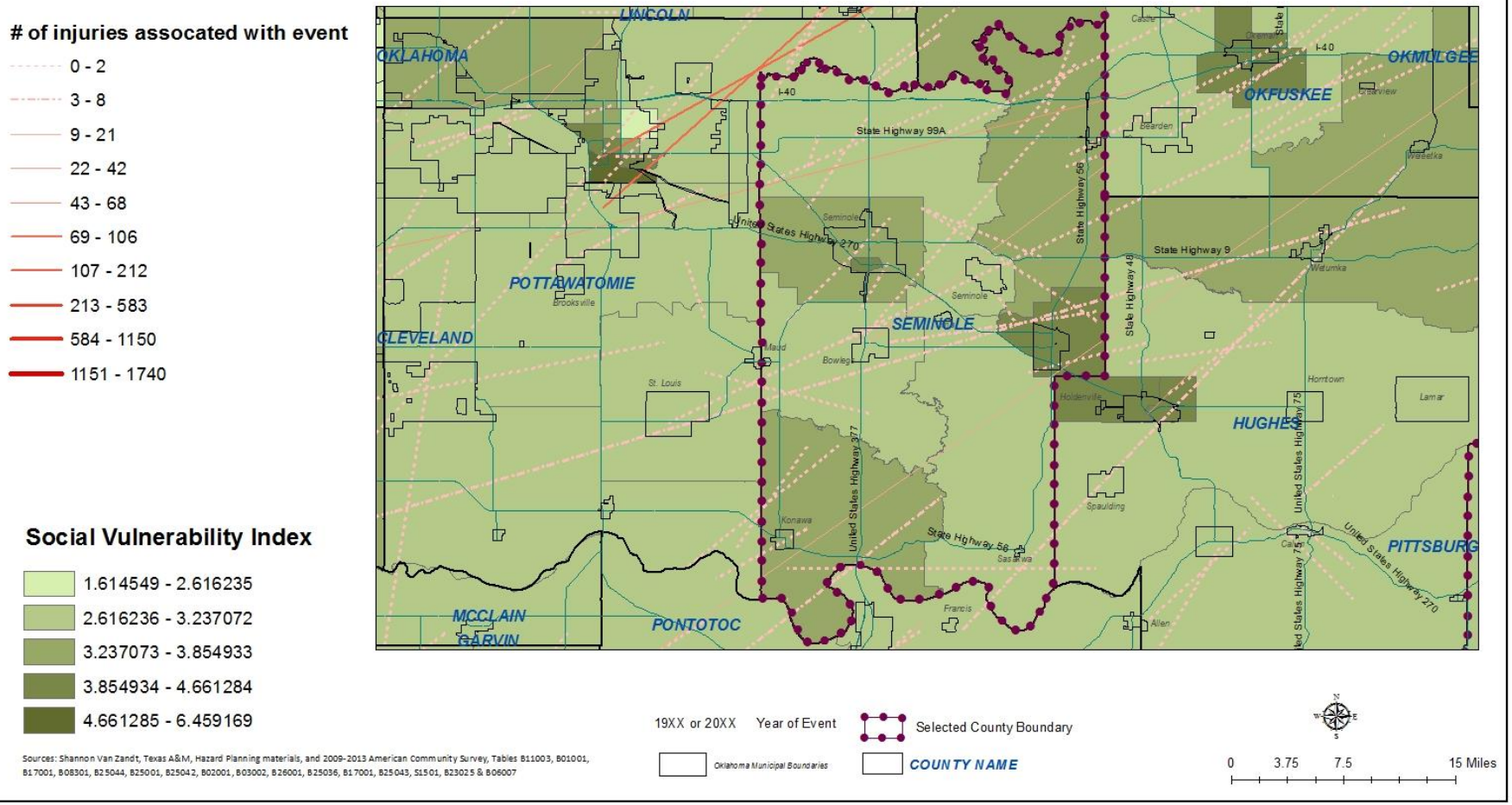


Sources: Shannon Van Zandt, Texas A&M, Hazard Planning materials, and 2009-2013 American Community Survey, Tables B11003, B01001, B17001, B08301, B25044, B25001, B25042, B02001, B03002, B26001, B25036, B17001, B25043, S1501, B23025 & B06007

