BUFFALO COUNTY, SOUTH DAKOTA

HAZARD MITIGATION PLAN

JULY 2022

Prepared by:

Buffalo County Disaster Mitigation Planning Team

Technical Assistance Provided By:

Planning & Development District III
PO Box 687
Yankton, SD 57078

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CHAPTER I
PLANNING PROCESS

Background

This plan is an update of the Buffalo County Pre-Disaster Mitigation Plan, which was approved by FEMA in March 2017. The purpose of the plan is to prevent or reduce losses to people and property that may result from future hazard events in Buffalo County. The plan identifies and analyzes hazards relevant to the area, and proposes a mitigation strategy to minimize future damage that may be caused by those hazards. The document will serve as a strategic planning tool to help mitigate against future disaster events.

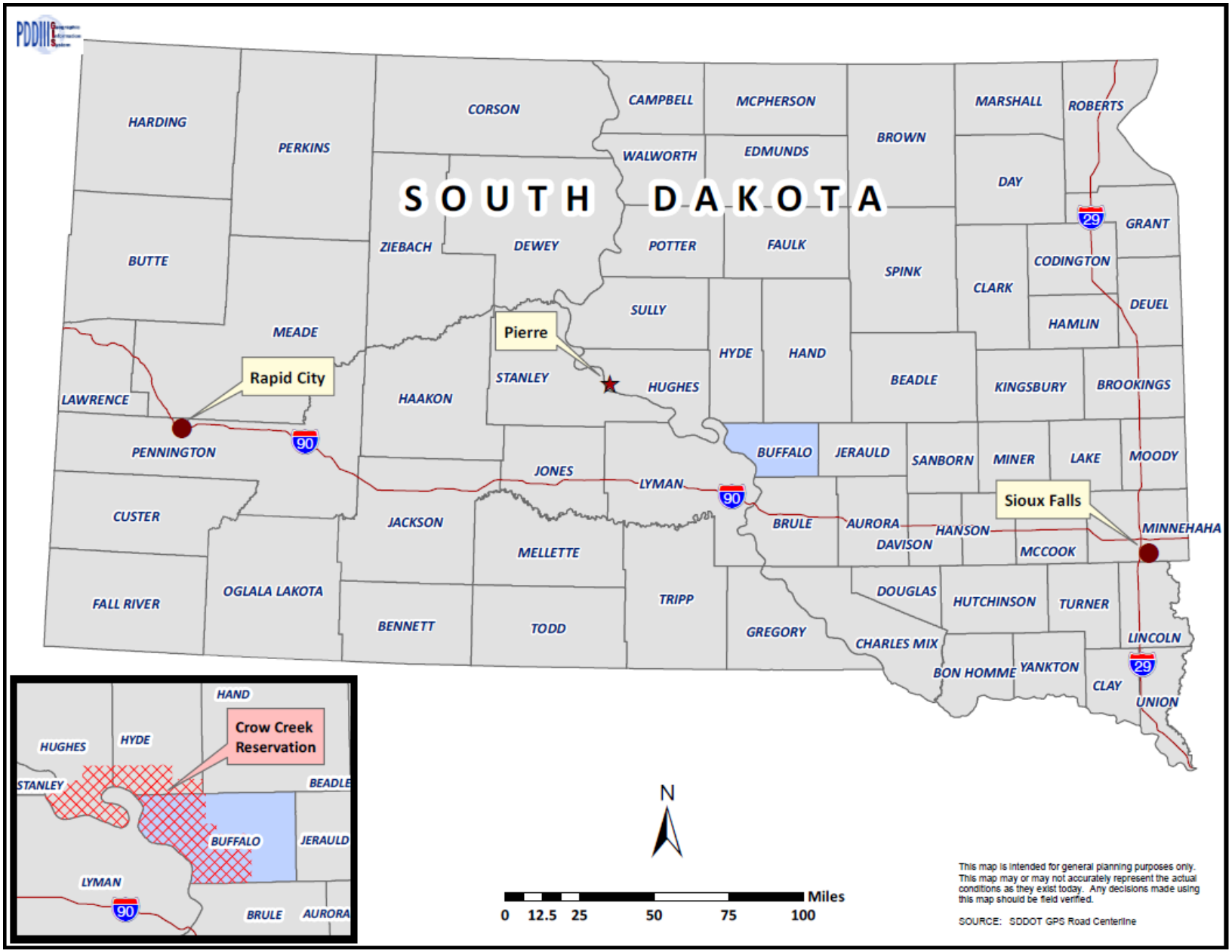
This is a multi-jurisdictional plan, as both Buffalo County and the Crow Creek Sioux Tribe participated in the plan's development, as they did when the current plan (that is, the plan now being updated) was being developed. The plan covers all of the Crow Creek Indian Reservation, which includes land in Buffalo, Hughes, and Hyde Counties.

Production of the plan was the ultimate responsibility of the Buffalo County Emergency Management Director, who served as the County's point of contact for all activities associated with this plan. The Crow Creek Emergency Management Director served as the point of contact for the Crow Creek Tribe. Information used to develop the plan was received from a disaster mitigation planning team (see **Appendix B**).

The plan itself was written by an outside contractor, Planning & Development District III of Yankton, South Dakota, one of the state's six regional planning entities. The office has an extensive amount of experience in producing various kinds of planning documents, including municipal ordinances, land use plans, and zoning ordinances, and it is an acknowledged leader in geographic information systems (GIS) technology in South Dakota. Furthermore, its staff has written disaster mitigation plans for all sixteen of the counties in the District's planning area, including Buffalo County's current plan.

The following staff members of Planning & Development District III were involved in the production of the plan. John Clem, a Community Development Specialist, was the project manager and author of the plan. Assisting Mr. Clem was Harry Redman, a Geographic Information Systems Professional, who produced maps for the plan, directed the floodplain risk analysis (see **Chapter III**), and completed the county land cover analysis (see **Chapter II**).

Figure 1.1 – Buffalo County/Crow Creek Reservation Location



Development of Planning Team

The initial planning stages for this plan update began in 2018 when an application was submitted to FEMA for Hazard Mitigation Grant Program (HMGP) funds to help pay for the update. The HMGP funds were awarded to the County in September 2020. Following this, John Clem, the Buffalo County Emergency Management Director, and the Crow Creek Emergency Management Director began to develop the methodology and strategy to be used to update the plan.

The first step was to organize the disaster mitigation planning team, the group of individuals representing the participating jurisdictions and other stakeholders at the planning team meetings. These individuals provided information and various documents that were used to produce the plan, reviewed drafts of the plan as it was being assembled, and reviewed and approved the final version of the plan. Personnel at the county and tribal level with the authority to regulate development were a priority for inclusion on the team. Invited to participate on the planning team were representatives from the following groups:

- Buffalo County (commissioners, auditor, director of equalization, highway superintendent, etc.)
- Crow Creek Sioux Tribe (tribal council members, treasurer, school superintendent, public works director, housing authority director, etc.)
- Bureau of Indian Affairs (BIA)
- Indian Health Service Fort Thompson Health Center
- U.S. Army Corps of Engineers

Each individual on the planning team had at least one of the following attributes to contribute to the planning process:

- Significant understanding of how hazards affect Buffalo County and the Crow Creek Reservation.
- Substantial knowledge of the county and tribal infrastructure systems.
- Resources at their disposal to assist in the planning effort, such as maps or data on past hazard events.
- The authority to help implement the mitigation strategy that was developed.

Appendix B provides documentation of the planning meetings that were held to develop the plan.

Outreach Effort

Throughout the plan's development, efforts were made to obtain involvement in the plan beyond just the planning team. Outreach also was made to emergency management directors in nearby counties, as well as the South Dakota Office of Emergency Management.

At the end of the process, a press release was printed in the local newspaper announcing that the plan was complete and available for public review and comment. See **Appendix A** for documentation of the public outreach effort.

Planning Meetings

Meetings were held at Fort Thompson on the Crow Creek Reservation and at the Buffalo County courthouse in Gann Valley as the plan was being developed. The purpose of the meetings was to inform the team members about the mitigation planning process, to gather information used to develop the risk assessment, to develop the mitigation strategy, and to discuss how the plan will be implemented. Leadership and guidance at the planning meetings was provided by John Clem of Planning & Development District III, the Buffalo County Emergency Management Director, and the Crow Creek Emergency Management Director.

The planning process associated with the plan's development was relaxed and informal, and free-flowing discussion was always encouraged. No subcommittees were formed, no votes were taken or motions made, and decisions were made by mutual consensus of the planning team members. Everyone's opinion was respected, nobody was discouraged from voicing their opinion, and no one was made to feel any less important than anyone else.

Initial Meeting – Introduction and Risk Assessment

The first meeting of the planning team occurred at Fort Thompson. This meeting was organized by Buffalo County commissioner Donita Loudner, who is an enrolled member of the Crow Creek Sioux Tribe, and Crow Creek Tribal Emergency Management Director Kason Comes Flying [1]. This meeting introduced the participants to the mitigation planning process. Discussion occurred about how the plan would be developed in the coming months, and about the basic goals to be achieved with the mitigation plan.

Following this, the current disaster mitigation plan was reviewed, particularly the risk assessment section. Discussion occurred about how various hazards impact Buffalo County and the Crow Creek Reservation, especially the most important community assets and critical facilities. These assets are shown on the hazard vulnerability maps included at the end of **Chapter III** and are listed in **Appendix D**. Discussion also occurred regarding the existing resources and capabilities to mitigate against the hazards, and whether other risks not analyzed in the current plan should be addressed.

A review of the progress toward implementing the proposed mitigation actions included in the current plan also was made. A list summarizing progress on the actions is included in **Chapter IV**.

[1] Buffalo County Emergency Management Director Katheryn Benton was not able to attend.

Discussion also occurred about how to get broader public input into the planning process, and whether any other potential stakeholders not already present should be invited to participate in the planning process.

Jurisdictional Meetings – Develop Mitigation Strategy

After the initial planning team meeting, the risk assessment was completed by the Planning & Development District III office using various methods, as discussed in **Chapter III**. The next step in the process was development of the mitigation strategy. To assist the County and Tribe in developing the strategy, the results of the risk assessment, including a summary of the textual information presented in **Chapter III**, maps showing hazard-prone areas, and tables showing the value of property at risk, were distributed. A list of potential mitigation actions based on FEMA's guidance document *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* also was distributed to the County and Tribe.

The selection of the actions took place during official meetings of Buffalo County and the Crow Creek Tribe, which ensured that the process was open to public involvement. Details about the actions, such as estimated cost, the party responsible for implementation, and priority level, were discussed. The final list of actions proposed by the County and Tribe is presented in **Chapter IV** (see **Table 4.2**).

Final Meeting – Plan Review and Plan Implementation

Following the jurisdictional meetings, the Planning & Development District III office completed a first draft of the plan, which was distributed to the County and Tribe. A final meeting was then held to review the draft and discuss how the plan will be implemented. At the meeting, which was attended by both the Buffalo County Emergency Management Director and the Crow Creek Tribal Emergency Management Director, it was stressed that cooperation and communication between Buffalo County and Crow Creek Tribal officials will be needed to make sure the plan is effective. Another point of emphasis was that no county or tribal decisions should be made or actions taken that are contrary to the goals of this plan. Maintenance of the plan also was discussed, specifically how the plan will be monitored, evaluated, and updated in the coming years. The meeting ended with a discussion about how to keep the general public and other stakeholders involved in the mitigation planning process going forward.

After the meeting, some additional information was added to the plan based on discussion at the meeting, and the plan was made available for public review. After a short comment period, the plan was submitted to the South Dakota Office of Emergency Management.

Acknowledgements

The Planning & Development District III office would like to thank the members of the Buffalo County Disaster Mitigation Planning team for participating in the planning meetings and for supplying information for the plan. Special thanks go to Treon Fleury, BIA Wildland Fire Operations Specialist, for providing updated information about wildfires that have occurred

on the Crow Creek Reservation. We also thank Buffalo County Emergency Management Director Katheryn Benton and Crow Creek Tribal Emergency Management Director Kason Comes Flying for providing leadership at the meetings, and Buffalo County Commissioner Donita Loudner for making the arrangements for the initial meeting at Fort Thompson.

Thanks also are extended to Heather Allemang, Jim Poppen, Kyle Kafka, and Marc Macy at the South Dakota Office of Emergency Management for information and guidance in developing the plan.

CHAPTER II
COMMUNITY PROFILE

Background

This chapter serves as a basic introduction of Buffalo County and the Crow Creek Reservation. Topics addressed in this chapter cover the area's physical conditions, population and socio-economic characteristics, utilities and infrastructure, and services. Following chapters are devoted to assessing risks in the area, presenting a mitigation strategy, and discussing how the plan will be implemented.

General Description

Buffalo County is located in central South Dakota, as shown in **Figure 1.1**. It covers approximately 487 square miles in area, about half of which is comprised of the Crow Creek Indian Reservation, which also extends into Hughes and Hyde Counties. The reservation's total land base is approximately 400 square miles.

According to the 2020 Census, Buffalo County had a population of 1,948, of whom 1,795 reside on the Crow Creek Reservation. The largest community in the area covered by this plan is Fort Thompson (pop 1,375), the headquarters of the Crow Creek Tribe. Other populated places are Gann Valley (pop 14), Big Bend (pop ≈75), Crow Creek (pop ≈100), and Stephan (pop ≈150). Gann Valley is the Buffalo County seat and Stephan is the location of the Crow Creek Tribal School.

Physical Characteristics

The area covered by this plan is very lightly settled, with most of the land devoted to livestock grazing, although some crops are grown, especially in irrigated areas along the Missouri River where the land is level. The eastern half of Buffalo County is fairly level to gently rolling, as is much of Crow Creek Reservation land in Hughes and Hyde Counties, but there are some rugged areas along the Missouri River. There are many wetlands in the area, some of which are now used as waterfowl or wildlife production areas.

Figure 2.1 – Political Map

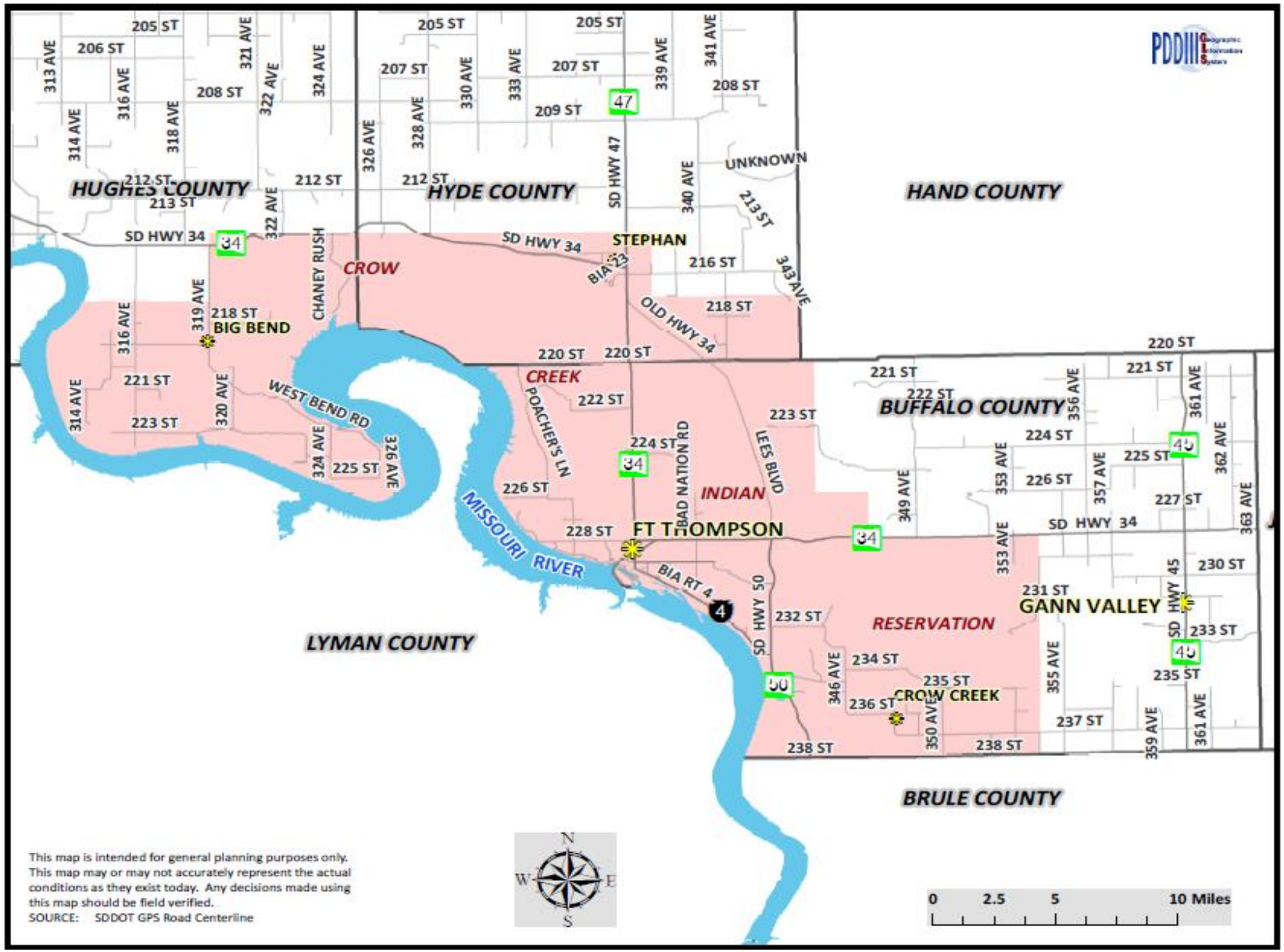


Table 2.1 provides a breakdown of the land cover in Buffalo County. The table is based off satellite imagery from the United States Geological Service's National Land Cover Database, processed using ArcGIS computer mapping software. As the table shows, most of Buffalo County's land cover is grassland; developed land makes up only a very small fraction of the land area. Crow Creek Reservation land in Hughes and Hyde Counties has a similar mix of land cover. **Figure 2.2** is a graphic representation of Buffalo County's land cover.

Table 2.1 - Vegetative Land Cover

Cover Type	Sq Miles	% of Total Area
Grassland	351.0	72.0
Cultivated crops	64.8	13.3
Pasture land	34.8	7.1
Open water	17.6	3.6
Developed land (open space)	9.5	1.9
Wetlands	4.0	0.8
Forested land	3.9	0.8
Developed land (low to high intensity)	1.2	0.2
Barren land	0.5	0.1
TOTAL AREA	**487.3**	

Source: http://www.mrlc.gov/index.php

As in most of South Dakota, the climate of the area is characterized as sub-humid and continental, which means that summers are often hot and winters can be very cold. There are no large bodies of water or mountain ranges to mitigate against these extremes. High temperatures in summer can exceed 100 degrees Fahrenheit [2], while winter lows can drop below -20 degrees. Precipitation averages about 20 inches per year, but during drought years the amount can be much less. Most of the precipitation occurs during the spring and early summer; winter snow is not frequent, but snow cover on the ground is fairly constant during many winters. Blizzards and other types of winter storms are a definite hazard. Following is climate data in the county as reported from the Gann Valley weather station.

