BEAVER COUNTY 2022-2027

HAZARD MITIGATION PLAN UPDATE

Abstract

This project is a result of the combined efforts of the Citizens of Beaver County, Beaver County Emergency Management, the Beaver County Commissioners, the Oklahoma Department of Emergency Management (OEM), the Federal Emergency Management Agency (FEMA) and the Oklahoma Economic Development Authority (OEDA) working together to produce this 5-year plan update. The purpose of Hazard Mitigation Planning is to improve the health, safety and welfare of the citizens of Beaver County through development of effective strategies that can be implemented to mitigate the negative effects of known natural hazards.

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Contents

This effort was funded by FEMA, OEM, Beaver County, the Towns of Beaver, Gate and Knowles, and the Balko, Beaver, Forgan and Turpin School Districts

Chapter 1 Introduction

1.1 Overview of planning area

Beaver County is located in the Panhandle region of the State of Oklahoma. The County is bounded on the north by Meade County, Kansas; on the south by Lipscomb & Ochiltree Counties in Texas. To the west is Texas County, OK and to the east is Harper County, OK.

1.2 A brief history

The Oklahoma Panhandle has an unusual settlement history. Before the arrival of European explorers, the Panhandle was home to Southern Plains villagers. It became part of the United States in 1846 when Texas joined the US. When Texas sought to enter the Union in 1845 as a slave state, federal law, based on the Missouri Compromise, prohibited slavery north of 36°30' parallel. Under the Compromise of 1850, Texas surrendered its lands north of 36°30' latitude. The border of Kansas was established at the 37th parallel in 1861.

This strip of land, just 34 miles wide and 166 miles long, was left with no state or territorial ownership from 1850 until 1890. It was officially called the "Public Land Strip" and was commonly referred to as "No Man's Land" (Gibson, 1981). In 1886, Interior Secretary L. Q. C. Lamar declared the area to be public domain and subject to "squatter's rights." Settlers flooded the region in anticipation of making claims under the Homestead Act, which came to fruition in 1891 (Turner, 2020).

When Oklahoma Territory and Indian Territory were combined in 1907 as the state of Oklahoma, the land was divided into Beaver, Texas, and Cimarron counties. The Oklahoma Panhandle had the highest population at its first census, more than double its current population. Agriculture began changing from subsistence farming to grain exports.

The Panhandle was severely affected by a regional drought during the 1930s. The drought began in 1932 and created massive dust storms. By 1935, the area was widely known as the Dust Bowl. The dust storms were largely a result of poor farming techniques and plowing of the native grasses that held the fine soil in place. Despite government efforts to implement conservation measures and change the basic farming methods of the region, the Dust Bowl persisted for nearly a decade. It contributed significantly to the length of the Great Depression in the United States. Each of the three counties experienced a dramatic loss of population during the 1930s.

The maximum recorded population of Beaver County was in 1920 when there were 14,048 people counted in the Census (US Census Bureau).

There are four incorporated towns, Beaver (pop. 1515), Forgan (547), Gate (93) and Knowles (11). Several unincorporated areas were also founded near the time of Statehood (1907), the most populous of these are Turpin, Balko, and Slapout. The location of about two dozen ghost towns are known to locals.

BEAVER COUNTY OK		
Historic population		
Census year	*Pop.*	*%±*
1900	3,051	—
1910	13,631	346.80%
1920	14,048	3.10%
1930	11,452	−18.5%
1940	8,648	−24.5%
1950	7,411	−14.3%
1960	6,965	−6.0%
1970	6,282	−9.8%
1980	6,806	8.30%
1990	6,023	−11.5%
2000	5,857	−2.8%
2010	5,636	−3.8%
2019 (est.)	5,311	−5.8%

uscensus 2020

1.3 Demographics

In 2019 Beaver County population was estimated to be 5,311 representing a slight decline since the 2010 Census. There were 2,682 housing units of which 73.5% (1,971) were occupied and 26.5% (711) were vacant. Average household size is 2.9.

Population density and hazards. According to the U.S. Census Bureau, the county has a total area of 1,818 square miles, of which 1,815 square miles is land and 2.8 square miles (0.2%) is water. The residential density is estimated to be about one household per square mile. That figure does not fully reflect conditions in the field, since about 41% (2,166) of the people live in three populated areas, Beaver, Forgan and Turpin. Therefore 3,145 people live in the remainder of the county, which would be about 1,084 rural households, or one household per every 1.7 square miles, borne out by observations on the ground. This low density means that a rural household may not have immediate access to help in the event of an emergency or a natural disaster. Another consideration is that cell phone service in the county can be unreliable.

Entity	*Median Age*	*Median Income*	*% of people in poverty*
Beaver County	39	$ 52,349	11.4
Oklahoma	37	$ 54,449	15.7

1.4 Economy

The economy is largely based on crop and livestock agriculture, with gas and oil field employment throughout the region. Service occupations are next most common, including healthcare, public safety, restaurants and food service workers. Education, law and local government also employ a significant number of people in the county.

1.5 Recreation

A mile north of the town of Beaver is Beaver Dunes Park, featuring an extensive formation of sand dunes left by ancient seas that once covered the area. The park features 520-acres of dune

buggy riding on 300 acres of sand hills, as well as fishing, hiking trails, a playground and two campgrounds. Pioneer Campground is located adjacent to the off-road vehicle area and has direct access to the dunes. This campground features 13 campsites with water and electric hookups. The Hackberry Bend Campground has seven sites with water and electric hookups, as well as 10 tent sites and a primitive cabin rental next to Beaver Lake, a two-acre lake stocked with trout, channel cat and largemouth bass.

Lake Evans Chambers is located 23 miles southeast of the Town of Beaver. The lake has one boat ramp, two latrines, and one water well. Anglers can expect good bass and channel catfish fishing and the opportunity to take crappie, white bass, and bluegill.

1.6 Geography

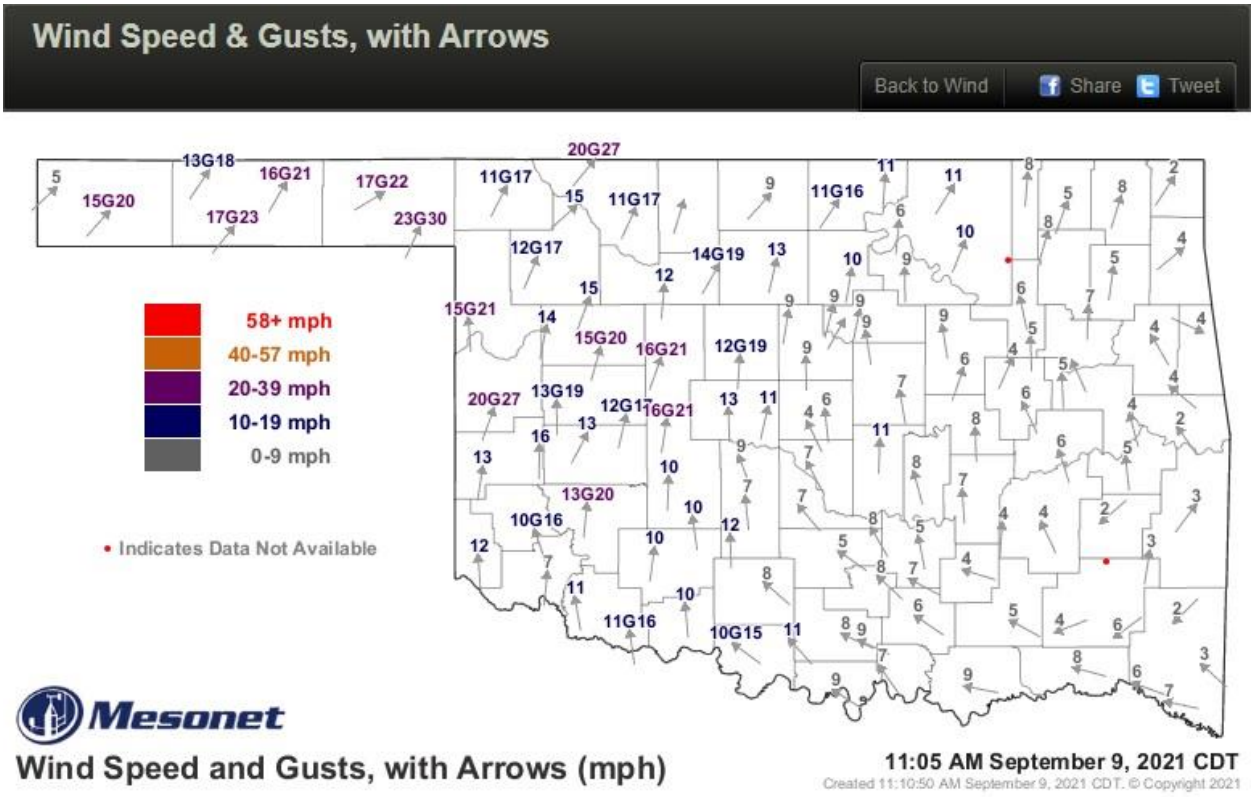
Beaver County is part of the High Plains geographic region. The High Plains are generally flat grassland, drained eastward by the Platte, Arkansas, and Canadian rivers.

1.7 Climate

The High Plains are mainly semi-arid steppe land and are generally characterized by rangeland or marginal farmland. Beaver County has a semi-arid climate with cool, dry winters and hot, wetter summers, with an average rainfall of 21.24 inches, most of that occurring in May through August. Typical plant communities of the region are shortgrass prairie, prickly pear cacti and scrub.

NOTE: The Oklahoma Panhandle is perceived by most people to be very windy. While average wind speeds of 15 to 20 mph aren't extreme, it is gusty, with frequent gusts of 25 to 40 mph. There are few trees or other landscape features to break the wind. Therefore, one's awareness of wind in Beaver County is nearly constant.

See wind graphic of a day selected at random, below.


Wind Speed & Gusts, with Arrows
Back to Wind
Share
Tweet
58+ mph
40-57 mph
20-39 mph
10-19 mph
0-9 mph
• Indicates Data Not Available
Mesonet
Wind Speed and Gusts, with Arrows (mph)
11:05 AM September 9, 2021 CDT
Created 11:10:50 AM September 9, 2021 CDT. © Copyright 2021

Chapter 2 the Planning Process

2.1 Participating Jurisdictions

Participating jurisdictions include Beaver County, The Towns of Beaver, Gate and Knowles; Balko Beaver, Forgan, and Turpin School Districts. The point of contact for the 2022 Beaver County Hazard Mitigation Plan Update (HMPU) is Beaver County Emergency Manager Keith Shadden, at bcem@beaver.okcounties.org

2.2 Overview of the Planning Process

The Beaver County HMPU was developed through a series of public meetings with County Commissioners, Town Board members, the Local Community Group (LCG), and individual members of the public. All meetings were held in accordance with Oklahoma Open Meeting law. Public opinion surveys and personal conversations were also used to solicit comments at all stages of the planning process. The LCG provided oversight. The Planning Committee assisted with plan development. Public participation provided guidance on the challenges and needs of each jurisdiction.

Content of meetings:

A survey instrument (replicated in Appendix A) was used as a tool to facilitate discussions during *Meeting 1 initial presentations* to each jurisdiction. We asked what the specific concerns were for each Hazard listed, and then we discussed what solutions or mitigation actions participants thought were needed. We asked them to rank each Hazard by degree of danger and finally, they prioritized each hazard by considering events over the 10 year period between January 2011 and December 2020. Using those parameters, we sorted the responses and determined an average score, to rank the priorities. A copy of the score sheet is attached in Appendix A.

Information sessions were public meetings with the Local Community Group (LCG), held for the purpose of keeping the group informed of our progress and receiving comments on the work at each stage from various community stakeholders, including Emergency responders, Fire department volunteers, local Health department staff, Pipeline representatives and other participants who attended meetings and offered insight.

Staff then conducted research on potential mitigation activities by reviewing the previous Beaver County HMP, FEMA approved mitigation actions, the State of Oklahoma Hazard Mitigation Plan and other Planning documents as shown in a table below. This work resulted in *Meeting 2 Draft Action Items.* This second set of meetings were held in all jurisdictions to discuss the items that had been included in the previous plan, which items had been completed and which should be carried forward to the Update. Options for other mitigation activities were presented by staff. Local preferences for mitigation actions were compared to FEMA guidelines and participants worked to select their preferred action items.

When the Draft Plan Update was completed, we took a paper copy to each jurisdiction for *Meeting 3 Final review* and electronic copies were also provided to all jurisdictions and the public

during a 30-day comment period. Additional electronic copies were sent by email to adjacent jurisdictions and other individuals. A press release was published and the draft was posted on the OEDA website. Comments were received and incorporated into the document. At the close of the 30-day comment period, the BCHMPU was submitted to the Oklahoma Department of Emergency Management (OEM) for review.

2.3 Stakeholder Participation

Local Community Group (LCG) members (oversight)

Community Group	*Name*	*Role*	*Method of contact*
Slapout Fire Dept	Cathy Starbuck	Fire Dept, EMT	Email and meetings
Beaver EMT	Dusty Bailey	EMT	Email and meetings
Beaver EMT & Town	David Glascock	Town Board	Email and meetings
Beaver Co Health Dept	Kerry Stafford	P&R Coordinator	Email and meetings
Beaver Co EM	Steve Madden	Assistant to BCEM	Email and meetings

Planning Committee members (plan development)

The Planning Committee was directly involved in development of the HMPU.
The content of each meeting is more fully described in Section 2.2, above.
Meeting 1: Provide community info, discuss hazards, discuss capability & needs assessment
Meeting 2: Review draft goals; determine current hazard mitigation needs; discuss strategies
Meeting 3: Review final draft HMPU, approve final draft Action Items
Primary Contacts are in **bold** print.

Organization	*Name*	*Title*	*Contribution to planning process*
OEDA	**Gail Thomas**	Planner	Data collection and analysis; draft documents; present data & information
Beaver County	**Keith Shadden**	BCEM	Organize and coordinate meetings; grant administration; OEM; contracts; provided hazard data; mitigation
Beaver County	**Roy Fleming**	District 1, Chair	Meeting 1, Meeting 2, Final review
Beaver County	CJ Rose	District 2	Meeting 1, Meeting 2, Final review
Beaver County	Kerry Rigler	District 3	Meeting 1, Meeting 2, Final review
Town of Beaver	**Dave Drew**	Admin	Meeting 1, Meeting 2, Final review
Town of Gate	**Troy DeWitt**	Vice Mayor & FD	Meeting 1, Meeting 2, Final review
Town of Gate	Michelle Marr	Clerk	Meeting 1, Meeting 2, Final review
Town of Gate	Mike Dunsworth	Water Board	Meeting 1, Meeting 2, Final review
Town of Gate	Lance Richardson	Town Board	Meeting 1, Meeting 2, Final review
Town of Gate	Richard Boucher	Town Board	Meeting 1, Meeting 2, Final review
Town of Knowles	Delbert Dodson	Mayor	Meeting 1, Final review
Town of Knowles	Florence Dodson	Town Clerk	Meeting 1, Final review
Town of Knowles	**Kerry Hamilton**	Town Board	Meeting 2, Final review
Note: Primary contacts at schools changed over time due to relocation			
Balko PSD	**Roger Mundell**	Super 2020-21	Meeting 1
Balko PSD	**Braden Naylor**	Super 2021-22	Meeting 2, Final review
Beaver PSD	**Scott Kinsey**	Super 2020-21	Meeting 1

Beaver PSD	Jeremy Brashears	Principal 2020-21	Meeting 1
Beaver PSD	**Jeremy Brashears**	Super 2021-22	Meeting 2, Final review
Forgan PSD	**Travis Smaltz**	Super 2020-21	Meeting 1
Forgan PSD	**Freida Burgess**	Super 2021-22	Meeting 2, Final review
Turpin PSD	**K Curtis**	Super 2020-21	Meeting 1
Turpin PSD	**Travis Smaltz**	Super 2021-22	Meeting 2, Final review

Public Involvement

The public was involved in all stages of the planning process. The public was invited to attend all Commissioner, Town Board and LCG meetings. Public meetings were posted at the County Courthouse, Town Administration buildings and the OEDA office. Public comments were requested by use of flyers, personal contacts and distribution of a survey. Public feedback was incorporated into the plan by including public concerns in the vulnerability and impact sections detailed for each hazard in Section 3.4.1 through 3.4.10, and each of those concerns were considered during the development of the mitigation action items.

Activity	Entity	Date	Comments
Citizen Interviews	OEDA, BCEM	Initiated 9/15/2020	Throughout planning process
Survey distributed	Planner, jurisdictions	Initiated 8/31/2020	Throughout planning process
Information session	LCG	10/29/2020	Presented info to LCG
Information session	LCG	3/31/2021	Request input from LCG
Mtg 1; Initial Presentation	Beaver County	4/19/2021	Commissioner's Mtg
Mtg 1; Initial Presentation	Town of Beaver	4/14/2021	Town Board Meeting
Mtg 1; Initial Presentation	Town of Gate	6/07/2021	Town Board Meeting
Mtg 1; Initial Presentation	Town of Knowles	6/07/2021	Town representatives
Information session	LCG	6/25/2021	Presented info to LCG
Mtg 2; Draft Action items	Beaver County	8/30/2021	Commissioner's Mtg
Mtg 2; Draft Action items	Town of Gate	9/7/2021	Town Board Meeting
Mtg 2; Draft Action items	Town of Beaver	9/9/2021	Town Board Meeting
Mtg 2; Draft Action items	Town of Knowles	9/10/2021	Town representatives
Flyers inviting public comment	All jurisdictions	9/10/2021	Flyers posted for a 30-day Public Comment period
Website	OEDA	9/16/2021	Draft Plan posted
Final Review of Draft Plan	Town of Knowles	9/21/2021	Town representatives
Information session	LCG	9/24/2021	LCG Reviews progress
Final Review of Draft Plan	Town of Beaver	9/27/2021	Town Hall
Final Review of Draft Plan	Beaver County	9/27/2021	Commissioner's Mtg
Final Review of Draft Plan	Town of Gate	10/04/2021	Town Board Meeting
Press release	Herald/Democrat	10/22/2021	Local Beaver newspaper

2.4 Other Participating Stakeholders

This is a record of other stakeholders; organizations and agencies that made significant contributions to the BCHMPU. Each of these participants attended meetings, provided

information or helped with capability and risk assessments, hazard assessments and organizing local priorities.

Neighboring Communities, Businesses, and Non-Profit Agencies Contacted

Entity	Person	Title	Contact	Contribution to plan
Town of Forgan	Delbert Cash	Public works	In-Person	Hazard Information & needs
Town of Forgan	Beverley Hall	Clerk	In-Person	Hazard Information & needs
Town of Forgan	Gina Walsh	Former Mayor	In-Person	Hazard Information & needs
Town of Forgan	T. Mitchell	Mayor	In-Person	Mitigation Actions needed
OEDA	Tom Sheats	Fire Coordinator	Email	Data, Mitigation needed
Ochiltree Co TX	Wayne Floyd	EM	Email	Review draft; comments
Seward Co KS	Greg Standard	EM	Email/Phone	Review draft; comments

State and Federal Agencies Contacted

Agency	Name	Title	Contact	Contribution to this plan
OEM	Matt Rollins	Planner	Phone, email	Project guidance
OFMA	Joe Remondini	USACOE Retired	In-Person	Flood information
OWRB	Jon Philipps	Planner	Email	Flood data
NRCS	Troy Collier	Conservationist	Email, Phone	Soil/Flood Info and data
OK Forestry	Drew Daily	Fire Staff	Email	Fire data, Hazard Info

2.5 Plans, Documents, and Literature Reviewed

During development of the Beaver County Hazard Mitigation Plan Update, several existing plans and documents were reviewed. Data and information from these documents was incorporated into the plan. Of particular importance was disaster history and strategies recommended to mitigate the effects of such disasters. Location of critical infrastructure was reviewed and updated.

Agency/Document	Relevant Info Incorporated into Plan
US Census Bureau Population Data	Demographic, economic, housing data, ACS 2019
National Climatological Data Center (NCDC)	Storm history, Climate data 2000-2020
OWRB Panhandle Watershed Region Report	Watershed and Groundwater information, 2020
OWRB Hydrologic Drought Report	Drought history and data
OK State University Extension Service	Drought & Impact on Ag Water Resources Feb 2018
Oklahoma Conservation Commission	Watershed Fact Sheet; Beaver County 2020
US Dept of Environmental Quality (DEQ)	Hazardous waste permit sites 2020
US Dept of Environmental Quality (DEQ)	WaterWeb, Impaired waters 2020
US Dept of Environmental Quality (DEQ)	NPDES Discharge sites 2020
US Dept of Environmental Quality (DEQ)	Brownfields 2020
FEMA Map Service Center	Flood data, maps, NFIP information
NRCS, Woodward office	Flood data, information; Red Cedar information
US Geological Survey	Data on seismic activity 2000-2020
State University Agricultural Extension Service	Drought, Land management
State Department of Transportation	Disaster history, roads and bridges

2.6 Plans Reviewed

During development of this update of the HMPU, other State and regional plans were reviewed for information on known hazards and mitigation activities in Oklahoma. A list of those plans is shown in the table below. Information from those Plans was incorporated into this plan.

State of Oklahoma	Hazard Mitigation Plan 2019
Harper County Oklahoma	Hazard Mitigation Plan Update 2020
Beaver County OK	Emergency Operations Plan
Beaver County OK	Hazard Mitigation Plan 2008
Balko Public School District	Emergency Operations Plan
Beaver Public School District	Emergency Operations Plan
Forgan Public School District	Emergency Operations Plan
Turpin Public School District	Emergency Operations Plan

2.7 Continued Public Involvement

The Beaver County Emergency Manager with the assistance of OEDA and the planning team will conduct an annual review of the Plan. The plan will be updated every five years. The public will be able to directly comment on and provide feedback about the Plan by contacting the Beaver County Emergency Manager. Public meetings will be publicized and open for public comment.

After the Hazard Mitigation Plan Update is adopted, a copy of the plan will be placed at the Beaver County Court House and made available to the public. Copies of the plan will be distributed to each City/Town Hall, Emergency Management Director, School Superintendent and local Library. The public will be invited to become involved in fund raising for specific Hazard Mitigation activities and educational opportunities over the life of the plan.

2.8 Plan Monitoring, Evaluating and Updating

The Beaver County Emergency Management Director will be responsible for monitoring, evaluating, and updating all components of the HMPU. These procedures will follow hazard mitigation planning requirements as outlined in 44 CFR. The plan will be monitored, evaluated and updated by the Beaver County Emergency Manager with the assistance of the Local Community Group (LCG) over a five-year period. The Emergency Manager will be the lead contact for calls and scheduling of meetings.

Monitoring – tracking the implementation of the plan over time
Evaluating – assessing the effectiveness of the plan in achieving its stated purpose and goals
Updating – reviewing and revising the plan at least once every five years

Monitor. The Beaver County Emergency Manager (BCEM) will maintain contact with a representative of each jurisdiction who will monitor the progress of the mitigation actions on an annual basis. Each jurisdiction will provide a list of completed action items. The BCEM will provide a report to the LCG each year. The BCEM will monitor all aspects of the HM Plan, to include the following actions:

- ✓ Monitor the hazard analysis for changes and additions; record new data as events occur
- ✓ Monitor objectives and determine if they continue to meet hazardous conditions

- ✓ Monitor the implementation of the plan's action items; document completion of action items
- ✓ Determine if there are implementation problems, such as financial, technical, political, legal, or issues of coordination with other agencies

Evaluate. The BCEM will review the Hazard Mitigation Plan annually to ensure progress on mitigation objectives. Post disaster reviews will be used to evaluate the effectiveness of stated objectives as implemented. These findings will be documented by the Beaver Co EM. The planning committee members will meet annually to discuss post disaster reviews, and to:

- ✓ Evaluate the risk assessment to ensure the hazards, vulnerabilities and impacts originally addressed are still valid
- ✓ Evaluate the goals and the mitigation strategies to ensure they continue to address the priorities of each participating jurisdiction

Update. Two years before this plan expires, the plan update process will begin with the Beaver County Emergency Manager and the Local Community Group (LCG). The emergency manager and the planning committee will reconvene plan development meetings for the Beaver County Hazard Mitigation Plan Update, to discuss the progress made on this plan, update the capability and risk assessments, and revise the objectives and strategies as needed. A draft plan will be submitted to Oklahoma Emergency Management for review twelve months before the current plan expiration. Any revisions will be incorporated into the document as necessary, and the plan resubmitted to FEMA for approval. Once approved, participating jurisdictions will adopt the plan by resolution.

Chapter 3 Hazard Identification and Risk Assessment

3.1 List of Identified Hazards included and excluded

Hazards that were considered for this update are listed below in alphabetical order and are prioritized in Chapter 4, Mitigation Strategies. The hazards included are consistent with those addressed in the Oklahoma State Hazard Mitigation Plan with the exception of Dam Failure, Expansive soils, Landslide and Subsidence.

Hazards not addressed. Dam Failure. There are no High-hazard dams in the planning area or upstream. *Expansive soils.* According to the Oklahoma State Hazard Mitigation Plan, the relative abundance of Expansive Soils in the Planning Area is low-medium. The Planning Area has not recorded issues related to Expansive Soils. In addition, low residential density in rural areas and few structures with basements indicate a very low risk of damage due to shrink-swell potential. *Landslide.* Due to development patterns of existing structures and infrastructure, there is a low risk of damage or injury from landslide in the county and no significant events have been recorded. *Land subsidence* is primarily a concern in Eastern Oklahoma; areas associated with historic mining activity. No underground mining activity is known to have occurred in Beaver County (OKHMP, 2019).

Committee members, the Planning Team and other stakeholders discussed the frequency and severity of past disasters and completed the Hazard Vulnerability Assessment. Presidential disaster declarations, fire data, weather events, climate history, flood conditions, soil types and geological records were evaluated and that data was recorded in this plan. Public comments and surveys were used to identify known risks and set the priorities of the community.

Hazards considered. The hazards listed below are applicable to all jurisdictions of Beaver County.

Hazard
Drought
Earthquake
Extreme Heat
Flood
Hail
High Wind
Lightning
Tornado
Wildfire
Winter Storm

3.2 Disaster History

Nine Federally-declared disasters have occurred in Beaver County since the start of 2011. Two were severe storms and tornados, three were winter weather (snow and ice storms), two fires, and two were public health disasters related to the COVID-19 pandemic.

Federally Declared Disasters in Beaver County 2011 – 2020				
	Incident Period:	Declaration Date:	Disaster ID	Event
1	January 31, 2011 - February 5, 2011	February 2, 2011	EM-3316-OK	Severe Winter Storm
2	February 24, 2013 - February 26, 2013	April 8, 2013	DR-4109-OK	Severe Winter Storm And Snowstorm
3	January 13, 2017 - January 16, 2017	February 10, 2017	DR-4299-OK	Severe Winter Storm
4	March 6, 2017	March 7, 2017	FM-5177-OK	Ok Wildfire Outbreak Complex
5	April 28, 2017 – May 2, 2017	May 26, 2017	DR-4315-OK	Severe Storms, Tornadoes, Flooding
6	May 7, 2019 and continuing.	June 1, 2019	DR-4438-OK	Severe Storms, Straight-line Winds, Tornadoes, Flooding
7	March 7, 2020	March 7, 2020	FM-5306-OK	Oklahoma 412 Fire Complex
8	January 20, 2020 and continuing	March 13, 2020	EM-3509-OK	Oklahoma COVID-19
9	January 20, 2020 and continuing	April 5, 2020	DR-4530-OK	COVID-19 PANDEMIC

3.3 Hazard Probability Rating

To determine the probability of future hazard events, the number of events of each type was documented and divided by the number of years being considered. In this case, the storm and event data was drawn from the National Center for Climate Data (NCDC), a division of the National Oceanic and Atmospheric Administration (NOAA).