Social Vulnerability - Impacts on Housing & Disaster Resiliency

Tornado Events 1950 - 2014

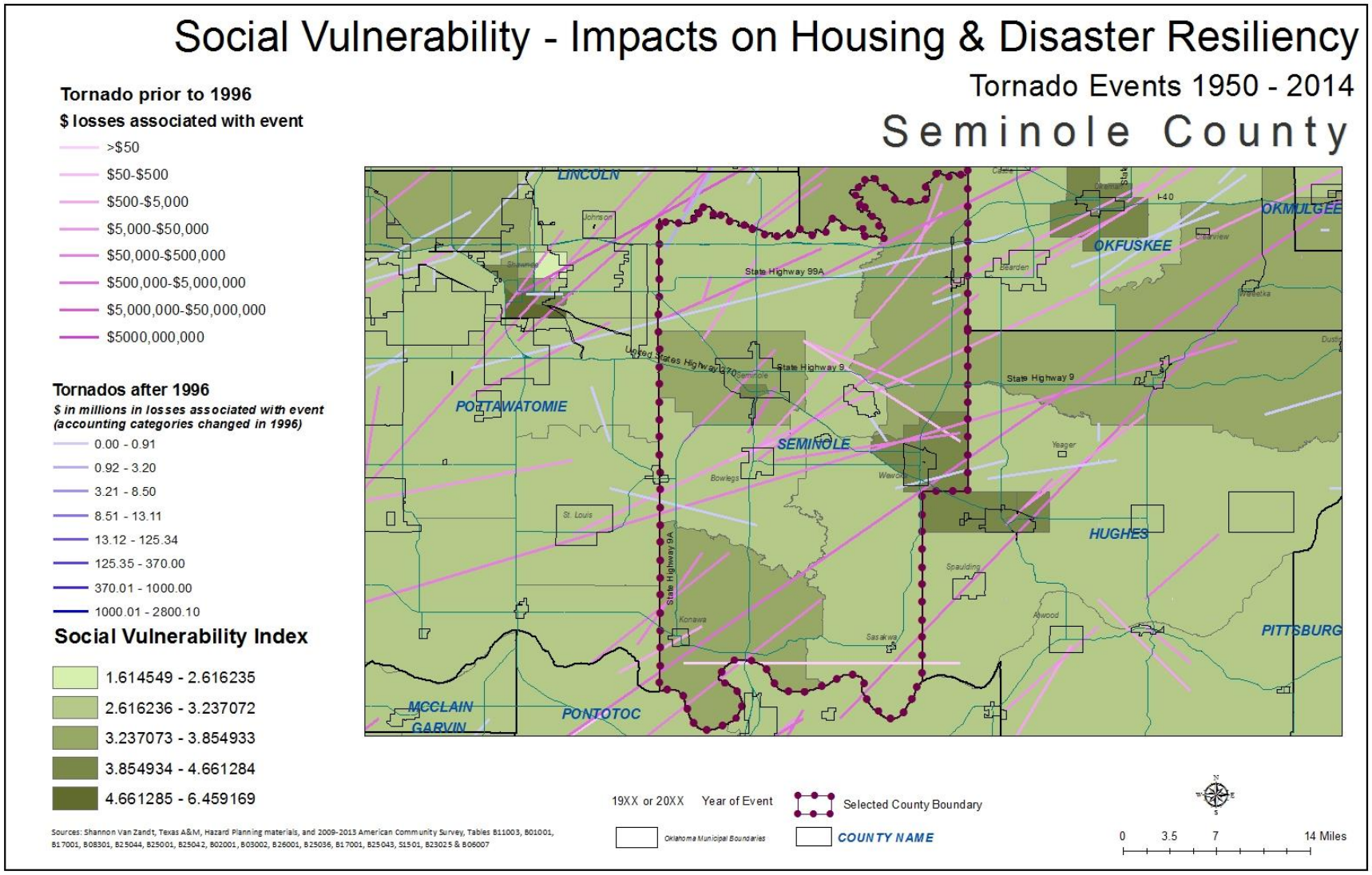
Seminole County



Social Vulnerability - Impacts on Housing & Disaster Resiliency

Tornado Events 1950 - 2014

Seminole County



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Wildfire

Historical Context: "The City of Seminole has the potential of grass fires and wildfires in and around the city limits and wild land urban interface areas, particularly the areas with high density of red cedars." (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

TABLE 2-10

Seminole Fire Department Response Statistics Grass Fire, Brush Fire, Wildland Fire Nov. 2009-Oct. 2015			
Year	**Type of Incident**	**Number of Incidents**	**Acres Burned**
*2009	Grass Fire	2	1.00
2010	Grass Fire, Brush Fire, Wildland Fire	53	359.91
2011	Grass Fire, Brush Fire, Wildland Fire	131	2,449.09
2012	Grass Fire, Brush Fire, Wildland Fire	84	1,882.40
2013	Grass Fire and Brush Fire	30	56.19
2014	Grass Fire, Brush Fire, Wildland Fire	60	91.82
*2015	Grass Fire, Brush Fire, Wildland Fire	46	321.35
Total	Grass Fire, Brush Fire, Wildland Fire	413	5,160.76

*2009 statistics began in November 2009
*2015 statistics current as of October 11, 2015

Mitigation Strategy / Recommendations from HMP: "Based on past experiences; dry conditions during 10 months of the year, numerous small grass and wildfires; and the wooded areas having a significant amount of tall grasses and weeds, the potential of future grass and wildfires in and around the City of Seminole is "HIGHLYLIKELY". The City of Seminole is susceptible to wildfires. Public information efforts are necessary to help reduce the potential losses of residential and commercial structures in certain areas of the city."(Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

Winter Storm

Historical Context: "The City of Seminole and Seminole Public Schools have the potential for winter snow and ice storms. These events can be extremely paralyzing to the city. Even though the terrain is generally flat these events can still overwhelm the residents and their ability to travel to work, school, or other areas of the county. Along with affecting local activities, winter storms can have negative impact on the City of Seminole as a main transportation artery for central Oklahoma. (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