Table 2.2 - Monthly Climate Conditions in Buffalo County (1897 – 2009)

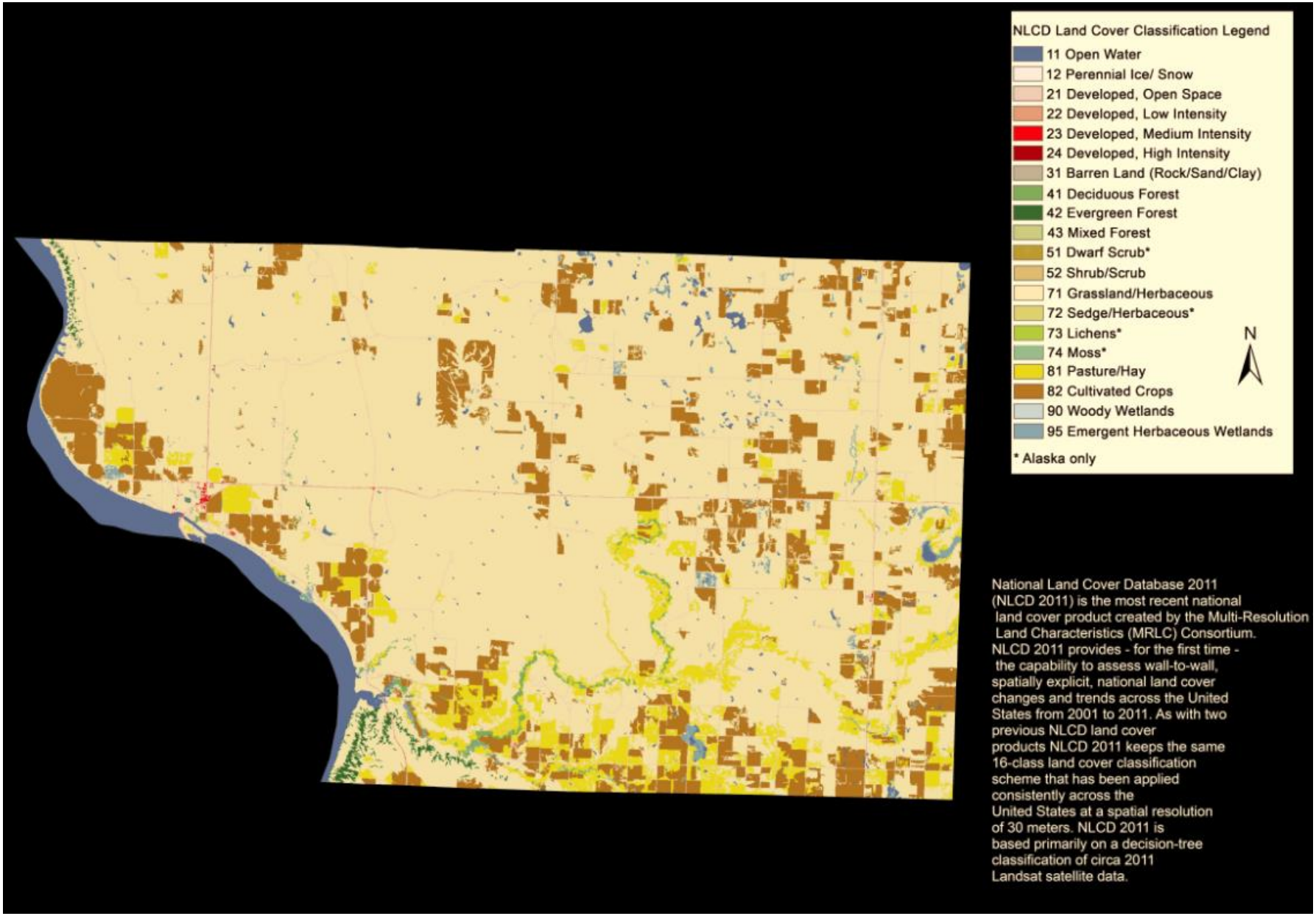
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave High	26.9	32.1	44.3	59.9	71.5	81.1	89.1	87.7	77.8	64.4	45.2	31.4
Ave Low	4.3	9.1	20.6	33.0	44.3	54.8	60.6	58.6	48.0	35.5	21.5	9.5
Ave Precipitation	0.4	0.5	1.0	1.9	2.9	3.5	2.6	2.4	1.7	1.4	0.6	0.4
Ave Snowfall	4.0	5.1	5.5	2.7	0.1	0.0	0.0	0.0	0.0	0.7	3.5	4.6

Source: High Plains Regional Climate Center (www.hprcc.unl.edu/data/historical/)

The average high and low are in degrees Fahrenheit; the precipitation figures are in inches

[2] According to the National Weather Service, Sioux Falls, South Dakota has averaged about two days per year of 100 degree temperatures since records began to be kept in 1893.

Figure 2.2 – Buffalo County Land Cover



The impact that climate change may have on the county is difficult to predict with any certainty. The South Dakota Hazard Mitigation Plan discusses climate change in some depth, analyzing its possible impacts for each of the hazards affecting the state. According to the plan, mean temperatures have been increasing in the northern Great Plains region where South Dakota is located, especially in the winter. This trend may lead to increased evaporation and drought frequency, which will compound water scarcity problems. Across South Dakota, there is a long-term trend of increasing annual precipitation, among the highest in the country. The majority of this increase is occurring in the spring and fall seasons, and there is high confidence that precipitation extremes will increase in frequency and intensity that could exacerbate flooding.

Communities that are already the most vulnerable to weather and climate extremes will be stressed even further by more frequent extreme events occurring within an already highly variable climate system. According to the plan, increased demand for water and energy will constrain development, stress natural resources, and increase competition for water. New agricultural practices will be needed to cope with changing conditions. Still, there is no consensus as of yet on climate change science, and therefore it is difficult to make any definitive plans for climate change at this time.

Socioeconomic Description

Buffalo County is very lightly settled - the population density is only about four people per square mile. In comparison, the State of South Dakota, which is one of the least densely populated states in the nation, has a population density of 10.5 per square mile, and the national figure is 89.5. The county's population has declined slightly from its peak in 2000, but is projected to increase in the near future, with almost all the growth expected to occur on the Crow Creek Reservation.

Table 2.3 - Buffalo County Population Change

Pop 1950	Pop 1960	Pop 1970	Pop 1980	Pop 1990	Pop 2000	Pop 2010	Pop 2020	Pop 2030 Projected
1,615	1,547	1,739	1,795	1,759	2,032	1,912	1,948	2,144

Sources: U.S. Census (factfinder.census.gov/faces/nav/jsf/pages/index.xhtml); University of South Dakota Governmental Research Bureau

Table 2.4 provides basic demographic information for Buffalo County. The table shows that a large majority of the county's population is composed of American Indians, almost all of whom live on the Crow Creek Reservation. The table also shows that the county's population base is quite young in comparison to state and national figures, which bodes well for future population growth within the county.

Table 2.4 - Racial and Age Characteristics (2019)

Entity	White Pop	Black Pop	American Indian Pop	Asian Pop	Other Race & Multiple Races	Hispanic Pop	Population Under 18	Population 65 and Over	Median Age
Buffalo Co.	14.7%	0.0%	81.4%	0.0%	3.9%	0.7%	37.9%	7.2%	25.8
Crow Creek Res	6.5%	0.0%	89.7%	0.0%	3.8%	0.4%	37.6%	5.5%	25.3
South Dakota	80.7%	2.0%	8.8%	1.5%	7.0%	4.4%	24.3%	17.4%	37.7
United States	61.6%	12.4%	1.1%	6.0%	18.8%	18.7%	22.2%	16.5%	38.5

Source: U.S. Census (data.census.gov/cedsci/profile)

The local economy is largely dependent upon agriculture. The Crow Creek Tribe's major economic occupation is cattle ranching and farming, and the tribe operates a large irrigated farm under the Big Bend Farm Corporation. The tribe also operates the Lode Star Casino in Fort Thompson. Government, education, and health care are other important employment sectors on the Crow Creek Reservation. Industry and manufacturing are almost non-existent. Because of the lack of quality jobs, incomes in the area are very low. Population growth would be higher if there were more local employment opportunities; instead, many of the young have to leave the area to look for job opportunities elsewhere.

Table 2.5 - Socioeconomic Characteristics (2019)

Entity	Median Household Income	Poverty Rate – All People	High School Grad or Higher	Bachelor's Degree or Higher
Buffalo Co.	$34,808	39.7%	78.1%	8.5%
Crow Creek Res	$32,279	41.1%	76.4%	7.3%
South Dakota	$59,533	11.9%	92.1%	29.7%
United States	$65,712	12.3%	88.6%	33.1%

Source: U.S. Census (data.census.gov/cedsci/profile)

Infrastructure and Utilities

Transportation

The primary transportation routes in the area are SD Highways 34, 45, 47, and 50. On the Crow Creek Reservation there also are some highways maintained by the Bureau of Indian Affairs. There are no railroads or airports in Buffalo County or the Crow Creek Reservation.

Utilities

Water service in most of the area covered by this plan is provided by the Mid Dakota Rural Water District. The Crow Creek Water District serves the Ft. Thompson area and the Aurora-Brule Water System serves the southeast part of Buffalo County, including Gann Valley. Regarding wastewater disposal, Fort Thompson has a wastewater collection and treatment system. Residents elsewhere in the area use individual septic tanks and drainfields.

Solid waste service is provided by the Tri-County Landfill, which operates a landfill located in neighboring Brule County. A designated rubble site is located outside Fort Thompson.

Electric power is provided to Buffalo County and most Crow Creek Reservation households by the Central Electric Cooperative. The Dakota Energy Cooperative serves reservation households in Hyde County, including Stephan, and the Oahe Cooperative serves Hughes County, including the Big Bend community. There is no natural gas service available in Buffalo County or on the Crow Creek Reservation.

The primary telephone company serving area residents is MidState Communications. Cellular phone service is available throughout the area, but there are still some places where signals are weak or nonexistent. Internet providers include Native American Telecom, which provides free internet service for Crow Creek tribal members in Fort Thompson.

Services

Medical Services

The primary medical facility in Buffalo County is the Indian Health Service (IHS) Clinic in Fort Thompson. The clinic has triage capabilities for stabilizing injured persons, who are then transported to the Sanford Mid-Dakota Medical Center in Chamberlain. People needing serious medical attention can be transported to trauma center hospitals in Rapid City or Sioux Falls. Another local medical facility is the Horizon Health Care Clinic in Fort Thompson, which opened in 2015.

Fire and Emergency Response

Two fire departments serve the area covered by this plan. The Bureau of Indian Affairs Wildfire Management Branch in Fort Thompson fights wildfires on the Crow Creek Reservation (but provides no response for structural fires), and the Gann Valley Fire Department serves the eastern half of the county.

The Crow Creek Sioux Tribe Ambulance Service is the main emergency medical service provider for the Crow Creek Reservation. The Missouri Valley Ambulance Service, based in Chamberlain, serves a small part of Buffalo County and also provides mutual aid in place with the Crow Creek Ambulance Service. The Kimball Ambulance Service covers the east side of Buffalo County.

Education

Crow Creek Tribal Schools operates a K-12 boarding and day school located in Stephan in Hyde County. A Head Start program operates in Fort Thompson.

CHAPTER III
RISK ASSESSMENT

Background

The risk assessment provides the foundation for the rest of the mitigation planning process. It sets the stage for identifying mitigation goals and actions to help Buffalo County and the Crow Creek Tribe become more resilient to disasters, and it answers the following questions: What are the hazards that could affect Buffalo County and the Crow Creek Tribe? What could happen as a result of those hazards? How likely are the possible outcomes? When the outcomes occur, what are the likely consequences and losses?

As outlined in the South Dakota Hazard Mitigation Plan, the Federal Emergency Management Agency defines risk assessment terminology as follows:

- **Hazard**—A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.
- **Vulnerability**—Vulnerability is susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions.
- **Exposure**—Exposure describes the people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area the hazard could affect.
- **Risk**—Risk depends on hazards, vulnerability, and exposure. It is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. It refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.
- **Risk Assessment**—The process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from hazards.

According to FEMA's mitigation planning guidance, the basic components of the risk assessment are: 1) identifying hazards that affect the planning area, 2) profiling the hazards, 3) conducting an inventory of community assets, and 4) estimating losses. This process measures the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards by assessing the vulnerability of people, buildings and other property, and infrastructure to natural hazards.

After reviewing the risk assessment section of the current plan, the planning team decided that no major changes were needed to the risk assessment. However, many of the tables have been updated with more current information, including **Table C.2** in **Appendix C**, which lists significant hazard events in the county.

Identifying Hazards

The planning team began the risk assessment by reviewing the South Dakota Hazard Mitigation Plan, focusing on the hazards identified in that plan. The team also reviewed the risk assessment section of the county's current mitigation plan, and it was decided that all of the hazards discussed in that plan should be kept for this update, with no other hazards added or deleted.

Following this, the planning participants reviewed historical records of hazard events that have occurred in the county, relying on the National Climatic Data Center's Storm Events Database. See **Table C.2** in **Appendix C** for a list of the storm events.

After reviewing these sources, the planning team settled on the hazards they wanted to address in this plan, those that they considered to pose a significant threat to Buffalo County and the Crow Creek Reservation. Following are the hazards addressed in this plan as selected by the team:

- **Winter storms (includes blizzards, heavy snow, icing, and high wind events)**
- **Summer storms (includes thunderstorms, tornados, hail, and high wind events)**
- **Flooding**
- **Drought**
- **Wildfire**

The planning team acknowledges that additional hazards could have been addressed in this plan. High wind events, for instance, are not considered separate from winter storms and summer storms. Following is a list of other hazards the team considered but chose not to include in this plan, with a justification for their omission:

- Geologic Hazards – these hazards, which include earthquakes and landslides, are given a limited level of planning analysis in the South Dakota Hazard Mitigation Plan, but the state is not particularly vulnerable to such events. For example, the plan states that earthquakes have never caused significant damage in South Dakota. A map generated through the U.S. Geological Service Earthquake Hazards Program website indicates that there is only about a two or three percent chance that a quake of at least magnitude 5 will occur in the area covered by this plan in any 100 year period, and virtually no chance of a magnitude 6 or greater earthquake [3]. The largest earthquake known to have affected the area was a 4.4 magnitude quake in 1983 that had an epicenter in Hyde County just north of the Buffalo County line. Regarding landslides, a review of the United States Geological Survey's Landslide Incidence and Susceptibility Map indicates the potential of a

[3] A magnitude 5 earthquake is considered moderate, potentially causing varying amounts of damage to poorly constructed buildings, but significant damage would be unlikely to occur. A magnitude 6 quake is strong, with the potential to cause damage to well-built structures.

landslide occurring along the Missouri River, but any such event likely would be localized and minor in scale.

- Agricultural pests and diseases - this hazard is given a moderate level of planning analysis in the South Dakota Hazard Mitigation Plan. However, the planning team considered the subject matter to be outside the intended focus of this plan.
- Hazardous materials - this hazard is given a moderate level of planning analysis in the South Dakota Hazard Mitigation Plan. But again, the planning team considered the subject matter to be outside the scope of this plan, as they wanted to focus on natural hazards.
- Infectious diseases – the team considered the possibility of addressing the Coronavirus and other types of infectious diseases, but decided the subject matter was outside the focus of this plan.

Hazard Profiles

In this section, each of the hazards the planning team chose to focus on is described in terms of the hazard's ***location***, its ***extent***, the ***history*** of the hazard's occurrence, the ***probability*** of future events, and the local ***resources and capabilities*** available to mitigate against the hazard. In addition, a background description of each hazard is presented at the beginning of each hazard's profile.

- ***Location*** is the geographic area within Buffalo County and the Crow Creek Reservation that is affected by each of the hazards. Some of the hazards - winter storms, summer storms, and drought - do not have a geographic definition at this level of analysis, since they occur in all areas of the planning area more or less with equal frequency. Flooding and wildfires, however, do impact specific areas more than others. The maps presented at the end of this chapter show locations vulnerable to flooding. A map showing areas most vulnerable to fires is presented on page 41.
- ***Extent*** is the strength or magnitude of the hazard, which is described in a variety of ways depending on the type of hazard. For example, tornado strength is measured on the Fujita Scale, high wind events are measured by speed, fire is measured in terms of acres affected, and certain hazards are measured in terms of the duration of the event.
- A brief section on the ***history*** of each hazard's occurrence in Buffalo County and the Crow Creek Reservation is presented, with a brief description of some of the most significant events. More information about the hazard events that have impacted the area is presented in **Appendix C**, including a comprehensive list of weather-related hazard events that have occurred in the area since 1960, and records of hazard events that resulted in a major disaster declaration.
- ***Probability*** of occurrence of a hazard impacting an area is the likelihood that such an event will occur. In this plan, a hazard with a "high" probability is one that is expected to occur at least five times over a ten year period, a "moderate" probability hazard is expected to occur from two to five times in any given ten year

period, and a "low" probability hazard would be expected to occur no more than twice per ten year period. Determination as to the probability of hazard events occurring in the future was based largely on an analysis of the frequency of past hazard events.

- Information about the existing ***resources and capabilities*** to mitigate against each hazard is included. This includes plans and regulatory mechanisms, administrative and technical resources, financial resources, and education and outreach.

Winter Storm

Description

Winter storms historically occur from late fall to the middle of spring, varying in intensity from mild to severe. There is a long warning time associated with most winter storms, giving people time to prepare, but they still have a major impact in South Dakota, regularly destroying property and killing livestock. Such storms are generally classified into four categories - freezing rain, sleet, snow, and blizzard - with some taking the characteristics of different categories during distinct phases of the storm.

Freezing rain coats objects with ice, creating dangerous conditions. Sleet does not generally cling to objects like freezing rain, but it does make the ground very slippery, increasing the number of traffic accidents and personal injuries due to falls. Heavy snow can make travel difficult, and can collapse roofs.

Blizzards occur when snow is combined with high wind, producing blowing snow that results in low visibility. When such conditions arise, blizzard warnings are issued. These warnings take effect when wind conditions are at least 35 mph and temperatures of 20 degrees Fahrenheit or less over an extended period of time are expected. Severe blizzard conditions exist when heavy snow is accompanied by winds of at least 45 mph and temperatures of 10 degrees Fahrenheit or lower. Early blizzards in South Dakota were so devastating that the state once had the dubious distinction of being called the Blizzard State.

Winter storms can have a big impact on the power lines operated by rural electric providers, especially when they are accompanied by high winds or freezing rain. They can knock down power lines, which tend to be the most vulnerable elements of the electrical grid, and can even snap the poles.

Location

The topography of South Dakota is such that no part of the state is immune from the effects of winter storms. Farmland and grassland, which covers most of the state, offers little resistance to high winds and drifting snow, and there are no large bodies of water or mountain ranges to mitigate against temperature extremes. All areas of the planning area are equally likely to be impacted by winter storms.

Extent

The extent of winter storms in Buffalo County can be quite substantial. In terms of snowfall, many winter storms in the county have dropped more than 10 inches of snow. In terms of duration, some winter storms in the county have resulted in power outages of over a week in some locations, although typical outages last for no more than a few hours. Regarding wind speed, **Table C.2** in **Appendix C** shows numerous records of high wind events occurring during the winter months with wind speeds in excess of 50 miles per hour.

History

Table C.2 in **Appendix C** lists many significant winter storms that have impacted Buffalo County and the Crow Creek Reservation. As **Table C.1** in **Appendix C** shows, winter storms resulting in a major disaster declaration occurred in Buffalo County in 1995, 1996, 1997, 2001, 2010, and 2019.