Probability was determined by calculating the:
Total number of events/Total number of years = Probability % of event occurring each year
Based on the above calculation, probability is quantified as follows:

High = > 80%
Medium = 30 - 79%
Low = 10 - 29%
Very Low = < 10%

Beaver County		
Hazard	Probability: Events/time	Probability Rating
Drought	91/120 weeks = 75.8%	Medium
Earthquake	3 events/10 yrs = 30%	Medium
Extreme Heat	67.4 days each year/10yrs = >100%	High
Flood	15/10 yrs = >100%	High
Hail	57/10 yrs = >100%	High
High Wind	76/10 yrs = >100%	High
Lightning	4-5 strikes per sqkm/yr = >100%	High

Tornado	10/10 yrs = 100%	High
Wildfire	7/10 yrs = 70%	Medium
Winter Storm	10/10 yrs = 100%	High

3.4 Profiled Hazards

Each hazard listed in the plan has been profiled individually, and includes the following sections: Description, Location, Extent, Previous Occurrences, Probability of Future Events, Vulnerability and Impact.

3.4.1 Drought

A drought is a period of drier-than-normal conditions. If dry weather persists and water supply problems develop, the dry period can become a drought.

The Oklahoma State Extension website states that "Drought is different from other natural hazards such as flood or wildfire, where negative impacts are felt very quickly. Drought follows a slow and accumulating process . . . This characteristic makes drought preparedness very challenging (OKState 2018)." The article points out three types of drought, Meteorological, Agricultural and Hydrological. Together, these contribute to social (economic) effects of drought.

Meteorological drought is lower precipitation than is typical for a specific area, and precedes the other types. The terms Agricultural drought and Hydrological drought are most pertinent to this assessment. Agricultural drought depends not only on precipitation, but soil conditions, groundwater or surface water as well. Crops are also more susceptible to insufficient moisture at certain stages of development. Hydrological drought refers to the impact of precipitation deficiency on water levels in streams, lakes, reservoirs and groundwater. This is a long-term type of drought that can have an impact on wells and public water supplies.

Location

Drought is a hazard that affects the water supply for all jurisdictions.

Extent

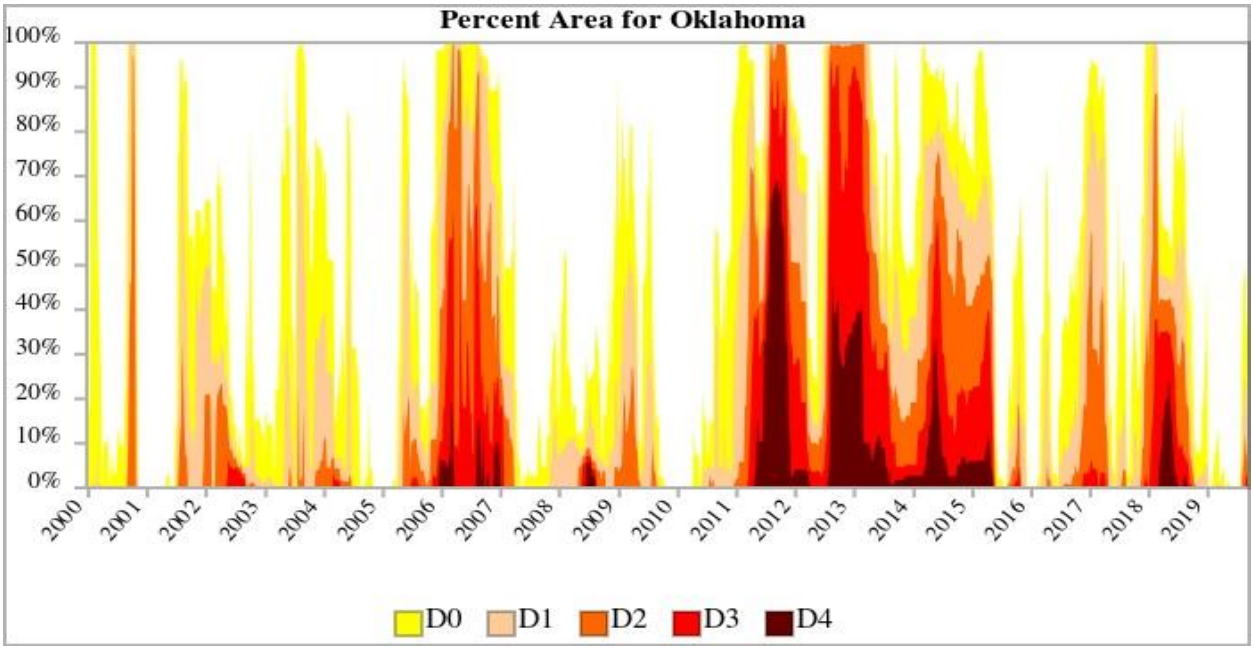
The planning area uses the Palmer Drought Severity Index (PDSI) to classify a deficiency or excess of precipitation. Values in Beaver County may fall at any point on the scale. All participating jurisdictions have experienced drought conditions ranging from 0 to <-4.0 on the scale, and may expect such conditions to occur in the future. Because the county has a semi-arid climate, overly moist conditions occur less frequently.

Palmer Drought Severity Index		
	< -4.0	Extreme Drought
	-3.99 to -3.0	Severe Drought
	-2.99 to -2.0	Moderate Drought
	-1.99 to -1.0	Mild Drought
	-0.99 to -0.5	Incipient Drought

	-0.49 to 0.49	Near Normal
	0.5 to 0.99	Incipient Moist Spell
	1.0 to 1.99	Moist Spell
	2.0 to 2.99	Unusual Moist Spell
	3.0 to 3.99	Very Moist Spell
	> 4.0	Extreme Moist Spell

Previous Occurrences

The history of Northwest Oklahoma is closely tied with drought. The land in Beaver County was unbroken prairie sod until the late 1880's when people began to build homesteads and engage in agricultural production. During the 1930's, a combination of drought conditions combined with poor soil management practices in Kansas, Oklahoma and Texas resulted in an environmental disaster known as the Dust Bowl, which some sturdy people endured from 1931 until 1939. That period represents the worst drought in American history. Beaver County was severely impacted. Improved soil management practices were implemented over the following decades. The graph shown below illustrates drought periods in the State of Oklahoma from 2000 through 2019 (Drought in OK, 2020).



The table below documents a history of drought conditions in Beaver County during the period from 2011 through 2020 (520 weeks). Over that 10 year period, 395 (or 75.96%) of those weeks drought conditions were present (DM, 2020).

2011 THRU 2020				
County	Weeks of Drought	Start Date	End Date	
Beaver	233	12/28/2010	6/9/2015	Dec 2010 – Jun 2015
Beaver	10	3/1/2016	5/3/2016	March to May 2016

Beaver	29	10/4/2016	4/18/2017	Oct 2016 to April 2017
Beaver	11	6/13/2017	8/22/2017	June 2017 - Aug 2018
Beaver	48	9/5/2017	7/31/2018	Sept thru July 2018
Beaver	2	12/18/2018	12/25/2018	December 2018
Beaver	4	2/12/2019	3/5/2019	February
Beaver	24	8/6/2019	1/14/2020	Aug thru Jan
Beaver	34	4/21/2020	12/8/2020	April to Dec 2020
	395	**520**	**WEEKS**	**75.96%**
https://droughtmonitor.unl.edu/Data/DataDownload/WeeksInDrought.aspx				

Probability of Future Events

Converted to months, drought monitor records show that drought conditions were present during 91 of 120 months, about 76% = Medium. It should be noted that Beaver County was in a continuous state of drought from December 2010 until June of 2015; a period of 4.5 years. Another period of drought lasted most of the 13 months between June 2017 and August 2018.

According to the State of Oklahoma HMP, "Droughts are projected to increase in severity and frequency due to climate change. Even if annual precipitation amounts do not change much, higher temperatures will increase evaporation from lakes, soils, and plants, stressing agricultural and natural systems. Models project that Oklahoma will experience a decrease in soil moisture across all seasons by the end of the century, with the greatest decrease in the summer" (Wehner et al. 2017).

Projected water demand

At the same time, water demands are expected to increase over the next few decades and aquifer levels may be expected to fall. "Further, rising temperatures will lead to increased demand for water and energy, which could stress natural resources (Shafer et al. 2014)" (SCIPP, 2018). Such conditions would intensify the vulnerability of Beaver County to drought.

Table 28 - Summary of Projected Water Demands, AFY (Table 28) (OWRB, 2012)

County	2007	2010	2020	2030	2040	2050	2060
Beaver	37,314	37,846	39,173	40,524	41,923	43,149	44,865

Vulnerability and Impacts

Due to its geographical location in a semi-arid ecological zone, NW Oklahoma is more vulnerable to drought than the eastern part of the state. The impacts of drought are a safety and economic threat to Beaver County. In addition to reductions in streamflow, lake and aquifer levels, which can severely impact domestic and municipal water supplies, drought can reduce significantly the amount of water available to crops and livestock, trigger deadly wildfires, and devastate the environment. Some impacts of drought are described in the Table below.

Ogallala Aquifer

A contributing factor to the risk from drought in Beaver County is the fact that much of the water supply is sourced from the Ogallala Aquifer. This aquifer underlies a massive land area stretching from southern South Dakota to north Texas, including northwest Oklahoma. The Ogallala-High Plains Aquifer is one of the world's largest groundwater sources. During the 1990s, the aquifer held some three billion acre-feet of groundwater. In 2012, it supported more than $35 billion in crop production each year (USGS 2012). In subsequent years, crop production has risen.

Throughout the region, agricultural production is increasingly dependent on irrigation from groundwater wells to mitigate the impact of low precipitation levels. Over time, consistent heavy draw on groundwater supplies for agricultural purposes has had a significant impact on aquifer levels.

The aquifer supplies drinking water to 82% of the 2.6 million people who live within the boundaries of the High Plains study area (USGS 2012). The effect of that demand combined with irrigation of thousands of acres of farmland in eight states creates a situation that may become unsustainable at some point.

Groundwater recharge. The rate at which fresh water enters the system is limited by several factors. In many locations, the aquifer is overlain with a shallow layer of caliche that is practically impermeable; this increases runoff and limits the amount of water available to recharge the aquifer (Gutentag, 1984).

Farmers are pulling water out of the Ogallala Aquifer faster than rain and snow can recharge it. Between 1900 and 2008, some 89 trillion gallons were drained from the aquifer – equivalent to two-thirds of Lake Erie. Depletion is threatening drinking water supplies. "Day Zero" – the day wells run dry – has arrived for about 30% of the aquifer. Within 50 years, the entire aquifer is expected be 70% depleted.
(Lauer, 2020)

DROUGHT	
Beaver Co	
Vulnerability	Drought causes a reduction in quantity and quality of water supply from both surface water and groundwater sources for humans, industry, crops and livestock
	Beaver County is a rural area with an economy heavily based on agriculture; during drought, surface water is reduced, therefore water supplies for rural residents, crops and livestock are drawn more heavily from wells and aquifers

	The Ogallala Aquifer is a groundwater supply utilized in a eight state region and cannot be placed under local control
	Risk of wildfire increases with drought and low humidity
Impact	Loss of agricultural production and economic stress caused by drought can result in reduced tax revenues to support local government
	Depletion of the Ogallala Aquifer is hazardous to the long term sustainability of life and business in Beaver County
	During drought, depletion of alluvial groundwater is intensified, reducing the supply of fresh water to municipal wells
	There is an increased risk of wildfire, with a reduced availability of water for fire suppression (municipal supplies and pond levels)
Towns of Beaver, Gate and Knowles	
Water supply wells	Beaver - Ogallala Aquifer; 2 primary wells
	Gate - Alluvial Aquifers; 2 municipal wells, some small private wells
	Knowles - Alluvial aquifers; 2 municipal wells, a few private wells
Vulnerability	The population relies on municipal water supply and individual wells; lack of rainfall intensifies depletion of water supply
	Many people who live in local towns are employed in the agriculture industry and therefore are vulnerable to loss of production income that comes with drought
	Fire danger is intensified during periods of drought
Impact	Quantity and quality of municipal water supply may be reduced
	Drought has a negative impact on agricultural production and jobs, retail trade serving agricultural families, and the personal and business tax base
	Drought brings an increased threat of fire, while less surface water is available for fire suppression
Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	Schools are dependent on private wells or municipal water supply, which are affected by drought
	Schools are dependent on tax revenue from agricultural production
	Drought increases fire danger
Impact	Quantity and quality of potable water may be reduced
	Water rationing may prohibit watering the athletic field increasing the chance of injury to student athletes
	Economic stress results in reduced tax revenues for funding schools
	Increased risk of fire occurs while water supply for fire suppression is at a low point

3.4.2 Earthquake

An earthquake occurs when two blocks of the earth suddenly slip past one another. The surface where they slip is called the fault or fault plane. The location below the earth's surface where the earthquake starts is called the hypocenter, and the location directly above it on the surface of the earth is called the epicenter.

Most earthquakes occur as the result of slowly accumulating pressure that causes the ground to slip abruptly along a geological fault plane on or near a plate boundary. The resulting waves of vibration within the earth create ground motion at the surface that vibrates in a very complex manner.

The Oklahoma Geological Survey (OGS) is a state agency for research and public service charged with studying the state's land, water, mineral and energy resources. OGS began earthquake monitoring more than 40 years ago with its first seismic station that is still in operation near Leonard, Oklahoma. In April 2015, the OGS determined that the majority of recent earthquakes in central and north-central Oklahoma are very likely triggered by the injection of produced water in disposal wells (Earthquakes in Oklahoma, 2020).

Location

In Beaver County, all participating jurisdictions are at risk of earthquake. While the risk of earthquake is county-wide, damage from these events is primarily limited to fixed structures, therefore towns and residential clusters, businesses and schools, roads, bridges, pipelines and other infrastructure such as electrical equipment, water and sewer lines are subject to potential damage.

It should be noted that earthquakes that occur in adjacent states could impact the Beaver County community as well. According to the US Geological Survey (USGS), there is low risk of earthquake in SW Kansas, but there is a greater risk of regional impacts from geologic structures in the Texas Panhandle. Most of the earthquakes in the Texas Panhandle occur along the boundary between the Amarillo – Wichita Uplift (AWU) and the Anadarko Basin system. This area contains subterranean faults extending from north of Amarillo into southwestern Oklahoma (TXEQ, 2021). The northern part of that boundary passes through the Texas Panhandle south of Beaver County.

The Anadarko Basin is a geologic depositional and structural basin centered in the western part of the state of Oklahoma and the Texas Panhandle, extending into Kansas and Colorado. The basin holds one of the most prolific natural gas reserves in North America, with ultimate gas production in excess of 100 trillion cubic feet (2,800 km3) of gas. In 2010, the U.S. Geological Survey estimated that the Anadarko Basin held 27.5 trillion cubic feet of natural gas and 410 million barrels of natural gas liquids (NGL) (Anadarko, 2021). Therefore, many transmission pipelines are in place to move the gas and oil from the basin to the rest of the United States. A map on page 22, below, illustrates pipelines that pass through Beaver County.

Extent

Beaver County refers to the USGS standards for classification of earthquake magnitude and intensity. The Modified Mercalli Scale is used to classify the intensity, while the Richter scale measures magnitude. Earthquakes that have occurred in the planning area have been measured in the range from 2.5 to 2.7 magnitude and I and II on the Modified Mercalli scale, but an earthquake of any classification on the scale could occur.

Magnitude	Mercalli	Description	Earthquake Effects
2	I	Instrumental	Not felt except by a very few under especially favorable conditions.
	II	Feeble	Felt only by a few persons at rest, especially on upper floors of buildings.
3	III	Slight	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
	IV	Moderate	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
4	V	Rather Strong	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5	VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
5	VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6	VIII	Destructive	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
7	IX	Ruinous	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
	X	Disastrous	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
8	XI	Very Disastrous	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Catastrophic	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

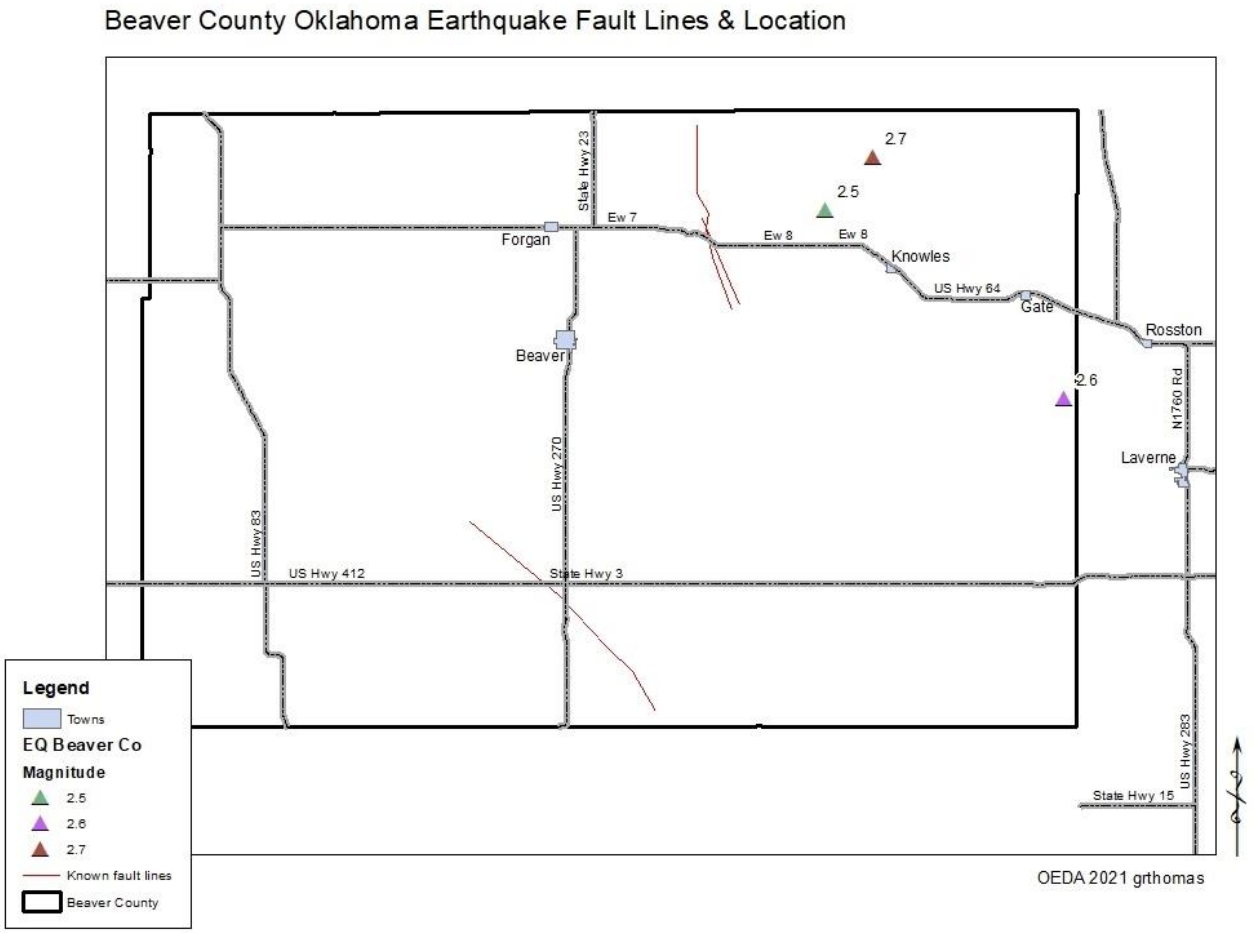
Source: http://earthquake.usgs.gov/learn/topics/mercalli.php

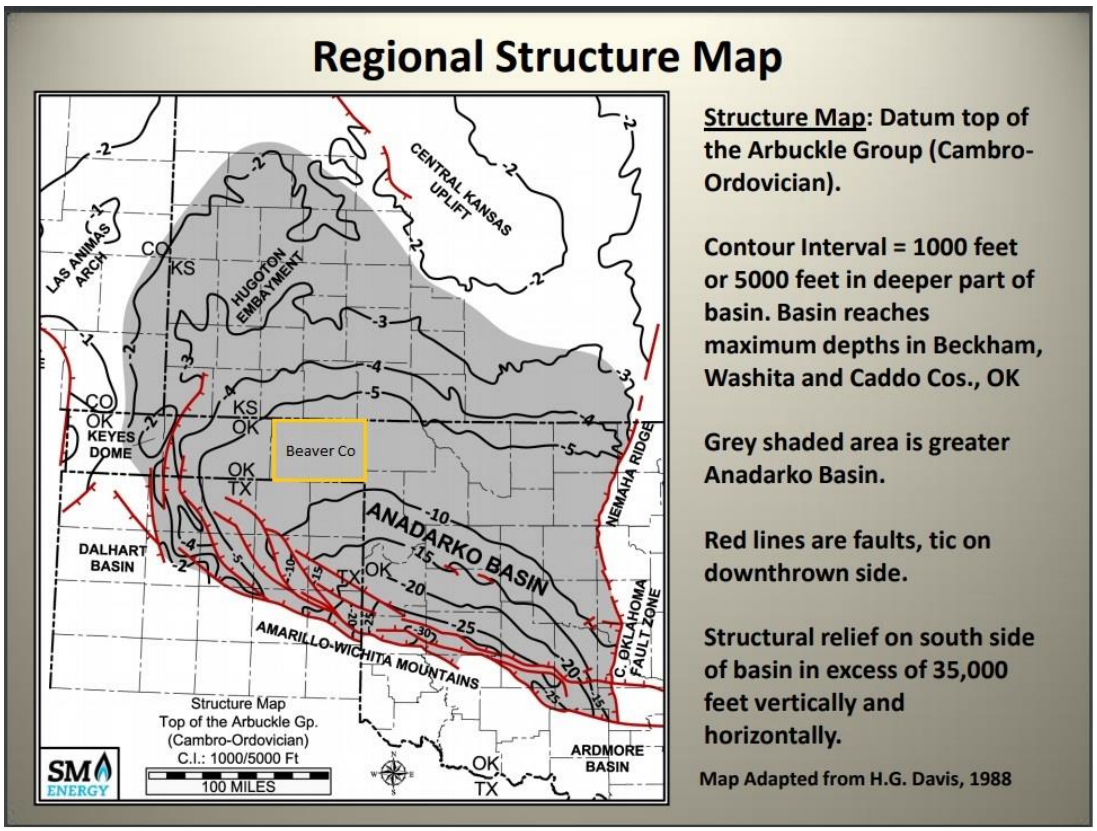
Previous Occurrences

Data gleaned from the Oklahoma Geological Survey; University of Oklahoma indicate that over a 10 year period (2011 through 2020), 3 earthquakes occurred in Beaver County, of magnitude 2.5, 2.6 and 2.7 *Instrumental to Feeble* (See map below). These seismic events are so mild that residents nearby may not even notice them.

Event id	Date	Magnitude	Mercalli	Latitude	Longitude	Depth (km)
FID 2044	3/25/2016	2.6	II	36.7662	100.0157	5
9574	5/3/2019	2.7	II	36.95933333	-100.2105	6
20638	12/12/2019	2.5	II	36.92466667	-100.2578333	6

https://ogsweb.ou.edu/eq_catalog/





http://www.ogs.ou.edu/MEETINGS/Presentations/OilGasMar2012/MITCHELL_ANDARKO.pdf

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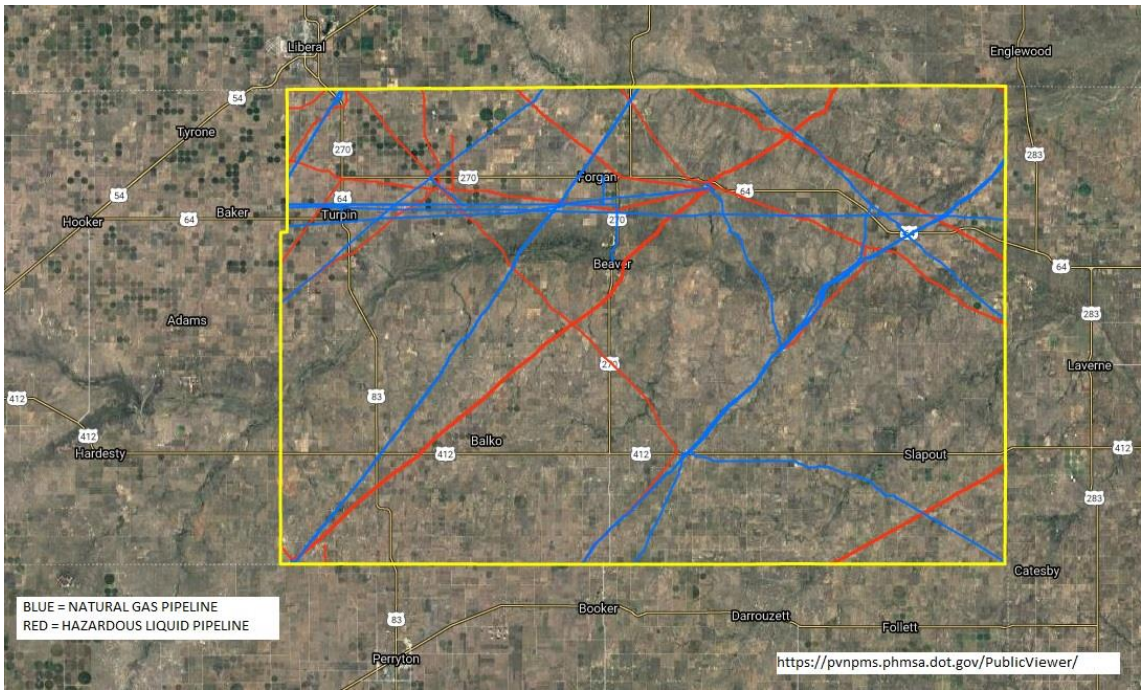
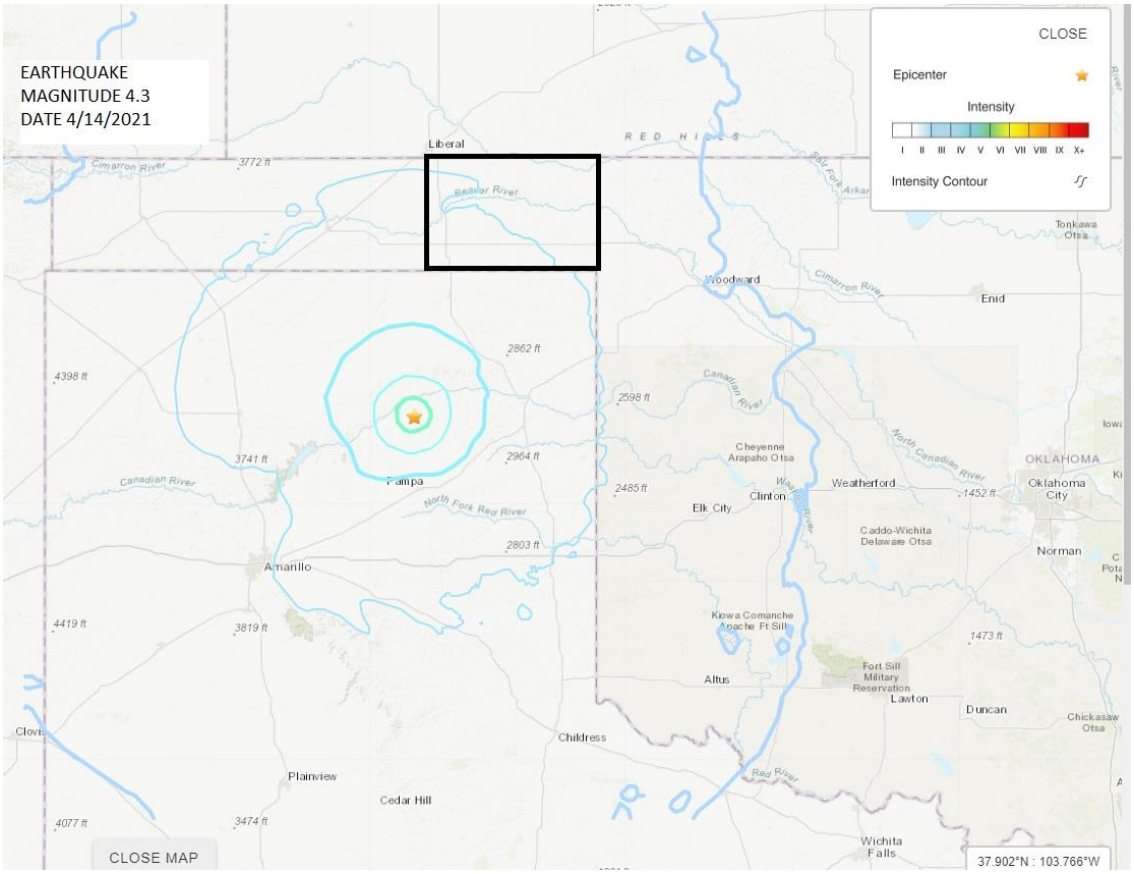
The map below illustrates pipelines that pass through Beaver County.