TABLE 2-11

City of Seminole Winter Storms 2005-2015 Information provided by the National Climatic Data Center (NCDC)			
Type of Winter Storm	**Date**	**Description**	**Estimated Damage**
Ice Storm	12/20/2013	Freezing rain prevailed through the event with widespread 1/4 to 1/3 inch ice accumulations on trees, power lines and other elevated surfaces.	No recorded damage
Winter Storm	02/08/2011	Two to four inches of snow was measured around Seminole county, including two inches measured in Seminole. Numerous wind gusts over 30 mph were reported for several hours greatly reducing visibilities and causing considerable blowing and drifting of the snowfall.	
Winter Storm	02/01/2011	Eight inches of snow was measured at Seminole. Wind gusts over 40 mph also created considerable blowing and drifting of the snowfall, which reduced visibilities. The event began during the evening hours of 1/31	No recorded damage
Winter Storm	01/31/2011	Thunder sleet, freezing rain, and snow began during the late evening, with wind gusts increasing to over 30 mph by midnight. The majority of the storm occurred on 2/1.	No recorded damage
Ice Storm	01/28/2010	Glaze accumulations averaged around a half of an inch on elevated surfaces, with some areas receiving near 3/4 of an inch. Widespread tree and power line damage was reported across the county, resulting in thousands without power. Several roads had to be closed due to tree limbs and power lines lying across them.	No recorded damage
Blizzard	12/24/2009	Five to eight inches of snow accumulated, with isolated totals up to ten inches. Frequent wind gusts of 50 to 60+ mph created considerable blowing and drifting snow, and greatly reduced visibilities.	No recorded damage
Winter Storm	01/26/2009	Two and a half inches of sleet accumulated in and around Seminole. Much of the total was a result of a band of thundersleet that moved through Seminole county early on the 27th. Prior to the sleet, 3/8 of an inch of ice glaze accumulated.	No recorded damage
Ice Storm	12/09/2007	Widespread tree damage was reported across the county. Numerous traffic accidents occurred as a result of the ice accumulation, which occurred mainly on bridges and other elevated surfaces.	No recorded damage
Winter Storm	01/12/2007	The freezing rain and sleet occurred mainly over central and southwest Oklahoma, with mainly freezing rain over the southeast. The slick and hazardous roads caused many schools remained closed for several days after the winter precipitation had ended.	$80,000.00 property damage
Winter Storm	11/29/2006	Ice glaze accumulations of up to 1/2 an inch were also reported across parts of central and southern Oklahoma. The winter precipitation caused hazardous travel across the area with numerous accidents reported.	No recorded damage

Mitigation Strategy / Recommendations from HMP: "The City of Seminole has an extensive history of winter storms and ice storms. These have ranged in severity from heavy snow to severe ice conditions. Heavy accumulations of ice also bring down trees, electrical wires, telephone poles and lines, and communication towers. Most electric and telephone lines in the City of Seminole are above ground which exposes them to winter weather. Communications and power can be disrupted for days and weeks while utility companies work to repair the extensive damage. In extreme cases, especially those involving elderly, handicapped, or very young, it is necessary to move them to shelters where they can stay until they return home. Even though shelters are provided after a few days, most make arrangements with friends or relatives in

unaffected areas to stay with them". (Proposed City of Seminole Hazard Mitigation Plan 2015-2020)

"Future mitigation efforts should focus on keeping utility easements clear of vegetation in order to minimize the impact of future severe winter storms and on maintaining effective de-icing and snow clearing activities on roads in and around the City of Seminole". (Proposed City of Seminole Hazard Mitigation Plan 2015-2020).The HMP action projects include measures to address this hazard.

C.2.1.2; C.2.1.6; C.2.1.7; C.2.1.8 Shelters from Disaster Event

Most cities in Seminole County have online databases of shelters with locations of private shelters.

Interviews with the Seminole City Emergency Manager yielded an estimate total of 350 individual shelters that have been registered and 1 public shelter (a public school, operated by the state) that are documented at the city and/or county level.

Interviews with the Seminole County Emergency Manager yielded an estimated total of 2 public shelters in the major towns in Seminole County. These were identified as churches. The County Emergency Manger was not aware of how many private shelters were listed on the online database for private shelters. It was indicated that these were maintained by the local fire department.

Based on this information and information gained from the interviews more public shelters are needed for the cities in Seminole County, however no estimates were provided.

C.2.1.3 Public Policy and Governance to Build Disaster Resiliency

For the City of Seminole, the comprehensive plan included language and goals for a storm water management plan to address local flooding issues. Most public policies intended to build disaster resiliency focused of flood management practices and stormwater runoff.

C.2.1.4 Local Emergency Response Agency Structure

No current Hazard Mitigation Plans were identified for the county, though two were identified as being updated.

The Emergency Mangers for Seminole County and the City of Seminole both stated that they are the primary contacts in the events of emergencies. They also work in coordination with fire departments, law enforcement, and 911 emergency calls.

The structure for response to address any perceived vulnerabilities in the county will be included in the Hazard Mitigation Plans once they have been completed and accepted by the state and FEMA.