A serious winter storm with ice hit Buffalo County in January 1995, resulting in FEMA Disaster Declaration 1045. Unusual foggy January weather resulted in a heavy crust of ice forming on many of the power lines in central South Dakota, including Buffalo County. The addition of high winds caused power poles to snap. Deep drifts of snow made it difficult for power company repairers to gain access to the damaged power lines, and in many areas county snow removal equipment was required to provide access. In the affected counties, at least 13,435 households were without electric power for varying periods of time, with some homes without power for 12 days. Statewide, more than 1,700 power poles had to be replaced, and the damage estimate was over $3.8 million.

One of the most serious winter storms to occur in the state happened between October 22 and 24, 1995, resulting in FEMA Disaster Declaration 1075. As the storm moved eastward across South Dakota, ice and five to 15 inches of wet snow formed on electric lines, poles, and trees. Winds associated with the storm caused lines to slap together and poles to snap, producing widespread power outages to large portions of rural South Dakota, including Buffalo County and the Crow Creek Reservation. The damage included broken poles, broken wires, and substation failures due to transmission line damage. The storm also forced major transportation delays because of snow accumulation on roadways and poor visibility. The combination of power outages and travel difficulty resulted in numerous cancellations and delays in school openings. Total statewide damage was estimated at over $13 million, and approximately 30,290 households were affected by power outages.

A severe winter storm in 2001 resulted in FEMA Disaster Declaration 1375. Statewide, the event caused over $10,000,000 in estimated damages. In Buffalo County, there was over $13,000 in public assistance costs and over $73,000 in damage to rural electric infrastructure.

A very damaging ice storm struck the area in January 2010, resulting in FEMA Disaster Declaration 1887. The Central Electric Cooperative suffered major damage to its power lines in neighboring counties, but little damage to its infrastructure in Buffalo County.

A late-season winter storm struck South Dakota in March 2019, resulting in FEMA Disaster Declaration 4440. The storm resulted in approximately $17,000 of public assistance funds allocated in Buffalo County.

Probability

Table C.2 shows numerous records of significant winter storm events in Buffalo County since the mid-1990s, an average of about three and a half per year. Therefore, based on the historic evidence, the probability of a significant winter storm affecting the area in a given year is high. The probability of a winter storm causing substantial damage (e.g. power lines blown down) in any given year is at least moderate.

Resources and Capabilities

Following is a description of the local resources and capabilities available for dealing with winter storm events.

- The following facilities can be used to provide shelter to people following a disaster event or other emergency situation.

Table 3.1 – Shelter Facilities

Community	Facility	Capacity	Generator	Kitchen
Ft Thompson	Crow Creek Tribe Admin Building Gym	125	No	Yes
Big Bend	Community center	≈ 50	No	Yes
Crow Creek	Community center	≈ 50	No	Yes
Gann Valley	Fire Hall	100	Yes	Yes
Stephan	Crow Creek School Gym	740	Yes	Nearby

- Buffalo County and the Crow Creek Tribe each have equipment for dealing with winter storms. A list of the county's equipment can be found in the Buffalo County Local Emergency Operations Plan.
- Each of the electric cooperatives serving the area - Central Electric, Dakota Energy, and Oahe - maintain a list of priority projects in their work plans. Each cooperative is a party to the South Dakota Electric Cooperatives Mutual Aid Plan, which commits participating cooperatives to come to the aid of other cooperatives in times of emergency.
- The Buffalo County Local Emergency Planning Committee (LEPC) plans for winter operations annually, which helps ensure a safe and efficient response for people in need of emergency assistance.

Summer storm

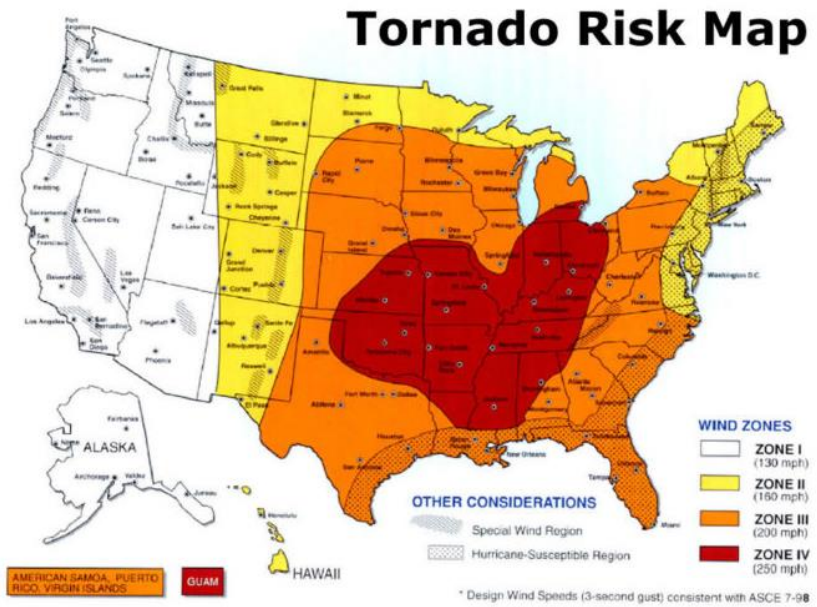
Description

Summer storms can include heavy rainfall, hail, tornadoes, and thunderstorm activity. These events usually are associated with unstable weather conditions. In Buffalo County and the Crow Creek Reservation, most damage from summer storms occurs because of high wind events and/or hail. Hail is always closely connected with thunderstorms. Hailstones can be

pea-sized, up to the size of baseballs. Large hailstones are dangerous to people and animals, but most hail damage is typically suffered by crops or structures. Most years there is some amount of property or crop damage reported in the area.

Tornadoes are the most dramatic type of summer storm experienced in Buffalo County, and are a special source of concern. They are one of nature's most violent storms, capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be a mile wide and can extend for more than 50 miles. Tornadoes mostly occur in South Dakota during the months of May, June, and July. The greatest period of tornado activity is between 4 PM and 6 PM. Tornadoes present a tough mitigation challenge, since few structures can withstand the violent winds of a twister.

South Dakota is located near the northwest edge of the core area of tornado activity in the United States, as shown in this image. Often referred to as "tornado alley", this part of the country is particularly susceptible to tornadoes in part because the terrain is relatively flat, which allows warm, humid air from the Gulf of Mexico and cool, dry air from Canada to crash into each other, creating large super cells. According to the National Oceanic and Atmospheric Administration's Storm Prediction Center, South Dakota ranked eighth in the nation in the frequency of tornadoes from 1950 to 1994, with a total of 1,139 tornadoes reported in the state (an average of 25.3 per year). During this period, there were 11 deaths in the state attributed to tornadoes, and 243 injuries. South Dakota ranked 27th in the nation in tornado damage, with average annual losses of $3.8 million.



Location

Summer storms are equally likely to occur in all parts of the planning area.

Extent

The extent of summer storms can be measured in many ways. In terms of wind speed, **Table C.2** in **Appendix C** shows several records of thunderstorms that produced wind speeds over 60 knots (about 69 miles per hour), as well as several other summer high wind events with wind speeds over 50 knots. **Table C.2** also shows 29 events with hail over one inch in diameter. In terms of onset, summer storms typically develop with a long warning time,

although certain hazards associated with such storms, such as hail or tornadoes, can develop more suddenly.

Regarding tornadoes, **Table C.2** shows one record of a tornado with a magnitude greater than F1. The following table lists the entire range of tornado strength according to the enhanced Fujita scale.

Table 3.2 – Enhanced Fujita Scale

Scale	Wind Speed (MPH)	Potential Damage
EFO	65 to 85	Minor damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86 to 110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111 to 135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136 to 165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings; trains overturned; trees debarked; heavy cars lifted off ground and thrown; structures with weak foundations badly damaged.
EF4	166 to 200	Devasting damage. Well-constructed and whole-frame houses completely leveled; some frame homes may by swept away; cars and other large objects thrown and small missiles generated.
EF5	Over 200	Incredible damage. Well-built frame houses destroyed with foundations swept clean of debris; steel-reinforced concrete structures critically damaged; tall buildings collapse or have severe structural deformations; cars, trucks, and trains can be thrown approximately 1 mile.

https://en.wikipedia.org/wiki/Enhanced_Fujita_scale

History

As shown in **Table C.2** in **Appendix C**, Buffalo County and the Crow Creek Reservation have experienced many summer storms that have caused significant damage, including many storms that were accompanied by a tornado. **Table C.1** In **Appendix C** shows that several of these storms resulted in a major disaster declaration.

A notable summer storm occurred in June 2015, causing substantial property damage and resulting in FEMA Disaster Declaration 4233. This microburst storm had winds estimated at 100 miles per hour that destroyed several homes in Fort Thompson, causing the death of a man when his trailer home was flipped over. There were also many downed power lines and trees. Public assistance costs to the Crow Creek Tribe were over $450,000.

Probability

Table C.2 shows that numerous significant summer storm events have occurred in Buffalo County, well over one per year on average. Therefore, based on the historical evidence, the probability of a summer storm occurring somewhere in the county in a given year is high.

However, the probability of a storm causing significant damage (e.g. damaging hail or a tornado) in the county in a given year is low to moderate.

Regarding tornadoes, **Table C.2** shows 11 days in which a tornado was recorded in Buffalo County since 1960, an average of one every five or six years. It is likely that other tornadoes occurred in the county during this period and were unnoticed or unreported.

Resources and Capabilities

Following is a description of the local resources and capabilities available for dealing with summer storms.

- Outdoor warning sirens are located in Fort Thompson, Big Bend, Crow Creek, and Stephan.
- There are public facilities in the county and on the reservation that can be used as an emergency storm shelter. In Fort Thompson, the Crow Creek Tribal Administration Building gymnasium is below ground level and is considered a safe option during all but the most violent tornadoes. Also, several small tornado safe rooms, each with a maximum occupancy of about ten people, have been placed in various locations on the outskirts of Fort Thompson. Another small tornado safe room was placed outside the courthouse in Gann Valley. In Stephan, the elementary school gym is designed to withstand 200 mph winds for a short period of time.
- The Gann Valley Fire Department and the Bureau of Indian Affairs Wildfire Management Branch both have weather spotters on staff.
- The Buffalo County Emergency Management office actively participates in severe weather public awareness campaigns in conjunction with the State Office of Emergency Management and the National Weather Service. The office communicates regularly with local officials regarding severe weather awareness and training opportunities.
- As described above under the Winter Storm profile section, each of the electric cooperatives serving the area maintain a list of priority projects in their work plans, and each is a party to the South Dakota Electric Cooperatives Mutual Aid Plan.

Flooding

Description

Floods are among the most serious and costly disaster events. In South Dakota, there are two main climatologic causes of flooding: runoff from rainfall and runoff from melting snow. The water from rainfall or melting snow flows overland until it reaches a nearby river or lake. If the river or lake cannot hold all of the water that is entering it, some of the water will begin to overflow, causing flooding. The size of the flood is influenced by such factors as the intensity or length of the rainfall, melting rate of the snow, and the infiltration of the water into the ground.

Following is a description of the four types of flooding that have the potential of impacting Buffalo County and the Crow Creek Reservation, based on information in the South Dakota Hazard Mitigation Plan:

- Flash flooding, which results from several inches or more of rain falling in a very short period of time. This high intensity rainfall is commonly caused by powerful thunderstorms that cover a small geographic area. The flood that occurs as a result of this runoff happens very rapidly, and is generally very destructive, although usually only a small area is affected.
- Long-rain flooding, which results after several days or even weeks of fairly low-intensity rainfall over a widespread area. This is the most common cause of major flooding. The ground becomes "water logged," and the water can no longer infiltrate into the ground. The flooding that results is often widespread, covering hundreds of square miles, and can last for several days or many weeks.
- Flooding resulting from melting snow in the spring. This type has characteristics of both flash floods and long-rain floods. The area covered is generally not as large as that covered by the long-rain flood, but is typically larger than that covered by the flash flood. Generally, the flood lasts for several days, occurring when large amounts of snow melt rapidly due to warm temperatures. Flooding can be made worse if the ground remains frozen while the snow melts, causing melt water to run off rather than infiltrating into the ground. Some of the largest floods in South Dakota have been the result of melting snow and ice.
- Dam failure, resulting from natural or man-made causes. Buffalo County and the Crow Creek Reservation are vulnerable to this type of flood primarily because of the dams that impound the Missouri River, including the Big Bend Dam, which is located near Fort Thompson. The Big Bend Dam is considered to be a high hazard dam, one whose loss would cause major economic loss, and in which there are anywhere from a few to hundreds of inhabited structures located in the predicted area of inundation. The Rank Dam is another high hazard dam located in the county.

Location

In the past, the greatest flooding threat in South Dakota was along the Missouri River, which flows south/southeastward across the state in a deep, wide channel. Flooding along the river used to be an annual threat until a series of huge dams along the river, including Big Bend, was constructed in the 1950s. Now, most of the Missouri River within South Dakota consists of a chain of reservoirs impounded by the dams. From north to south, these dams are Oahe, Big Bend, Fort Randall, and Gavins Point. The dams were built for flood control, to provide water for irrigation, and for the generation of hydroelectricity [4].

Because of the dams, the threat of flooding from the Missouri River has been greatly reduced, although it has not been entirely eliminated. In 2011, significant flooding along the river did

[4] Construction of the dams required the complete relocation of the Fort Thompson community, and it resulted in the inundation of some culturally significant sites on the Crow Creek Reservation along the Missouri River, including burial sites and other places considered sacred by the Crow Creek people.

occur. The primary cause of the flooding was very heavy snowmelt at the river's source in the Rocky Mountains, along with extremely high spring rains throughout much of the river's drainage basin. The complicated politics concerning river management also played a role in the disaster that unfolded over the next few months.

In addition to land adjacent to the Missouri River, there are other low-lying areas of Buffalo County and the Crow Creek Reservation that are somewhat vulnerable to flooding. One such location is along Crow Creek, which flows in a generally east to west direction through the southern part of Buffalo County.

Extent

The extent of flooding in Buffalo County or the Crow Creek Reservation has rarely been truly significant, with the notable exception of the Missouri River flooding in 2011. Minor, localized flooding typically occurs in the county after very heavy rain events, especially in the spring following snowy winters. Floodwater depth is usually not significant. In terms of duration, flooding can cause road closures lasting from less than a day to several weeks or longer.

History

As shown in **Table C.1** in **Appendix C**, several flood events have resulted in a major disaster declaration in Buffalo County. **Table C.2** in **Appendix C** shows many other flooding events that have impacted the county. Following is a summary of some of the more significant floods the county has experienced.

Flooding in 1995 resulted in FEMA Disaster Declaration 1052. All of South Dakota had above normal precipitation from January through May, with many weather stations in the central and eastern portions of the state experiencing their all-time wettest Spring. Damage was caused by ground saturation and flooding due to very high residual groundwater tables from 1994, heavy winter snow and spring rain, and rapid snowmelt. Many roads were under water due to high groundwater saturation, causing interruption of emergency services. Damage also included power transmission and distribution facilities owned by rural electric cooperatives. In the area impacted by the flood, surveys identified over 3,000 homes with some type of damage, the majority caused by groundwater seepage of one to three inches into basements. In many areas the water table rose almost to the surface, saturating septic drain fields and preventing proper treatment of wastewater. The total damage estimate in the affected counties was over $35 million, which included $9.3 million in damage to public infrastructure.

Flooding in 1997 resulted in FEMA Disaster Declaration 1173, which was declared for all counties in South Dakota. At the time, the event was considered one of the top ten natural disasters ranked by FEMA relief costs. From November 1996 through February 1997, the weather across the eastern part of the state was cold and very wet, with record setting snowfall in many places. The persistent cold greatly limited snowmelt between storms, which caused snow to pile up from 10 to 24 inches deep. An early April blizzard added to the snow pack, and heavy rain later in the month combined to further saturate the ground. Prairie potholes turned into lakes, causing many people to be evacuated from their homes and

farms, and preventing farmers from planting thousands of acres of land. The flood caused over $87 million in damage statewide, and took the lives of two people.

Flooding in 2008 resulted in FEMA Disaster Declaration 1774. Total public assistance costs from the flood in Buffalo County were over $35,000.

Flooding in the spring and summer of 2010 was the worst in a decade, resulting in FEMA Disaster Declaration 1915. The event caused over $43,000 of public assistance costs throughout the county, primarily due to flooding of county and township roads.

The Missouri River flood of 2011 may have been the most notable flooding event ever to occur in the recorded history of South Dakota, resulting in FEMA Disaster Declaration 1984. The flood resulted in over $45,000 of public assistance costs throughout Buffalo County. Also in 2011, very heavy rain of up to seven inches in June caused flash flooding across the county. Some evacuations took place, and some homes in Fort Thompson near the Lode Star Casino were flooded.

Probability

Based on the historic evidence, the probability of minor flooding occurring somewhere in the planning area in a given year is moderate, but the probability of flooding resulting in significant damage is low. It is a certainty that flooding will continue to impact the area to some degree, no matter what mitigation actions are pursued.

Resources and Capabilities

Buffalo County participates in the National Flood Insurance Program (NFIP). The county is in good standing with the program and has a flood ordinance designed to reduce flood risk. The Crow Creek Tribe is not participating in the NFIP. The following table provides information on NFIP participation in Buffalo County.

Table 3.3 – National Flood Insurance Program Information

Jurisdiction	NFIP Participation Status	Program Date	Current Effective Map Date	Insurance Policies in Force	Amount of Coverage	Number of Claims	Total Claims Paid
Buffalo Co	Yes	06/08/98	(NSFHA)	0	$0	$0	$0
Crow Creek Tribe	No						

Sources: www.fema.gov/policy-claim-statistics-flood-insurance; Marc Macy, SD NFIP Coordinator

Following is a description of other local capabilities for mitigating damage from flooding.

- The U.S. Army Corps of Engineers has an emergency action plan in place for the Big Bend Dam. The Corps also has jurisdictional control over construction activity in the area surrounding Lake Sharpe, which is the body of water impounded by the dam. Any work in this area requires regulatory review and permitting. Major repairs were made to the dam following the 2011 flood, including additional riprap and repairs to the spillway, which are ongoing.

- Inspection and maintenance of dams, culverts, and other drainage structures is performed regularly in Buffalo County.

Drought

Description

Drought is a deficiency in precipitation over an extended period of time, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal, recurrent feature of climate that occurs in virtually all climate zones. Human factors, such as water demand and water management, can exacerbate the impact that drought has on a region.

Droughts can occur at any time of the year, but the consequences are worse during the summer growing season, especially after winters with little precipitation. A small departure in normal precipitation from May through August can have a significantly negative impact on crop production. The demand for water for multiple uses also impacts water availability. Rural water systems that were originally designed to supply water for people are now also being used for cattle and to fight wildfires, taxing the limits of the systems.

Drought in South Dakota is often accompanied by periods of extreme heat. According to the National Weather Service, among natural hazards, only the cold of winter—not lightning, hurricanes, tornadoes, floods, or earthquakes—takes a greater toll on human life. Between 1936 and 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation, and in the heat wave of 1980, more than 1,250 people died. Elderly people, small children, those with chronic illnesses, and those on certain medications are particularly susceptible to heat stress.

Location

All areas of the county and reservation are equally likely to be impacted by drought.