On April 14, 2021, a 4.3 magnitude earthquake occurred in the Texas panhandle, strong enough to be felt in the Town of Beaver.



Previous Occurrences NW Texas

"Although the exact number of earthquakes that have affected the Texas Panhandle is unknown, nearly 91 percent of known Texas Panhandle earthquakes since 1907 have had Richter Scale magnitudes less than 5.0. Only three known earthquakes have had magnitudes at or above 5.0. The largest known earthquake in the Texas Panhandle had a Richter Scale magnitude of 5.4 and occurred on 30 July 1925. No known earthquakes in our area have had a magnitude of 6.0 or greater, but there is no guarantee that has never happened since the seismic record is extremely small. Frohlich and Davis (2002) estimated that an earthquake with a magnitude greater than 6.0 might occur every 300 years in the Texas Panhandle, which could result in serious damage if it occurred near an inhabited location. An earthquake with a magnitude between 5.5 and 6.0 is estimated to occur every 50 to 100 years in the Texas Panhandle (TXEQ, 2021)."

Probability of Future Events

There is a 30% probability that an earthquake will occur in Beaver County in any given year (3/10 = 30%) Medium probability.

Vulnerability and Impact

While earthquakes recorded in the planning area to date have not resulted in reports of damage, all participating jurisdictions are vulnerable to potential damaging events.

Structures. In the event of a larger quake, structures can be damaged. Of special concern throughout the planning area is public infrastructure, such as roads, bridges, pipelines, oil storage sites and utility installations. Local roads and bridges are in a chronic state of deferred maintenance. Only 8% occupied residential structures of were built in the last 20 years (165 of 1,971), and 67% of all occupied housing was built prior to 1980 (ACS, 2021).

Many of the standing agricultural building were constructed from the time of settlement in the early 1900's through the 1970's. Since 1980, many smaller farms and ranches have been absorbed by larger entities, leaving abandoned buildings and farmsteads in disrepair. These buildings may still be in use as rental properties, or as shelter for crops and livestock, but were not constructed to withstand earthquake.

People. Vulnerable populations include groups of children or elderly people inside schools, hospitals and nursing homes who may be difficult to protect or evacuate at the time of a damaging event. In addition to the danger from damaged building materials, cabinets which can spill open, loose objects that may fall, or shelves that become dislodged during such an event, pose a risk of injury to anyone in the vicinity.

EARTHQUAKE	
Beaver Co	
Vulnerability	The Beaver County Courthouse was built in 1926 around the original 1907 stone courthouse. It is a red brick 75 by 75 feet two-story courthouse on the National Register of Historic Places
	About 80% of agricultural and residential buildings in the county were built prior to 1980, and therefore constructed prior to the adoption of modern building codes
	Because the perceived risk of earthquake is low, shelves and cabinetry are not earthquake resistant
	Fixed infrastructure is vulnerable to earthquake damage, including pipelines, public utilities, roads, bridges
	Pipelines run across the County in all directions (see map above), owned by a variety of companies and subject to frequent changes in ownership
	Most roads and bridges throughout the county are aging structures that suffer from deferred maintenance
	"Tank batteries" for oil storage are scattered throughout the rural landscape. These containers become corroded due to weather over time, weakening the structures

Impact	Due to date of construction and obsolete building practices, older agricultural and residential structures are more susceptible to damage from shaking
	Both active and inactive pipelines can contain hazardous material. There is no local control of these lines and the potential for damage in the event of an earthquake is unknown
	Aging roads and bridges may become cracked or unstable
	Utility infrastructure is damaged by earth movements
	In the event of a break in a pipeline, there is a danger of airborne noxious gases or explosion
	People or livestock indoors or near buildings may be harmed by falling debris in older buildings not built to modern codes
	Outdoor oil storage facilities may be damaged, causing environmental hazards from spilled contents
Town of Beaver	
Vulnerability	Beaver has public water and sewer infrastructure that could be damaged by shaking
	The town has a concentration of residential and business buildings 90% of which were built before 1980
	A concrete grain elevator stands at the North end of town, built in 1950
Impact	Structures may be damaged; people indoors or near buildings may be harmed by falling debris
	Older streets and bridges may be cracked, older infrastructure can be damaged by shaking
	Grain elevators are critically important to the agricultural economy. If the elevator were damaged, storage and shipment of Ag products will be disrupted
Town of Gate	
Vulnerability	Gate has a concentration of older residential and business buildings that could be damaged in the event of an earthquake; 70% of houses were built before 1980 and the remaining 30% prior to 2000
	The Gate water tower is a tank structure built in 1954; more than 65 years old
Impact	Structures may be damaged; people indoors or near buildings can be harmed by falling debris; roads and bridges may be cracked, infrastructure is damaged by shaking
	The water tower could be subject to failure or collapse in the event of earthquake
Town of Knowles	
Vulnerability	Knowles has a concentration of older residential and business buildings that could be damaged in the event of an earthquake. Of 13 houses in Knowles, 9 were built prior to 1950, and two in the 80s. One home was built in 2015
	A grain elevator with tin siding and several associated structures stands in town; still in use, the structure is on the National Register of Historic Places but no funds are currently available for restoration or strengthening the structure
Impact	Structures may be damaged; people indoors or near buildings may be harmed by falling debris; streets and bridges may be cracked
Beaver, Balko, Forgan and Turpin School Districts	

Vulnerability	School buildings and accessory structures were built between 1932 and 2019. Older structures may be more vulnerable to earthquake damage, staff and children are concentrated in these buildings
	Shelves or cabinets are not adequately secured with tie downs; windows are not coated with shatterproof film
	The Emergency Operations Plans do not include earthquake safety protocol
Impact	During an earthquake, buildings and other structures can be damaged by shaking; windows may shatter, shelves can collapse or spill contents, posing a risk to health and life.
	Students and staff have not been educated about the potential for earthquake to occur, and the related safety protocol, decreasing their ability to protect themselves adequately in an earthquake event

3.4.3 Extreme Heat

Summertime temperatures routinely climb above the 100-degree mark, which can create very uncomfortable conditions, especially when combined with high humidity. Temperatures that hover 10 degrees or more above the average high temperature for an area, and last for several days or longer, is one measure of extreme heat. Humid conditions can persist and air quality can deteriorate during the summer when a dome of high atmospheric pressure creates a temperature inversion that traps a stagnant air mass near the ground.

Location

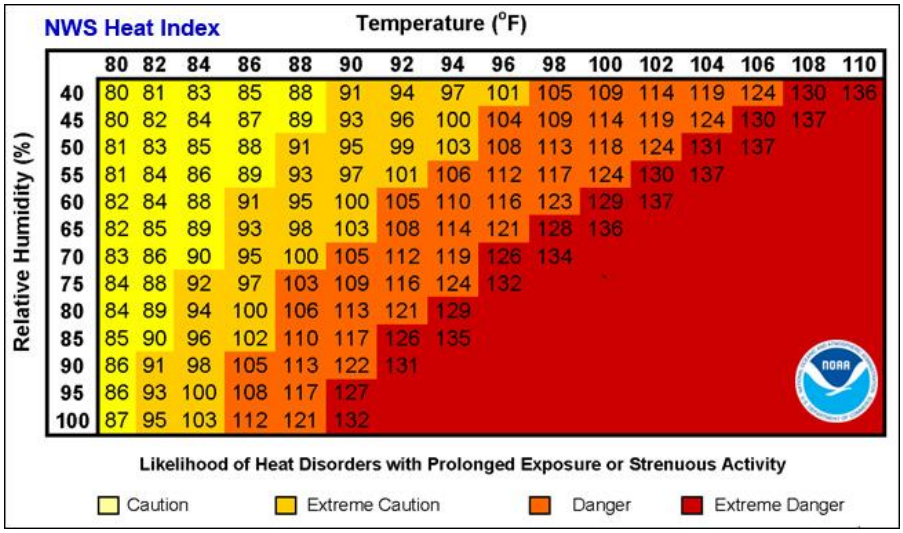
Extreme heat events affect the entire planning area. Urbanized areas with more concrete and asphalt tend to have somewhat higher temperatures than open and vegetated areas, therefore it could be expected that the towns of Beaver and Forgan may record a slightly higher temperature than the unincorporated part of the county.

Extent

The planning area uses the Heat Index Chart to categorize Extreme Heat, and values that fall anywhere on the Index may be expected to occur.

Temperature and Humidity. Extreme heat conditions in Beaver County are a function of heat and humidity; illustrated below using a Heat Index Chart. A status of Danger can occur at temperatures as low as 82 degrees Fahrenheit when humidity is at 90% and may be expected to reach Extreme Danger when temperatures reach 90 with high humidity. At temperatures of 98 degrees and above, humidity as low as 40% creates a dangerous situation. Oklahoma humidity is typically between 43% and 83% during summer days (Climate, 2019).

The combined effects of rising temperatures and humidity present a situation where humans and animals may experience heat disorders which, at extreme levels can be fatal.



Previous Occurrences

Referring to the heat chart, one way to identify periods of extreme heat is to record the number of days in the danger and extreme danger categories when temperatures reached 90 degrees or more and humidity is greater than 70%. When temperature or humidity exceeds those levels, conditions always pose a danger of heat disorders to unsheltered people or animals.

Over the period from 2011 through 2020, temperatures reached greater than 90 degrees on about 73.4% of summer days, while more than 82.5% of all summer days reached over 70% humidity (June, July and August = 920 days). These days overlap in that nearly all days over 90 degrees also reach humidity of 70% or greater.

"Danger and Extreme Danger"

Beaver County Heat data	Days over 90F	Days over 70% Humidity	Days exceeding 90 degrees and greater than 70% humidity
Summer days	676 of 920	759 of 920	674 of 920
10 year average	73.48%	82.5 %	**73.4%**

Included in the above figures are the twenty-three percent of those summer days that exceed 100 degrees, as illustrated below. Virtually all summer days that reach temperatures of 100 degrees are days of "Extreme Danger."

"Extreme Danger"

Beaver County Heat data	Days over 100F	Days over 60% Humidity	Days exceeding 100 degrees and greater than 60% humidity
Summer days	216 of 920	906 of 920	216 of 920
10 year average	23.48%	98.47%	**23.48%**

Probability

Throughout Beaver County, all jurisdictions can expect summer temperatures to exceed 90 degrees with humidity of at least 70% or more on an average of 67.4 days a year (67 events/year = >100%), High probability.

Vulnerability and Impact

Extreme heat events affect all jurisdictions. Humans, crops and livestock suffer injury or death from extreme heat. In extreme heat situations local emergency responders accompany fire departments on calls, in the event they are needed to treat fire fighters for heat disorders. Infrastructure such as roads, bridges and electrical lines are damaged due to expansion and contraction during extreme temperatures. Children and elderly or disabled persons are especially vulnerable to heat stress.

EXTREME HEAT	
Beaver Co	
Vulnerability	The county is a rural area and there are many low income and elderly individuals. Of all people in the county, 11.4% are below the poverty level; 7.7% of people age 65 and over are in poverty. Some people cannot afford to buy or operate air conditioners all summer, and at times there are breakdowns or power loss
	County workers, emergency response personnel and other people working outdoors must sometimes work in extreme conditions
	Extreme heat conditions directly affect agricultural production of crops and livestock by causing severe heat stress
	Beaver County has aging infrastructure that is more vulnerable to expansion and contraction due to extreme temperatures
Impact	There is a danger of heat exhaustion for all people and especially vulnerable low income elderly who do not have the ability to withstand extreme heat events. Fire fighters and people working outdoors need to be cooled down periodically to avoid heat disorders
	Loss of production in crops and heat disorders in livestock have a negative economic impact on the county and reduce tax revenue
	Older infrastructure is weakened by extreme temperature effects of expansion and shrinkage over decades
Town of Beaver	
Vulnerability	14.4% of the population is below the poverty level and 18.2% are over age 65
	The Town has older infrastructure which is more vulnerable to a cycle of temperature extremes
	Emergency personnel and other people working outdoors must sometimes work in extreme conditions
Impact	Low income households cannot always afford to have air conditioning, and elderly people are more susceptible to the effects of extreme heat
	Extreme heat expansion causes stress on infrastructure over a period of decades
	Extreme temperatures can cause heat disorders in emergency response personnel and people working outdoors

Town of Gate	
Vulnerability	Gate lacks a temperature-controlled place of refuge
	8.2% of the population is below the poverty level and 21.2% of residents are over age 65. Low income households may not have air conditioning, and elderly people are more vulnerable to heat stress
	The town has older infrastructure that is vulnerable to a cycle of temperature extremes
	There is no city pool for midday relief from heat
	Emergency personnel and other people must work outdoors in extreme conditions
Impact	The lack of cooling stations impacts economically-challenged residents who do not have the ability to withstand extreme heat events, particularly elderly populations, the disabled and families with very young children
	Extreme temperatures cause heat disorders in emergency response personnel and people working outdoors
	Extreme temperatures cause damage to infrastructure in freeze/thaw cycles over decades
Town of Knowles	
Vulnerability	In the Town of Knowles, 28.6% of the population is over age 65
	The town has older infrastructure that is vulnerable to a cycle of temperature extremes
	Outdoor workers and emergency personnel may be working in extreme conditions
Impact	Older residents have less ability to withstand extreme heat and may not be able to drive to a temperature controlled shelter
	Heat stress causes damage to infrastructure
	Extreme temperatures cause heat disorders in emergency response personnel and people working outdoors
Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	Due to the climate in NW Oklahoma, most school buildings must be air-conditioned
	Children and staff are vulnerable to heat stress. Although most extreme heat events occur during summer months when school is not in session, extreme heat does occur on school days and during summer activities
	Staff is not trained in extreme heat safety protocols; Emergency Operations Plans do not address extreme heat hazards
Impact	Schools may have to close due to excessive heat when AC systems fail or are overwhelmed
	There are increased cooling costs to maintain air-conditioned areas
	Buses must have adequate AC
	Children can be negatively impacted by extreme heat. Safety protocols and staff training for extreme heat events is needed to protect staff and student health, especially for student athletes

3.4.4 Flood

River flooding is when a river rises to its flood stage and spills over the banks. The amount of flooding is usually a function of the amount of precipitation in an area, the amount of time it takes for rainfall to accumulate, previous saturation of local soils, and the terrain around the river system. A river located in a broad, flat floodplain will often overflow to create shallow and persistent floodwaters in an area that do not recede for extended periods of time. The excess water can be from snowmelt or rainfall far upstream. Flood effects can be local, impacting a neighborhood or community. They can also be very large, affecting entire river basins and multiple states.

Base flood. The terms "base flood," "100 year flood," and "one-percent annual chance flood" are often used interchangeably. The boundary of the Base Flood (1% flood) is intended to be equivalent to the Flood Hazard Boundary (FEMA, 2021).

Flash Flood. "Flash flood" is a flood caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash flooding occurs when excessive rainfall temporarily exceeds the design capabilities of drainage facilities, and is not identified on flood hazard maps.

NFIP Participation

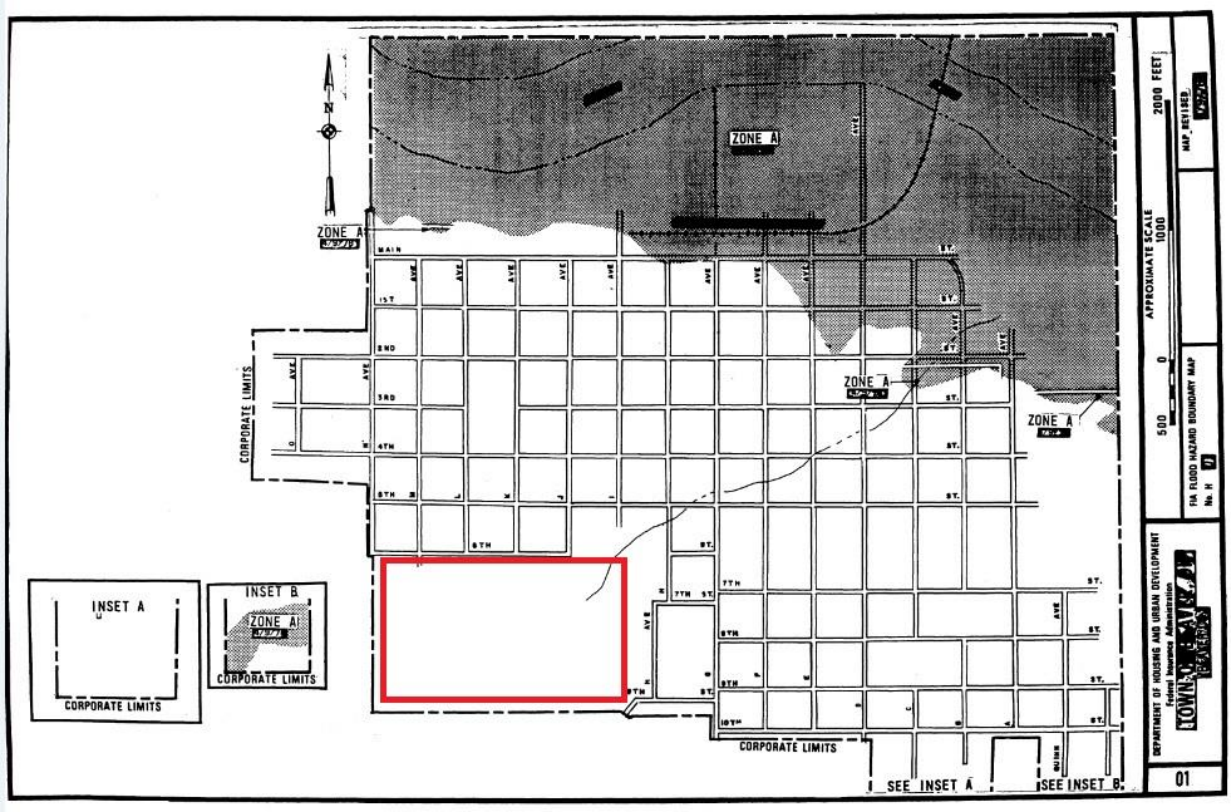
The Town of Beaver does participate in the National Flood Insurance Program (NFIP). Other jurisdictions in Beaver County have not been mapped by FEMA and do not participate in the NFIP. No repetitive loss structures have been identified in the planning area. See NFIP map, Page 30, below. A Red outline shows the approximate location of Beaver Schools.

Location

Riverine flooding. The Beaver River flows along the north edge of the Town of Beaver where it does pose a potential flood hazard. Another small area identified as a 1% flood area is on the south edge of town as shown in inset B on the NFIP map. The source of that potential inundation is a tributary of the Beaver River.

Stormwater and Overland flow. All jurisdictions are subject to flash flooding when the amount of rainwater exceeds the capacity of the drainage system.

FEMA Map Service Center; Panel 40009B Town of Beaver OK



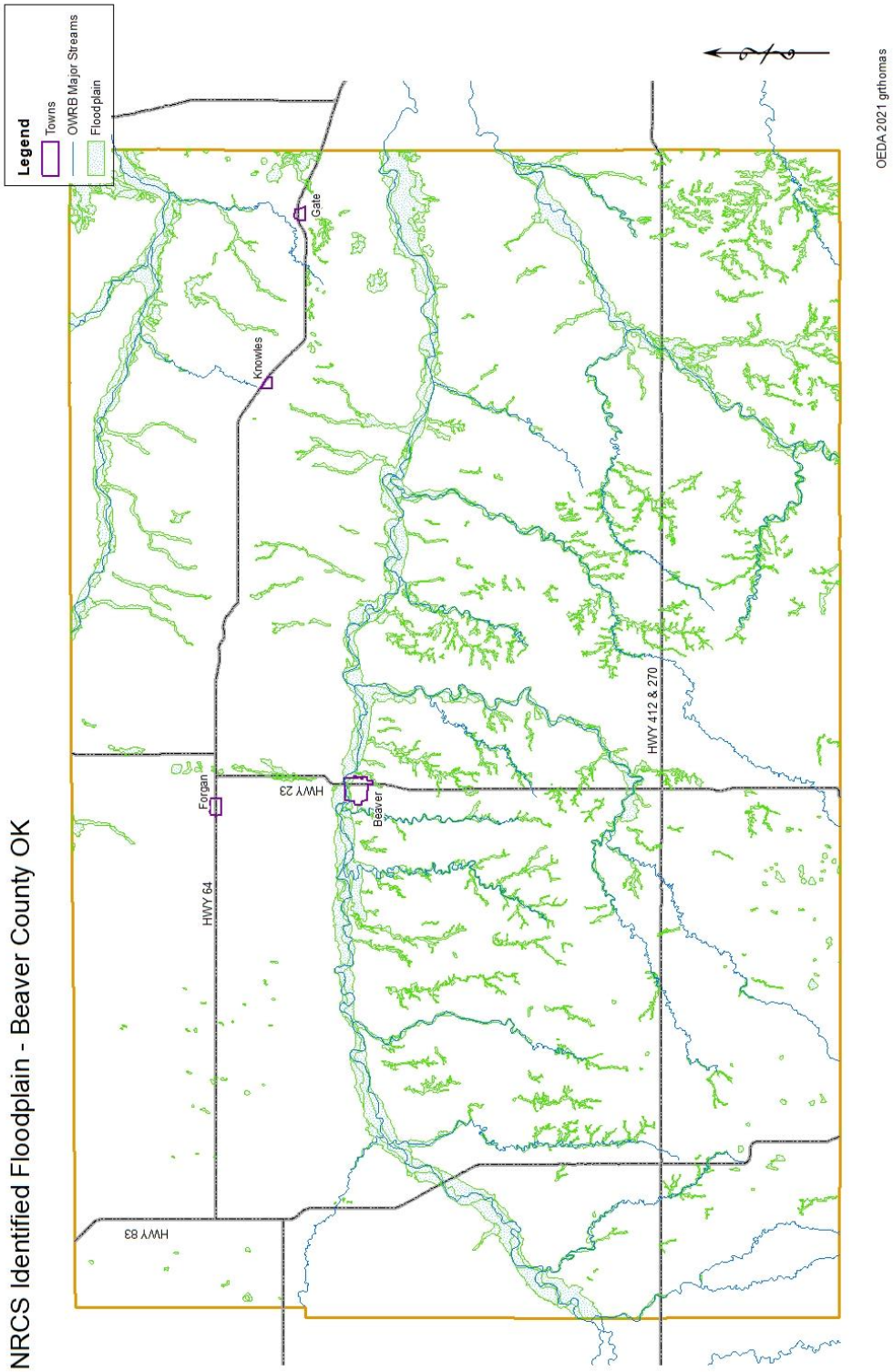
NRCS Data and Maps

Topography, elevation and soil type data was used by the local Natural Resources Conservation Service (NRCS) to determine the flood hazard boundary for a 1% flood. From that data, detailed maps were created for the remainder of Beaver County and are reproduced below. The Towns of Gate or Knowles do not have floodplain ordinances because there are no identified flood hazards within the municipal boundaries. The data indicates that the Towns of Gate and Knowles, or the Balko, Beaver, Forgan or Turpin Public School properties are not expected to be impacted by a 1% flood.

Extent

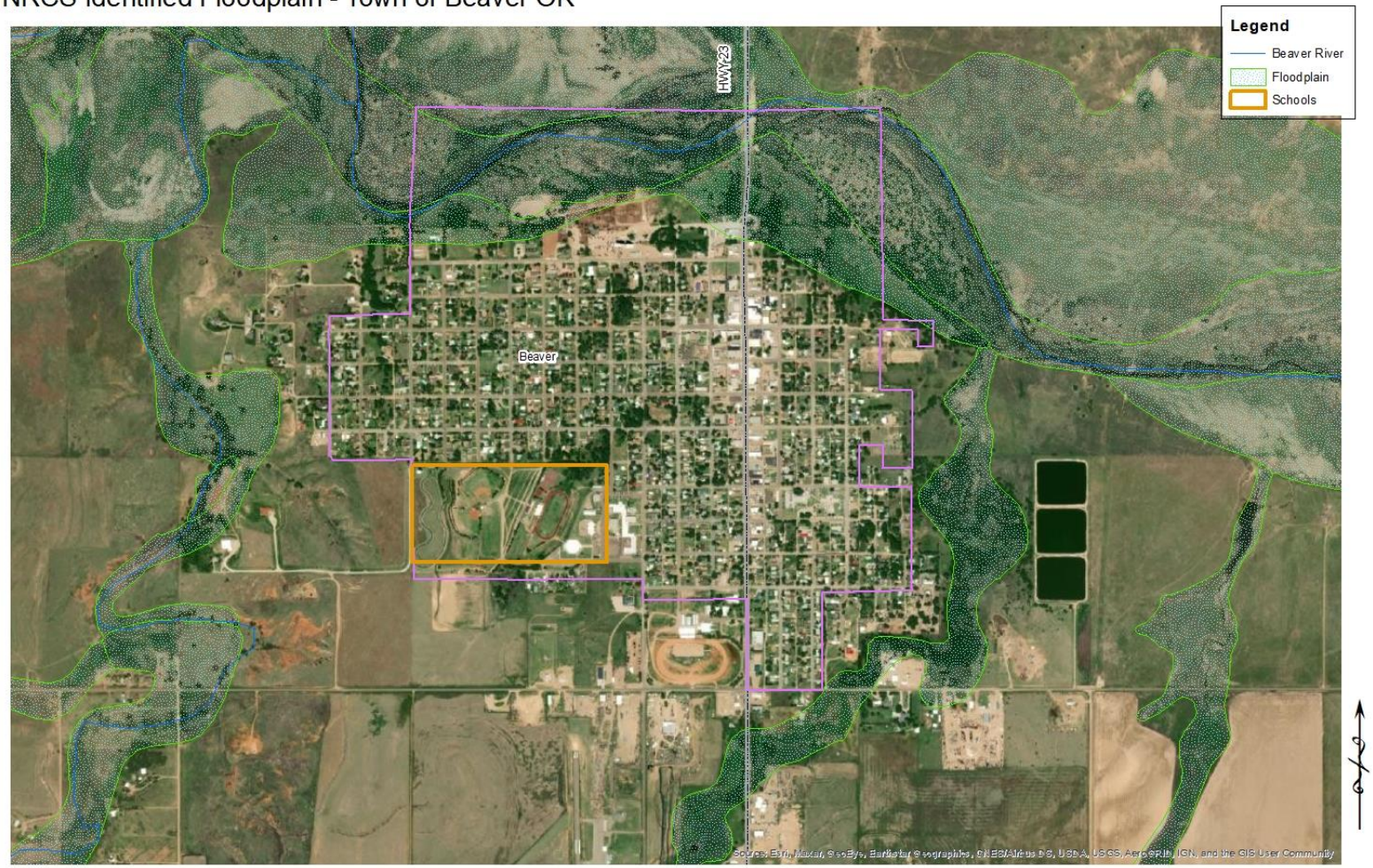
The NRCS flood data and resulting maps are based on USGS topographical maps with 2 foot contour intervals, therefore the areas shaded in green can be expected to have up to 2 feet of flooding (Collier, 2019). Floodplains as identified and mapped by the Oklahoma Natural Resources Conservation Service (NRCS) are illustrated below.