C.2.1.5 Threat & Hazard Warning Systems

The identified Threat & Hazard Warning Systems for Seminole County include:

- ☐ Sirens (Numbers of sirens and siren coverage were not found nor included in the *Proposed* City of Seminole HMP)
- ☐ Phone notification (Emergency text messages)
- ☐ Emergency Broadcast System

Social Vulnerability

Based on the research work done by the Texas A&M University Hazard Reduction and Recovery Center, an added component is being included in this section. Social vulnerability can place households at a further disadvantage during and after a disaster. This analysis is assessing for the county the levels of social vulnerability based on demographic indicators to highlight 'hotspots' or counties that have higher social vulnerability. That combined with Hazard Mitigation Plans – or lack thereof – can highlight places where additional work is needed to reduce impacts on households.

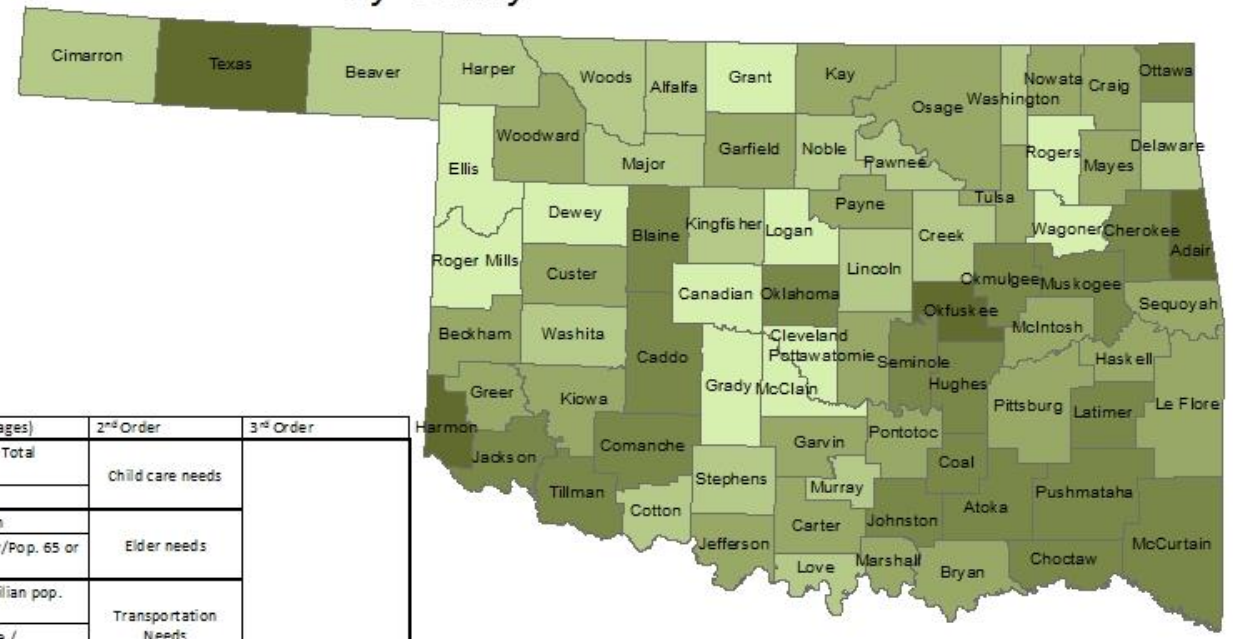
Social Vulnerability Analysis - Seminole County