Extent

Drought severity, the most commonly used term for measuring drought, is a combination of the magnitude and duration of the drought. In terms of magnitude, Buffalo County has experienced four years of annual precipitation less than two thirds its average since 1960. Those years were 1974, 1976, 2002, and 2012. In terms of duration, it is not unusual for Buffalo County to experience periods of below normal precipitation that last for several months. During the 1930s, drought conditions persisted for multiple years. In an area that is so highly dependent on agriculture, the impact of a major drought can be significant. Although most agricultural producers now have crop insurance and agricultural practices today are more advanced, the impacts of drought can still be serious.

History

Buffalo County and the Crow Creek Reservation have experienced many significant droughts. The drought of 1976 was one of the most severe in recent years, resulting in South Dakota's only drought emergency declaration to date. Only nine inches of rain was recorded for the

year at the Gann Valley weather station. Drought in 1980 and 1981 affected the entire state of South Dakota, and was rated as a 10 to 25 year event. Drought in 2012 was so devastating that the State of South Dakota activated a Drought Task Force.

The most significant drought in the area's history occurred in the 1930s, the so called dust bowl years. The drought came in three waves, 1934, 1936, and 1939-1940, but some parts of the Great Plains experienced drought conditions for as many as eight consecutive years. The soil, depleted of moisture, was lifted by the wind into great clouds of dust and sand which were so thick they concealed the sun for several days at a time. The "black blizzards" were caused by sustained drought conditions, compounded by years of land management practices that left topsoil susceptible to the forces of the wind.

Probability

Table C.2 in **Appendix C** shows at least one drought record in Buffalo County in five of the years since 1999. Based on this, the probability of a significant drought occurring in the county in any given year is moderate. The probability of a truly severe drought impacting the county, such as occurred in 2012, is low, expected to occur no more than twice per ten years.

At the statewide level, the developers of the South Dakota Hazard Mitigation Plan cite tree ring research spanning a period of about 400 years indicating that multi-year droughts as significant as the 1930s drought occur on average every 57 years in South Dakota. Based on historical records, notable droughts have occurred somewhere in the state on average about every 12 years.

Resources and Capabilities

Resources at the local level to mitigate the impacts of drought are available. The rural water systems serving the area - Mid Dakota Rural Water District, the Crow Creek Water District, and the Aurora-Brule Water System - each have limits on the amount of water they will distribute within their service areas, and could take such action during extreme drought conditions. Likewise, the communities served by the water systems could enact regulations restricting non-essential water use, such as for watering lawns and washing cars.

In the agricultural sector, most farmers in Buffalo County have crop insurance, which helps lessen the financial impact of drought. Furthermore, modern agricultural practices are more advanced (such as no-till farming and the development of more drought-tolerant crops), so farmers can better withstand years of below average rainfall.

Resources available at the state or regional level include the State Drought Task Force, which was activated during the severe drought of 2012. The goal of the task force is to monitor drought conditions by gathering the most current data available and to make sure that South Dakotans have access to that information as quickly as possible. The group coordinates the exchange of drought information among government agencies and agriculture groups, fire managers, and water-supply organizations. Another resource is the Natural Resource Conservation Service, which has information available about how to deal with droughts.

Wildfire

Description

Wildfires are uncontrolled conflagrations that spread freely through the environment. They are considered a serious concern in the area covered by this plan. Such fires that occur near populated areas pose threats not only to natural resources, but also to human life and personal property. Wildfires are most likely to occur during extended dry periods, and can be particularly dangerous when they are spread by high winds.

Location

Wildfires are most likely to occur in large areas of extensive brush or unmanaged vegetation. In this area, this primarily means grassland and pastures, which together make up almost 80 percent of Buffalo County's land base (see **Figure 2.2**). Grassland fires are considered to be quite dangerous because they tend to spread faster than forest fires and are thus difficult to attack. A secondary area of concern is the hills and draws along the Missouri River, which contain a significant - and increasing - amount of cedar trees and thick brush. Fires there are difficult to fight because of the uneven terrain. Another concern is controlled burns that get out of control, which can occur almost anywhere in the county.

Extent

Small wildfires affecting a few acres or less are not uncommon in the area. The following table shows all wildfires that burned at least 25 acres on the Crow Creek Reservation from 2005 through 2021. Few records are available for fires that have occurred on non-reservation land in Buffalo County.

Table 3.4 – Wildfires on the Crow Creek Reservation (2005 – 2021)

Date	Fire Name	Acres Affected		Date	Fire Name	Acres Affected
8/29/2005	Chaos	1,453		3/21/2010	Opener	52
7/15/2006	Pick-up	600		3/19/2011	Windy	66
7/16/2006	Twins 1	113		9/10/2012	West Wolf	110
7/16/2006	Twins 2	113		9/11/2012	River Run	34
7/17/2006	Dual	80		12/13/2014	Deer	50
4/15/2007	East Housing	25		3/9/2016	March On	45
3/15/2009	Flash	80		3/28/2016	Final 4	200
9/30/2009	Bean	28		7/27/2016	Cottonwood	25
11/07/2016	Hunter	69		3/07/2017	Nunpa	51
5/14/2020	Puddles	77		10/14/2021	Hot Wheels	148
7/03/2021	Double Trouble	25				

Source: Bureau of Indian Affairs Wildland Fire Operations Specialist

History

Some notable wildfires have occurred in the area, but nothing on a truly destructive scale. The most destructive fire was the Chaos Fire of 2005.

Probability

Wildfires affecting less than ten acres are likely to occur somewhere in Buffalo County most years, but large scale wildfires are much less common. **Table 3.4** shows only two wildfires over 250 acres in size between 2005 and 2021. Based on this period of analysis, the probability of a significant wildfire can be considered low. The probability of a wildfire causing serious damage also is low.

Resources and Capabilities

The Bureau of Indian Affairs Wildfire Management Branch and the Gann Valley Fire Department have firefighters who have had training in fighting wildfires, and both departments have adequate equipment and protective gear for their volunteers to handle most of the wildfires they are likely to encounter. In addition, mutual aid agreements are in place to ensure that assistance is available during serious wildfires and other emergency events.

Following is a summary of the other local resources and capabilities available for dealing with wildfires.

- Buffalo County has regulations in place regarding open burning within the county. When weather or other conditions exist which may make open burning hazardous, the county commissioners may prohibit or restrict open burning.
- A requirement is in place that those wanting to start controlled burns must first contact the Buffalo County sheriff or the Gann Valley Fire Department.

Vulnerability and Loss Potential

This section assesses the vulnerability of Buffalo County and the Crow Creek Reservation to each of the hazards just profiled. Vulnerability is defined as the extent to which people and property are exposed to harm or damages created by a hazard. The method of determining vulnerability varies by the type of hazard and the availability of data, but each methodology is based on either potential for loss or actual losses. Following is a description of each specific methodology used.

Potential Loss Methodologies

- There are no designated flood hazard zones anywhere in the planning area, so FEMA's HAZUS loss estimation software was used to estimate potential losses from flooding. HAZUS produces a flood polygon and flood-depth grid that represents the 100-year floodplain, with losses calculated using national baseline inventories (buildings and population) at the census block level. The maps generated by HAZUS are not as accurate as FEMA's Flood Insurance Rate Maps, nor is the resulting data, but HAZUS is still a helpful planning tool for communities

that have not been mapped by the National Flood Insurance Program [5].

- Data on the population living in wildfire threat zones was used to estimate potential wildfire losses.
- The value of buildings within Buffalo County and the Crow Creek Reservation was used to estimate potential losses due to winter storms and summer storms (building exposure).
- Population density within the Buffalo County and the Crow Creek Reservation was used to estimate potential losses due to winter storms and summer storms.

Actual Loss Methodologies

- The National Climatic Data Center's Storm Events Database was consulted for historical information regarding weather-related events (see **Table C.2** in **Appendix C**).
- Records from FEMA were consulted for federal assistance provided to Buffalo County and the Crow Creek Tribe following major disaster declarations through FEMA's Public Assistance program (see **Table C.1** in **Appendix C**).
- Data from the U.S. Dept of Agriculture Risk Management Agency was used to assess crop loss due to a variety of natural hazards.
- Information from the National Drought Mitigation Center's Drought Impact Reporter was used to assess the local impact of droughts.
- Records from the Bureau of Indian Affairs Wildland Fire Operations Specialist were used to assess the historical impact of wildfires in the area.

At the conclusion of the vulnerability assessment for each hazard, development trends are considered to determine whether the county's vulnerability to the hazard might increase in the future. Information on development trends in the county was obtained by analyzing population trends and projections, and through discussion with county and tribal officials about where housing development and other growth may be likely to occur. Other factors, including the possible impact of climate change, also are considered.

At the end of the chapter, the county's vulnerability to each hazard is summarized. Vulnerability is characterized as either "low", "moderate", or "high", based on the results of the risk analysis. A brief discussion of vulnerable populations within the county also is presented.

[5] A limitation of HAZUS is the inadequacies associated with its hydrologic and hydraulic modeling, especially in sparsely populated areas where census blocks - the basis of the loss calculations - are large. The software assumes the population and building inventory to be evenly distributed over the census blocks, whereas in reality flooding may occur only in a small part of the block where there are few buildings or people. Also, HAZUS uses default national databases that may not be applicable at the local level.

Winter Storms

All areas of South Dakota are vulnerable to winter storms, and the consequences of such storms can be great. They can disrupt the power supply when electrical lines are brought down by high winds, falling trees, or extreme ice buildup. Everyday activities can be significantly disrupted when road conditions deteriorate because of snow cover or precipitation that freezes on road pavement. In extreme situations, roads can be closed because of accumulated snow for days or even weeks. Winter storms also can kill or injure livestock, and can cause significant crop losses when they occur early in the growing season.

The rural areas of the county may be somewhat more vulnerable to winter storms than the towns. In the context of this plan, this includes virtually everyone living outside Fort Thompson. For example, transmission of electricity in rural areas is dependent on many miles of power lines located in open country that is highly susceptible to high wind events, especially when combined with freezing rain (high winds can snap power poles, and freezing rain and sleet forms ice on the lines, making them heavy and more susceptible to being blown down). Rural residents also are vulnerable if roads are blocked by snow for an extended period of time and they cannot travel into town for groceries, medical supplies, or other important items.

To assess vulnerability to winter storms, the methodology that was used in the South Dakota Hazard Mitigation Plan was essentially followed for this plan. The following factors were considered:

- The number of prior winter storm events in Buffalo County and on the reservation
- Past damage amounts
- Buffalo County's building exposure
- Population density

Prior Events:

Table C.2 in Appendix C shows that numerous significant winter storms have occurred in Buffalo County and the Crow Creek Reservation, including blizzards, ice storms, heavy snows, and extreme cold events. The authors of the South Dakota Hazard Mitigation Plan found that there were 49 total winter storm events in the National Climatic Data Center's Storm Events Database between January 1993 and August 2016 for Buffalo County, ranking the county 64th among the state's 66 counties.

Past Damage Amounts:

Winter storms have the potential to cause significant amounts of damage. Substantial damages following major disasters have been recorded for the Central Electric Cooperative's infrastructure located within Buffalo County, and many other winter weather events have caused significant damage in the county and on the Crow Creek Reservation (see **Table C.2**).

Given Buffalo County's agriculturally-based economy, another method to determine vulnerability is to look at the impact of winter storms on the county's agricultural producers.

Farmers typically protect themselves from the impacts of adverse weather and other natural hazards by insuring their crops against losses through multi-peril crop insurance, which is underwritten by the Risk Management Agency, a part of the U.S. Dept of Agriculture. Data on indemnity payouts for crop loss in Buffalo County due to various types of winter weather events between 2000 and 2017 was obtained from the Risk Management Agency, and is presented in the table on the following page. During this period of analysis, winter weather-related payouts represented just under 10% of all indemnity payouts in Buffalo County.

Table 3.5 – Crop Loss Due to Winter Weather

Year	Frost	Freeze	Cold Winter	Cold Wet Weather
2000	$0	$0	$151,143	$0
2001	$0	$0	$679,558	$8,099
2002	$32,492	$24,858	$3,013	$0
2003	$6,596	$0	$4,864	$0
2004	$19,971	$116,583	$0	$0
2005	$10,236	$9,715	$2,958	$0
2006	$27,315	$444	$8,045	$0
2007	$0	$0	$71,719	$0
2008	$0	$0	$3,362	$203,346
2009	$0	$34,051	$164,067	$16,501
2010	$0	$0	$0	$0
2011	$0	$1,115	$26,203	$21,117
2012	$26,165	$12,197	$0	$0
2013	$0	$21,525	$70,137	$209,477
2014	$0	$7,229	$18,979	$5,436
2015	$0	$16,960	$1,091,576	$4,449
2016	$0	$1,224	$3,884	$549,238
2017	$21,674	$6,353	$28,631	$0

Source: USDA Risk Management Agency (www.rma.usda.gov/data/cause.html)

Building Exposure:

The total value of buildings in Buffalo County is approximately $114,735,000, according to the South Dakota Hazard Mitigation Plan, which ranks the county last among the state's counties. The median figure for South Dakota counties is approximately $605,000,000. The county's building exposure thus can be considered low.

Population Density:

Buffalo County and the Crow Creek Reservation are very sparsely populated. The county has an average of only 3.9 people per square mile, well below the state figure of 10.5 people per square mile, and far below the national figure of 89.5. Buffalo County would have to be rated low in terms of population density.

Development Trends

Looking ahead, the expected population increase may increase vulnerability to winter storms and other hazards. This would be especially so in regards to growth that occurs in the housing areas located some distance from Fort Thompson. Climate change also may have an impact on local vulnerability to winter storms. According to the South Dakota Hazard Mitigation Plan, the winter season is warming at a faster rate than any other season in South Dakota, but winter storms and blizzards will continue to be a severe weather hazard in the state. Warmer winter temperatures could mean more ice and freezing rain events, which would impact electrical utilities and communication systems, the transportation system, and livestock. An increase in the frequency of large snowfall events also is being experienced in the northern U.S. There remains some uncertainty in projections for the coming decades, but the rising trend of extreme precipitation events is something that needs to be considered.

Summer Storms

All areas of Buffalo County and the Crow Creek Reservation are vulnerable to summer storms, especially those that are accompanied by tornadoes, lightning, or large hail. Typical damage from summer storms includes blown down power lines, crop damage from hail and high wind, property damage if a populated area is struck, and flooding as the result of heavy rain. Like the rest of the Great Plains, Buffalo County is especially vulnerable to summer storms accompanied by high wind because the landscape is open and there is little topographic relief to block the wind. Infrastructure and facilities located at higher elevations, such as the bluffs along the Missouri River, may be particularly vulnerable to high wind events.

Vulnerable populations include the elderly, the sick, those with a mobility limitation, and people who happen to be outside during a storm event. People living in mobile homes are also vulnerable, since such structures can be overturned by winds of 60 to 70 miles per hour if they are not anchored properly.

As with winter storms, the methodology that was used in the South Dakota Hazard Mitigation Plan to assess vulnerability to summer storms was followed for this plan. The following factors were considered:

- The number of prior summer storm events in the county
- Past damage amounts
- The county's building exposure
- Population density

Prior events:

Table C.2 in Appendix C shows many significant summer storms that have been recorded in Buffalo County and the Crow Creek Reservation, including hailstorms, thunderstorms, lightning, and tornadoes. The table shows 14 recorded tornadoes. The authors of the South Dakota Hazard Mitigation Plan assigned a rating of 2 (out of 10 maximum) to Buffalo County in terms of the frequency of tornadoes recorded between 1950 and 2016, and also assigned a rating of 2 for tornadoes of magnitude F1 or greater.

Past Damage Amounts:

Summer storms have the potential to cause significant amounts of damage, especially when accompanied by tornadoes or hail. Many summer storm events that have caused significant property and/or crop damage in Buffalo County and on the Crow Creek Reservation are shown in **Table C.2**.

As with winter storms, another method to determine vulnerability to summer storms is to look at the impact of such storms on agricultural producers. Summer storms can cause a lot of damage to cropland, especially when they are accompanied by hail. Data on indemnity payouts for crop loss in Buffalo County due to hail as well as high wind events between 2000 and 2017 was obtained from the Risk Management Agency, and is presented in the table below. During this period of analysis, summer storm-related payouts represented about 4% of all indemnity payouts in Buffalo County.

Table 3.6 – Crop Loss Due to Severe Summer Weather

Year	Hail	High Wind		Year	Hail	High Wind
2000	$52,782	$0		**2009**	$26,502	$0
2001	$0	$0		**2010**	$53,341	$0
2002	$4,807	$0		**2011**	$43,204	$0
2003	$134,984	$0		**2012**	$317,006	$1,364
2004	$141,025	$17,236		**2013**	$4,933	$20,299
2005	$51,218	$0		**2014**	$84,396	$0
2006	$0	$788		**2015**	$54,426	$124,690
2007	$267,797	$32,826		**2016**	$6,620	$42,140
2008	$3,767	$96,026		**2017**	$25,657	$65,420

Source: USDA Risk Management Agency (www.rma.usda.gov/data/cause.html)

Building Exposure:

The total value of buildings in Buffalo County is approximately $114,735,000, according to the South Dakota Hazard Mitigation Plan, which ranks the county last among the state's counties. The median figure for South Dakota counties is approximately $605,000,000. The county's building exposure thus can be considered low.

Population Density:

Buffalo County and the Crow Creek Reservation are very sparsely populated. The county has an average of only 3.9 people per square mile, well below the state figure of 10.5 people per square mile, and far below the national figure of 89.5. Buffalo County would have to be rated low in terms of population density.

Development Trends

Looking ahead, the expected population increase may increase vulnerability to summer storms. This would be especially true in regards to growth that occurs in the housing areas

located some distance from Fort Thompson, as many of the residents would lack access to a storm shelter.

Regarding the impact of climate change, the South Dakota Hazard Mitigation Plan cites the Climate Science Special Report from 2017, which states that damages from convective weather hazards, such as severe thunderstorms and tornadoes, have undergone the greatest increase relative to other extreme weather since 1980. The plan states that the tornado season is getting longer, and that an increase in potential days for severe thunderstorms is projected for the mid to late 21st century, although the largest increases are projected for neighboring regions of the Midwest and the southern plains. There is some uncertainty in these projections, but severe thunderstorms and tornadoes will remain a hazard in South Dakota.

Flooding

Buffalo County and the Crow Creek Reservation are vulnerable to flooding. Because of the specific nature of flooding, vulnerability is analyzed first on a general county-level basis, and then specifically for each community. Given the degree to which flooding is geographically-based, this approach made the most sense to the planning team.

General Flood Vulnerability

There are no designated flood hazard zones located in the county. According to the HAZUS analysis that was run for the South Dakota Hazard Mitigation Plan (see Table 3-45 of that plan), the potential building damage loss from flooding in Buffalo County is only $645,000, whereas the median figure for all South Dakota counties is approximately $2,800,000. This ranks Buffalo 58th among the state's 66 counties in this measure of vulnerability. The potential displaced population was determined to be 79 people, compared to the state median of 255 per county.

As of July 2021, there are no National Flood Insurance Program policies in Buffalo County or the Crow Creek Reservation, and no flood insurance claims have been paid since 1978. There are no repetitive loss properties in the county or on the reservation. See **Table 3.3** on page 25 for further details about NFIP participation in the county.