Beaver County NRCS Floodplain Maps:



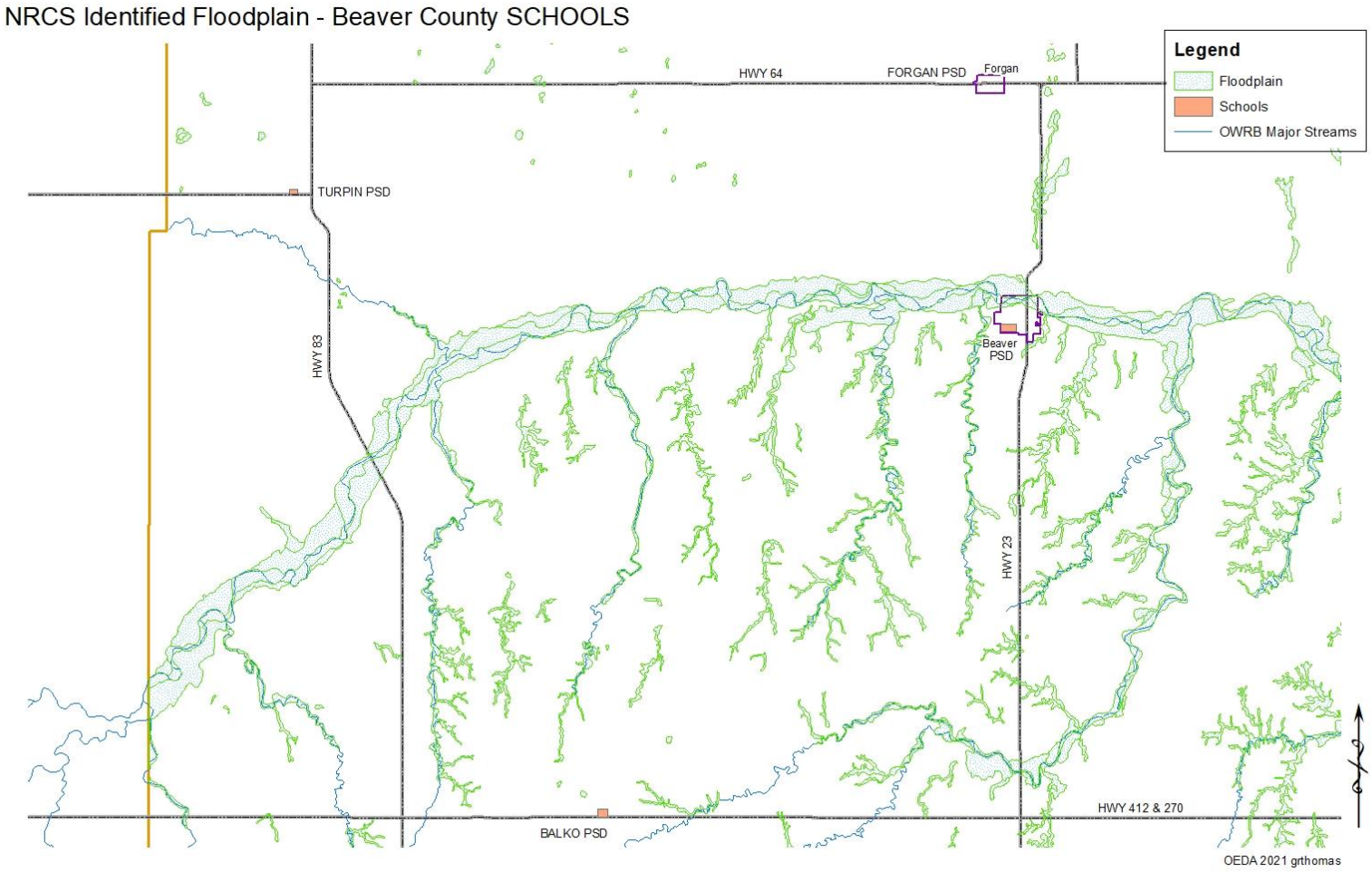
MAP 1 BEAVER COUNTY FLOODPLAIN

NRCS Identified Floodplain - Town of Beaver OK



OEDA 2021 grthomas

MAP 2 TOWN OF BEAVER FLOODPLAIN



Location of Schools in Beaver County

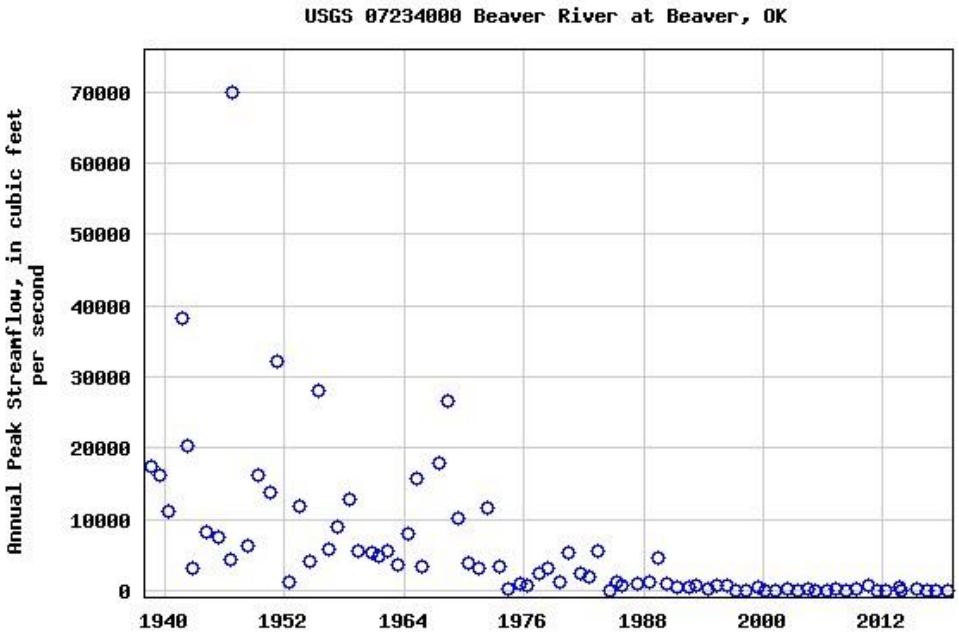
Floodplain Regulation

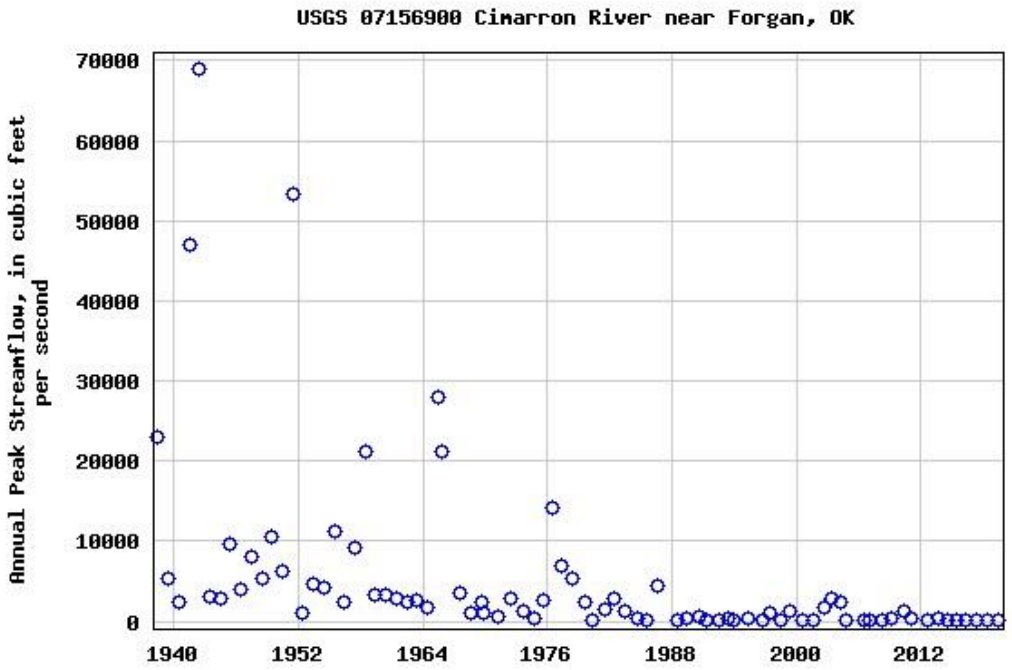
Beaver County does not regulate development in flood areas. The Town of Beaver has adopted the NFIP map and has a floodplain ordinance to regulate building in known flood areas. The Town Manager acts as Floodplain Manager with support from staff at the Oklahoma Economic Development Authority (OEDA).

At the time the Panhandle was settled for agricultural use in the early 1900's, the Beaver River was a larger river than it is today. In addition to surface water drained from the watershed, the Ogallala Aquifer is a primary source of water in the Beaver River. While drought affects the volume of surface runoff available to the river, a massive increase in crop irrigation over the last 5 decades has negatively impacted the water level in the aquifer, reducing stream depth of the river. Stream gauge data shows a consistent drop in water level since 1970.

The river was known for occasional floods, including an October 1923 flood amounting to 109,000 acre-feet of water, and a September 1941 flood in which the Beaver's flow increased to 44,200 cubic feet per second. The river's most recent flow of significance was in October 1965 at 17,800 cubic feet per second.

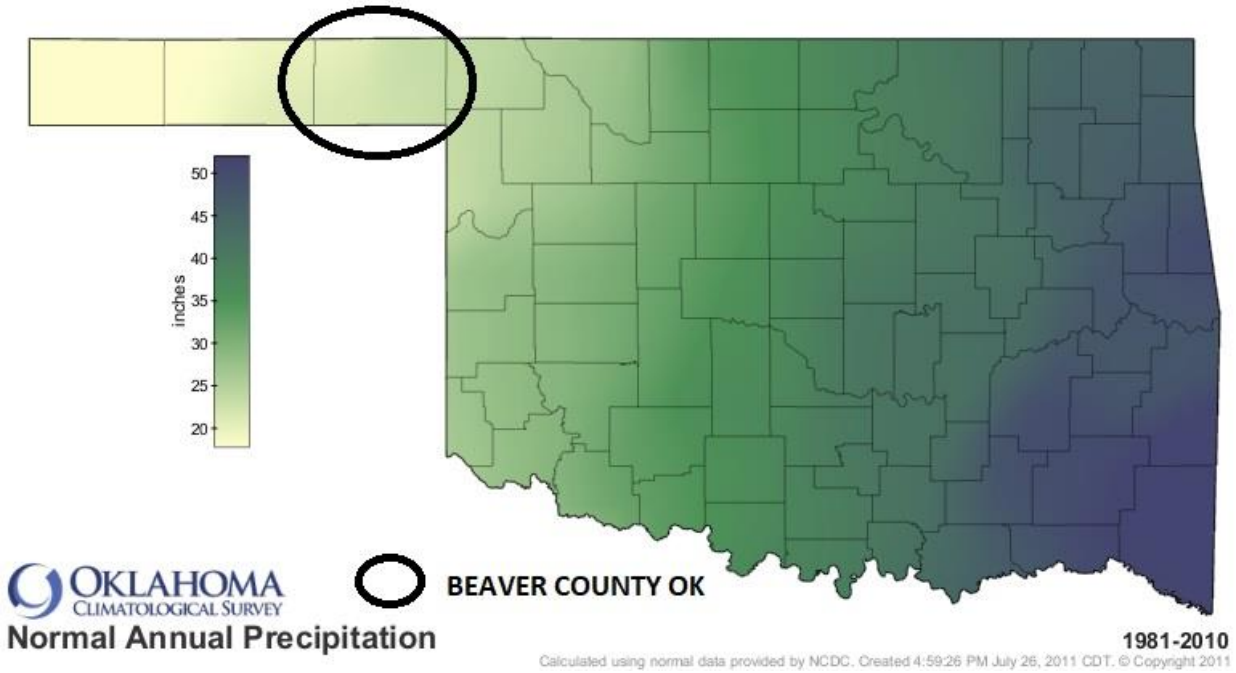
Currently, the Beaver River and its tributaries flow with water intermittently, in part because the underground source of the river, the Ogallala Aquifer, being the water table beneath far western Oklahoma and parts of seven other Western states as well, has been subject to depletion in recent decades due to increased irrigation and drinking-water withdrawals (Layden, 2013).





(usgs, 2021)

Average precipitation. Beaver County records show that there are about 60 days each year when precipitation occurs. Average precipitation amounts to about 22 inches a year (Climate, 2020).



Previous Occurrences

Between 01/01/2011 and 12/31/2020 eleven flash floods have occurred in Beaver County, and four other incidents of minor flooding were recorded. (NOAA, 2021). It should be noted that all flood events in the NOAA storm record in the last 10 years have been flood events of brief duration and associated with heavy rain.

Beaver County Flood Events 2011 through 2020

DATE	LOCATION	EVENT TYPE	FLOOD CAUSE	EVENT NARRATIVE
8/7/2013	BOYD	Flash Flood	Heavy Rain	Heavy rain from a squall line led to flash flooding over the western portion of Beaver County. The Beaver County Emergency Manager reported that flash flooding was covering U.S. Highway 83, 13 miles south of Turpin.
8/7/2013	BEAVER	Flash Flood	Heavy Rain	The Beaver County Emergency Manager reported that 4 inches of rain fell in Beaver over a short period of time. This led to flash flooding in town and on US270/SH23, 5 miles south of Beaver. Some roads in Beaver had 4 to 6 inches of water covering the road, and flood waters had gotten into homes, businesses, and the courthouse.
10/28/2013	BEAVER	Flash Flood	Heavy Rain	Thunderstorms were able to produce 1.55 inches of heavy rain within an hour. This heavy rain led to flash flooding across the city. The Beaver County EM reported 6 to 8 inches of fast flowing water on Avenue E in front of the Sheriff's office, and on Douglas Ave.
6/4/2013	ELMWOOD	Minor Flooding	Heavy Rain	A line of thunderstorms moved across Beaver County during the late evening hours of the 4th. This line produced heavy rain across the county. The Beaver County Emergency Manager reported minor flooding southeast of Elmwood (Beaver County). After the line of thunderstorms moved into western Oklahoma the flood water receded.
6/6/2014	BOYD	Flash Flood	Heavy Rain	A line of intense rain producing thunderstorms moved over Beaver County during the evening hours of the 6th. This rain led to flash flooding on US Highway 83 near the Beaver River Bridge (Beaver County). The highway was closed for a few hours before reopening.
6/6/2014	BEAVER	Flash Flood	Heavy Rain	A line of intense rain producing thunderstorms moved over Beaver County during the evening hours of the 6th. This rain led to flash flooding on rural roads 8 miles east southeast of the town of Beaver (Beaver County). Flash flooding subsided not long after developing as the thunderstorms moved into western Oklahoma.

6/16/2013	BEAVER	Minor Flooding	Heavy Rain	Thunderstorms produced periods of heavy rain which lead to minor flooding across Beaver County. The Beaver County Emergency Manager reported low lying areas from Beaver to Elmwood to Bryans Corner had filled with water. No roads were reported to be impacted by this nuisance flooding. After the line of thunderstorms moved to the southeast of the eastern Oklahoma Panhandle the flood waters receded.
7/31/2013	BOYD	Minor Flooding	Heavy Rain	Discrete thunderstorms brought periods of heavy rain which lead to minor flooding near the community of Boyd. The Beaver County Emergency Manager reported that some water was reported on Highway 83 but was not enough to stop traffic. The Oklahoma Department of Transportation did place signs on the highway to warn of possible water on the road. By 9 PM CST the flood waters had receded as the thunderstorms moved well south of this area.
6/22/2014	KNOWLES	Flash Flood	Heavy Rain	Heavy rain over northern Beaver County near the town of Knowles led to flash flooding 2 miles south of town. A county road south of Knowles was completely washed out.
8/27/2014	CLEAR LAKE	Flash Flood	Heavy Rain	Intense rainfall led to the development of flash flooding on County Rd 1450 southeast of the town of Beaver, and bar ditches in this area were also full.
6/22/2018	BALKO	Minor Flooding	Thunder storm Wind	Widespread severe weather occurred across the Panhandles. As such several severe storms were reported across the Panhandles, along with some minor flooding, and a couple tornadoes.
8/23/2019	BEAVER	Flash Flood	Heavy Rain	Flooding was reported in Beaver with water rushing across low lying areas on US Highway 270/412.
8/23/2019	FORGAN	Flash Flood	Heavy Rain	Flooding was reported with water covering roadways in Forgan.
8/23/2019	BEAVER	Flash Flood	Heavy Rain	Water was reported inside a convenience store in north Beaver.
8/10/2020	KNOWLES	Flood	Heavy Rain	Bar ditches flooded and standing water in low lying areas

Probability of Future Events

The probability for a Flash Flood or Minor Flood event in Beaver County is 15 events in 10 years 15/10 = >100% High probability. The probability for a Base Flood event (1% flood) which fills or overflows the identified floodplain area is very low and most recently occurred near the Town of Beaver in 1965.

Vulnerability and Impact

Topographic maps produced by the US Geological Survey (USGS Quadrangles) show that the Towns of Gate and Knowles, and the Balko, Beaver, Forgan and Turpin PSDs are located on relatively high ground within their respective watersheds and therefore have very low risk of a Base flood event. Overland flow remains a hazard and drainage structures must be configured in a way that directs stormwater effectively.

Low density population, a modest economy and corresponding low tax base all contribute to a situation where Beaver County has many older roads and bridges that were not designed to modern standards and suffer from deferred maintenance. Those structures are more vulnerable to damage from excess water. Most town streets in Beaver are designed with shallow dips at intersections that drain water off the street. There are few storm drains. Throughout the County, few structures are located in known flood areas. Residents have either built according to local knowledge of flood areas or flood damaged structures have not been rebuilt.

FLOOD	
Beaver County	
Vulnerability	Beaver County has many older roads and bridges still in use that were not constructed to modern standards and lack adequate flood capacity or erosion control features
	Low population and modest economic activity limit the tax revenue available for maintenance each year
	Several roads, including Hwy 23 N of Beaver, are subject to water over the road at times of heavy rain, posing a threat to human life
	Ditches have the capacity to hold low level floods but ponding persists and infiltration is slow due to the high concentration of clay in the soils and compaction of soils in ditches
Impact	Erosion due to flood weakens road and bridge infrastructure; excess storm water causes erosion and floods roads when water volume overwhelms the capacity of drainage ditches
	Standing water becomes stagnant over a period of time and poses a health risk from breeding mosquitos and other life
Town of Beaver	
Vulnerability	Residential and commercial structures are at risk from rising flood water associated with the Beaver River; overland sheet flow impacts some structures
	Most streets are not designed with storm drains
	Existing drainage and storage structures reach capacity quickly and overflow
	Where ponding occurs, infiltration is slow due to the presence of clay minerals in soils and compaction of soils in ditches
	A few residential and commercial structures adjacent to the Beaver River are at risk from rising flood water
Impact	Overland sheet flow damages residential and commercial structures
	Erosion due to flood weakens street and bridge infrastructure

	Storm water causes erosion and floods the streets when water volume overwhelms the capacity of drainage ditches
	Standing water becomes stagnant over a period of time and poses a health risk from breeding mosquitos and other life
Town of Gate	
Vulnerability	The Town of Gate lies at a relatively high elevation compared to the surrounding topography, therefore overland flow is the primary flood risk
	Streets are not designed with storm drains
	Infiltration is slow due to the presence of clay minerals in soils and compaction of soils in ditches
Impact	Sheet flow and storm water overwhelm the capacity of drainage systems
	Ponding water infiltrates slowly, providing breeding grounds for mosquitos and other undesirable life
Town of Knowles	
Vulnerability	The Town of Knowles lies at a relatively high elevation compared to the surrounding topography, therefore stormwater drainage is the primary flood risk
	Streets lack adequate drainage and storage capacity
	Ponding occurs and there is a slow rate of infiltration due to clay minerals in the soil
Impact	Storm water overwhelms the capacity of drainage systems
	Water infiltrates slowly, providing breeding grounds for mosquitos and other undesirable life
Balko, Beaver, Forgan and Turpin School Districts	
Vulnerability	While school district structures are not located in flood hazard areas, there is a risk of damage from overland flow around Beaver, Forgan and Turpin Schools where some drainage structures are inadequate to contain and direct stormwater (Balko does not report drainage problems)
	Water over local roads poses a hazard to bus transportation
Impact	Transportation to school is disrupted when water floods the roads
	Flooding around parking areas and buildings poses a barrier to access for disabled students, staff or visitors
	Overland sheet flow damages buildings or parking lots

3.4.5 Hail

Hail is a form of precipitation that consists of solid lumps of ice, which are individually called hailstones. Hail formation requires an atmospheric environment of strong, upward moving air, called an updraft, within the subfreezing region of a thunderstorm cloud. Large hail stones greater than an inch in diameter (quarter size), can result from a severe thunderstorm and require a very powerful updraft to form. Most large hail is the product of supercell thunderstorms, which have a sustained rotating updraft that moves growing hailstones through the height of the cloud before falling to the ground.

HAIL DIAMETER SCALE	
Diameter (Inches)	Description
1/4”	Pea
1/2”	Small Marble
3/4”	Penny or Large Marble
7/8”	Nickel
1”	Quarter
1 1/4”	Half Dollar
1 1/2”	Walnut or Ping Pong Ball
1 3/4”	Golf Ball
2”	Hen’s Egg
2 1/2”	Tennis Ball
2 3/4”	Baseball
3”	Teacup Size
4”	Grapefruit
4 1/2”	Softball

Location

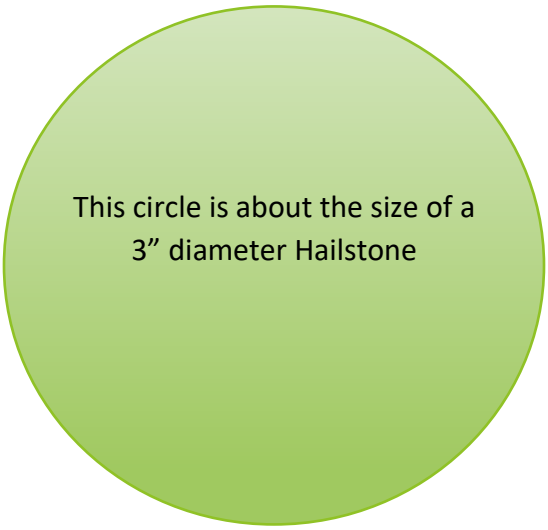
Hail affects all jurisdictions in the planning area.

Extent

The planning area uses the Hail Diameter Description Scale to categorize Hail events. Hailstones of any size described on the chart can be expected to occur.

Another factor that affects the amount of damage that can result from hail is the speed at which it falls. Velocity is affected by the height of a falling object due to the constant acceleration of gravity. For small hailstones produced at lower atmospheric heights, the expected fall speed is between 9 and 25 mph. For hailstones that fall in a severe thunderstorm (1 inch to 1.75-inch in diameter), the expected fall speed is between 25 and 40 mph.

In the strongest, upper level supercells which produce some of the largest hail, the expected fall speed can reach between 44 and 72 mph or more. While there is a degree of uncertainty in these estimates due to variability in a hailstone’s shape, degree of melting, fall orientation, and environmental conditions such as wind (NOAA, 2020), a 3 inch hailstone falling at 70 mph certainly has the potential to cause serious damage or death.



Previous Occurrences

There were 57 hail storms recorded by NOAA during the 10 year period January 2011 through December 2020 resulting in 121 reports issued by spotters across the county. It is important to note that different sizes of hail may be recorded by individuals over the duration of a single storm as it moves through various jurisdictions.

Most hail recorded was between ¾ inch and 1 inch diameter. Ninety percent (90%) of all hail reported measured 2" or less. Records show one storm in 2017 produced hailstones up to 3.5 inches across. Remarkably, in 2011 a storm produced hailstones that measured 4.5 inches diameter and documented in two locations, one reported by Law Enforcement SW of Slapout, and the other thirty miles away at Beaver by the Beaver County Emergency Manager (NOAA, 2021).

HAIL REPORTS 2011-2020	
Magnitude (inches)	% of Reports
1" or less	49%
1.25	8%
1.5	9%
1.75	21%
2.0	3%
2.5	2.5
2.75	5%
3.5	1%
4.5	1.5%

Probability of Future Events

Hail falls in the planning area an average of 5 or 6 times each year. The probability of a hail event is greater than 100%; High probability.

Vulnerability and Impact

Injury to people or animals, damage to crops and structures varies with the size and velocity of hailstones and the duration of the event.

The cost of damages to buildings and infrastructure must be borne by owners or insurance companies. Disruption of the economic purpose of affected structures is a cost which may be difficult to quantify and absorb.