Base Social Vulnerability Indicators (%)		2nd Order	3rd Order
1.) Single Parent Households	15.98%	0.226 (Child Care Needs)	**3.511 Social Vulnerability 'Hotspot' or Area of Concern**
2.) Population Under 5	6.65%		
3.) Population 65 or Above	16.63%	0.302 (Elder Needs)	
4.) Population 65 or Above & Below Poverty Rate	13.54%		
5.) Workers Using Public Transportation	0.07%	0.062 (Transportation Needs)	
6.) Occupied Housing Units w/o Vehicle	6.10%		
7.) Housing Unit Occupancy Rate	80.15%	2.607 (Temporary Shelter and Housing Recovery Needs)	
8.) Rental Occupancy Rate	26.10%		
9.) Non-White Population	33.38%		
10.) Population in Group Quarters	2.33%		
11.) Housing Units Built Prior to 1990	80.64%		
12.) Mobile Homes, RVs, Vans, etc.	15.21%		
13.) Poverty Rate	22.94%		
14.) Housing Units Lacking Telephones	3.36%	0.314 (Civic Capacity Needs)	
15.) Age 25+ With Less Than High School Diploma	17.70%		
16.) Unemployment Rate	9.17%		
17.) Age 5+ Which Cannot Speak English Well or Not At All	1.13%		

Sources: Shannon Van Zandt, Texas A&M, Hazard Planning materials, and 2009-2013 American Community Survey, Tables B11003, B01001, B17001, B08301, B25044, B25001, B25042, B02001, B03002, B26001, B25036, B17001, B25043, S1501, B23025 & B06007

Social Vulnerability Index

By County



Levels of Social Vulnerability Analysis

Base Social Vulnerability Indicators (Percentages)	2nd Order	3rd Order
1. Single parent households with children/ Total Households	Child care needs	Social vulnerability "Hotspot" or area of concern
2. Population 5 or below/Total Population		
3. Population 65 or above/Total Population	Elder needs	
4. Population 65 or above & below poverty/Pop. 65 or above		
5. Workers using public transportation/Civilian pop. 16+ and employed	Transportation Needs	
6. Occupied housing units without a vehicle / Occupied housing units (Hus)		
7. Occupied housing units / Total housing units	Temporary Shelter and housing Recovery needs	
8. Persons in renter occupied housing units/ Total housing units		
9. Non-white population/Total population		
10. Population in group quarters / Total population		
11. Housing units built 20 years ago / Total housing units		
12. Mobile Homes/ Total housing units		
13. Persons in poverty / Total population		
14. Occupied housing units without a telephone/ Total occupied HU	Civic Capacity needs	
15. Population above 25 with less than high school/ Total pop above 25		
16. Population 16+ in labor force an unemployed/ Pop in Labor force 16+		
17. Population above 5 that speak English not well or not at all / Pop >5		

Source: Shannon VanZandt, Texas A&M, Hazard Planning materials; 2009-2013 American Community Survey, Tables B11003, B01001, B17001, B08201, B25044, B15001, B25042, B01001, B08003, B26001, B25035, B17001, B25042, B15001, B15003 & B05007

Legend

Social Vulnerabiity "Hot Spots"