In addition to impacting buildings and other structures, some county and tribal infrastructure is vulnerable to flooding. Flood damage frequently involves washed out or damaged roads and drainage culverts, often occurring in the spring, especially following winters with heavy snow.

Flooding also has a major impact on agriculture. Spring flooding can delay farmers getting into their fields to plant, and later in the growing season it can damage crops. Data on indemnity payouts for crop loss in Buffalo County due to flooding, as well as excess moisture/precipitation, between 2000 and 2017 was obtained from the Risk Management Agency, and is presented in the following table. During this period of analysis, flood-related payouts represented just under 10% of all indemnity payouts in Buffalo County.

Table 3.7 – Crop Loss Due to Flooding

Year	Flooding	Excess Moisture/ Precipitation		Year	Flooding	Excess Moisture/ Precipitation
2000	$0	$22,625		**2009**	$0	$433,582
2001	$0	$258,676		**2010**	$1,213	$1,323,176
2002	$0	$2,914		**2011**	$0	$841,748
2003	$0	$2,040		**2012**	$0	$59,958
2004	$0	$0		**2013**	$0	$55,507
2005	$0	$62,226		**2014**	$0	$74,771
2006	$0	$0		**2015**	$0	$41,586
2007	$0	$86,436		**2016**	$0	$99,461
2008	$0	$405,816		**2017**	$0	$11,400

Source: USDA Risk Management Agency (www.rma.usda.gov/data/cause.html)

2019 was probably the worst year ever in terms of flooding's impact on South Dakota's agricultural producers. The state ranked first in the nation with almost 4 million acres of farmland prevented from being planted due to flooding, more than double the next nearest state. However, Buffalo County was not as severely impacted as most other counties in South Dakota, ranking 61st in the state with a total of approximately 4,250 acres not planted.

Buffalo County and the Crow Creek Reservation also are vulnerable to flooding due to dam failure, primarily because of the Big Bend Dam, which impounds Lake Sharpe. With a storage capacity of 1,859,000 acre-feet, Lake Sharpe is one of the largest man-made reservoirs in the United States. As mentioned earlier, it had once been thought that the system of dams on the Missouri River had essentially eliminated the threat of flooding along the river. However, flooding did occur along the Missouri in 2011, due to heavy snowmelt at the river's source in the Rocky Mountains and extremely high rainfall throughout the river's drainage basin in the spring of 2011. Mismanagement of dam releases - which can be considered a type of dam failure - exacerbated the situation. In the highly unlikely event that the Big Bend Dam completely failed, water would inundate farmland along the river, and it might also impact some residences [6]. However, none of the cultural sites listed in **Appendix D** is considered to be at risk from flooding.

There is also some flooding vulnerability associated with several smaller dams within the county, including the Rank Dam. Originally built in 1935, this privately owned dam is considered to be a high hazard dam, which could cause extensive economic loss if it failed.

Local Flood Vulnerability

At the community level, flood vulnerability was determined primarily by using FEMA's HAZUS loss estimation software to estimate potential losses from flooding during a 100-year flood event, and by using GIS software to determine the value of property at risk of being flooded. The following table summarizes the results of the HAZUS analysis, showing flood risk in Fort

[6] The predicted inundation level is shown in the U.S. Army Corps of Engineers Big Bend Dam Inundation Study, but it is not available for reproduction in this plan.

Thompson. It should be noted that the HAZUS analysis included some land located on the outskirts of the community.

Table 3.8 – HAZUS Base Flood Loss Estimation Results

Community	Building Structural Damage	Debris Generated	Households Displaced	People Needing Shelter
Ft Thompson	$1,383,400	1,445 tons	20	3
Gann Valley	$0	0 tons	0	0

Source: FEMA HAZUS loss estimation software

Using GIS technology, the flood prone areas identified by HAZUS were overlaid on parcel data to determine the amount of property potentially at risk to flooding. The table below shows the result of the analysis.

Table 3.9 – Property in Flood Prone Areas

Community	Number of Housing Units	Assessed Value (Land) *	Assessed Value (Improvements) *
Ft Thompson	9	$183,000	$45,000
Gann Valley	1	$110,000	$15,000

Sources: HAZUS; Buffalo County Director of Equalization

* Since most property in Fort Thompson is owned by the Crow Creek Tribe and is not assessed by the county, the valuation figure understates the value of property vulnerable to flooding in Fort Thompson.

Flood risk also was analyzed using the FloodFactor website, which uses a probabilistic flood model that shows any location's risk of flooding from rain, rivers, tides, and storm surges. According to the analysis, there are 13 properties in Fort Thompson that have greater than a 26% chance of being severely affected by flooding within the next 30 years, but no properties at risk in Gann Valley.

Development Trends

The expected population growth in the county is not likely to increase vulnerability to flooding, as growth is not expected to occur in areas prone to flooding. A factor that may increase vulnerability to flooding is the continuing conversion of wetlands and other marginal land to agricultural production. Farming these marginal lands is increasing the probability and severity of flooding in certain areas as the land's natural capacity to absorb excess surface water is decreased. The primary impact is on rural roads and infrastructure. Precise statistics on the amount of road damage that flooding has caused over the years in Buffalo County are not available, but there appears to be little doubt that county and township roads are suffering more flood-related damage than they used to. Future updates to this plan could explore this trend in more depth.

The nature and frequency of flooding also could be altered by climate change. There is no comprehensive assessment of how climate change might affect flooding in South Dakota, but regional trends for the northern Great Plains show a trend toward less frequent, but more intense, rain events. Climate projections indicate that 1-day, 20-year return events may

increase in frequency by 8% to 16% in the coming decades. In the northern Great Plains region, this is compounded by an overall wetter trend of about 15% increase when comparing the years 1986-2015 to 1901-1960. The additional moisture overall can add to the increase in precipitation per extreme event.

Drought

Without question, Buffalo County is vulnerable to drought. As shown in **Table C.2** in **Appendix C**, there are 19 drought records for the county in the Storm Events Database just since 1999, with many more droughts known to have occurred before then. The biggest impact of drought in Buffalo County is in the agricultural sector, which is not surprising, given the county's heavy reliance on farming. Non-irrigated cropland is most susceptible to drought, and yield reductions due to moisture shortages can be aggravated by wind-induced soil erosion.

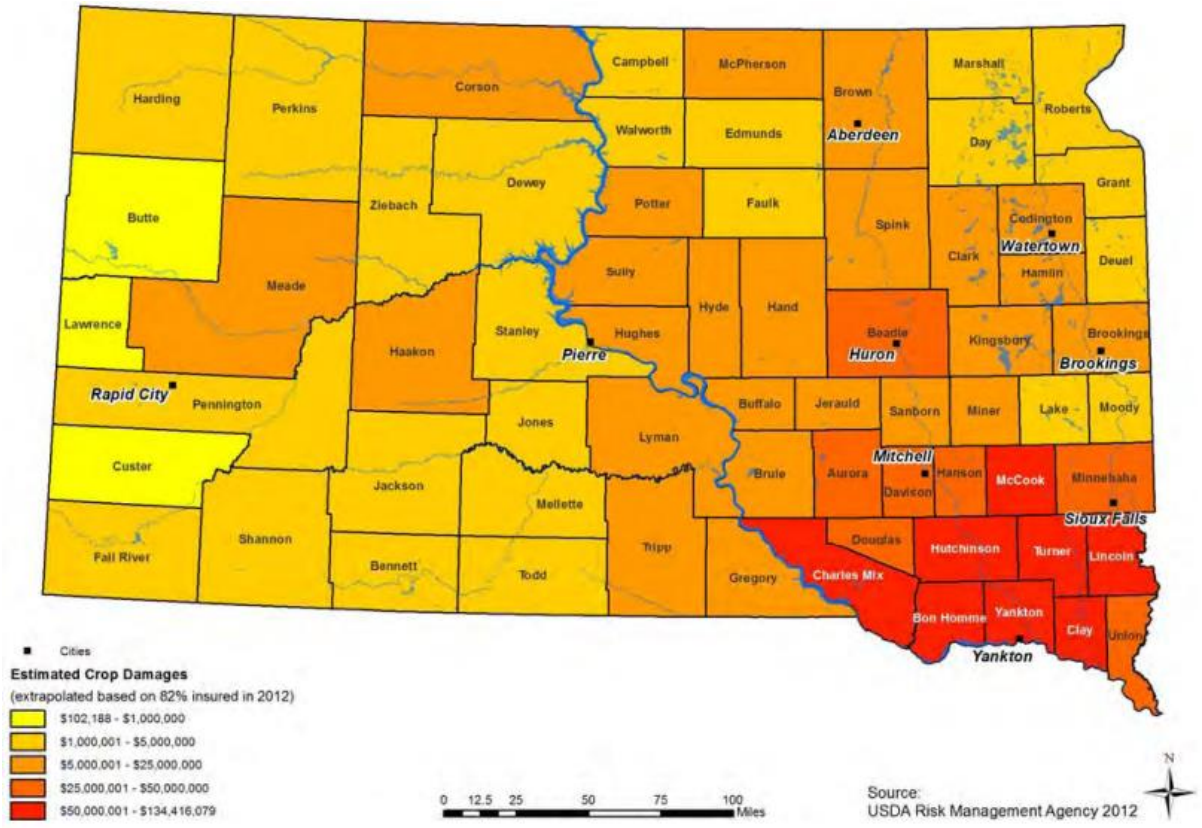
Data on indemnity payouts for crop loss in Buffalo County due to drought and heat between 2000 and 2017 was obtained from the Risk Management Agency, and is presented in the table below. During this period of analysis, drought-related payouts accounted for over 71% of all indemnity payouts in Buffalo County, far higher than any other type of payout. It is safe to say that drought is one of the costliest natural hazards facing Buffalo County farmers. Statewide, drought also appears to be the costliest natural hazard statewide for South Dakota farmers. From 2000 through 2017, drought payouts accounted for approximately 50% of all indemnity payouts in the state.

Table 3.10 – Crop Loss Due to Drought and Heat

Year	Drought	Heat		Year	Drought	Heat
2000	$1,577,546	$22,986		**2009**	$44,917	$0
2001	$386,822	$31,098		**2010**	$0	$0
2002	$3,093,701	$68,463		**2011**	$0	$0
2003	$1,433,990	$44,149		**2012**	$6,845,201	$184,066
2004	$454,037	$0		**2013**	$1,256,956	$0
2005	$406,629	$83,808		**2014**	$100,503	$0
2006	$3,264,006	$46,534		**2015**	$375,593	$0
2007	$393,233	$114,697		**2016**	$566,774	$0
2008	$11,758	$0		**2017**	$7,229,402	$0

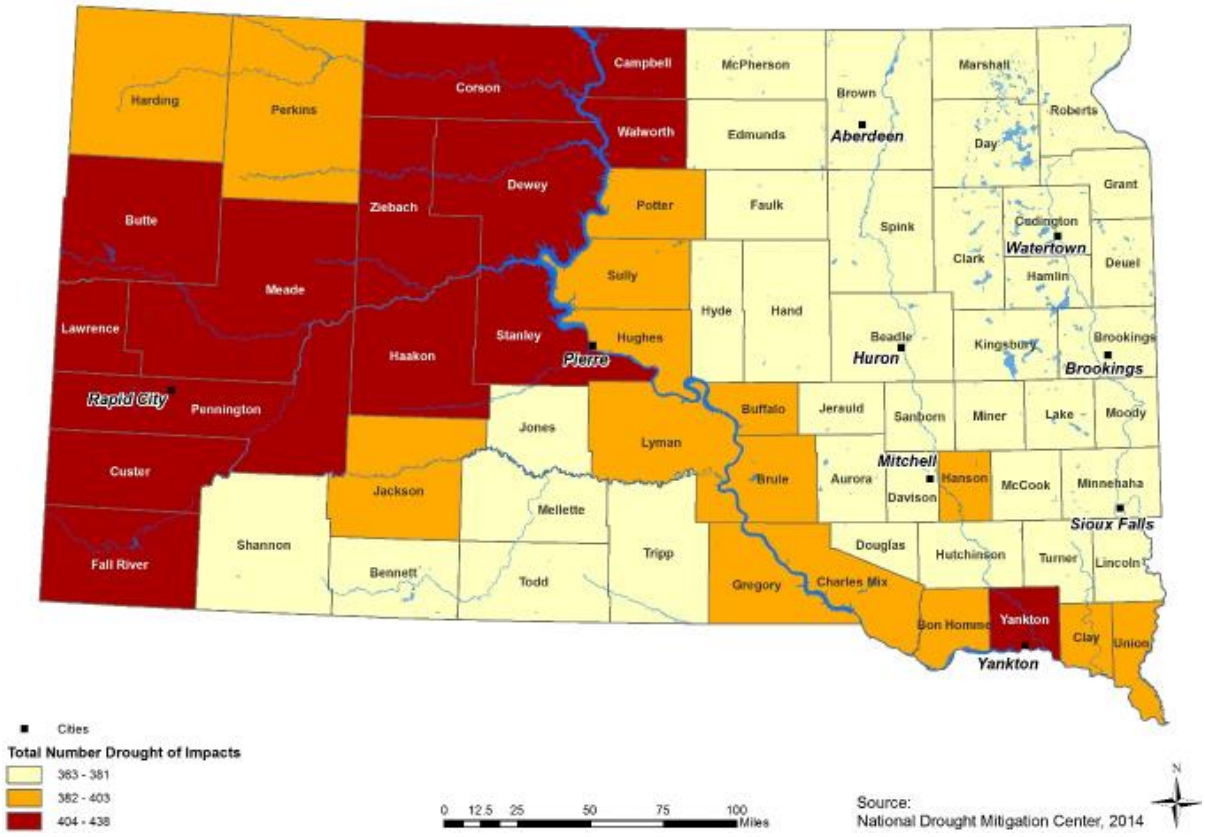
Source: USDA Risk Management Agency (www.rma.usda.gov/data/cause.html)

As the table shows, the 2012 drought had a major impact on the county's agricultural production. The figure on the following page, as reproduced from the South Dakota Drought Mitigation Plan, shows the 2012 drought's impact statewide.



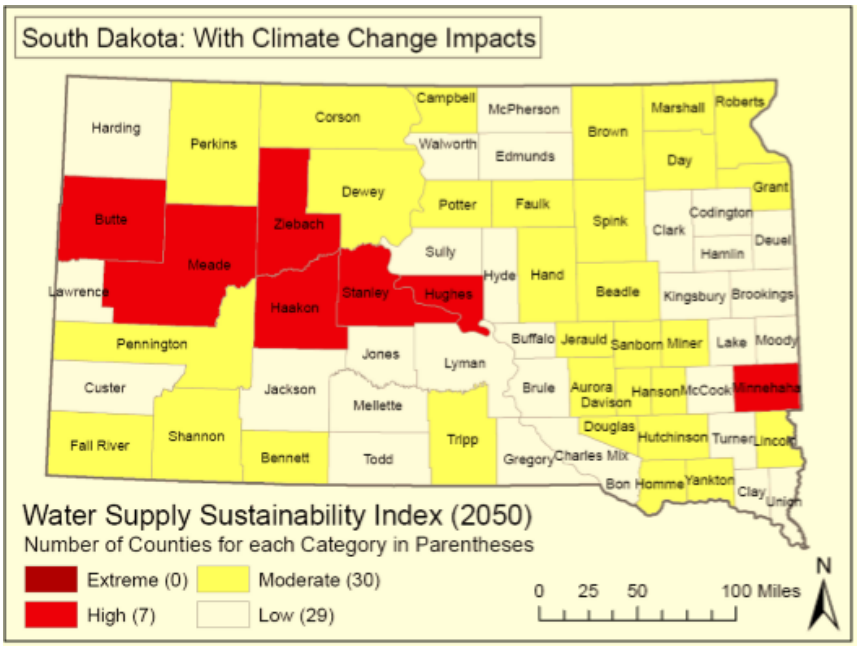
To determine which areas of the state are most vulnerable to the agricultural impacts of drought, the authors of the South Dakota Drought Mitigation Plan conducted an analysis comparing crop losses in each county to the total value of the county's crops. Crop value was taken from the 2012 Census of Agriculture, while crop loss was based on the Risk Management Agency's crop indemnity data for the period 2000 to 2014. The resulting loss ratio is the average annual loss divided by total crop value; the higher the ratio the higher the vulnerability. Buffalo County's average annual loss from drought for the 2000 – 2014 period was $1,481,847, compared to a total crop value of $22,972,000, resulting in a loss ratio of 6.5%. In comparison, the average loss ratio figure for South Dakota counties was 3.1%. The authors of the South Dakota Drought Mitigation Plan assigned a "Moderate" vulnerability rating for Buffalo County for this measure of drought vulnerability.

Vulnerability also was assessed by reviewing the South Dakota Drought Mitigation Plan's section on the National Drought Mitigation Center's Drought Impact Reporter. The Drought Impact Reporter analyzes drought impact information from a broad range of areas, including the social, economic, and environmental realms. As shown in the figure on the following page from the South Dakota Drought Mitigation Plan, Buffalo County is in the middle range of counties in terms of number of drought impacts.



Development Trends

Vulnerability to drought may increase in coming years if current land use trends continue and more marginal land in the county is brought into agricultural production. Climate change also may increase the frequency and severity of droughts in the future, according to many climate prediction models. As described in the South Dakota Drought Mitigation Plan, an analysis performed for the Natural Resources Defense Council examined the effects of climate change on water supply and demand in the United States. The study found that more than 1,100 counties may face higher risks of water shortages by mid-century as a result of climate change. The figure shown here from the Natural Resources Defense Council, as reproduced



from the South Dakota Drought Mitigation Plan, shows that Buffalo County is not one of the counties expected to face water shortages in the future due to climate change.

Wildfire

Wildfire risk in Buffalo County and the Crow Creek Reservation can be determined by analyzing historical records of actual wildfire losses (see **Table 3.4**), or by estimating potential wildfire losses. To analyze potential wildfire loss, data from the SILVIS Lab at the University of Wisconsin was used. The SILVIS data is classified into various categories based on the density of housing and vegetation in specific areas. Areas are classified as High, Moderate, or Low Risk threat zones. High Risk zones are areas of moderate to high density housing within heavily vegetated areas, Moderate Risk zones are areas of lower housing unit density within areas of high vegetation, and Low Risk zones have little vegetation and/or very low density housing. The map that was generated using SILVIS data showed a few very small areas of fire risk in the county and one large high risk area centered on Fort Thompson, shown here. The total population in Buffalo County in the High or Moderate risk zones is summarized in the following table.