HAIL	
Beaver Co	
Vulnerability	Rural residential and agricultural structures of all vintage and a variety of construction materials are scattered throughout the county. Some of those are more vulnerable due to age of construction, siding materials applied or type and age of the roof
	Due to the relatively mild winters, personal vehicles, farm equipment and larger trucks are often stored outdoors
	Livestock frequently graze open land, away from roofed structures
	Infrastructure such as electrical power lines, transformers and associated equipment is exposed to the weather
Impact	Hail events cause crop losses from minor damage to total loss
	Unsheltered livestock are stressed or injured
	Damage to vehicles ranges from minor dents to total loss of value
	Roofs, siding and windows on residential, business and school buildings are damaged
	Utility equipment such as substations, power lines and transformers are damaged by large hail

Town of Beaver	
Vulnerability	A population of about 1300 people, with all the associated residential and commercial buildings are concentrated in the Town of Beaver. Structures date from 1887 to 2019; older roofs are more vulnerable to damage from hail. About 12% of the people are below the poverty line; 44% are low to moderate income and may not be able to maintain structures in good repair or purchase better quality materials. Poor quality roofing and siding is more easily damaged
	Due to the relatively mild winters, personal vehicles, equipment and trucks are often stored outdoors
	Municipal utility services such as electric power and communication systems vulnerable to hail are also sited in or near Beaver
Impact	Damage to structures and vehicles ranges from minor cosmetic damage to total loss of value
	Roofs, siding, windows and appurtenances on residential and commercial structures suffer damage from hail events
	Damage to electrical infrastructure such as power lines and substations causes loss of power
Town of Gate	
Vulnerability	A population of about 85 people, with associated residential and commercial buildings are concentrated in the Town of Gate. Structures date from the 1880's to 1999. Such older roofs are more vulnerable to damage from hail. About 33% of the people live on less than $25,000 a year; 32% are over age 60. Low income and elderly residents may not be able to keep structures in good repair or purchase better quality materials. Old and poor quality roofing and siding is more easily damaged.
	Due to the relatively mild winters, personal vehicles, equipment and trucks are often stored outdoors
	Gate is served by electric power and communication systems vulnerable to hail; the low population density makes utility service more expensive (per household) to maintain, while revenue is modest
Impact	Damage to structures and vehicles ranges from minor cosmetic damage to total loss of value
	Roofs, siding, windows and appurtenances on residential and commercial structures suffer damage from hail events
	Damage to electrical infrastructure such as power lines and substations causes loss of power
Town of Knowles	
Vulnerability	Knowles has a seasonally variable population of about 8 to 12 people, with 6 viable residential structures. The US Census lists 13 dwellings, of which only 2 were built since 1990 (in the last 30 years). Most other structures in town were constructed prior to 1940
	Large hail can impact trees and power lines

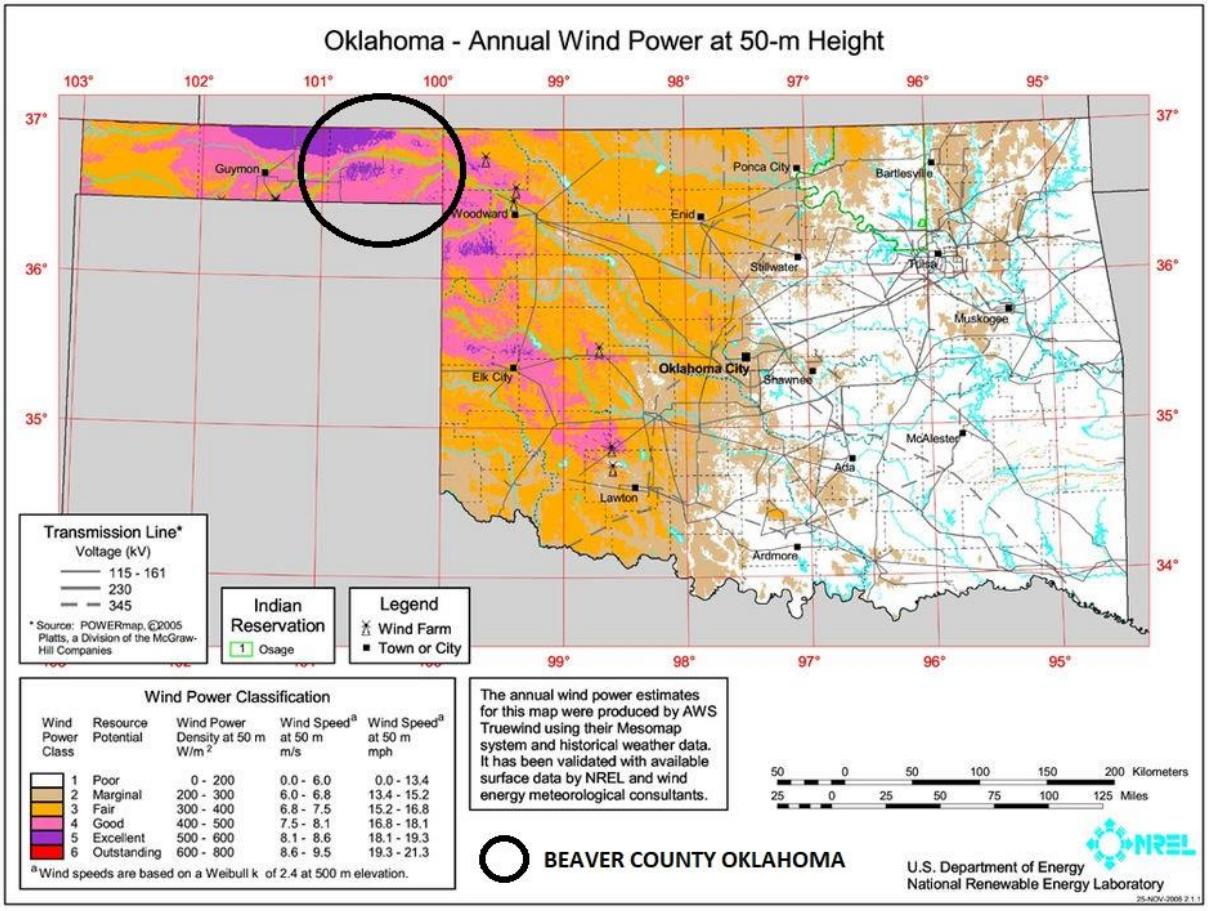
Impact	Roofs, siding, windows and outside structures such as antennas are damaged by hail events. Aging residential structures with deferred maintenance will be damaged more extensively than a well-built modern home
	Damage to electrical infrastructure such as power lines and substations causes loss of power
Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	Buildings, buses and other vehicles, outdoor structures are exposed to the weather
	School buildings have roof-mounted HVAC equipment, antennas and vents which can be damaged by hail
Impact	Hail damages roofs, siding, windows and appurtenances, vehicles stored outside
	Lighting and scoreboards on athletic fields are damaged by hail
	People who are caught outdoors may be injured

3.4.6 High Winds

High winds can result from thunderstorms, strong cold front passages, or gradient winds between high and low pressure. Damaging winds are often called “straight-line” winds to differentiate the damage they cause from tornado damage. Downdraft winds are a small-scale column of air that rapidly sinks toward the ground, usually accompanied by precipitation as in a shower or thunderstorm. A downburst is the result of a strong downdraft associated with a thunderstorm that causes damaging winds near the ground. For wind speed definitions, see Chart on page 45, below.

Location

High winds affect the entire planning area. Average wind speed in Beaver County is estimated to be about 15 mph according to the website USA.com (Wind, 2021). For purposes of wind farm development, the US Department of Energy classifies wind in Beaver County to be “Fair” to Excellent” (between 15 and 20 mph) as illustrated below. Consistent wind together with the low population density, makes the Oklahoma Panhandle an attractive location for wind farms.



Extent

Wind speeds are classified according to the Beaufort Wind Chart shown below. The planning area can experience any wind speed on the Beaufort Wind Chart.

Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH Range	MPH Average	Terminology	Description
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	22	Fresh breeze	Smaller trees sway.
6	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	Severe gale	**Light structure damage.**
10	55-63	60	Storm	**Trees uprooted. Considerable structural damage.**
11	64-73	70	Violent storm	**Widespread structural damage.**
12	74-95	90	Hurricane	**Considerable and widespread damage to structures.**

Webpage: http://www.weather.gov/iwx
Twitter: @nwsiwx
Facebook: NWSNorthernIndiana

Previous Events

NOAA Storm records include high wind events over 35 knots which is about 40 mph. During the period between January 2011 and December 2020, there were 155 days when high winds were recorded in the NOAA database, 39 of which were high wind alone and 116 were reports of high winds associated with thunderstorms. Over that period, the highest wind speed recorded in the planning area was 125.5 mph at Forgan on August 9, 2011.

Days with High Wind Events			
Year	High Winds	T storm & HW	All
2011	3.0	4.0	7
2012	5.0	3.0	8
2013	2.0	10.0	12
2014	4.0	4.0	8
2015	0.0	5.0	5
2016	3.0	4.0	7
2017	1.0	5.0	6
2018	1.0	9.0	10
2019	1.0	6.0	7
2020	6.0	0.0	6
		10 year total	76

Probability of Future Events

The probability of a high wind event is High; 76/10 = > 100% probability. Several high wind events can be expected to happen each year.

Vulnerability and Impact

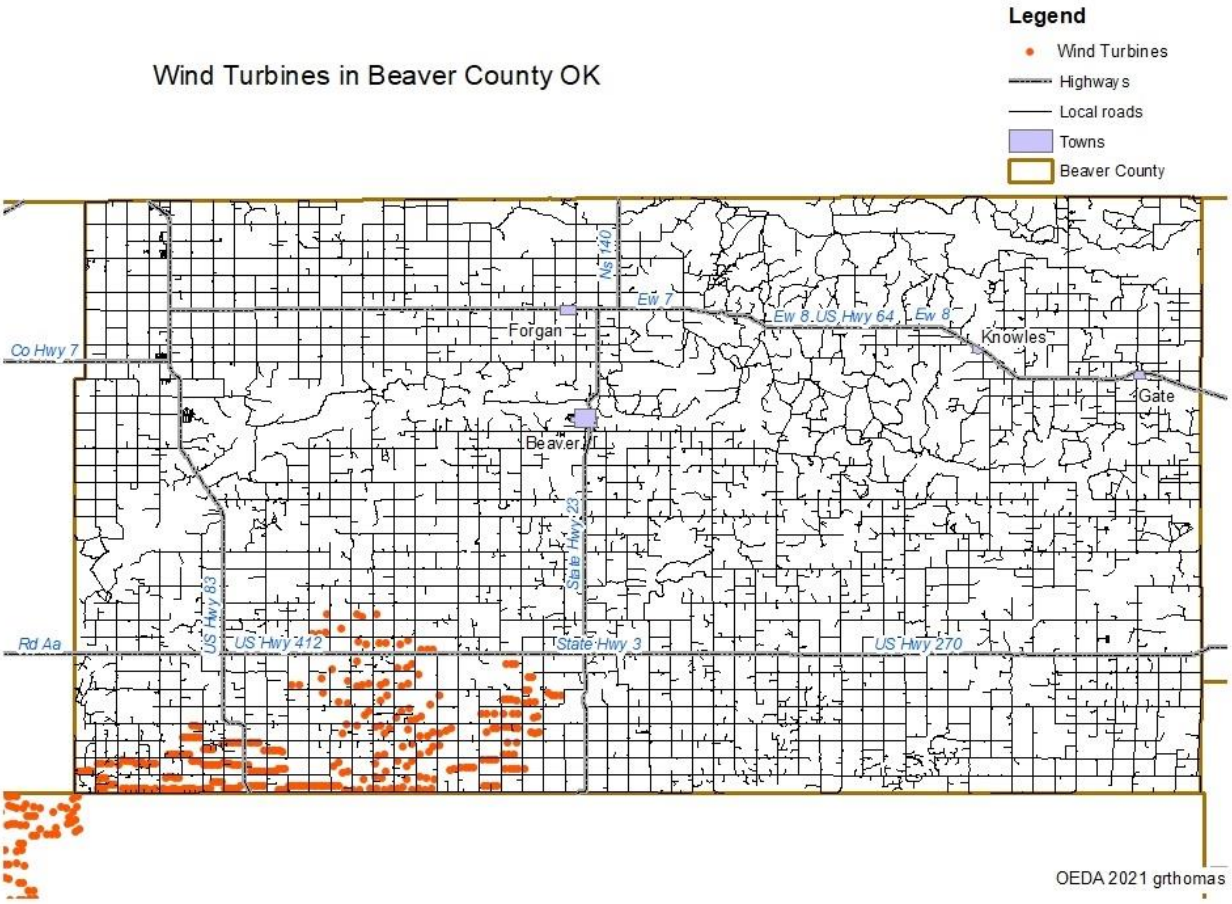
The quality and age of building materials affect the resilience of structures during high winds.

High Wind	
Beaver Co	
Vulnerability	Buildings, especially roofs are vulnerable to the effect of high wind. Depending on wind speed, debris of various material and weight is carried aloft
	Emergency communication systems are partly dependent on land lines. The 911 system has not yet been completed. There are coverage gaps in cell phone service
	Utility infrastructure; above ground power lines and poles are vulnerable to high wind
	Trees are uprooted or broken, limbs take down utility lines
	Wind increases the danger that fire will spread
	Many semi-trucks and high profile vehicles travel local highways to facilitate economic activity
	Because there are many jobs in natural resources and construction that require crews to be able move from one location to another for relatively short periods of time, there are many high-profile, lightweight RV's and campers utilized as living space in the county
Impact	Structures and infrastructure are directly damaged, while power outages from broken electrical lines may cause secondary (indirect) impacts such as loss of emergency communications, or endanger the health of people who may be dependent on power for medical devices
	When electrical lines fall, it may be necessary to close roads until power companies can ensure public safety

	Eye injuries occur from dust or debris in the air
	Sustained winds of 30 mph or gusts of 45 mph will make it difficult to drive high profile vehicles such as semi-trucks and RVs (NWS, 2020). Parked vehicles can be overturned at higher wind speeds depending on the weight of the load
Town of Beaver	
Vulnerability	Residential, commercial and governmental buildings and utility infrastructure are exposed to damaging wind events.
	Electric lines and poles are vulnerable to damage in high wind events
	Trees are uprooted or broken
	Wind increases the danger that fire will spread
	There are 2 RV parks in Beaver, and private campers are stored outdoors in residential neighborhoods
	There are about 64 mobile homes in the Town of Beaver. Mobile homes are less able than traditional homes to withstand the effects of high winds, especially those built prior to modern standards
	Many homes have satellite antennas or other appurtenances attached to walls or roofs
Impact	Roofs are damaged by loss of shingles or other roofing material
	Wind driven projectiles cause injury to people or animals, destroy windows and result in other property damage
	Interruptions in communications due to damaged equipment can slow emergency response
	Wind delivers additional oxygen to fires, increasing fire intensity and spread
	RV's and campers are blown over and damaged by debris carried aloft
	Older mobile homes are not built to modern wind resistance standards. A mobile home's long, broad sides act as sails, catching the wind and then sometimes flexing greatly in response. This can quickly damage a mobile home unless it's properly stabilized and strengthened according to standard
	Uprooted or broken trees pull down power lines and block streets
Town of Gate	
Vulnerability	Residential, commercial and governmental buildings and utility infrastructure are exposed to extreme weather events
	Census data counts 60 dwellings in town; 40 occupied and 20 vacant. There are additional old houses in various states of disrepair scattered throughout the community. Where lots are unkempt, some of the trees that grow there are less resilient species such as cottonwood, mulberry or poplar
	The Gate water tower is an aging elevated tank, built in 1954. According to Town officials, this structure is unstable and vulnerable to high winds
	Winds increase the possibility that fires will spread
Impact	Roofs are damaged by loss of shingles or other roofing material
	Structures that suffer from deferred maintenance are more susceptible to wind damage

	Flying debris causes injury to people or animals, destroys windows and results in other property damage
	Interruptions in communications can slow emergency response
	Uprooted or broken trees pull down power lines, damage adjacent structures and block streets. On neglected lots, they become a nuisance and fire hazard
	If the water tower were to collapse, no water supply would be available in town until a time when it could be replaced, potentially for months or years
	Wind delivers additional oxygen to fires, increasing fire intensity and spread
Town of Knowles	
Vulnerability	Of 13 houses, 4 are occupied and 9 are vacant, older and in poor condition. There are additional old houses and buildings in various states of disrepair scattered throughout the community
	Where lots are unkempt, some trees that grow there are less resilient species such as cottonwood, poplar and mulberry. When such trees are not maintained, they can be uprooted or drop limbs during high winds which brings down power lines and causes damage adjacent structures
	Above ground electrical infrastructure lines and poles are vulnerable to high wind events, especially when trees are impacted
	Dilapidated structures can lose siding and roofing material, especially sheets of tin
Impact	Old roofs are more easily damaged by loss of shingles or other roofing material
	Flying debris causes injury to people or animals, destroys windows and results in other property damage
	Eye injuries occur from dust or debris in the air
	Power outages from broken electrical lines may cause secondary impacts such as loss of emergency communications, and can endanger the health of people who may be dependent on power for medical devices
	Residences and trees in a poor state of maintenance can be more easily damaged
	Trees are uprooted or broken, limbs take down utility lines
Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	None of the school building windows have shatterproof film on them to protect them from flying debris during a high wind event
	The schools are dependent on the municipal power system. These systems use above-ground power lines, which are very susceptible to high wind damage
	Debris of various weight and material is carried aloft
	High winds can move high profile vehicles such as school buses
Impact	Students and staff are at higher risk of injury should flying debris impact classroom windows
	Power outages interrupt school operations and result in a loss of school days
	Wind-blown debris causes injury and property damage. Windows are broken
	High winds create dangerous conditions for transport of students.

Wind turbines are located in southwest Beaver County. They are designed to shut down at a given speed to protect the equipment from damage.


Wind Turbines in Beaver County OK
Legend
Wind Turbines
Highways
Local roads
Towns
Beaver County
Co Hwy 7
Ns 140
Ew 7
Forgan
Ew 8
US Hwy 64
Knowles
Gate
Beaver
State Hwy 23
US Hwy 83
Rd Aa
US Hwy 412
State Hwy 3
US Hwy 270
OEDA 2021 grthomas

3.4.7 Lightning

According to the National Weather Service, a thunderstorm is defined as a rain-bearing cloud that produces lightning. Lightning is a discharge of intense atmospheric electricity, accompanied by a vivid flash of light, from one cloud to another or from a cloud to the ground. Lightning is formed by the separation of positive and negative charges that occur when ice crystals collide high up in a thunderstorm cloud. As lightning passes through the atmosphere the air immediately surrounding it is heated, causing the air to expand rapidly. The resulting sound wave produces thunder.

Lightning often strikes outside of the heavy rain in the thunderstorm and may occur as far as 10 miles away from any rainfall. “Dry” thunderstorms that do not produce rain that reaches the ground are most prevalent in the western United States. Falling raindrops evaporate, but lightning can still reach the ground and can start wildfires. "Heat lightning" is actually lightning from a thunderstorm too far away for thunder to be heard.

All thunderstorms are dangerous. Every thunderstorm produces lightning. In the United States, an average of 300 people are injured and 80 people are killed each year by lightning (NWS, 2021).

According to the National Weather Service (NWS), cloud-to-ground (CG) lightning is the most damaging and dangerous form of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to Earth. However, an appreciable minority of flashes carry positive charge to Earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life.

> *Positive lightning makes up less than 5% of all strikes. However, despite a significantly lower rate of occurrence, positive lightning is particularly dangerous for several reasons.*
>
> *Since it originates in the upper levels of a storm, the amount of air it must burn through to reach the ground is usually much greater. Therefore, electric fields associated with positive Cloud-to-Ground (CG) strikes are typically much stronger than those associated with negative strikes. The flash duration is also longer with peak charge and potential up to ten times greater as compared to negative CG strikes; as much as 300,000 amperes and one billion volts . . . Also, positive flashes are believed to be responsible for a large percentage of forest fires and power line damage. Thus, positive lightning is much more lethal and causes greater damage than negative lightning (NWS, 2021).*

Location

All jurisdictions in the planning area are subject to Lightning hazard.

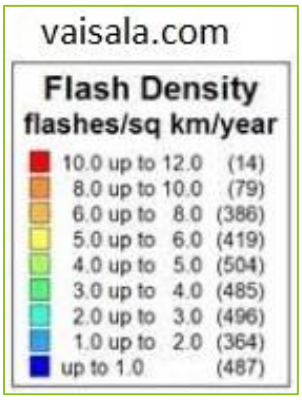
Extent

The Vaisala Flash Density scale is used to measure lightning in Beaver County. Evaluating lightning density gives an accurate picture of how much lightning occurs in states or counties of various

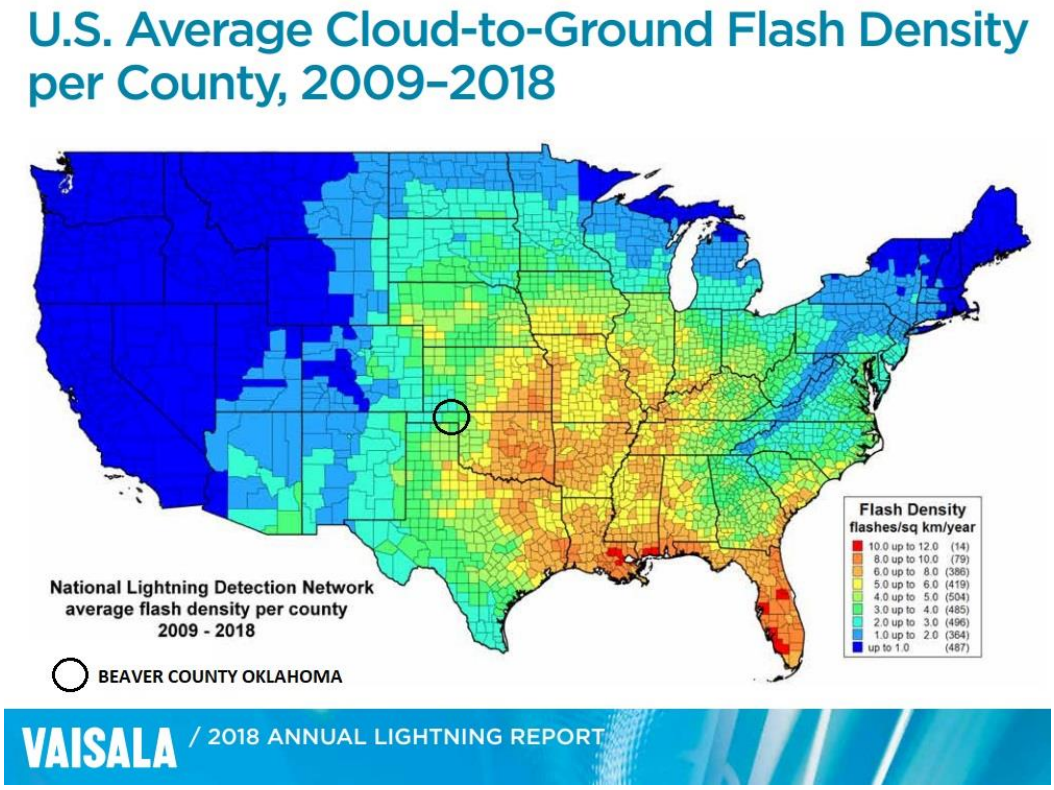
sizes. Density is stated as cloud-to-ground (CTG) strikes per square km per year (Vaisalia, 2019). Lightning occurs frequently throughout the entire planning area each year. Lightning flash density values from 0 to 12 on the Vaisala maps scale can be expected to occur.

Previous Occurrences

Lightning strikes occur during thunderstorm events tracked by NOAA. For the period January 2011 through December 2020, there were 48 Thunderstorms recorded in the NOAA storm data record for Beaver County. During that decade, lightning events in Beaver County have damaged structures, electrical infrastructure and caused loss of power. The financial impact has not been tracked.



The 2009-2018 Vaisala Cloud-to-Ground Flash Density Map below shows that annual counts for cloud-to-ground lightning strike density in Beaver County 2009 through 2018 indicate an average frequency of about 3-5 flashes per square/km per year. These strikes occurred with somewhat greater than average frequency in 2018 and 2019 when there were an estimated 4-8 flashes per sq/km per year (Vaisalia, 2019).



Probability of Future Events

The NOAA storm data records that were evaluated covered 10 years; 2011 through 2020. Thunderstorm probability is about 4.8 storms per year. Lightning occurs at a frequency of 4-5 cloud to ground strikes per square kilometer every year. That results in a probability of greater than 100% that lightning will occur in a given year; High probability.

Vulnerability and Impacts

Throughout the planning area, property, life and health are negatively impacted by lightning strike events. Direct impacts are those which result from physical proximity to a lightning strike, damaged communication equipment, or ignition of flammable material. Indirect impacts are those which occur as a secondary effect of a strike, such as when a breakdown in communication disrupts the emergency response system.

In rural areas, tank batteries are hit with some regularity. A tank battery is a group of containers used to store crude oil, located near sites where oil is produced. When hit by lightning they can release a significant amount of hazardous material. Tank batteries are protected with lightning suppression devices, but according to some oil industry safety companies, existing industry standards have not kept pace with the advances in oil field technology. As a result, lightning & static related issues will continue to plague the industry. A contributing factor is the age of a tank battery installation, when corrosion reduces the protective effects of grounding devices over time (PetroG, 2015).

The Turpin Fire Department was dispatched to a Tank Battery Fire March 16, 2020 at approximately 6:30pm. The tank battery was located 2 miles north of Turpin. The fire department arrived on scene about 5 minutes after the fire started and was able to extinguish the blaze quickly. The Turpin Fire Department remained on scene for about an hour. Cause of the blaze was determined to be a lightning strike (News, 2020).

Certain types of trees are more likely to be struck by lightning due to high starch or moisture content, including Ash, Maple, Oak, Pine, Red Cedar and Poplar. When lightning hits a tree, the electrical current moves down the branches and trunk and heats the water within the tree into steam. This steam causes the affected areas to explode and often the tree will instantly splinter. Lightning-damaged trees are a liability in the landscape because they are more likely to drop branches or fall (Rawson, 2018).