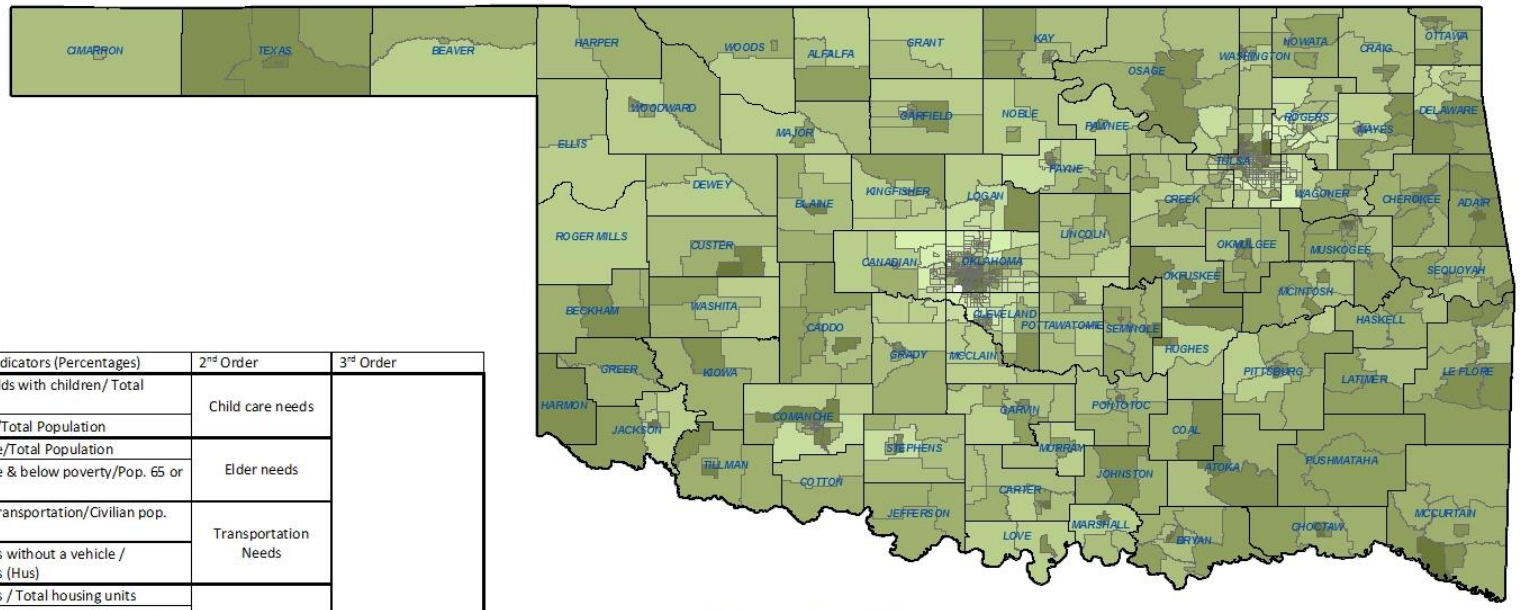
- 2.6340 - 2.9760
- 2.9761 - 3.2170
- 3.2171 - 3.4180
- 3.4181 - 3.6370
- 3.6371 - 3.9500

0 25 50 100 Miles

Social Vulnerability - Impacts on Housing & Disaster Resiliency

Base Social Vulnerability Indicators (Percentages)	2nd Order	3rd Order
1. Single parent households with children/ Total Households	Child care needs	Social vulnerability "Hotspot" or area of concern
2. Population 5 or below/Total Population		
3. Population 65 or above/Total Population	Elder needs	
4. Population 65 or above & below poverty/Pop. 65 or above		
5. Workers using public transportation/Civilian pop. 16+ and employed	Transportation Needs	
6. Occupied housing units without a vehicle / Occupied housing units (Hus)		
7. Occupied housing units / Total housing units	Temporary Shelter and housing Recovery needs	
8. Persons in renter occupied housing units/ Total housing units		
9. Non-white population/Total population		
10. Population in group quarters / Total population		
11. Housing units built 20 years ago / Total housing units		
12. Mobile Homes/ Total housing units		
13. Persons in poverty / Total population		
14. Occupied housing units without a telephone/ Total occupied HU	Civic Capacity needs	
15. Population above 25 with less than high school/ Total pop above 25		
16. Population 16+ in labor force an unemployed/ Pop in Labor force 16+		
17. Population above 5 that speak English not well or not at all / Pop >5		