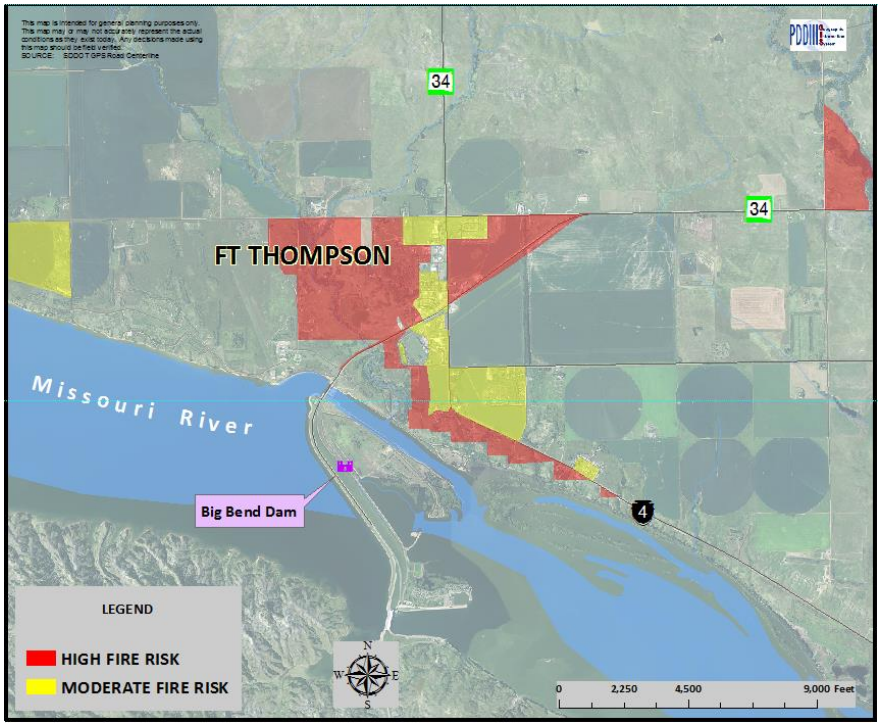


Table 3.11 – Population in Wildfire Risk Zones in Buffalo County

Housing Units	Total Population	Median Home Value	Total Home Value
299	1,071	$67,500	$20,182,500

Source: State of South Dakota Hazard Mitigation Plan, based on data from the SILVIS Lab at the University of Wisconsin–Madison

The population of 1,071 living in a High or Moderate Risk threat zone is not especially high, but it does represent 56% of Buffalo County's total population, the 17th highest percentage among South Dakota counties. Putting things in perspective, in the state of South Dakota as a whole about 25 percent of the population lives in a wildfire threat zone.

Development Trends

Looking ahead, the expected population growth may increase vulnerability to wildfire, especially if growth occurs in the areas of Fort Thompson identified as being at high risk of fire. Another factor that could increase wildfire vulnerability is the continued spread of cedar trees in Buffalo County and the Crow Creek Reservation. These trees are spreading quickly in the area, especially in the hilly terrain along the Missouri River. The fuel load they represent could turn an otherwise routine brush fire into a very serious situation. Efforts to control their spread have met with only limited success.

Climate change also may increase local wildfire vulnerability. The South Dakota Hazard Mitigation Plan cites a U.S. Forest Service study that indicates the potential for an increase in future lightning activity and a higher frequency of weather patterns conducive to surface drying. These factors, together with higher summer temperatures, will likely increase the annual window of high fire risk by 10 to 30%. The plan states that predictions past 2040 are largely speculative, but there will be an increase in the potential for drought and the number of days in any given year with flammable fuels, which may extend the fire season.

Risk Assessment Summary

In this section, the vulnerability of Buffalo County to each of the hazards profiled is summarized. Maps are presented at the end of the section to augment the analysis, showing areas within each community where vulnerability to flooding exists; the graphic on page 41 showed areas most vulnerable to wildfire. Vulnerability to winter storms, summer storms, and drought is not mapped, as those hazards are likely to impact all areas of the county more or less equally. A brief discussion of vulnerable populations within the county also is presented.

- **Winter Storms**

Buffalo County's vulnerability to winter storms can be considered high. All areas of Buffalo County are vulnerable to winter storms. Major winter storms accompanied by heavy snow or freezing rain contribute to the vulnerability of county residents by making roads dangerous for travel. The isolation of county residents living outside Fort Thompson puts them at increased risk. Some of these residents are more than 20 miles from the nearest place with groceries, medical service and supplies, or other important items. If roads are blocked by snow for an extended period of time, some rural residents, particularly the elderly, may be at risk. Winter storms accompanied by high winds have the potential to damage residential and commercial property in the county, as well as infrastructure. A major concern is the vulnerability of rural electric power infrastructure. When winter storms are accompanied by high winds and freezing precipitation, ice can build up on powerlines, which can cause the lines and poles to come down. It is a certainty that the county will remain vulnerable to winter storms no matter what mitigation actions are taken.

- **Summer Storms**

Buffalo County's vulnerability to summer storms can be considered moderate. All areas of the county are vulnerable to summer storms, and are highly vulnerable to summer storms that are accompanied by tornadoes or hail. Although the county's population density is low and infrastructure development is not extensive, a large amount of cropland in the county is vulnerable to the effects of hail and other violent summer weather. Residents of Fort Thompson are particularly vulnerable, since most of the housing stock there lacks a basement. The lack of building codes in the county impacts vulnerability to summer storms accompanied by high winds.

- **Flooding**

The overall vulnerability of Buffalo County to flooding can be described as low. Most of the vulnerability is to cropland and to rural county and tribal roads. Following is a summary of vulnerability to flooding in each of the communities:

Fort Thompson: There is some vulnerability here, as shown in **Table 3.9** and **Table 3.10**. The total assessed value of property at risk in Fort Thompson is less than $200,000, but since much of the property in the community is owned by the Crow Creek Tribe and not assessed, the actual vulnerability is higher than indicated. However, no critical facilities or infrastructure in Fort Thompson appear to be at risk of flooding. As noted earlier, the FloodFactor analysis found that 13 properties in Fort Thompson have greater than a 26% chance of being severely affected by flooding within the next 30 years, which is 15% of all properties in the community.

Gann Valley: The HAZUS software identified flood prone land on the northern edge of Gann Valley, along an unnamed tributary of Crow Creek (see **Figure 3.3**). No critical facilities or infrastructure is located in the flood prone area.

- **Drought**

Buffalo County's vulnerability to drought can be considered at least moderate, and is certain to continue for the foreseeable future. All areas of the county are vulnerable to drought. The impact is primarily to the agricultural sector, where significant losses have occurred. Residential and commercial impacts of drought are minor.

- **Wildfire**

The overall vulnerability to wildfire in Buffalo County can be considered moderate, with most of the vulnerability in the wooded draws along the Missouri River and in the Fort Thompson area. Despite the fact that few large wildfires have occurred within the county in recent years, approximately 56% of the county's population is considered to be living in a High or Moderate Risk wildfire threat zone, well above the statewide figure of 25%. The continued spread of cedar trees is a factor that may increase vulnerability to wildfire in some areas, especially in the rugged terrain along the Missouri River.

Vulnerable Populations

To conclude the risk assessment summary, the issue of vulnerable populations is considered. Such individuals, including the very young, the elderly, those with physical or mental disabilities, and the very poor, may be particularly vulnerable to disaster events. Populations that tend to be isolated in some way from the rest of the community, such as racial minorities and those who are not fluent in English, also may be more vulnerable.

The South Dakota Hazard Mitigation Plan includes a section on social vulnerability, using the Social Vulnerability Index for the United States. This index, compiled by the University of South Carolina Hazards and Vulnerability Research Institute, measures the social vulnerability of counties to environmental hazards. The index synthesizes 30 socioeconomic variables that may contribute to reducing a community's ability to prepare for, respond to, and recover from hazards. The primary variables are race and ethnicity, wealth, percentage of elderly residents, percentage of special needs individuals, and service industry employment. According to the index, Buffalo County is in the top 20% of the most socially vulnerable counties in the nation to environmental hazards, and is considered to be the most vulnerable of South Dakota's 66 counties. This is presumably due to the county's very low household income level and high percentage of minorities.