Lightning	
Beaver Co	
Vulnerability	Beaver County is an agricultural community where people commonly work with machinery outdoors and animals graze on open land. Both are at risk for bodily injury or loss of life due to lightning strikes

	Lightning suppression devices are not installed on all county buildings; Many privately owned agricultural buildings are not equipped with lightning suppression devices
	Most utility infrastructure is above ground and exposed to weather events which cause power outages
	Several companies engage in natural resource extraction in Beaver County. Oil storage tanks are sited on rural parcels around the county. Known as "tank batteries," these groups of storage containers are vulnerable to lightning strikes
	Emergency communication systems are partially dependent on above-ground land lines making them susceptible to lightning strikes
Impact	People or animals struck by lightning need immediate lifesaving medical attention; the low density of the rural population means that Emergency responders may have to travel some distance in response to life-threatening events
	Power outages put health and life at risk for people who are dependent on electrical power to operate medical devices
	When tank batteries are hit by lightning, they burst into flame, destroying property, releasing hazardous material & contributing to the incidence of wildfire
	Lightning strikes start other fires especially during drought conditions when any spark can ignite ready tinder
	When communication is disrupted, people are left with limited ways to summon help in case of emergency
Town of Beaver	
Vulnerability	People working outdoors or using outdoor recreation areas such as the Beaver municipal golf course, swimming pool and local parks are exposed to risk from lightning
	Most residential, commercial and municipal structures lack lightning suppression devices
	Utility infrastructure is exposed to weather and components are vulnerable to lightning damage, particularly electrical transformers or substations
Impact	Staff at the golf course and the municipal pool must rely on anecdotal information and personal experience to determine when facility visitors should seek shelter from lightning
	Electronics inside buildings are destroyed by the power surge of a lightning strike passing through the electrical grid, which can disable critical communication systems
	Loss of power puts the health of individuals at risk when home medical equipment relies on electricity. Fires are initiated by lightning strikes that hit flammable materials, especially after periods of dry weather
	Fires are initiated by lightning strikes that hit flammable materials, especially after periods of dry weather

Town of Gate	
Vulnerability	The Town of Gate is 17 to 25 miles from the nearest medical clinic or hospital
	There are 17 vacant dwellings and other unoccupied properties, most of which have weedy trees for which maintenance is long deferred. These weedy trees are overgrown, sit close to the residential structures and are exposed to natural elements making them vulnerable to lightning strikes and susceptible to causing damage after being hit
Impact	Response time of emergency personnel is slowed by disruptions to the emergency communication system. Electronics inside buildings are destroyed by the power surge of a lightning strike passing through the electrical grid, which can disable critical communication systems, putting people at risk
	Loss of power puts the health of individuals at risk when they depend on electricity to operate medical equipment
	Abandoned residential structures are more often hit by lightning strikes when trees grow up near the structure and trees are not properly maintained
	Tree damage leads to downed power lines
Town of Knowles	
Vulnerability	Most residential and agricultural structures in Knowles are not equipped with lightning detection or grounding devices
	People working outdoors or engaging in outdoor recreation are vulnerable. Knowles is 26 miles from the nearest medical clinic or hospital
	Emergency communication systems are partially dependent on above-ground land lines. When power loss occurs, emergency response is delayed
	Due to a reduction in population over decades, there are many vacant lots and neglected properties in Knowles. These sites are more likely to have weedy trees for which maintenance has been deferred
Impact	People who are struck by lightning need immediate medical attention while response time of emergency personnel is slowed by disruptions to the emergency communication system
	Loss of power puts the health of individuals at risk when they depend on electricity to operate medical equipment
	Abandoned residential structures are more often hit by lightning strikes when trees grow up near the structure, increasing fire danger
	Tree damage leads to downed power lines
Beaver, Balko, Forgan and Turpin School District	
Vulnerability	School buildings, play yards and sports stadiums are among areas where lightning can be a danger to people and property
	Staff, parents and students don't have a clearly articulated plan for dealing with lightning
Impact	On August 21, 2021, a lightning strike caused $20,000 in damages to electronics at Beaver PSD
	Electronic scoreboards can be struck; metal bleachers exposed to lightning place people at additional risk
	Misunderstandings occur among parties when lightning strike protocols for safety are unclear

3.4.8 Tornado

Tornados are violently rotating columns of air that reach from the bottom of a cumulonimbus cloud to the ground. Tornados are found in severe thunderstorms, but not all severe thunderstorms produce tornados. While all tornados touch both the ground and the bottom of a cloud, it is possible for only part of the tornado to be visible.

A tornado may be on the ground for only a few seconds, or last for over an hour. They can appear in a variety of shapes and sizes, ranging from thin, rope-like circulations to large, wedge-shapes greater than one mile in width. However, a tornado's size is not necessarily related to its wind speed. The strongest tornados can have wind speeds in excess of 200 mph. In NW Oklahoma, most tornados occur between 3PM and 9PM, during the months of March through May, but may occur anytime the necessary atmospheric conditions of wind shear, lift, instability, and moisture are present.

Beaver County lies in a weather area often referred to as Tornado Alley, characterized by interaction between cold, dry air from Canada, warm to hot, dry air from Mexico and the Southwestern U.S., and warm, moist air from the Gulf of Mexico. Meteorologically, the region is ideally situated for the formation of supercell thunderstorms, often the producers of violent (EF-2 or greater) tornadoes (NOAA 2019)

The interactions among these three contrasting air currents produces severe weather with a frequency virtually unseen anywhere else on our planet. An average of 62 tornadoes strike the state each year – one of the highest rates in the world by square mile of land area. (US Tornado Climatology, 2010).

Location

Beaver County has a history of tornado activity. Tornados affect the entire planning area.

Extent

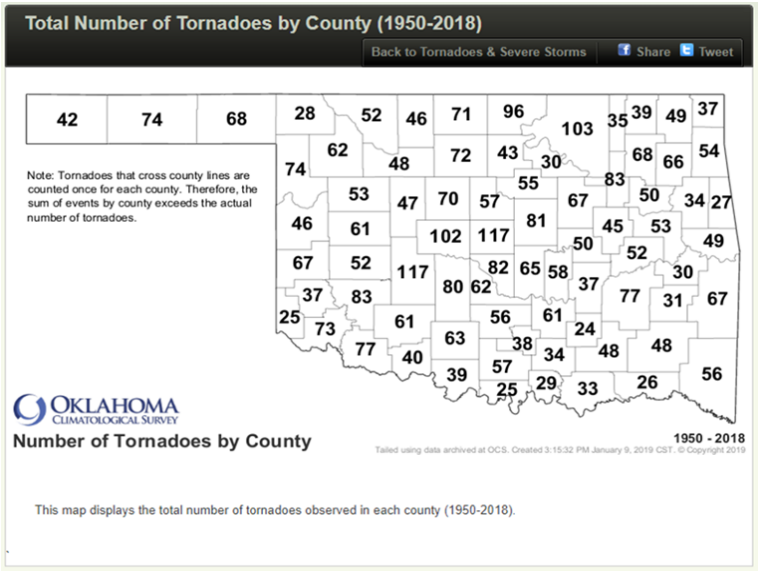
The scale of intensity for tornados in Beaver County is measured by the Enhanced Fujita Scale as illustrated below. The Planning area can expect tornados of any magnitude on the scale to occur.

The Enhanced Fujita Scale or EF Scale (which became the standard in 2007) is used to assign a tornado a 'rating' based on estimated wind speeds and related damage. When tornado-related damage is surveyed, it is compared to a list of Damage Indicators (DIs) and Degrees of Damage (DoD) which help estimate better the range of wind speeds the tornado likely produced. From that, a rating (from EF0 to EF5) is assigned.

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

NOTE: The classification of tornados in Beaver County should be viewed with the caveat that tornados are rated on the EF Scale by evaluating the amount of damage to structures directly in the path. In this low-density rural area where few structures are present, a severe storm may bypass most homes, barns or buildings. Therefore, the intensity of some tornados may not be accurately evaluated if they have passed mostly through open range.



Previous Occurrences

Between 1950 and 2018, 68 tornados were recorded in Beaver County, with many more occurring in adjacent counties. In regard to the graphic shown to the right, it should be noted that tornados that cross county lines are counted as an event for each county. NOAA storm records from 2011 through 2020 below, show ten Tornado events in Beaver County (NOAA, 2021).

Beaver County OK Tornados 2011-2020					
LOCATION	DATE	EVENT TYPE	EF-SCALE	SOURCE	EVENT NARRATIVE
BOYD	6/11/2011	Tornado	EF0	NWS Storm Survey	Tornado briefly touched down near the intersection of U.S. Highway 83 and North 1228 Road about five miles north of Boyd Oklahoma in Beaver County around 1850 CST. There was no damage found from this tornado and the maximum estimated wind speeds were around fifty-six knots. The path length was approximately one tenth of a mile and the path width was estimated to be twenty-five yards. There were no injuries or fatalities reported.

CLEAR LAKE, FORGAN	5/28/2013	Tornado	EF0	NWS Storm Survey	A landspout tornado formed during the afternoon hours of the 28th. Witness described the landspout as a brief spin-up that started from the ground and connected with the base of a developing thunderstorm near U.S. Highway 83 approximately 4 miles south of Beaver (Beaver County). Very little damage was evident given the tornado formed over grasslands and away from developed real estate. The max estimated wind speed was 60 mph.
TURPIN	8/7/2013	Tornado	EF0	NWS Storm Survey	A weak EF0 tornado touched down 3.5 miles west-southwest of Turpin, Oklahoma during the evening hours of the 7th. A supercell thunderstorm spawned the tornado, which lasted for 6 minutes but produced no damage. The maximum wind speed was estimated to be 65 mph.
CLEAR LAKE, ELMWOOD	6/22/2014	Tornado	EF0	NWS Storm Survey	This tornado developed across eastern Beaver County near Slapout (Beaver County). The tornado caused minor damage to an old barn as well as minor roof damage to a manufactured home. A few outbuildings were also damaged as the tornado drifted south across US. Highway 412. The winds were estimated at 80 mph.
ELMWOOD, LOGAN	11/16/2015	Tornado	EF1	NWS Storm Survey	A tornado developed in Ochiltree County, Texas then continued to move northeast crossed into Beaver County, Oklahoma. Tree and fence damage was found near the Texas/Oklahoma state line. A rating of EF-1 was given with a maximum wind speed of 86 mph.
BALKO	5/16/2017	Tornado	EF0	Storm Chaser	Report of tornado on the ground 1 mile south and 2 miles west of Balko. Brief touchdown.
BALKO	6/22/2018	Tornado	EF0	Trained Spotter	Trained spotter reported brief touchdown with no damage.
FORGAN	5/17/2019	Tornado	EFU	Storm Chaser	Tornado made a touchdown in Beaver County around 733 PM CDT and crossed over the OK/KS state line around 735 pm. It then continued for at least another 5 minutes into rural southern KS. No damage was reported as the tornado remained in rough, open country.
SLAPOUT	5/23/2019	Tornado	EF2	NWS Storm Survey	The tornado began in Lipscomb County in Texas, crossed into southeast Beaver County Oklahoma and crossed into Ellis and Harper Counties from there. The tornado got stronger and larger with time, but mainly damaged trees, fences and power poles in the area of this survey - EF rating 2

CLEAR LAKE	8/23/2019	Tornado	EF0	NWS Storm Survey	The tornado touched down near a rural ranch home. Significant tree damage occurred in that location along with damage to the roof of a barn and the porch and roof of one home. Another outbuilding was destroyed further along the path.

Probability of Future Events

Over the period 2011-2020, ten tornados were recorded in Beaver County, resulting in a probability of 100% chance of a tornado in any year, High probability.

Vulnerability and Impact

The entire planning area is vulnerable to tornado damage. Damage is caused by a combination of wind speed and debris carried by the wind. People, animals and every type of structure, farm, business, residential and public buildings are vulnerable to tornado damage, as are critical facilities, recreation areas, vehicles, crops, livestock and trees. High profile vehicles, campers, carports and mobile homes that are not properly anchored to the ground become unstable at wind speeds over 40 mph. Anchored mobile homes can be seriously damaged when tornadic winds gust over 80 mph.

Indirect effects. While structural damage is common, secondary impacts of tornado events can be equally serious, particularly the loss of power. Communication equipment can be damaged, making the delivery of emergency services more difficult. Cellphone and radio towers are exposed to wind, rain and flying debris. Power outages can take time to repair, putting health at risk for individuals dependent on medical devices. Food storage or buying a gallon of gas becomes a challenge during loss of electrical power. Post-storm impacts include the loss of the economic use of damaged buildings or equipment and the cost to repair.

One study showed that 50 percent of tornado-related injuries are suffered during rescue attempts, cleanup, and other post-tornado activities. Nearly a third of injuries resulted from stepping on nails. Because tornados often damage power lines, gas lines, or electrical systems, there is always a risk of fire, electrocution, or an explosion (CDC, 2012).

TORNADO	
Beaver Co	
Vulnerability	People, animals and every type of structure, farm, business and residential buildings are vulnerable to tornado damage
	80% of homes in the county were built before 1980, 60% prior to 1960
	Some residential sites do not have tornado shelters
	There is an RV park in the county, south of Beaver; no storm shelter is provided
	Trees are not properly maintained
	Electric utility infrastructure is above ground

Impact	Older homes were not built in accordance with formal building codes, therefore the ability to withstand storms is unknown
	People are forced to seek shelter in structures that were not designed to withstand tornados
	Unanchored RV's or mobile homes suffer damage at wind speeds over 40 mph; anchored mobile homes can be seriously damaged when tornadic winds gust over 80 mph (F0)
	Trees that are not maintained are at greater risk of being uprooted or losing limbs when tornadic winds occur, bringing down power lines and damaging adjacent structures
	Downed power lines and wind-blown debris pose a danger to vehicle travel on local roads and highways
Town of Beaver	
Vulnerability	Most residential sites do not have private storm shelters
	There are two RV campgrounds in Beaver; campers are lightweight and subject to damage from wind and debris
	Some dwelling structures are mobile homes, especially on the east side of town
	Nursing homes and medical facilities in Beaver are especially vulnerable due to the unpredictability of a tornado route and the difficulty of evacuating patients and staff that may be in the path of danger
Impact	People are forced to seek shelter in structures that were not designed to withstand tornados, or travel to a public shelter
	Unanchored RV's or mobile homes suffer damage at wind speeds over 40 mph; anchored mobile homes can be seriously damaged when tornadic winds gust over 80 mph (F0)
	In addition to the physical risk to people, post-storm impacts include the loss of the economic use of damaged buildings or equipment and the cost to repair
Towns of Gate and Knowles	
Vulnerability	Most residential sites do not have storm shelters
	Older residential structures in the towns are in various states of disrepair
	Some properties have loose debris present
	Many residents are elderly
	Trees suffer from deferred maintenance
Impact	People are forced to seek shelter in structures that were not designed to withstand tornados
	Structures in poor repair are less resistant to the effects of tornadic winds
	Loose scrap metal and assorted junk become projectiles when borne aloft by high speed tornadic winds
	Elderly people may not be able to drive to a public safe room
	Trees that are not properly cared for will lose branches or be uprooted more quickly than a well maintained tree. Falling tree limbs cause power lines to come down and power outages to occur

Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	School buildings and sports facilities are vulnerable due to the unpredictability of a tornado path
	Windows are mostly original to the date of building construction and have not been reinforced to withstand wind-blown debris
	Children are separated from their families while at school
Impact	People are always at risk when a tornado is present
	Old windows pose a significant risk to life if shattered by debris blown aloft
	Staff caring for children separated from family face challenges of communication, safe reunification and authorization for medical care

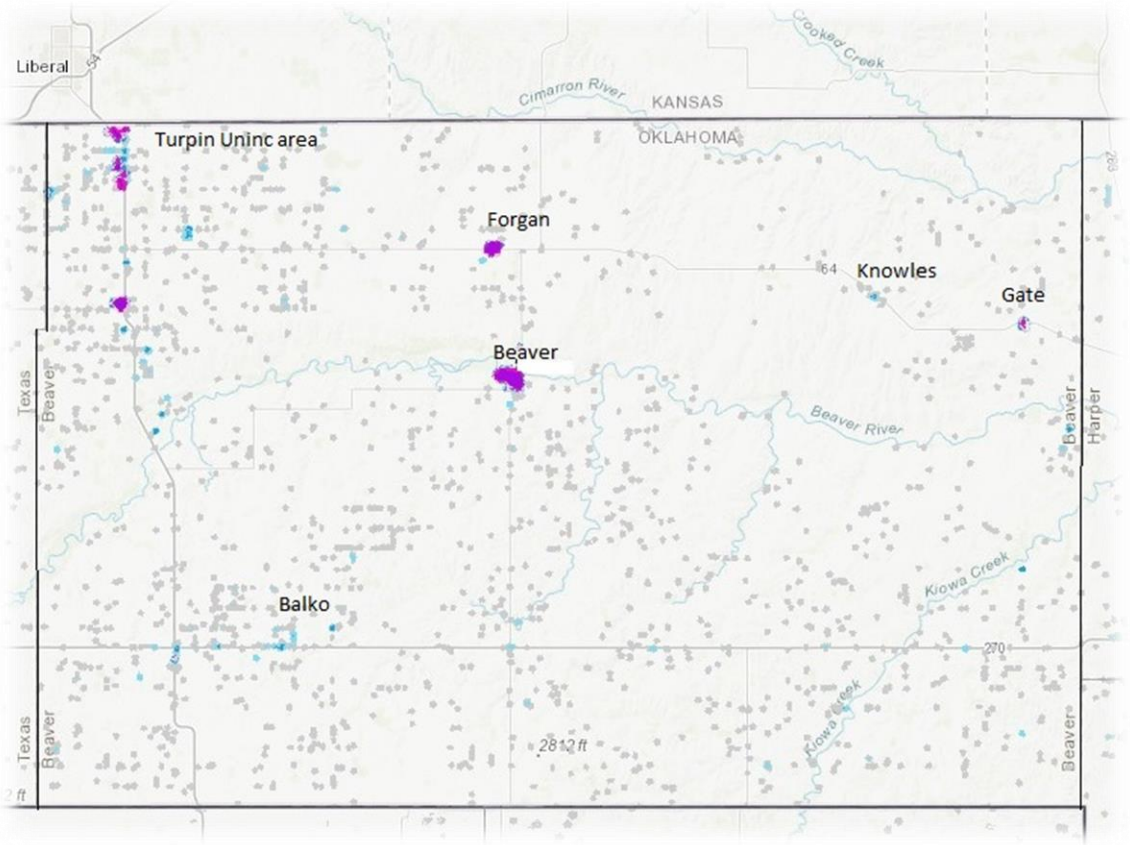
3.4.9 Wildfire

Description. Wildfire is an uncontrolled fire in a rural or wilderness area. The majority of wildfires occur when precipitation is low. A wildfire often begins unnoticed and can spread quickly, lighting brush, trees, and structures. There are three different classes of wildfires. *A surface fire* is common in grasslands, or areas with open vegetation, and can spread quickly. *A ground fire* is a dense, very hot fire that has a thick fuel source and significantly damages the soil health where it occurs. *Crown fires* are those that move by jumping along the tops of trees. Wildfires often begin unnoticed, but are usually signaled by dense smoke that fills the area for miles around.

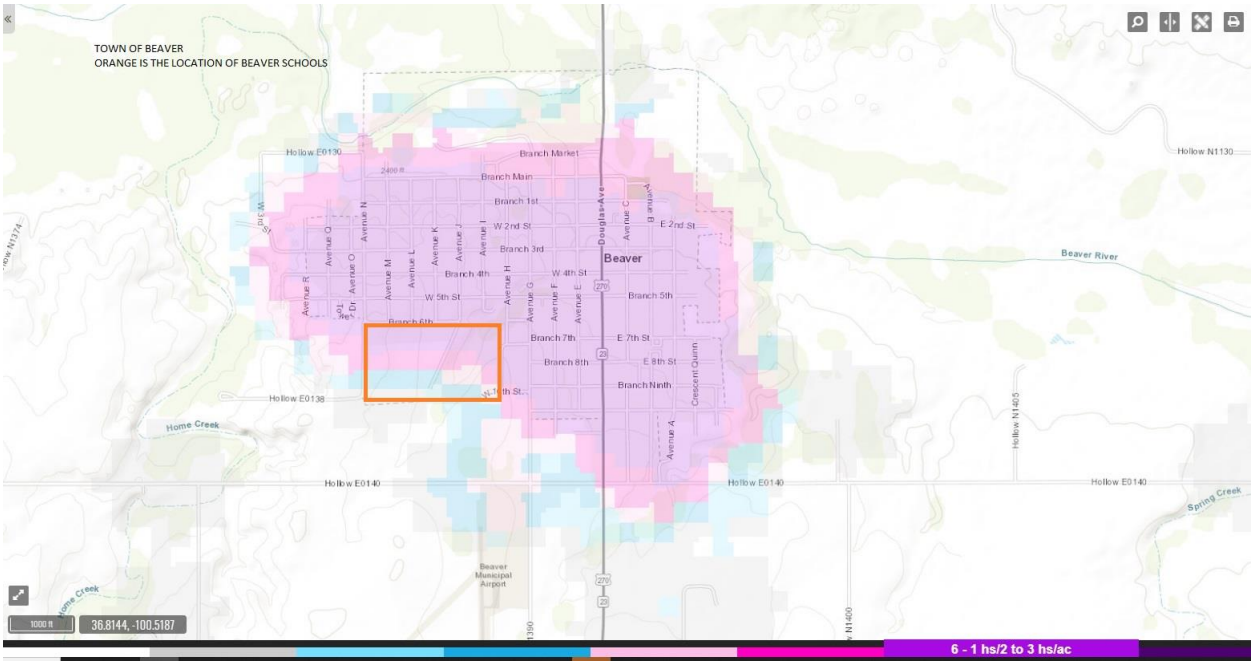
Location

All participating jurisdictions are at risk from the danger of wildfire. Agricultural crops and rangeland are present throughout the planning area, and surround all jurisdictions. Areas with Red Cedar trees are especially flammable. Masses of tumbleweeds and other dry, windblown plant materials build up in fence rows, brushy places and abandoned farmsteads, creating a tinderbox for sparks.

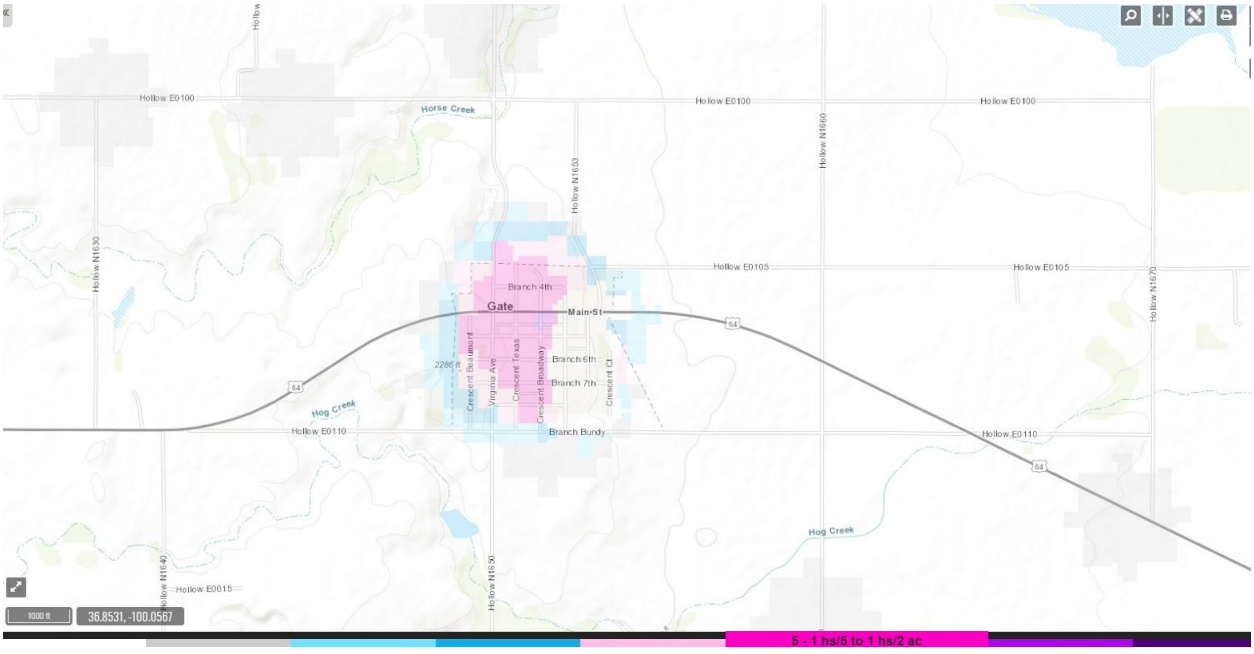
A fire that starts as a rural wildfire can quickly become a threat to rural structures and towns. The Wildland/Urban interface is illustrated in the map below (WUI, 2020). Brightly colored areas indicate residential clusters. Intensity of color indicates greater density of residential structures.