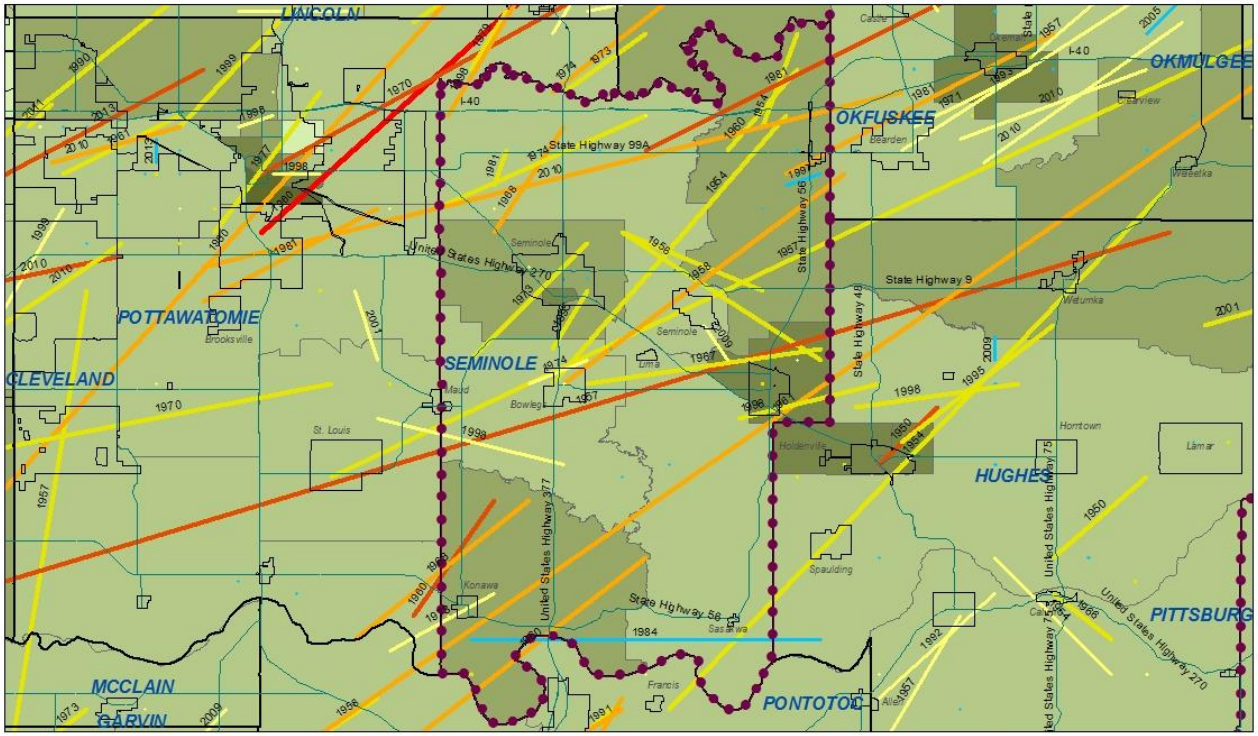
Sources: Shannon Van Zandt, Texas A&M, Hazard Planning materials, and 2009-2013 American Community Survey, Tables B11003, B01001, B17001, B08301, B25044, B25001, B25042, B02001, B03002, B26001, B25036, B17001, B25043, S1501, B23025 & B06007



Social Vulnerability - Impacts on Housing & Disaster Resiliency

Tornado Events 1950 - 2014

Seminole County



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Social vulnerability combined with the devastating impacts of a natural or man-made disaster can compound a household's ability to recover and in fact can place those individuals at an even great gap or disadvantage prior to the event (Shannon Van Zandt, Texas A&M, Hazard Planning).

This county falls above average per this index for social vulnerability when comparing as a county to other counties in the state. Various census tracts, Seminole area, Konawa and eastern portion of the county, have increased social vulnerability and attention to not placing housing in flood prone areas as well as provisions for tornados (shelters and recovery efforts after an event) should be considered for these areas.

Recommendations for this county:

- Continue to update and maintain county and city HMPs and include attention to areas within the county that in addition to physical vulnerability may have compounding social vulnerability factors.
- Efforts to strengthen building codes related to tornadoes and natural disasters should be considered.
- Planning for shelters from disaster events for multifamily, HUD and LIHTC units, in addition to all housing in the community should be incorporated with all efforts to increase housing.
- Continue to apply for grants and pursue funding for more public emergency shelters.