Figure 3.1 - Buffalo County/Crow Creek Reservation

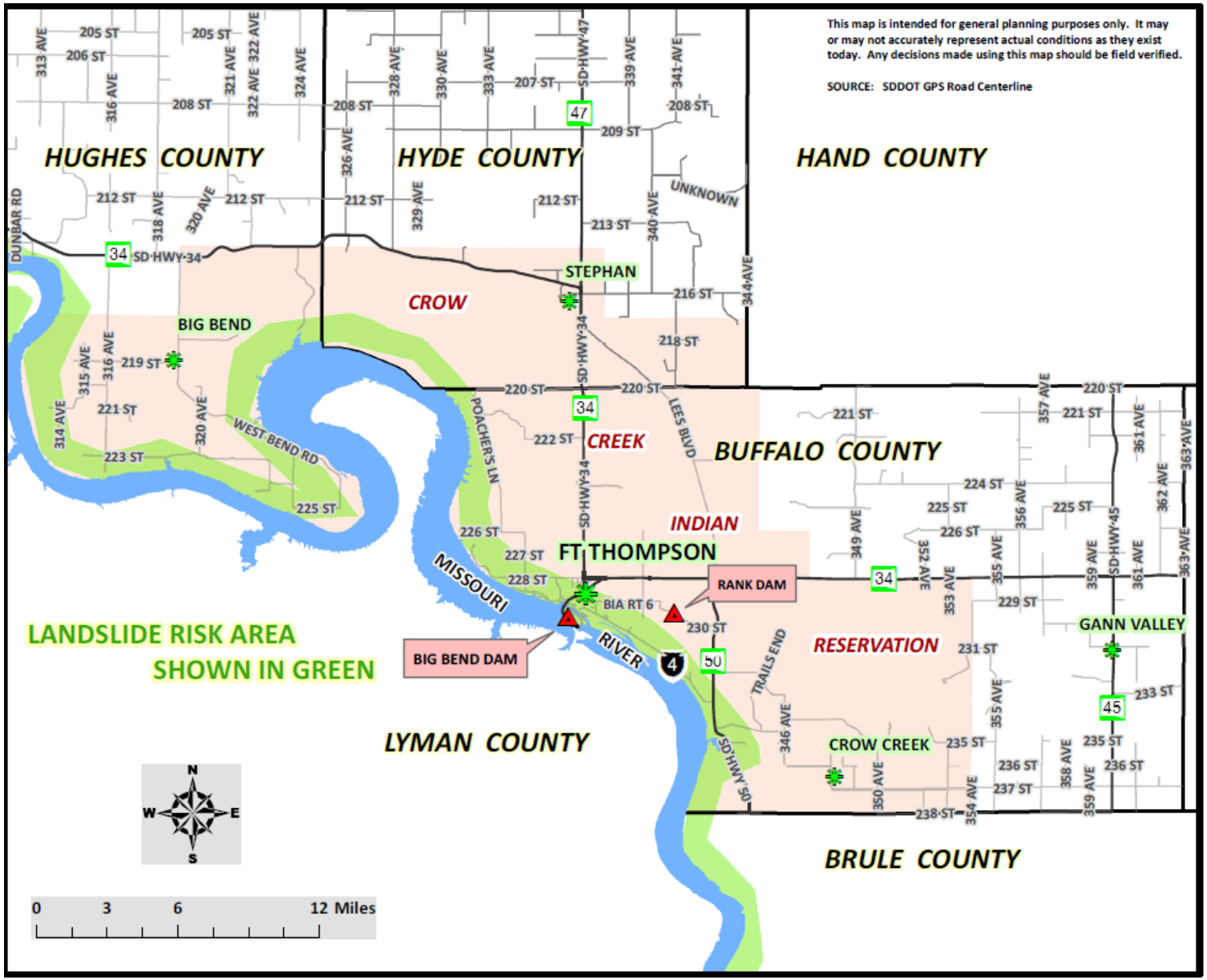


Figure 3.2 - Fort Thompson

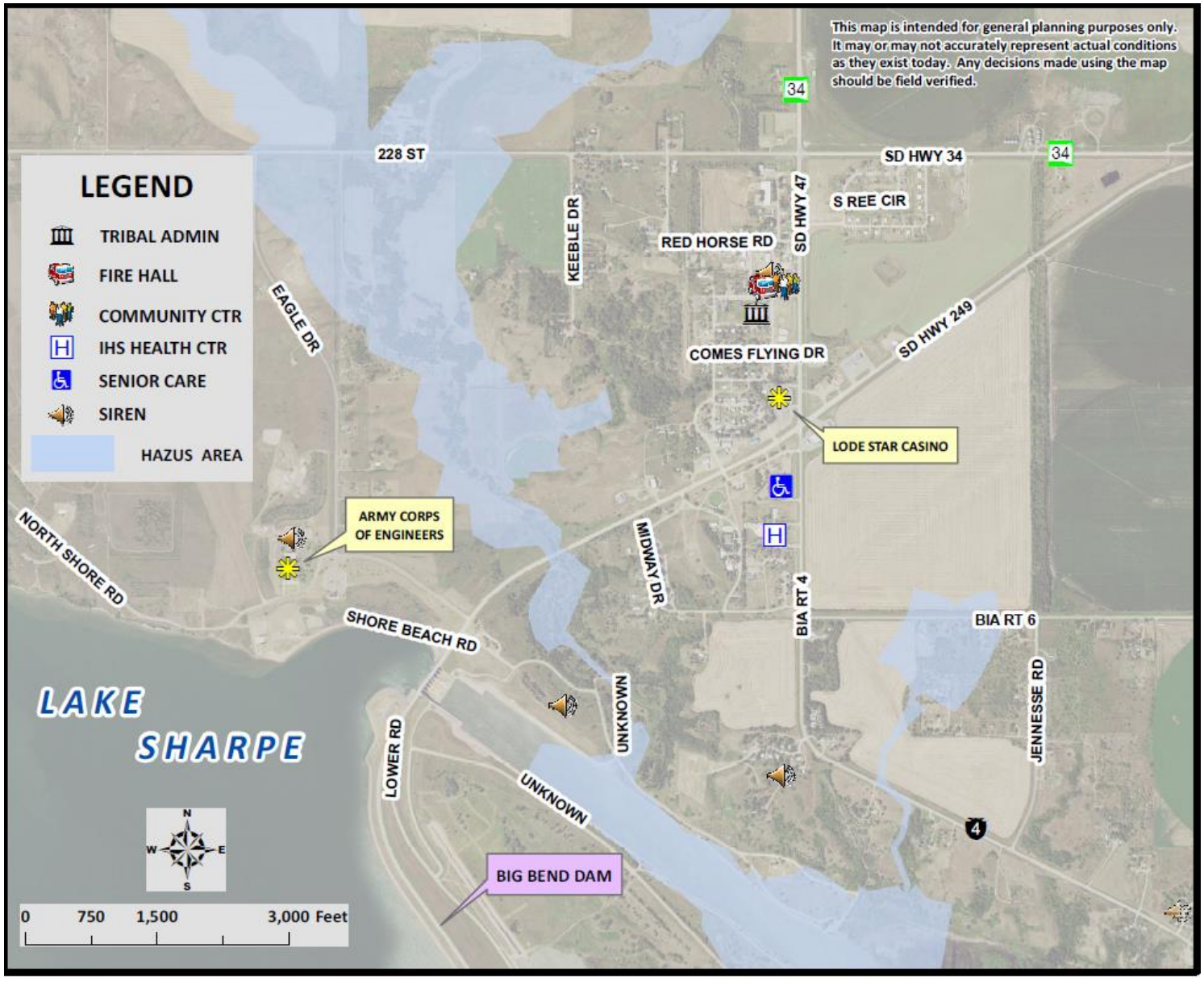


Figure 3.3 - Gann Valley

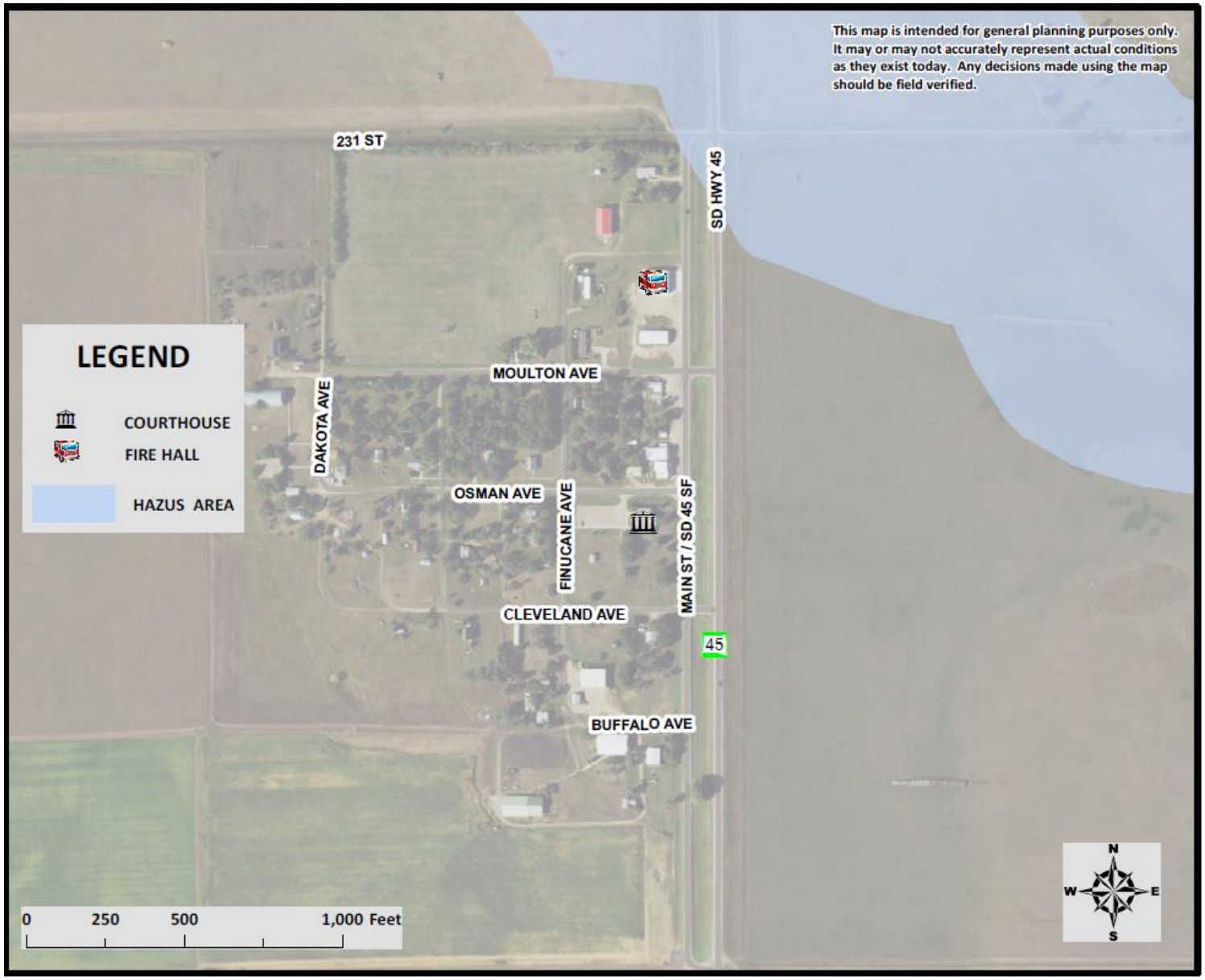


Figure 3.4 – Big Bend

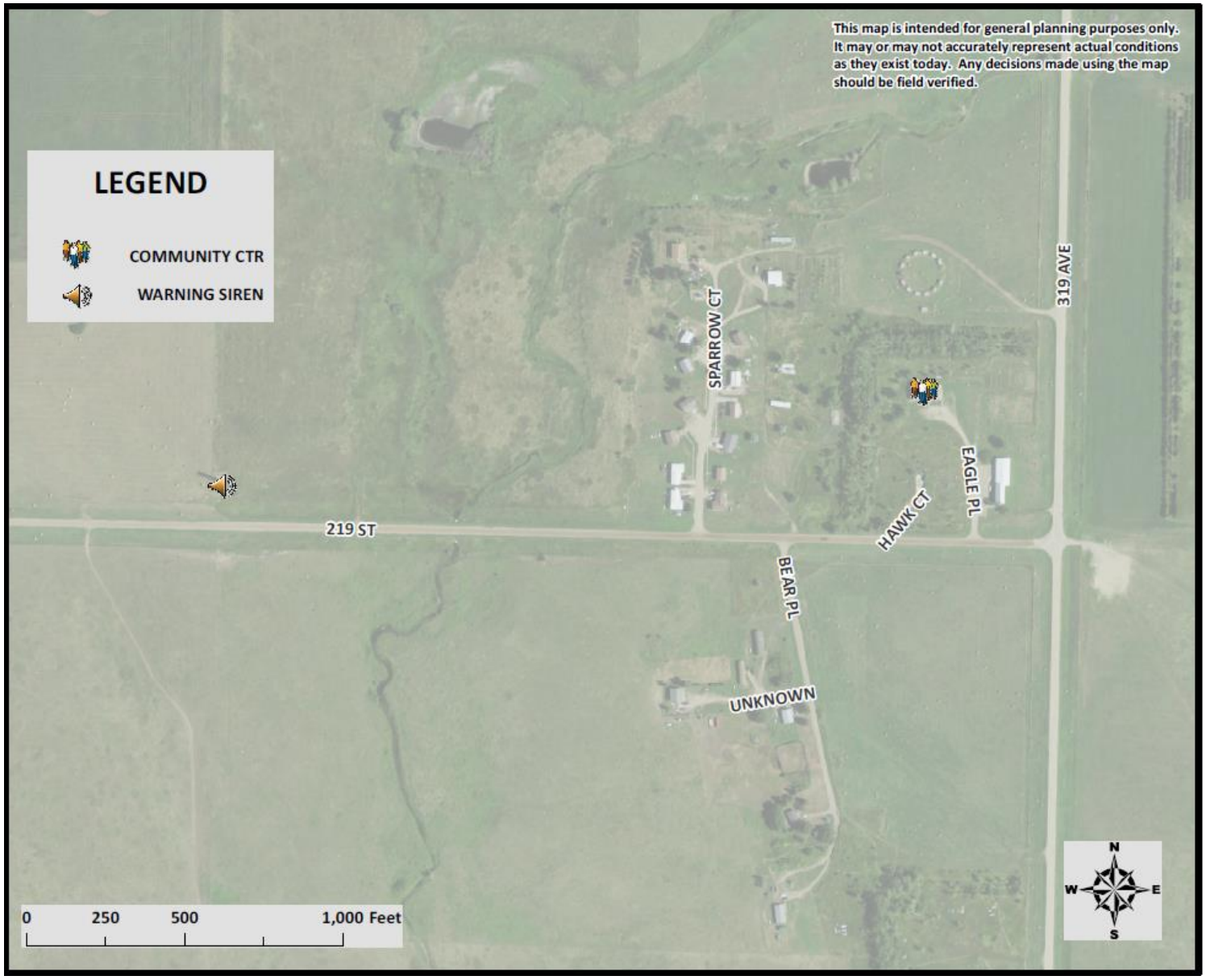


Figure 3.5 - Crow Creek Community

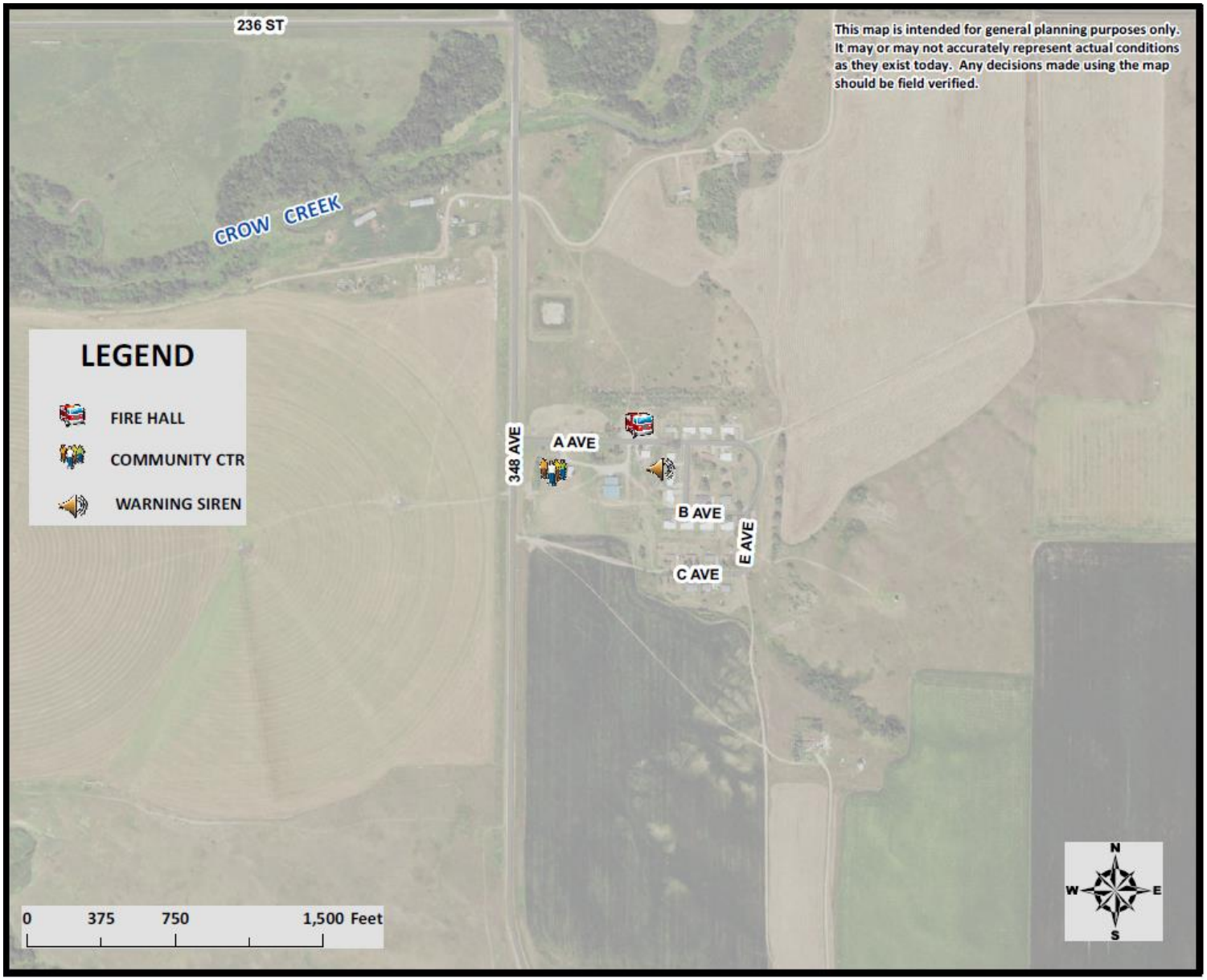


Figure 3.6 – Stephan

CHAPTER IV
RISK MITIGATION STRATEGY

Background

The previous chapter described the types of hazards most likely to impact Buffalo County and the Crow Creek Reservation, and discussed the County's and Tribe's vulnerability to each of the hazards. This chapter identifies the hazard mitigation goals and objectives that the planning team decided upon, and then focuses on a presentation of the mitigation actions proposed to achieve the goals and objectives. The chapter concludes with a discussion about how the proposed actions were prioritized.

Mitigation Goals and Objectives

At the beginning of the planning process, it was determined that the same general goals and objectives as listed in the county's current plan would be kept for this update, with one addition noted below. Among other considerations, the planning team wanted to ensure that the goals and objectives supported the priorities of the other planning documents that were reviewed as this plan was being developed. The following goals were identified:

- Minimize loss of life and injuries from hazards.
- Minimize damage to existing and future structures within hazard areas.
- Reduce losses to critical facilities, utilities, and infrastructure from hazards.
- Reduce impacts to the economy and the environment from hazards.
- Increase internal capabilities for hazard mitigation (new for this plan update).

After the team had settled on the goals, they began to focus more narrowly on each hazard by reviewing the results of the risk assessment and analyzing each jurisdiction's vulnerability to the hazards, and the severity of the threat posed by the hazards. Much of the discussion focused on damage caused by past hazard events, and what could be done to lessen or eliminate damage from future events. The planning team also considered how future development might affect the jurisdictions' vulnerability to each of the hazards faced.

Following are the specific mitigation objectives for each of the hazards as identified by Buffalo County and the Crow Creek Tribe:

Winter storm

- Reduce property and infrastructure losses due to winter storms.
- Ensure that people are adequately protected from the effects of winter storms.
- Minimize disruptions to the power distribution system.

Summer storm

- Reduce property and infrastructure losses due to summer storms.
- Ensure that people are adequately protected from summer storms.
- Ensure that people have adequate warning when violent weather threatens.

Flooding

- Reduce property and infrastructure losses due to flooding.
- Minimize development in areas that are prone to flooding.
- Maintain the natural and man-made systems that protect people and property from floods.

Drought

- Reduce economic and environmental impacts due to drought.

Wildfire

- Reduce property and infrastructure losses due to wildfires.
- Minimize development in areas that are prone to wildfires.

Mitigation Actions

With the goals and objectives identified by the planning team, the participating jurisdictions began the process of selecting mitigation actions that could be taken to accomplish the goals. The process began with a review of the actions listed in the county's current disaster mitigation plan and discussion about the progress that had been made to implement the actions. A list of the actions and a summary of the implementation status of each action is shown in the following table.

Table 4.1 – Progress on Implementing Previously Proposed Actions

Mitigation Action	Hazard	Current Status
BUFFALO COUNTY		
Continued National Flood Insurance Program compliance.	Flooding	Ongoing
Drainage improvements along county road system.	Flooding	Some progress has been made, but flooding in 2019 has set the County back.
Tornado safe room acquisition for Gann Valley.	Summer storm	Completed in 2018 using FEMA funds.
Participate in the StormReady Community Program.	Summer storm	Progress has been made, but the process has not been completed.
Participate in reverse 911 emergency notification system.	All hazards	No progress – no longer a priority.
CROW CREEK TRIBE		
Relief shelter construction for Crow Creek, Bad Nation, and Big Bend communities.	Summer storm	No progress – lack of funds.

Mitigation Action	Hazard	Current Status
Siren acquisition for Fort Thompson and Bad Nation.	Summer storm	In the process of being completed.
Tornado safe room acquisition for Fort Thompson, Crow Creek, Bad Nation, Big Bend, and Stephan communities.	Summer storm	Several small tornado safe rooms were installed in the Ft Thompson area in 2019 using FEMA funds, but no progress has been made elsewhere.
Drainage improvements in Ft Thompson, including the Knots Landing neighborhood and casino area..	Flooding	Some progress continues to be made, but more work is needed.
Contact state NFIP coordinator regarding NFIP participation.	Flooding	No progress has been made.

Following this review, a list of potential mitigation actions based on FEMA's guidance document *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* was reviewed. The actions on the list can be grouped into the following general categories:

- Prevention: Government administrative or regulatory actions or processes that influence building and development. Examples include:
  - Adopting zoning regulations.
  - Preserving open space.
  - Reviewing and strengthening local flood ordinances.
  - Adopting stormwater management regulations.
  - Adopting National Building Code standards.
  - Enacting measures to restrict non-essential water usage.

- Education and Outreach: Actions to inform and educate elected officials, stakeholders, property owners, and the general public about potential risks from hazards and potential ways to mitigate them. Examples include:
  - Developing a disaster mitigation public awareness program.
  - Participating in the StormReady program.
  - Participating in the Firewise Communities program.
  - Making presentations to school groups or neighborhood organizations.
  - Mailings to residents in hazard-prone areas.
  - Encouraging people to take various water-saving measures.

- Property Protection: Actions that modify existing buildings or infrastructure to protect them from a hazard or remove them from the hazard area. Examples include:
  - Property acquisition, elevation, or relocation, including elevating roads in flood-prone areas.
  - Making structural retrofits to facilities.
  - Replacing overhead utility lines with underground lines.

- Natural Resource Protection: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include:

- Using low-lying areas as natural water retention ponds.
- Restoring and preserving wetlands.
- Restoring stream corridors.
- Forest and vegetation management.
- Providing incentives for xeriscaping.

- Structural Projects: Actions that involve the construction of new structures to reduce the impact of a hazard. Examples include:
  - Upgrading stormwater infrastructure, such as culverts and storm sewer piping.
  - Building floodwalls.
  - Building tornado safe rooms.

It was explained that hazard mitigation is defined as *sustained action* taken to reduce or eliminate the long-term risk to people and property from hazards, as opposed to preparedness planning. Still, some actions to enhance disaster preparedness were discussed. Actions considered in this category included installing warning sirens in areas currently not well served and acquiring emergency power generators for critical facilities.

The final list of mitigation actions identified by the jurisdictions is shown in **Table 4.2**, which contains the following information for each action:

- The local priority rating.
- The project lead primarily responsible for implementing the action.
- The estimated time frame needed to accomplish the action. Short term actions are those that can be completed within a few years, while Long term actions may take several years or more to accomplish due to cost or other factors.
- The estimated cost to implement the action.
- Resources that may be available to help fund the action.
- The current status of the proposed action.

Prioritizing the actions is important because it is unlikely that all of them can be pursued simultaneously, especially when costly projects are being considered. Those actions providing the most overall benefit in terms of cost are likely to be pursued first, while some lower priority actions may never be implemented. The prioritization process was informal and somewhat subjective, but a methodology did help guide the process. This framework, which was suggested by the Planning & Development District III office, is based on the following criteria:

- Overall benefit - how many lives or how much property will be protected, and how much disruption will be prevented? Are there any critical facilities or important public infrastructure that will be protected?
- Financial feasibility - how expensive will the action be? Could the action qualify for grant or loan funding?

- Political feasibility – will the public support the action? Are there any groups or interests that may be opposed to the action and thus prevent it from being implemented?
- Technical feasibility – does the technology exist for the action to be implemented? Is the action likely to function as intended?
- Environmental feasibility - does the action have the potential to have an adverse impact on the environment?
- Legal feasibility – are there any legal issues that might prevent the action from being implemented?

Guesswork was kept to a minimum during the prioritization process. For instance, in determining the potential benefit of a given action, the amount of property that would be protected by the action could in some cases be estimated with a fair amount of certainty. Assessing the proposed actions in relation to the other criteria was sometimes more difficult. Determining the political feasibility of the actions may have been the most subjective part of the process, but the jurisdiction representatives generally had a good idea of how the public and vested interests would support the actions.

Funding considerations also are critical, because neither Buffalo County nor the Crow Creek Tribe have much discretionary money available to fund mitigation activities. Given this reality, it is unlikely that any mitigation action requiring substantial financial resources could be implemented locally without grant assistance. Following are potential sources of outside funding to help the jurisdictions accomplish mitigation projects:

FEMA grant programs

- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Rehabilitation of High Hazard Potential Dams (HHPD)

Other grant and loan programs/sources

- US Economic Development Administration
- US Department of Agriculture Rural Development grant/loan program
- US Indian Community Development Block Grant program
- South Dakota Community Development Block Grant program
- South Dakota State Homeland Security Program
- South Dakota Dept. of Agriculture and Natural Resources
- South Dakota Dept. of Transportation
- Western States Wildland Urban Interface Grant Program

Table 4.2 - Proposed Mitigation Actions

BUFFALO COUNTY	PRIORITY	PROJECT LEAD	TIME	COST	FUNDING	STATUS
Ensure continued NFIP compliance.	HIGH	County floodplain coordinator	SHORT	N/A	N/A	More training and program information will be requested from state NFIP coordinator.
Make drainage improvements along county roads.	HIGH	County Highway Superintendent	LONG	Unknown	DOT; FEMA	Projects are in early planning phase.
Generator for courthouse.	HIGH	County commission	MID	≈$30,000	FEMA	County intends to apply for funding as opportunities develop.
CROW CREEK SIOUX TRIBE	**PRIORITY**	**PROJECT LEAD**	**TIME**	**COST**	**FUNDING**	**STATUS**
Combined Tribal emergency services building to include fire response, emergency medical service, and law enforcement.	HIGH	Crow Creek Tribe EMD	MID	$4 million	DOJ	Conceptual planning for the facility is essentially complete. The Tribe intends to apply for funding in 2023.
Siren acquisition for Ft Thompson, Bad Nation, and other communities as needed.	HIGH	Crow Creek Tribe EMD	MID	$35,000	FEMA	Tribe intends to apply for funding as opportunities develop.
Tornado safe rooms for Ft Thompson, Crow Creek, Bad Nation, Big Bend, and Stephan communities.	HIGH	Crow Creek Tribe EMD	MID	$20,000/ structure	FEMA	Approximately 15 structures are needed. Tribe intends to apply for funding as opportunities develop.
Generator for Crow Creek tribal admin building, Crow Creek Ambulance Service, Crow Creek Housing Authority, Big Bend community center, and Crow Creek community center.	MID	Crow Creek Tribe EMD with other department heads	MID	Will vary by facility	FEMA	Tribe intends to apply for funding as opportunities develop.
Drainage improvements in Ft Thompson.	MID	Crow Creek Tribe EMD; BIA	LONG	Unknown	ICDBG; FEMA	Tribe intends to apply for funding as opportunities develop.

Potential Resources for Funding Assistance:

DOJ	US Dept of Justice	DOT	SD Department of Transportation
FEMA	FEMA Hazard Mitigation Grant Program	ICDBG	Indian Community Development Block Grant program

Mitigation Action Plan

This plan is intended to serve as the backbone for disaster mitigation planning within Buffalo County and the Crow Creek Reservation. To remain useful, the plan cannot exist in a vacuum – it is designed to work with other county and tribal planning and development tools and mechanisms. This section first describes how the mitigation plan will be incorporated into existing planning mechanisms, and concludes by describing how the mitigation strategy will be implemented by Buffalo County and the Crow Creek Tribe.

Plan Incorporation

It is important that the goals and actions included in this plan be integrated with the local plans and policies already in place. This is important, because neither this plan nor any of the others will work effectively if they contain contrary goals or policy recommendations. The following table shows the planning-related technical documents that currently exist, each of which was reviewed as this plan was being developed. Looking ahead, future updates of this plan should not be made without reviewing these planning tools.

Table 4.3 – Local Planning Mechanisms

	Capital Improvement Plan	Comprehensive Land Use Plan	Zoning ordinance	Building codes	Electrical Construction Plan	Housing Plan	Flood damage prevention ordinance	Drainage ordinance	Five Year Highway Improvement Plan	Hazardous Material s Plan
Buffalo County		X					X			X
Crow Creek Tribe		X								

Hazard mitigation concepts should be incorporated where appropriate into the policy documents listed in the table. The process by which this will occur is likely to be different for the County and Tribe, but a key part will be the involvement of the Buffalo County Emergency Management Director and the Crow Creek Tribe Emergency Management Director, who will discuss hazard mitigation at least annually with the respective county and tribal governing councils. It is also important that major development projects within the jurisdictions be undertaken based on sound hazard mitigation planning.

Hazard mitigation also is discussed in the 2019 Comprehensive Economic Development Strategy (CEDS) for the Planning & Development District III region, which includes Buffalo County. The CEDS, which is produced for the Economic Development Administration, analyzes development issues, opportunities, and challenges from a regional perspective. It is being updated at this time with a greater emphasis on the subject of economic resiliency, including the role that hazard mitigation can play in helping communities maintain their economic wellbeing. Information from this plan will be used as the CEDS is updated.