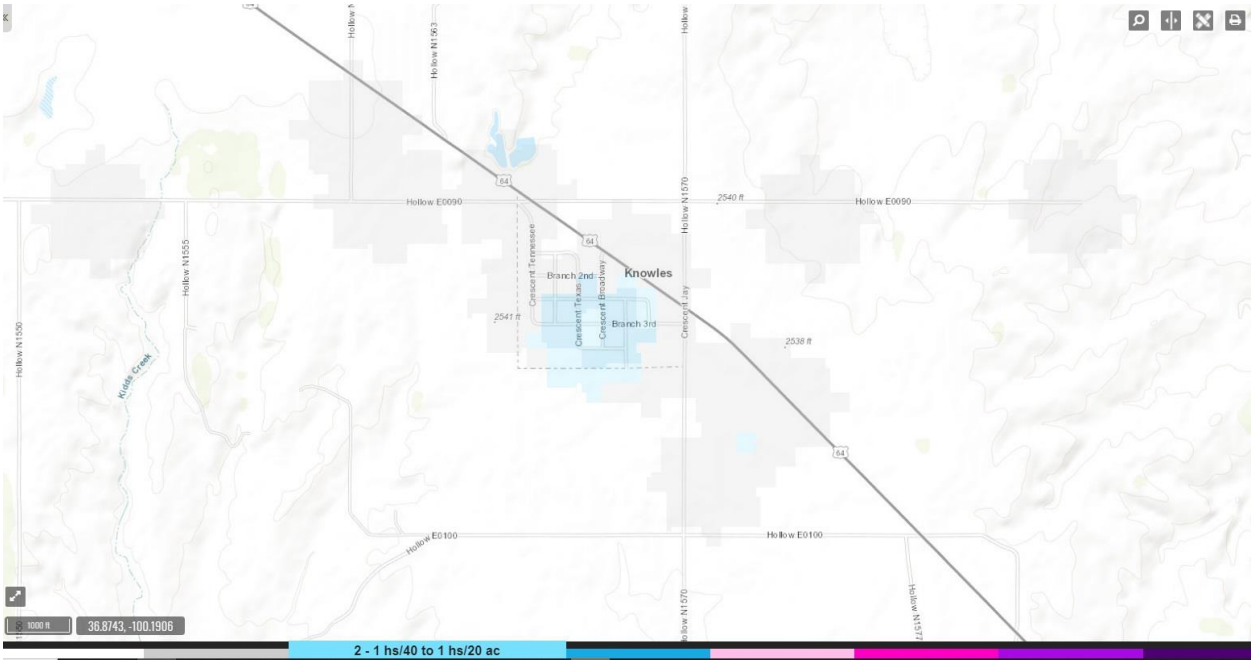
TOWN OF BEAVER, BEAVER SCHOOLS



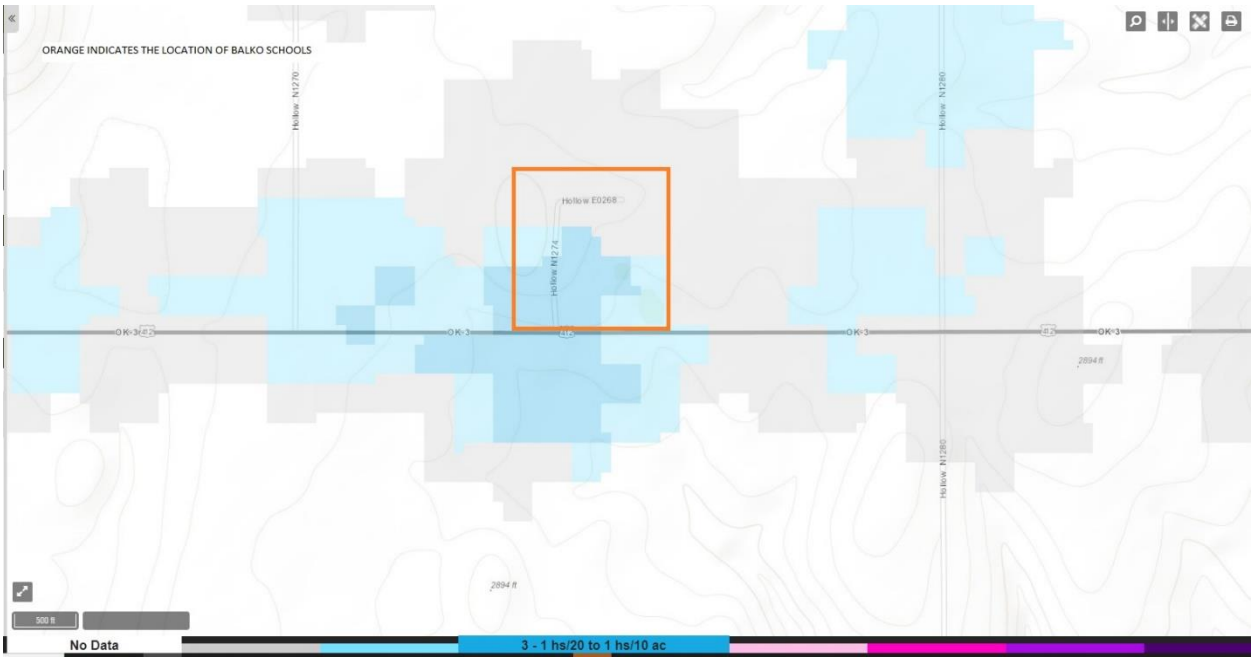
TOWN OF GATE



TOWN OF KNOWLES



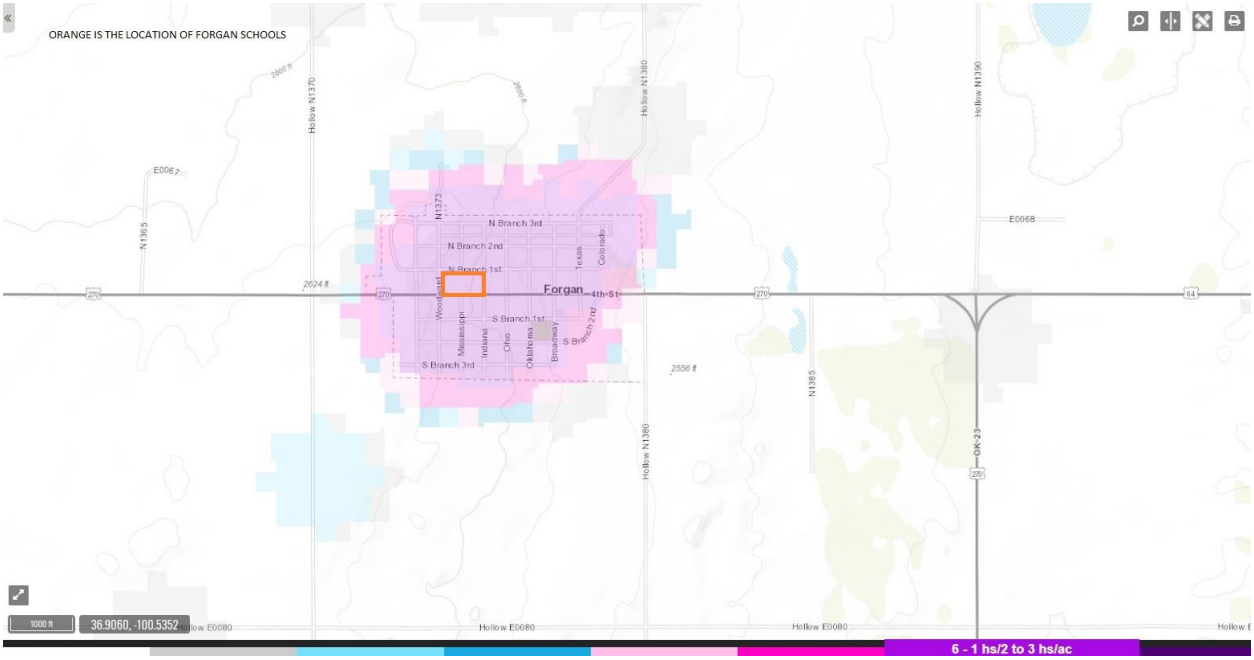
BALKO SCHOOLS



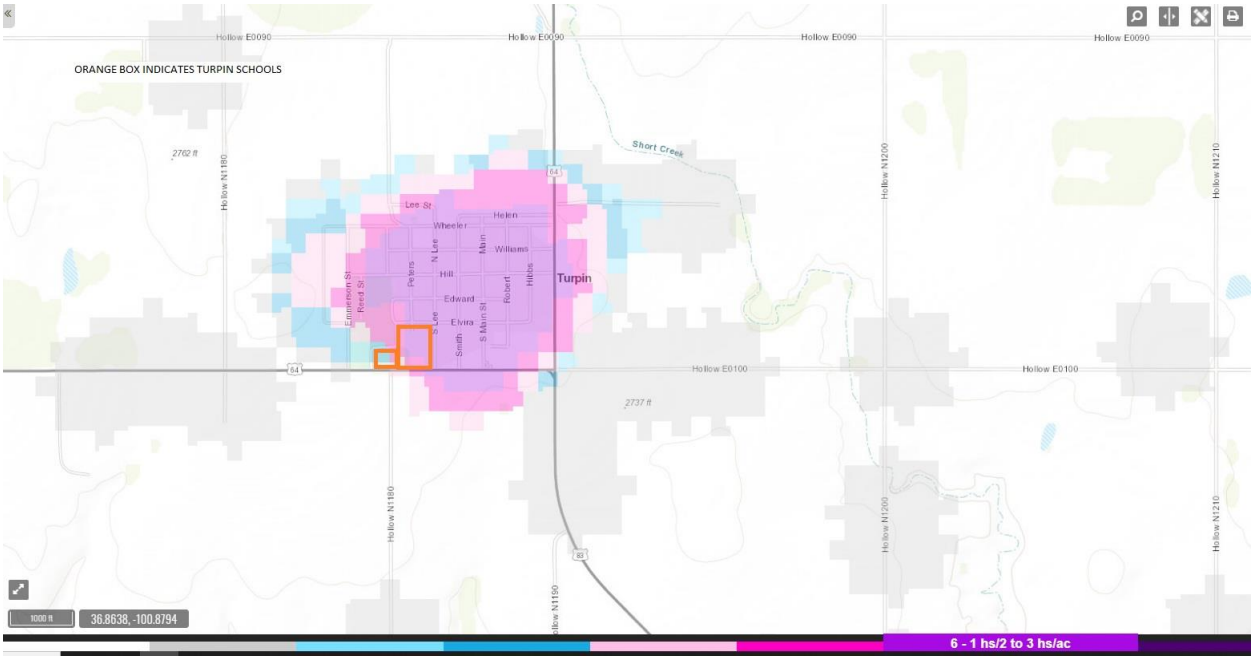
NOTE: There are no residential areas adjacent to Balko School property as shown on the above map. The aerial photo below is a more accurate rendering of the property. The School District does provide on-site Staff housing along the west and north perimeter of the property, as shown on the aerial photo below.

BALKO SCHOOL SITE

FORGAN SCHOOLS



TURPIN SCHOOLS



Extent

Spreading surface fires in brush, crops or grass are the most common wildfires in Beaver County. Relative humidity has an effect on the potential for wildfire events. During times of high humidity, prescribed burns can be used safely to control vegetation and improve pasture. When humidity is low, the danger of wildfire increases rapidly.

The Keetch-Byram Drought Index and the Fire Danger Rating System are used to classify the danger of wildfires, based on the amount of soil moisture and humidity present at a given time. The planning area can expect any value on these scales to occur.

The Keetch-Byram Drought Index with Fire Danger Rating Data	
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

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 very 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/		

Previous Occurrences

Incidents of fire response are recorded by the Oklahoma Department of Forestry. Small, localized wildfires occur every year and are logged with all fire calls by local fire departments. The state does not track these small fires but does identify large fires when they require a coordinated response. These are recorded in the NOAA Storm data records. Beaver County has had seven such fires in the last ten years (NOAA, 2021).

Beaver County Wildfires 2011-2020				
BEGIN DATE	BEGIN TIME	NAME	SIZE ACRES	EPISODE NARRATIVE
3/25/2016	1324	Clark/Meade Fire	1,300	The Clark/Meade Wildfire began around 1324CST about nine miles north northeast of Knowles Oklahoma in Beaver County. The cause of the wildfire was determined to be an incendiary device.
11/27/2016	1245	Beaver County Fire	2,500	The Beaver County wildfire began around 1354CST about nine miles west northwest of Slapout Oklahoma in Beaver county. The wildfire started south of Hollow E0215 or north of Hollow E0220 and east of Hollow N1530.
3/6/2017	1053	NW Oklahoma Complex Fires	More than 834,000	The Starbuck fire, by far the largest, began east of Beaver, Oklahoma and ran to the northeast into Kansas. Two other large fires occurred in adjacent Harper County at nearly the same time, the 283 fire and the Selman Fire.
3/23/2018	1522	NS149 & Hwy 3 Wildfire	2,000	The NS149 and Highway 3 Wildfire began around 1522CST about nine miles north northwest of Logan Oklahoma in Beaver County. The wildfire consumed approximately two thousand acres. There was a report that one home was destroyed by the wildfire.
2/2/2019	1230	Payne Wildfire	336	The Payne Wildfire began around 1230CST roughly thirteen miles east of Beaver Oklahoma in Beaver County. There was a report that a couple of barns were destroyed.
3/7/2020	1000	412 Fire	29,130	The 412 wildfire began around 1000CST about four miles east southeast of Balko Oklahoma in Beaver County. The wildfire was moving north northeast at a rate of one hundred and three feet per minute. The towns of Beaver and Forgan were evacuated. There was a report of five single residences which were damaged and another ten residences along with several other larger buildings were destroyed.
3/7/2020	1300	Beaver Road Fire	486	The Beaver Road wildfire began around 1300CST about four miles west of Elmwood Oklahoma in Beaver County.

Probability of Future Events

Over the last ten years (2011 – 2020) there have been seven severe wildfires, the Starbuck complex in 2017 being the most destructive. Numerous smaller wildfires occur every year and the probability that a wildfire will occur during any year is greater than 100%; High probability.

Vulnerability and Impact

The entire planning area is vulnerable to Wildfires, especially during times of low precipitation. Periods of drought and low humidity together with ever-present winds create extremely volatile conditions where any spark is blown to life.

Nearly all firefighters in the region are volunteers. Any fire can become a wildfire when response teams are too far away. Therefore, it is necessary to support the many small but well trained volunteer Fire Departments to improve response capability and reduce the potential for injury, loss of life and property.

Eastern Red Cedar is a highly flammable and invasive tree species that occurs throughout Beaver County. While some Red Cedar trees were native to NW Oklahoma, they were controlled by regular prairie fires. After 1900, the land was converted to agriculture and fire was suppressed. During the Oklahoma Dust Bowl in the 1930's many more of these trees were planted to form windbreaks. Today, Red Cedar is a noxious weed that spreads readily and takes root in old shelterbelts, fence lines, and abandoned farmsteads. The tumbleweed (Russian thistle) is another prolific noxious weed. Mature plants break off at ground level, creating windblown tumbleweeds that collect in fencerows or any brushy area, providing very dry tinder.

After the threat to humans, impacts of wildfires on livestock are especially tragic. Cattle moving away from a fire become trapped in fencing. After the 2017 Starbuck Fire, many hundreds of animals had to be shot to end their suffering; the carcasses were bulldozed into burial pits.

WILDFIRE	
Beaver County	
Vulnerability	Highly invasive and flammable Red Cedar grows in shelterbelts, abandoned farmsteads, fencerows and on fallow land. Tumbleweeds are prolific. Due to the nearly constant vigorous wind, tumbleweeds and dry brush collect in masses along fences and fill abandoned farmyards
	Drought with low humidity increases the danger. Extended periods of drought are common in the planning area
	428 people over age 75 live in Beaver County
	Above ground utility infrastructure is located throughout the county and electric power lines run along fencerows.
Impact	The environmental conditions create a situation where any spark can ignite dry grass or tinder and quickly become a wildfire. For example, spot welding of fences is one example of a typical cause of wildfire in Beaver County

	Loss of life and property damage is the impact of wildfire. People must be safely evacuated. One severe impact is when livestock becomes trapped by fencing and cannot escape the fire.
	Older people may not be able to to drive to safety. The low density of the population means these residents are spread widely across the landscape, complicating evacuation efforts
	The loss of crops, livestock, agricultural buildings and residential structures carries a tremendous economic cost both in terms of initial losses and continuing until items can be rebuilt or replaced
	Power lines are burned or left hanging when the poles burn off at ground level
Towns of Beaver, Gate and Knowles	
Vulnerability	Existing communication systems rely on backup power generators. Cell phone service has gaps in coverage areas
	Poorly maintained properties become clogged with tumbleweeds and other dry wind-blown material
	Many elderly people live alone in town
	Beaver has a nursing home and hospital with ill and older patients under care. These people are more difficult to evacuate
Impact	Larger fires can encircle a town; citizens do not always know which direction they should travel to evacuate safely.
	Fire causes loss of life and property; residents and business owners may be forced to abandon valuable property and are sometimes reluctant to move to safety
	Elderly may not be able to drive themselves to safety
	People with limited mobility such as hospital or nursing home patients suffer added stressors to health during evacuation
Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	Firebreaks are not maintained near school properties
	The Beaver, Balko, Forgan and Turpin PS Districts lack protocols for Wildfire response. In the Public School Emergency Operation Plans, the protocol for fire is focused on evacuation from structural fires, while protocols for evacuation during wildfires are not specifically addressed
	Cell phone service has gaps in its coverage
	Large quantities of smoke and ash are released into the atmosphere
Impact	Wildfires can approach too near school structures, firebreaks are needed
	When children must be evacuated from town during school days or school events, while they are separated from their families, the lack of emergency protocols increases the likelihood for confusion about evacuation destinations and procedures.
	Inadequate cellular communication systems inhibit school staff from receiving timely information outside of school buildings, and it reduces their ability to adequately communicate with parents. Misunderstandings and communication failures can occur among administration, staff, students, and parents when children are evacuated from a school facility.
	Smoke and ash cause respiratory issues

3.4.10 Winter Storm

Winter Storm can refer to a combination of winter precipitation, including snow, sleet and freezing rain. A severe winter storm can range from freezing rain or sleet to moderate snow over a few hours, or to blizzard conditions and extremely cold temperatures that last several days.

Blowing snow is wind-driven snow that reduces visibility and causes significant drifting. Blizzards occur when falling and blowing snow combine with winds of 35 mph or greater, reducing visibility to near zero.

Freezing rain is precipitation that falls, as liquid, into a layer of freezing air near the surface. When the precipitation makes contact with the surface, it forms into a coating or glaze of ice and even a small accumulation can cause a significant hazard.

Sleet is frozen precipitation that has melted by falling through a warm layer of the atmosphere and then refreezes into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and can accumulate like snow and become a hazard to motorists.

Ice storms are extended freezing rain events, lasting from several hours to days, when the freezing rain accumulates on surfaces and damages trees, utility lines, and roads. Ice loads on overhead power lines, combined with windy conditions, may cause the lines to "gallop." This forceful motion often causes the lines to break away from the connectors and poles, resulting in widespread power failure.

Wind Chill is used to describe the relative discomfort and danger to people from the combination of cold temperatures and wind. The wind chill chart from the National Weather Service shows the apparent temperature derived from both wind speed and temperature.

Location

The entire planning area is at risk from winter storms several times each year. Ice and freezing rain, snowfall, cold temperatures and wind pose a hazard to all residents and structures.

Extent

The Sperry-Piltz Ice Accumulation Index is used to categorize ice damage, as shown in the table below. Ice accumulation can be expected to occur at any level on the Sperry-Pilz Index. While serious winter weather events are not unusual, most storms in Beaver County are short-lived. It is unusual for snowfall to remain on the ground more than a few days (OKHMP, 2019).

The planning area also uses the National Weather Service (NWS) Windchill Chart to evaluate the potential for injury or loss of life due to low temperatures. Due to the unpredictable nature of winter storms, the planning area can experience a wide variety of temperatures referenced on the Windchill Chart (below). It is expected that temperatures of -20 or warmer can occur, with potential wind speeds at any level on the NWS chart, below.

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
0	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
2	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
3	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
4	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
5	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

NWS Windchill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Previous Occurrences

During the years 2011 and 2020, ten winter storms are recorded in the NOAA data. Smaller winter weather events happen each year in Beaver County.

Winter Storm/Winter Weather Events Beaver County 2011-2020					
	BEGIN DATE	BEGIN TIME	EVENT TYPE	SOURCE	SNOW/ICE INCHES
1	12/19/2011	600	Blizzard	County EM	5-6 in snow
2	2/20/2013	1900	Winter Storm	County EM	6 in snow
3	2/24/2013	2100	Blizzard	County EM	15 in snow
4	12/21/2013	1200	Winter Storm	County EM	6-7 in snow
5	11/17/2015	700	Winter Storm	LEO	6 in snow
6	11/26/2015	900	Ice Storm	County EM	1/2 in Ice; 1/2 in Snow
7	1/14/2017	1711	Ice Storm	County EM	>1 inch Ice
8	11/11/2018	1800	Winter Storm	Spotter	6 in snow
9	2/23/2019	401	Blizzard	Public	2 in snow
10	1/17/2020	730	Ice Storm	County EM	.25 in Ice

(NOAA, 2021)

Probability of Future Events

Ten winter storms recorded over a 10 year period indicates a probability that such a storm is likely to occur any year; 100% = High probability.

Vulnerability and Impact

Above ground electric utility infrastructure is vulnerable to ice, wind and snow, leading to loss of power. Ice accumulation causes tree damage and broken limbs which bring down power lines. Trees with weak branches include volunteer species such as Cottonwood, Elm, Poplar, and Mulberry (Miller, 2021). Many vacant lots in the planning area have such weedy trees.

Power loss during times of extreme temperatures has secondary impacts, especially for those who rely on electricity for medical support equipment.

WINTER STORM	
Beaver Co	
Vulnerability	Due to the temperate climate Beaver County does not often need heavy plows and trucks to remove snow. Therefore, the County is less equipped to deal with a severe winter storm event than a similar municipality at a more northerly latitude. There may be an extended time period before secondary roads are fully cleared. Beaver County has a responsibility to maintain 2000 miles of roadways.
	Poor road conditions cause motorists to become stranded
	Many people in Beaver County work outdoors engaged in agriculture, natural resource extraction or construction. Humans, crops and livestock are vulnerable to extreme temperatures, making these outdoor activities more dangerous
	Due to older and above-ground electrical utilities, power outages occur when there is ice accumulation and wind.

	Few households have backup power generator systems in place
	The emergency response system is partly dependent on backup generator power
Impact	Vehicle accidents due to heavy snow or icy roads and bridges put humans at risk of exposure to extreme temperatures while cell phone communication is unreliable in sparsely populated rural areas
	Farm workers, utility crews and rescue personnel are exposed to extreme conditions, risking injury and loss of life
	Economic losses to business and the tax base are incurred when agricultural production is impacted
	Utility infrastructure is damaged by ice accumulation and wind. Power disruptions can slow emergency communication
	Utility crews encounter difficulty reaching downed power lines in remote locations when roads are impassable
	When power fails and roads cannot immediately be cleared, people can be isolated at home without heat or access to supplies or medical care
	People are exposed to dangerously low temperatures in their homes and may resort to unsafe use of alternative heat sources including those that emit carbon monoxide
Towns of Beaver, Gate and Knowles	
Vulnerability	A Weather Alert broadcast system is needed at Beaver Airport. Current weather alerts come from Amarillo, 160 miles southeast of Beaver and more than 180 miles from Knowles or Gate
	Power outages occur due to ice accumulation and high winds
	Travel conditions deteriorate
	The temperate climate means the towns are not equipped for heavy duty snow removal
	Groceries or medical services are not available in the towns of Gate or Knowles; the nearest supplies are 17 to 30 miles away
	Trees are damaged by the weight of ice loads
Impact	Street crews lack heavy duty snow removal equipment; it can take several days to clear all town streets
	People are exposed to dangerously low temperatures in their own homes and may resort to unsafe use of alternative heat sources including those that emit carbon monoxide
	People are at risk of exposure in case of vehicle breakdown or accidents
	Falling tree limbs cause damage to structures and bring down power lines
	Access to essential supplies and medical services is disrupted

Beaver, Balko, Forgan and Turpin School Districts	
Vulnerability	Travel conditions deteriorate
	The community does not have many heavy trucks or snow plows; secondary roads cannot be cleared immediately
	Above ground electric utilities are exposed to weather
Impact	School staff, children and caregivers must travel in hazardous conditions to reach school or home, risking exposure
	While poor road conditions persist, schools are subject to cancellation or delay
	Power outages frequently occur. When there is a loss of power, school must be cancelled
	Power outages result in loss of refrigerated food in cafeteria

Chapter 4 Mitigation Strategy

4.1 Capabilities Assessment

The ability of a community to respond and recover from disasters is a function of the capabilities and resources available. Some of these capabilities include the skills of staff and employees; others are met by contracting for services on an as-needed basis.

In addition to staff skills, abilities and services, each incorporated municipality has the authority to impose regulations on land development, manage floodplains, and may be a provider of critical utilities or functions such as water, sewer, and electric services and waste collection.

For a good portion of each year, schools are responsible for nearly every child in a community and employ many other local people. Schools, therefore have a special interest in ensuring public safety from hazardous events. Other educational opportunities offered to a community can enhance the efficacy of pre-disaster planning and post-disaster management.

The tables below provide a summary of the administrative and technical capabilities currently in place in each participating jurisdiction. A mark (X) indicates that the jurisdiction was reported to have the authority to implement the specified regulatory tool and that the tool is currently in place.

4.1.1 Existing Institutions, Plans, and Ordinances

JURISDICTION	BUILDING CODE	ZONING ORD	SUBDIVISION ORD	FLOOD ORD	SITE PLAN REVIEW	COMPREHENSIVE PLAN	CAPITAL IMP PLAN	ECON DEV PLAN	EM RESPONSE PLAN	POST DISASTER PLAN
BEAVER COUNTY									X	X
TOWN OF BEAVER	X			X			X		X	X
TOWN OF GATE									X	X
TOWN OF KNOWLES									X	X

4.1.2 Administrative and Technical Capability

LOCATION	ENGINEER AVAILABLE	FLOODPLAIN MNGR	SURVEYORS	STAFF WITH EM EXP	STAFF W GIS OR HAZUS	SCIENTISTS (GEO, BIO, AG)	EM MANAGER	GRANT WRITERS
BEAVER COUNTY	X		X	X	X		X	X
TOWN OF BEAVER	X	X	X	X				X
TOWN OF GATE	X		X	X				X
TOWN OF KNOWLES	X		X					X
NOTES:	Hired by project		Hired by project		Towns use OEDA (COG)	Hired as needed	Towns use County EM	by Contract or COG

4.1.3 Financial Capabilities

JURISDICTION	CAPITAL IMP PROJ FUNDING	TAX AUTHORITY	UTILITY SERVICE FEES	DEVELOPMENT FEES	GEN OB FUNDS & BONDS	CDBG/REAP	FEDERAL FUNDS	STATE FUNDING
BEAVER COUNTY	X	X			X	X	X	X
TOWN OF BEAVER	X	X	X		X	X	X	X
TOWN OF GATE	X	X	X		X	X	X	X
TOWN OF KNOWLES	X	X	X		X	X	X	X

4.1.4 Education and Outreach Capabilities

JURISDICTION	LOCAL CITIZEN GROUPS INVOLVED	NON-PROFITS	ONGOING ED & INFO PROGRAMS	NATURAL DISASTER/SAFETY PROGRAMS	STORM-READY CERTIFICATION	FIREWISE COMMUNITY	PUB/PRIVATE PARTNERSHIPS FOR DISASTER ISSUES
BEAVER COUNTY	X	X	X				X
TOWN OF BEAVER	X	X					X
TOWN OF GATE		X					
TOWN OF KNOWLES		X					
NOTES:		AM RED CROSS					

4.1.5 School District Capability Assessment

SCHOOL DISTRICT ASSESSMENT	BALKO PSD	BEAVER PSD	FORGAN PSD	TURPIN PSD
HAS YOUR SCHOOL DISTRICT HAD POSITIVE RESPONSES TO BOND ISSUES?	YES	YES	YES	YES
BASED ON POPULATION IS YOUR SCHOOL DIST GROWING OR DECLINING?	DECLINE	DECLINE	DECLINE	STEADY
HAS THE DISTRCT TAKEN MEASURES TO PROTECT STUDENTS FROM HAZARD EVENTS?	DRILLS	DRILLS; SAFE SCHOOLS COMMITTEE	DRILLS	DRILLS
LIST ANY HAZARD EVENTS THAT DAMAGED YOUR SCHOOLS IN THE LAST 10 YRS:	HAIL; WIND	WILDFIRE	HAIL; WIND; STORMWATER	HAIL; WIND; WINTER STORM
CAPITAL IMPROVEMENT PLAN	ANNUAL	ANNUAL	ANNUAL	ANNUAL
EM MANAGEMENT PLAN; HAZARD RESPONSE	YES	YES	YES	YES
BUDGET; RAISE FUNDS FOR MITIGATION (BONDS)	YES	TIGHT BUDGET	TIGHT BUDGET	YES
PUBLIC/PRIVATE PARTNERSHIPS, CORP DONATIONS	YES	YES	YES	YES
DESIGNATED EMERGENCY MANAGER	YES	YES	YES	YES
PTO/PTA (BOOSTER CLUB)	YES	YES	YES	YES
LIGHTNING EVALUATION TRAINING FOR TEACHERS/COACHES	NO	YES	NO	YES/NO
POST DISASTER RECOVERY PLAN	YES	YES	NO	NO

Comments: In regard to technical capability, Staff is available for most local services, but people with special technical skills such as Grant Writers, Engineers, Surveyors and GIS Technicians are typically hired from the Regional COG or from nearby cities on an individual project basis. The County Emergency Manager provides services to all local jurisdictions.

Other critical capabilities: Hospitals, Medical Clinics and Residential Care facilities are located at Beaver. Volunteer Fire Departments and EMS are active in each community. These volunteer units are supported by a variety of local resources such as Department of Forestry programs and grants, Rural Economic Action Plan (REAP) grants, local fund-raising efforts and others.

There is another, informal asset that is a benefit to this region, and that is the high cultural value placed on being of service to one's neighbors. There is a remarkably strong and coordinated volunteer response (both physical and financial) in the event a fire or other disaster strikes.

4.1.6 Capability improvements

Because it is a rural county with low population density, Beaver County municipalities do not have the tax base to support many planning or construction projects. Therefore, each jurisdiction must be assertive in pursuit of grant funds and low-cost strategies for long range planning activities and to complete hazard mitigation projects. It is important for each municipality and school district to set aside local matching funds needed for annual grant applications, and to have a designated staff person to act as a point of contact for grant administration. The local COG (Council of Governments) can work with jurisdictions to facilitate access to many of these funding opportunities.

Public funding is available for strategies listed in the table below, such as Capital Improvement Planning (CIP) and Comprehensive Planning which are funded up to 100% of total project cost by Community Development Block Grants (CDBG-CIP) through the Oklahoma Department of Commerce. Other low-cost, high-impact strategies include membership in the Firewise communities program sponsored by the Oklahoma Department of Forestry and StormReady, which is sponsored by the United States National Weather Service.

There are several good programs at the Oklahoma Department of Emergency Management that support small communities in becoming more resilient, such as Safe Schools 101, which provides assessment of existing structures at no cost to the local community and makes recommendations for improvement. Schools may use the assessment to consider realistic options for hardening existing structures or plan the installation of safe rooms, as well as identify the safest places that may be used as areas of refuge already present in the school.

The following improvements would improve capability for the participating jurisdictions:

JURISDICTION	IMPROVEMENT
Beaver County	Become a Firewise Community
Town of Beaver	Develop and adopt a Comprehensive plan
	Become a Firewise Community
	Become a StormReady Community
Town of Gate	Develop and adopt a Capital Improvement Plan
	Become a Firewise Community
	Become a StormReady Community
Town of Knowles	Become a Firewise Community
	Become a StormReady Community
Balko, Beaver, Forgan, Turpin Schools	Participate in Safe Schools 101 Include Lightning Evaluation Training for staff

Other improvements

Beaver County Towns do not have as many regulatory ordinances as one might find in a city of larger size. While there is existing regulation of noxious weeds as identified by the State, some improvement could be made through the adoption of local policies to control Red Cedar and tumbleweeds in towns as well as rural areas, and more aggressive reporting and enforcement of Oklahoma Noxious Weed laws.

4.2 NFIP Participation

The Town of Beaver participates in the NFIP. No other jurisdictions in Beaver County participate in the NFIP. FEMA has not completed a study to determine additional flood hazard locations; FIRM maps for jurisdictions other than the Town of Beaver have not been published at this time. Local knowledge including NRCS data, is the primary source of flood data that is available.

4.3 Mitigation Goals

The purpose of mitigation is to save lives and reduce property damage. Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. In setting Goals, the planning team was guided by the State of Oklahoma Hazard Mitigation Plan (OKHMP, 2019). These were found to be appropriate for Beaver County.

Beaver County	Hazard Mitigation Goals
Goal 1	To protect life (reduce effects of hazards on people and livestock)
Goal 2	To protect property (reduce property damage)
Goal 3	To protect the environment (avoid environmental damage)
Goal 4	To increase public preparedness for disasters (prevention and safety)

4.4 Development of Action Steps

Mitigation can protect critical community facilities, reduce exposure to liability, and minimize disruption of community services. Examples of mitigation actions include land use planning, adoption of building codes, acquisition and demolition of structures in hazard-prone areas, or ensuring that appropriate shelters are available. Mitigation actions should be cost-effective and environmentally sound.

There are five mitigation action types:

- Local Plans and Regulations: Using authorities, policies, and codes to influence development
- Structure/Infrastructure Projects: Modifying or removing infrastructure to mitigate hazard
- Natural System Protection: Minimizing damage by preserving natural system functions
- Education and Awareness Programs: Informing citizens on how to mitigate hazards
- 5% Projects: Actions not quantifiable by a Benefit Cost Analysis, (i.e., sirens, generators, etc.)

Priorities

One method of prioritizing mitigation activities is to analyze each potential action by evaluating the "Social, Technical, Administrative, Political, Legal, Economic, and Environmental" (STAPLEE) effects of a proposed activity. This methodology was used to examine opportunities (benefits) and constraints (costs) of implementing each action from the perspective of all seven of the STAPLEE criteria.

STAPLEE Method of Mitigation Action Evaluation	
Category	**Evaluation**
Social	Community acceptance, Effect on segments of the population, educational
Technical	Technical feasibility, Long term solution, Secondary impacts
Administrative	Staffing, Funding available, Maintenance & operations
Political	Political support, Local leadership support, Public support
Legal	Jurisdictional authority, potential legal challenge
Economic	Benefits outweigh costs, contributes to economic goals, outside funding required
Environmental	Effect on land, water, species, consistent with sound environmental goals

Each of the STAPLEE categories were considered when developing action steps and that evaluation is recorded in the Action Tables below, labeled "Mitigation Action Evaluation." The priorities of the community as stated during public meetings and by survey were compared with the STAPLEE categories of potential benefit as a means of measuring the qualitative benefit to the community, and a score of 1 to 7 was assigned to indicate the number of potential benefits represented by an Action.

Preference was also given to the hazards viewed by the public as presenting the most frequent problems and the most severe consequences. For example, planning committee discussions and community survey comments indicated the top 4 concerns were tornado, wildfire, winter storm and high wind. Hail was frequently mentioned as a damaging event. Earthquake was uniformly

the hazard of least concern. Riverine flood is rare and confined to the north edge of the Town of Beaver, while stormwater flow and/or erosion is a concern for the Town of Knowles and the Beaver, Forgan and Turpin school districts. Tree maintenance is of concern throughout the County and is of special concern in Knowles. Specific actions developed to support mitigation goals are outlined below.

4.5 Action Plan

Action Item 1	**Initiate programs to create additional Safe Rooms for rural and town residents and schools in Beaver County**
Action Description	Safe Schools 101, OEM/FEMA shelter grants
Hazard(s) Addressed	Hail, Tornado
Jurisdiction(s)	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendent of Schools
Supports	Goals # 1, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	6: S,T,A,P,L,Ec
Potential Timeline	12-60 months
Cost	Staff time; leverage up to 25% of total project cost
Potential Funding Sources	HM Grant funds, Community Budget, REAP funds

Action Item 2	**Install rain-capturing devices for irrigation**
Action Description	Purchase and install rain-capturing devices to store or direct rainwater to reduce demand on aquifers
Hazard(s) Addressed	Drought
Jurisdiction	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendents of Schools
Supports	Goals # 2, 3, 4
Mitigation Type	5% Project
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	$1,000 to $15,000 per unit, depending on the type of system
Potential Funding Sources	Annual budget, Fund raising efforts

Action Item 3	**Install Lightning Suppression System at Critical Facilities**
Action Description	Install lightning protection and suppression systems protecting radios, repeaters, storm sirens, water wells, and other essential equipment at critical facilities
Hazard(s) Addressed	Lightning
Jurisdiction	All Jurisdictions
Responsible Party	County EM, Town Administrators, Superintendent of Schools
Supports	Goals # 1, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	5: T,A,P,L,Ec
Potential Timeline	12-24 months
Cost	$2,000 to $10,000
Potential Funding Sources	HMGP, Community Budget, REAP funds, Dept. of Agriculture and Dept. of Public Safety

Action Item 4	**Replace or upgrade existing water delivery systems to eliminate breaks and leaks**
Action Description	Design a phased plan, and make annual applications for grant funds for water supply infrastructure
Hazard(s) Addressed	Drought
Jurisdiction	Towns of Beaver, Gate & Knowles
Responsible Party	Town Administrators
Supports	Goals # 1, 2, 3, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	$7,500 - $22,500 per 100 feet
Potential Funding Sources	HMGP, Community Budget, REAP funds, Dept. of Agriculture and Dept. of Public Safety

Action Item 5	**Enhanced anchoring of rooftop-mounted equipment**
Action Description	Assess and reinforce anchoring of rooftop HVAC units, satellite dishes, etc
Hazard(s) Addressed	Earthquake, High winds
Jurisdiction	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendents of Schools
Supports	Goals # 2, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	3: T,A,Ec
Potential Timeline	12-60 months
Cost	$1,000 to $12,000
Potential Funding Sources	HMGP, Community Budget, REAP funds, Dept. of Agriculture and Dept. of Public Safety

Action Item 6	**Drill Additional Water Wells**
Action Description	Dig additional water wells to ensure that an adequate supply of water is available to residents and livestock
Hazard(s) Addressed	Drought
Jurisdiction	Beaver County, Towns of Beaver, Gate and Knowles
Responsible Party	County EM, Town Administrators
Supports	Goals # 1, 2, 4
Mitigation Type	Structure and Infrastructure Projects
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	$15,000
Potential Funding Sources	HMGP, Community Budget, REAP funds, Dept. of Agriculture and Dept. of Public Safety

Action Item 7	**Tie-down Ordinance for Mobile Homes and Other Structures**
Action Description	Write and adopt municipal ordinances to require tie-downs to secure mobile homes and propane tanks
Hazard(s) Addressed	High winds
Jurisdiction	Towns of Beaver, Gate and Knowles
Responsible Party	Town Administrators
Supports	Goals # 1, 2, 4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	6: S,T,A,P,L,Ec
Potential Timeline	12-60 months
Cost	Staff time
Potential Funding Sources	HMGP, Community Budget, REAP funds, Dept. of Agriculture and Dept. of Public Safety

Action Item 8	**Conduct a visual inspection of school buildings to assess vulnerability to EQ hazard**
Action Description	Establishing a school survey procedure and guidance document to inventory structural and non-structural hazards in and around school buildings.
Hazard(s) Addressed	Earthquake
Jurisdiction	Schools
Responsible Party	School Superintendents
Supports	Goals # 1, 2, 4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	3: T,A,Ec
Potential Timeline	12-60 months
Cost	Staff time
Potential Funding Sources	Staff Salaries

Action Item 9	**Join the "Firewise Communities" program**
Action Description	Using the Firewise strategy will enhance wildfire safety
Hazard(s) Addressed	Wildfire
Jurisdiction	Towns of Beaver, Gate and Knowles
Responsible Party	Town Administrators
Supports	Goals # 1, 2, 3, 4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	6: S,T,A,P,L,Ec
Potential Timeline	12-36 months
Cost	Negligible
Potential Funding Sources	Staff salary

Action Item 10	**Water Management and Drought Planning**
Action Description	Develop a program for municipal government and water supply providers defining water management actions along with preparation of a drought management plan
Hazard(s) Addressed	Drought
Jurisdiction	Towns of Beaver, Gate and Knowles
Responsible Party	Town Administrators
Supports	Goals # 1, 2, 3, 4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-36 months
Cost	Negligible
Potential Funding Sources	Staff salary

Action Item 11	**Create a database and map of Special Needs Population**
Action Description	Create a database of citizens who may be adversely affected by extreme temperatures or other hazard events
Hazard(s) Addressed	Extreme heat, High wind, Tornado, Wildfire, Winter storm
Jurisdiction	Beaver County, Towns of Beaver, Gate and Knowles
Responsible Party	County EM, Town Administrators
Supports	Goals # 1, 4
Mitigation Type	Local Plans and Regulations
STAPLEE Score	4: S,T,A,Ec
Potential Timeline	12-60 months
Cost	Negligible
Potential Funding Sources	Staff salary

Action Item 12	**Tree Management**
Action Description	Develop and implement programs to keep trees from threatening utility infrastructure, lives and property
Hazard(s) Addressed	High wind, Wildfire, Winter storm
Jurisdiction	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendents of Schools
Supports	Goals # 1, 2, 3, 4
Mitigation Type	Natural Systems Protection
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	Negligible
Potential Funding Sources	Staff salary

Action Item 13	**Implement enhanced stormwater management strategies to reduce erosion and facilitate recharge of groundwater**
Action Description	Redesign drainage system to modernize stormwater management and facilitate recharge (incorporate retention basins, install permeable pavements, convert to xeriscaping)
Hazard(s) Addressed	Drought, Flood
Jurisdiction	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendents of Schools
Supports	Goals # 2, 3
Mitigation Type	Natural Systems Protection
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	$1,000 to $100,000
Potential Funding Sources	OWRB, REAP, HM Grant funds

Action Item 14	**Increase Public Awareness**
Action Description	More outreach to the county residents to increase public involvement in Hazard planning, locations of shelters, and steps that can be taken to reduce the effects of hazards
Hazard(s) Addressed	Drought, Earthquake, Extreme heat, Flood, Hail, High winds, Lightning, Tornado, Wildfire, Winter storm
Jurisdiction	All Jurisdictions
Responsible Party	County EM, Town Administrators, School Superintendents
Supports	Goals # 1, 2, 3, 4
Mitigation Type	Education and Awareness Programs
STAPLEE Score	3: S,T,A
Potential Timeline	12-60 months
Cost	Staff time; $100 for printing and distribution of informational materials
Potential Funding Sources	Annual budget

Action Item 15	**Educate residents about collecting rainwater to water plants and xeriscaping**
Action Description	Offer Public education about rainwater harvesting and xeriscaping to preserve water
Hazard(s) Addressed	Drought
Jurisdiction	Towns of Beaver, Gate and Knowles
Responsible Party	Town Administrators
Supports	Goals # 2, 3
Mitigation Type	Education and Awareness Programs
STAPLEE Score	4: S,T,Ec,Env
Potential Timeline	12-60 months
Cost	Staff time; $100 printing and distribution of educational materials
Potential Funding Sources	Annual Budget

Action Item 16	**Educate residents about safe practices for using alternative heat sources**
Action Description	Provide information that all fuel-burning equipment should be vented to the outside; encourage homeowners to install carbon monoxide monitors and alarms
Hazard(s) Addressed	Winter storms
Jurisdiction	Beaver County, Towns of Beaver, Gate and Knowles
Responsible Party	County EM, Town Administrators
Supports	Goals # 1
Mitigation Type	Education and Awareness Programs
STAPLEE Score	4: S,T,A,Ec
Potential Timeline	12-60 months
Cost	Staff time; $100 printing and distribution of educational materials
Potential Funding Sources	Annual budget

Action Item 17	**Building Material Awareness - hail resistant roofing and window film**
Action Description	Provide information about hail resistant roofing and window film to schools, insurance agents, Contractors and Citizens
Hazard(s) Addressed	Hail
Jurisdiction	Beaver County
Responsible Party	County EM
Supports	Goals # 2
Mitigation Type	Education and Awareness Programs
STAPLEE Score	5: S,T,A,P,Ec
Potential Timeline	12-60 months
Cost	Staff time; $100 printing and distribution of educational materials
Potential Funding Sources	Annual budget

Action Item 18	**Installation of NOAA Receivers in Schools and Public Facilities**
Action Description	Purchase and install NOAA weather radio receivers in schools, hospital, nursing homes and other public facilities
Hazard(s) Addressed	Extreme heat, Hail, Lightning, Tornado, Winter storms
Jurisdiction	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendents of Schools
Supports	Goals # 1, 4
Mitigation Type	5% Projects
STAPLEE Score	6: S,T,A,P,L,Ec
Potential Timeline	12-60 months
Cost	$35 per unit
Potential Funding Sources	FEMA 5% project funding

Action Item 19	**Purchase and Installation of Generators To Power Critical Facilities**
Action Description	Purchase and install generators for critical facilities in all jurisdictions to provide electricy, heating, cooling and communications during power outages
Hazard(s) Addressed	Extreme heat, Hail, High wind, Tornado, Winter storms
Jurisdiction	All jurisdictions
Responsible Party	County EM, Town Administrators, Superintendents of Schools
Supports	Goals # 1, 4
Mitigation Type	5% Projects
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	$2,500 to $15,000
Potential Funding Sources	FEMA 5% project funding

Action Item 20	**Install additional Storm Sirens**
Action Description	There is a need for an additional storm sirens (especially in the Ponderosa/Quail Ridge area and at Bryan's Corner)
Hazard(s) Addressed	Tornado
Jurisdiction	Beaver County
Responsible Party	County EM
Supports	Goals # 1, 4
Mitigation Type	5% Projects
STAPLEE Score	7: S,T,A,P,L,Ec,Env
Potential Timeline	12-60 months
Cost	$30,000 t0 $100,000
Potential Funding Sources	National Weather Service, USDA, 25% local funding

Action Item 21	**Installation of a Weather Alert system at the Beaver Airport**
Action Description	Provide severe weather warning by radio for the entire county; Informing the public about severe winter weather impacts
Hazard(s) Addressed	Hail, High wind, Tornado, Lightning, Winter storm
Jurisdiction(s)	Town of Beaver
Responsible Party	Town Administrator
Supports	Goals # 1, 4
Mitigation Type	5%
STAPLEE Score	6: S,T,A,P,L,Ec
Potential Timeline	12-24 months
Cost	$2,000
Potential Funding Sources	HMGP, Community Budget, REAP funds, Dept. of Agriculture and Dept. of Public Safety

4.6 Integration of Data, Goals, and Action Items

Each jurisdiction in Beaver County will receive a copy of the 2022 Hazard Mitigation Plan Update so that the data, information, and hazard mitigation goals and actions be incorporated into other planning mechanisms. Regulations be adopted to facilitate implementation of Hazard Mitigation strategies. Hazard mitigation information and actions identified in this update will be incorporated into other plans when adopted or reviewed as follows:

Jurisdiction	Plan	When
Beaver County; Towns of Beaver, Gate, Knowles	Comprehensive Plans (if adopted)	Annual review, 20 year update
	Beaver County Emergency Management Plan	Annual review, annual update
	Beaver County Post-Disaster Recovery Plan	Annual review, annual update
Towns of Gate and Knowles	Capital Improvement Plans (if adopted)	Annual review, 5 year update
Balko, Beaver, Forgan and Turpin Public School Districts	Emergency Operations Plans	Annual review, annual update
	Post disaster recovery plans (if adopted)	Annual review, annual update

The Beaver County Emergency Management Plan and the Post-Disaster Recovery Plan cover all jurisdictions and are reviewed by the Emergency Management Director on an annual basis.

The Emergency Management Directors for Beaver County and the Town of Beaver, all Town managers and public works directors review priorities for capital improvements as part of fiscal planning on an annual basis. The action items project list from the Hazard Mitigation Plan will be reviewed during the budget planning process to document progress and ensure on-going prevention, preparedness, response, recovery, and mitigation of identified hazards.

The Beaver Capital Improvement Plan (CIP) is reviewed on an annual basis by the Town Board, Town EM, and Public Works Director. The Towns of Gate and Knowles are eligible to apply for CIPs, and it is recommended that they do so to improve capability and hazard resilience.

The Balko, Beaver, Forgan and Turpin School Districts each have a School Board and a designated Emergency Manager who are responsible for review and update of Emergency Operations Plans every year. The action items list from the Hazard Mitigation Plan will be reviewed during these plan updates to ensure the school district continues to seek opportunities to accomplish mitigation action items. Each Public School Board has the authority to distribute school funds and issue bonds as they pertain to proposed mitigation action projects. The public votes on bond issues to approve or deny funding.

Incorporation of previous HMP. The Oklahoma State Hazard Mitigation Plan incorporates local plans, including the Beaver County HMP, but local Capital Improvement Plans and School Emergency Operation Plans have been developed independently, and data or goals from the previous Beaver County HMP were not incorporated into those plans during the last 5 years.

Chapter 5 Plan Update and Prioritization Review

5.1 Changes in Jurisdictional Development

Two modest changes in development have occurred in Beaver County since the publication of the previous HMP. Those are: an increase in the number of Tank Batteries which are used as storage for petroleum products, and an increase in the number of wind turbines that have been built. Neither has made a significant change in vulnerability to hazard events in the county; both were addressed in this update as a component of utility infrastructure. No other changes in development have impacted the overall vulnerability of local jurisdictions. Housing and industry are both relatively stable.

5.2 Status of Previous Mitigation Action Items

The table below illustrates the status of hazard mitigation actions in the previous plan by identifying those that have been completed and those that have not been completed. Items in green will be carried forward in the new plan.

Beaver County Previous Mitigation Action Items			Done?	Carry forward?
1	Install Safe Rooms in Beaver County Schools	Installation of large safe rooms into existing structures of schools at Balko, Beaver, Forgan, and Turpin	NO	YES
2	Increase Public Awareness	More outreach to the county residents to increase public involvement in Hazard planning, locations of shelters, and steps that can be taken to reduce the effects of hazards	NO	YES
3	Installation of a NOAA Transmitter in Beaver County (Changed this to a "weather alert system")	There is a need for installation of a NOAA transmitter to provide severe weather warning for the entire county	NO	YES
4	Installation of NOAA Receivers in Schools and Public Facilities	Purchase and install NOAA weather radio receivers in schools, hospital, nursing homes and other public facilities	NO	YES
5	Purchase and Installation of Generators To Power Critical Facilities	Purchase and install generators for critical facilities in Beaver County such as the County Courthouse, municipal water wells, shelters etc.	NO	YES
6	Mobile Communications Equipment	Obtaining mobile communications equipment for spotters and Emergency Response Teams to assist with coordination and monitoring of shelters during severe weather	NO	YES
7	Establish Countywide Enhanced 911 Service	Establish 911 system to mitigate the loss of life and property	YES	NO

8	Purchase Lightning Prediction System for Schools	Provide THOR Guard detection systems for Beaver County School Districts	NO	DELETE
9	Lightning Suppression System at Critical Facilities	Install lightning protection and suppression systems protecting radios, repeaters, storm sirens, water wells, and other essential equipment at critical facilities	NO	YES
10	Tie-down Ordinance for Mobile Homes and Other Structures	Write and adopt county and municipal ordinances to require tie-downs to secure mobile homes and other mobile structures, both existing and new	NO	YES
11	Purchase of Pumper Fire Trucks - Wildfire Protection	Purchase of three pumper fire trucks to protect structures in rural Beaver County from wildfire	NO	DELETE
12	Installation of Dry Hydrants - Rural Beaver County	Install dry hydrants into nearby and developed water supplies reducing long distance water hauling during wildfires and to provide backup for both rural and town fire suppression	NO	DELETE
13	Drill Additional Water Wells	Dig additional water wells throughout Beaver County to ensure that an adequate supply of water is available to residents and livestock	NO	YES
14	Water Management and Drought Planning	Develop a program for municipal government and water supply providers defining water management actions along with preparation of a drought management plan	NO	YES
15	Tree Management	Work with local government, utility providers, and citizens to develop and implement programs to keep trees from threatening utility infrastructure, lives and property	NO	YES
16	Non-participating Municipalities to Become Members of NFIP	Take the necessary steps for Towns to become members of the National Flood Insurance Program	NO	DELETE
17	Database and Map of Special Needs Population	Create a database of citizens who may be adversely affected by extreme events	NO	YES
18	Public Education of Dangers Associated with Extreme Temperature Events	Work with local governments on a public education campaign to inform citizens of the dangers of extreme temperature events	NO	YES
19	Rectify Data Limitation and Data Deficiencies	To establish procedures to gather missing data on all hazards. A record keeping system will be developed to track each hazard	YES	DELETE

20	Code Enforcement for New Construction of Buildings and Infrastructure	Implement ordinances and have personnel to review plans for future development of buildings and infrastructure such as utilities	NO	DELETE
21	Building Material Awareness - Insurance agents, Contractors and Citizens	Promote the use of Hail Resistant shingles and building materials	NO	YES
22	Install a Storm Siren in the Community of Ponderosa/Quail Ridge	There is a need for an additional storm siren in the Ponderosa/Quail Ridge area	NO	YES

5.3 Changes in Jurisdictional Priorities

Drought has become a hazard of increased concern to local officials and residents of all jurisdictions in the planning area. Drought not only affects the annual availability of fresh water, it contributes to increased danger of wildfires and intensifies aquifer depletion posing a long-term threat to the agricultural economy and to municipal water supplies.

- ✓ ***Wildfires.*** The danger of Wildfire is a hazard that becomes an increasing threat when drought becomes more frequent or severe
- ✓ ***Aquifer depletion.*** The planning team took special note that the problem of aquifer depletion could become severe at some time in the next few decades

In recent decades, the Oklahoma Water Resources Board's Financial Assistance Program has provided billions of dollars in assistance to local water and sewer infrastructure projects, which has increased the drought resistance of local water treatment and distribution systems in towns and cities across the state. Beaver County municipalities are eligible to apply for assistance through that program.

An analysis conducted for the 2012 Update of the Oklahoma Comprehensive Water Plan (OCWP) estimated that Oklahoma faced an $82 billion need in such financing over the next 50 years (OWRB, 2012). This is an indication that the State recognizes the risk and is motivated to assist communities in mitigation of that long term hazard.

5.4 Conclusion

The Goals and Action Items detailed in this 2022 Hazard Mitigation Plan update are intended to be a guide to officials and residents of Beaver County as they continue to make progress towards becoming a safer community. As new information and new technology become available, this plan will be updated accordingly.

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APPENDIX A

1

Public Opinion Survey – Hazard Mitigation (2 pages) 4/01/2021

Beaver County Hazards to Consider:

Priority	Hazard	What are some of the problems with these hazards?
	Drought	
	Earthquake	
	Extreme Heat	
	Flood	
	Hail	
	High Wind	
	Lightning	
	Tornado	
	Wildfire	
	Winter Storm	

Comments

2

Public Opinion Survey – Hazard Mitigation (2 pages) 4/01/2021

Hazard	What are some solutions you would like to see?
Drought	
Earthquake	
Extreme Heat	
Flood	
Hail	
High Wind	
Lightning	
Tornado	
Wildfire	
Winter Storm	

Other Comments:

Score sheet: Priorities/ Danger

Priority	Beaver County	Town Beaver	Town Gate	Town Knowles	Balko PSD	Beaver PSD	Forgan PSD	Turpin PSD	AVG PRIORITY		
"1" IS TOP PRIORITY	Priority	Priority	Priority	Priority	Priority	Priority	Priority	Priority			
Drought	6	5	7	8	8	6	6	7	6.625	7	Drought
Earthquake	10	10	10	10	10	10	10	10	10.000	10	Earthquake
Extreme Heat	8	7	5	5	7	8	8	9	7.125	8	Extreme Heat
Flood	5	8	9	9	9	9	9	6	8.000	9	Flood
Hail	7	4	6	6	6	3	7	5	5.500	5	Hail
High Wind	4	6	3	4	4	5	4	4	4.250	4	High Wind
Lightning	9	9	8	7	5	7	3	3	6.375	6	Lightning
Tornado	3	1	2	2	1	2	1	2	1.750	1	Tornado
Wildfire	2	2	1	1	3	1	2	8	2.500	2	Wildfire
Winter Storm	1	3	4	3	2	3	5	1	2.750	3	Winter Storm
Level of Danger	Beaver County	Town Beaver	Town Gate	Town Knowles	Balko PSD	Beaver PSD	Forgan PSD	Turpin PSD	AVG LVL OF DANGER		
"5" IS MOST SERIOUS	Level of Danger	Level of Danger	Level of Danger	Level of Danger	Level of Danger	Level of Danger	Level of Danger	Level of Danger			
Drought	4	3	3	1	2	3	3	3	2.750	5	Drought
Earthquake	1	1	1	1	1	1	1	1	1.000	10	Earthquake
Extreme Heat	3	3	3	2	3	2	3	2	2.625	7	Extreme Heat
Flood	4	2	1	1	1	1	2	3	1.875	9	Flood
Hail	3	3	3	2	3	3	3	4	3.000	6	Hail
High Wind	4	3	4	3	3	4	4	4	3.625	4	High Wind
Lightning	2	2	2	1	3	3	4	4	2.625	8	Lightning
Tornado	5	5	5	4	5	5	5	4	4.750	1	Tornado
Wildfire	5	4	5	5	4	5	5	3	4.500	2	Wildfire
Winter Storm	5	3	4	3	4	4	3	4	3.750	3	Winter Storm

PRIORITY SORT	
1	Tornado
2	Wildfire
3	Winter Storm
4	High Wind
5	Hail
6	Lightning
7	Drought
8	Extreme Heat
9	Flood
10	Earthquake

The top 4 concerns were tornado, wildfire, winter storm and high wind. Hail was frequently mentioned as a damaging event. Earthquake was uniformly the hazard of least concern. Riverine flood is rare and confined to the north edge of the Town of Beaver, while stormwater drainage, overland flow and/or erosion is a concern for all jurisdictions.

DANGER SORT	
1	Tornado
2	Wildfire
3	Winter Storm
4	High Wind
5	Drought
6	Hail
7	Extreme Heat
8	Lightning
9	Flood
10	Earthquake

While drought is viewed as very dangerous, it ranked lower in priority, because of the perception that local jurisdictions have limited ability to mitigate that hazard.