Plan Implementation

The Buffalo County Emergency Management Director and the Crow Creek Tribe Emergency Management Director are both responsible for ensuring that the plan's mitigation strategy is implemented effectively. The directors will coordinate their activities with other county and tribal departments and agencies as needed. The jurisdictions they represent also will play a critical role in carrying out the action plan by identifying and prioritizing the actions they want to pursue, allocating resources for their implementation, and applying for funding assistance as needed. If and when they are able to secure funding for those projects with a significant financial cost, they will move forward with implementing their actions.

Since the county and the tribe operate independently of each other on many matters, effective implementation of this plan also will depend on a high level of communication and coordination between county and tribal officials. This may be a challenge, but the success that has been achieved in developing this mitigation plan gives reason to believe that the goals and objectives outlined in this plan can be achieved.

The availability of funding is critical to the success of this plan, as both Buffalo County and the Crow Creek Tribe have extremely limited financial resources. As discussed in the Socioeconomic section of **Chapter II**, this is one of the poorest places in the entire nation, so both the Tribe and the County must be efficient with any money they are able to allocate to hazard mitigation. The mitigation actions listed in **Table 4.2** should be considered when the jurisdictions begin the process of working on their annual budgets. In this way, the plan will not become a mere "wish list" of ideas for which there is no practical funding mechanism. To help ensure that this happens, the Buffalo County and Crow Creek Tribe Emergency Management Directors will continue to discuss hazard mitigation at least annually with the respective county and tribal governing councils, including the possibility of obtaining funds through FEMA or other sources for the projects they have identified.

If FEMA mitigation funds are awarded for a project, grant administration will be the responsibility of the local jurisdiction, which will appoint an individual who will be responsible for ensuring that the project is completed as proposed and that all grant award conditions and requirements are followed. A resource that can help the jurisdictions meet the FEMA grant requirements (and help develop the grant applications) is the Planning & Development District III office. District III staff have decades of experience working on various planning and community development activities within Buffalo County and the Crow Creek Reservation, and over a decade of experience working with the Buffalo County and Crow Creek Tribe emergency management offices.

CHAPTER V
PLAN MAINTENANCE

Background

Plan maintenance is a continuous process, which involves monitoring, evaluating, and updating the plan. It provides the foundation for an ongoing mitigation program and helps ensure that the plan remains relevant and effective. This chapter addresses how Buffalo County and Crow Creek Tribal officials intend to ensure that the plan will remain a dynamic, useful tool for mitigating against the impact of future disaster events.

Plan Monitoring and Evaluation

Ultimate responsibility for monitoring the plan and evaluating its effectiveness lies with the Buffalo County Emergency Management Director, who will continue to work closely with the Crow Creek Tribe Emergency Management Director. They will be supported by the Brule/Buffalo County Local Emergency Planning Committee (LEPC), which meets quarterly and includes representation from Buffalo County and the Crow Creek Tribe.

The LEPC will review the plan annually. Major points of discussion will include whether the risk assessment remains valid because of new development or other factors that may impact vulnerability to hazards, whether the mitigation goals and objectives identified in the plan remain sound, and whether progress is being made on implementing the mitigation actions identified in the plan. An opportunity also will be provided to add additional mitigation actions to the plan as needed. If any new projects are identified, the South Dakota Office of Emergency Management will be notified so that the project will be eligible for hazard mitigation assistance in the next funding cycle.

After the LEPC's plan review meeting, the Buffalo County Emergency Management Director will meet with the Buffalo County commission and the Crow Creek tribal council to discuss the progress being made to implement the plan. At this time, a determination will be made about whether the implementation strategy needs to be revised or the plan itself needs to be updated.

For the plan to remain effective, evaluation needs to be an ongoing process. This will help ensure that the plan remains relevant and able to meet local conditions and priorities, which can change. Following are some of the factors that can have a major impact on mitigation planning:

- Occurrence of a significant disaster event – Serious events can reveal flaws in local jurisdictions' disaster preparedness plans. The 9/11 terrorist strikes are a dramatic example of this type of event. The Missouri River flooding that occurred

in 2011 is another example of an event significant enough to necessitate a reexamination of local mitigation strategies.

- Change in the nature or magnitude of risks – Changing environmental conditions, increased development in sensitive areas, and other factors can be significant enough to cause localities to rethink their mitigation strategies. For example, climate change is a factor that could increase local vulnerability to drought and other hazards.
- Change in funding availability – The availability of money often determines whether an action can be implemented. For example, local budget cuts can delay, or prevent altogether, a mitigation project's implementation. On the other hand, grant opportunities for specific types of mitigation actions may argue for their implementation.
- Change in local priorities – Local priorities regarding mitigation projects can change for a number of reasons.
- Legal factors – Laws and regulatory requirements may change, which may make certain mitigation actions more or less feasible or desirable.
- Technological change – Advances in technology may make it possible in the future to address certain types of hazards more effectively or at lower cost.
- Other factors – There are many other factors that can have an impact on local disaster mitigation priorities and strategies. For example, a detailed engineering analysis may indicate that a proposed mitigation project may be much costlier than first estimated, which could make the action unpractical to pursue.

Updating the Plan

Updating this plan may occur at any time in response to any of the factors identified above. Otherwise, it is anticipated that Buffalo County will begin the process of updating the plan approximately two years prior to the plan's expiration date, with the Crow Creek Tribe expected to continue as a full participating partner in the process. Plan updates will reflect changes in growth and development, changing mitigation priorities, and progress in implementing the mitigation actions listed in this plan. The updating process will consist of the following general steps:

- Funding assistance to update plan obtained
- Hire contractor to write the plan
- Organize planning team
- Begin soliciting public participation and input
- Hold meetings of planning team to develop the plan
- Make draft of the plan available for public review and comment
- Submit plan for State review
- Revise plan as needed based on reviewer comments
- Plan submitted by State to FEMA

- Revise plan as needed based on reviewer comments
- Jurisdictional adoption of approved plan

Public Involvement

Throughout the development of this plan update, a sustained effort was made to involve the general public in the plan. Outreach included a press release that was printed in the local newspaper. Looking forward, the outreach strategy will evolve over time as different methods are used to get greater public participation in the mitigation planning process. Once approved, the plan will be available for the public to see at the Buffalo County courthouse and at the Crow Creek Tribal office. It also will be made available on the Buffalo County website. Other outreach activities may include:

- Community visits by the Buffalo County and Crow Creek Emergency Management Directors to discuss mitigation planning. These visits will occur at civic gatherings, community meetings on the reservation, and other events.
- Press releases about the plan published in the Chamberlain *Central Dakota Times.*

Another way for the public to participate in the mitigation planning process will be through the mitigation plan review meeting of the Brule/Bufffalo County LEPC. The local media is invited to all LEPC meetings, and the plan review meeting will be made known to the public through a public notice or press release in the Chamberlain *Central Dakota Times* stating that the plan will be reviewed at the meeting and that comments from the public are encouraged.

All comments and suggestions received from the public through any of the forums described above will be included in a public comment section in the plan's appendix.

APPENDICES

APPENDIX A: Outreach Effort

This section documents the outreach effort that was used to solicit input into the plan.

Initial Meeting - Email to Planning Team:

From: John Clem
Sent: Tuesday, February 22, 2022 9:40 AM
To: Brule/Buffalo EMS <brbufem@midstatesd.net>; kason.comesflying14@gmail.com; loudner_donita@yahoo.com
Subject: Buffalo County PDM Plan

Good morning everyone,

Following up the email I sent a couple of weeks ago, here's the process I'd like to use to update the Buffalo County/CCST Pre-Disaster Mitigation (PDM) Plan. We'll start with an initial meeting of the Planning Team, which I'd like to have in April. It would be best if we could have everyone together in Ft Thompson or Gann Valley, but we can have separate meetings like we did last time. County reps can include county commissioners, the auditor, highway superintendent, and treasurer. Tribal reps can include tribal commissioners, tribal resources, emergency services, and the school. IHS, BIA, and the Corps of Engineers also should be invited. The table on p.4 of the current PDM plan, which I've attached here, shows who attended the meetings the last time we updated the plan in 2016.

At the first meeting we'll talk about the concept of hazard mitigation, including the types of hazard mitigation projects the County and Tribe could pursue, and we'll review the current plan. After the meeting, the County and Tribe will decide which hazard mitigation projects they want to include in the plan. Then we'll come together for another meeting later this summer to wrap everything up.

So please start reaching out to your contacts to see what day in April would work for the first meeting. If it will be separate meetings, then obviously some coordination will be required. Thanks for your help, and let me know if there are any questions.

John Clem
Planning & Development District III
Yankton, SD 57078
800 952-3562
John.Clem@districtiii.org

Initial Meeting - Email to Donita Loudner:

From: John Clem
Sent: Monday, April 11, 2022 2:57 PM
To: loudner donita <loudner_donita@yahoo.com>
Cc: kason comesflying14 <kason.comesflying14@gmail.com>
Subject: PDM meeting

Donita,

Following up our conversation, here's a copy of the current Buffalo County/CCST Pre-Disaster Mitigation (PDM) Plan that should be forwarded to the other people you're inviting to the meeting this Thursday. The table on p.4 of the plan shows who attended the meetings the last time we updated the plan in 2016. Some of the groups that would be good to have at the meeting include:

- Tribal commission (at least one rep)
- Tribal finance office
- Tribal resources
- Emergency services
- School system
- BIA
- IHS
- Corps of Engineers

One of the main things I want to go over at the meeting is the status of the projects listed on p.60 of the current plan, and we'll also talk about what projects the Tribe can pursue in the future. Thanks for arranging the meeting, and we'll see you Thursday at 1:00.

John Clem
Planning & Development District III
Yankton, SD 57078
800 952-3562
John.Clem@districtiii.org

Initial Meeting - Email to Emergency Management Directors in Other Counties:

From: John Clem
Sent: Monday, April 11, 2022 3:09 PM
To: Allemang, Heather <Heather.Allemang@state.sd.us>; Kafka, Kyle <Kyle.Kafka@state.sd.us>; Roger Dwyer <oemdwyer@venturecomm.net>; aurcoemmgr@goldenwest.net; Margo Mitchell <margo.mitchell@lymancoso.org>
Cc: Brule/Buffalo EMS <brbufem@midstatesd.net>; kason comesflying14 <kason.comesflying14@gmail.com>
Subject: Buffalo County/Crow Creek Tribe PDM Plan

Good afternoon,

This is just an FYI that **Buffalo County and the Crow Creek Sioux Tribe** are beginning the process of updating their current Pre-Disaster Mitigation Plan. The first meeting will be held at the Crow Creek Tribal Office on April 14 at 1:00 PM. We welcome your participation, but note that this will be an in-person meeting only. Let me know if there are any questions about the meeting.

John Clem
Planning & Development District III
Yankton, SD 57078
800 952-3562
John.Clem@districtiii.org

Final Meeting - Email to Planning Team:

From: John Clem
Sent: Friday, June 10, 2022 10:48 AM
To: Brule/Buffalo EMS <brbufem@midstatesd.net>; kason comesflying14 <kason.comesflying14@gmail.com>; Donita Loudner <loudner_donita@yahoo.com>; buffalo.aud@midstatesd.net
Subject: Buffalo County/CCST PDM Plan

Good morning,

Following up the county commission and tribal council meetings held earlier this week, we're ready to go ahead and have the final meeting for the Buffalo County/CCST Pre-Disaster Mitigation Plan, which will take place **July 5 at 12:30 PM** at the courthouse just before the regular county commission meeting. All of you should plan to attend the meeting.

Attached is the latest draft of the plan, which I'd like everyone to review. The most important part is **Table 4.2 on page 55**, which lists the hazard mitigation projects the County and Tribe have selected to include in the plan. Please let me know if any projects should be added, deleted, or changed, or we can discuss at the meeting next month.

Thanks again and let me know if there are any questions.

John Clem
Planning & Development District III
Yankton, SD 57078
800 952-3562
John.Clem@districtiii.org

Final Meeting - Email to Emergency Management Directors in Other Counties:

From: John Clem
Sent: Wednesday, June 29, 2022 9:24 AM
To: Allemang, Heather <Heather.Allemang@state.sd.us>; Kafka, Kyle <Kyle.Kafka@state.sd.us>; Poppen, Jim <Jim.Poppen@state.sd.us>; Roger Dwyer <oemdwyer@venturecomm.net>; aurcoemmgr@goldenwest.net; Margo Mitchell <margo.mitchell@lymancoso.org>
Cc: Brule/Buffalo EMS <brbufem@midstatesd.net>; kason comesflying14 <kason.comesflying14@gmail.com>; buffalo.aud@midstatesd.net
Subject: Buffalo County/CCST PDM Plan

Good morning folks –

This is just an FYI that **Buffalo County and the Crow Creek Tribe** will be holding the final meeting to update their Pre-Disaster Mitigation Plan. The meeting will be held at the Buffalo County courthouse on **July 5th at 12:30 PM**. You are all invited to participate, but please note this is an in-person meeting only. Let me know if there are any questions about the meeting.

John Clem
Planning & Development District III
Yankton, SD 57078
800 952-3562
John.Clem@districtiii.org

Press Release After Completion of Plan:

APPENDIX B: Documentation of Meetings

This appendix includes the following items:

- Signup sheets from the planning team meetings.
- Minutes from the County and Tribal meetings as they discussed the mitigation actions they wanted to include in the plan.

SIGNUP SHEET – INITIAL MEETING:

Buffalo County Pre-Disaster Mitigation Planning Meeting

Fort Thompson

April 14, 2022

NAME	REPRESENTING
John Clem	Planning District III
Robert Todd	CCSA
Kason Comes Flying	CCSA/OEM
Thomas Thompson	CCST
Brian Sich	CCTS
Frank Gourneau	CCTS
Donita Loudner	Elderly Community Member
Treon Fleury	BIA
Samuel R. Charger	Ft. Thompson Indian Health Service
Jerilyn Traversie	Crow Creek Housing Authority
Carla Pickner	Crow Creek Sioux Tribe Secretary
Christine L. Obago	CCST Treasurer

SIGNUP SHEET – FINAL MEETING:

BUFFALO COUNTY MINUTES

BUFFALO COUNTY BOARD OF COMMISSIONERS
BUFFALO COUNTY COURTHOUSE, GANN VALLEY, SD
MITIGATION DISCUSSION – THURSDAY, JUNE 9, 2022 12:20PM
REGULAR MEETING - THURSDAY, JUNE 9, 2022, 1:00PM
BUFFALO COUNTY COURTHOUSE, GANN VALLEY, SD

Discussed the Buffalo County Pre-Disaster Mitigation (PDM) Plan.

Chairman Lloyd Lutter called the meeting to order at 1:00pm with Commissioners Donita Loudner and Dawn Cable present, none absent.

Also present was Steve Fox, Deputy States Attorney; Debi Ruiz, Central Dakota Times; Debra Morrison, Buffalo County Auditor; and several concerned citizens. Cable moved to accept the agenda, seconded by Loudner. Motion carried by all voting ayes.

Loudner moved to accept the May 10, 2022, minutes, seconded by Cable. Motion carried by all voting ayes.

Several concerned citizens addressed the commissioners.

Highway Superintendent Lowell Swanson gave fuel bids to commissioners. June Fuel quotes/bids from Total Oil, Inc. for Unleaded Gas @ $5.09 per gallon, Ethanol Gas @ $4.50 per gallon, Diesel #1 Dyed Premium @ $NA, and Diesel #2 Dyed Premium @ $4.79 per gallon. Motion to accept by Cable, seconded by Loudner. Motion carried by all voting ayes. Swanson then gave his monthly update to the commissioners. No action taken.

County Courthouse Assistant/Weed Supervisor Lee Sinkie gave his monthly update report to the commissioners. Sinkie gave his monthly Weed Supervisor report. No action taken.

Auditor/Register of Deeds Debra Morrison gave her monthly reports. There was one Notice of Hospitalization. Monthly End account with Treasurer (SDCL 7-10-3) reflected Cash on Hand: $400; C.D.: $200,000; Bank Balance: $2,064,016.54.

2022 Canvas Primary Election Ballots were read and signed off by Commissioners.
At this time, the board met to canvass the 2022 Primary Election held Tuesday, June 7th. Debra Morrison, Auditor, was present will be held on July 5, 2022, at 1:00pm. for the canvass results.

United States Senator (Republican):	Precinct 1	Precinct 2	Precinct 3
John R. Thune	32	7	10
Bruce Whalen	4	3	7
Mark Mowry	3	1	0
United States Representative (Republican):			
Dusty Johnson	29	7	9
Taffy Howard	11	4	8

Governor (Republican):			
Steven Haugaard	2	4	1
Kristi Noem	37	6	16
Constitutional Amendment C (Nonpartisan):			
YES	26	3	26
NO	36	18	61

Total County-Wide Turnout:

Courthouse hours have changed. Monday-Friday 8:00am-4:00pm.

Court Appointed Special Advocate (CASA) email was read requesting funds. Commissioners declined funding at this time. No action taken.

Discussed Avera Occupational Medicine – Random Drug and Alcohol Testing and who should be included in the testing. No action taken.

Executive session was entered into session for personal reasoning at 1:55pm. Motion to accept by Cable, seconded by Loudner. Motion carried by all voting ayes. Exited Executive Session at 2:40pm. Motion to accept by Loudner, seconded by Cable. Motion carried by all voting ayes.

APPROVAL OF DISPERSEMENTS (Payroll SDSL 6-1-10):

Commissioner, salary $400.00	Commissioner, salary $400.00
Commissioner, salary $400.00	Auditor/Register of Deeds, salary $3,333.33
Treasurer, salary $3,500.00	Director of Equalization, salary $3,333.33
States Attorney, salary $3,269.25	Sheriff, salary $3,977.60
Highway Superintendent, salary $4,666.67	Highway Assistant, hourly, $387.60
Courthouse Assistant, hourly $1,600.00	Weed Supervisor, $250.00
Office Assistant, hourly $600.00	Wellmark, group insurance $6,318.60
Aflac $550.62	Optilegra, group insurance $18.46
Quoin Bank $5,846.48	

APPROVAL OF DISPERSEMENTS (Election School, HAVA workers, Election School)

Wahinapa Charging Hawk, $389.00	Danielle Kirkie, 284.00
Rose Ducheneau, $281.00	Carol Grabin, $245.00
Julianne Blaine, $260.00	Kathy Yost, $234.32
Bonnie Koch, $245.00	Mariah Sazue, $924.50
Tamra Merrit, $272.72	Linda Ness, $51.30
Kathleen Pickner, $292.40	Shirley Drapeau, $50.00
Karen Sinkie, $45.00	Richard Sinkie, $53.40
Evelyn Wulff, $46.68	Yvette Isburg, 2,837.58

APPROVAL OF DISPERSEMENTS

Andrea Gunner, $722.00
Brooks Hardware $ Auto, $7.98
C&B Operations, LLC, $460.51
C&S Truck Sales and Salvage, $26.13
Central Electric, $452.58
Connecting Point, 312.50
Dacotah Diamond Elections, $250.00
Doug Barnett, $319.60 (void)
DS Solutions, $175.00
Election System $ Software, $810.00
Independent Viking Glass, $6688.50
Kimball Midwest, $179.28
Menards, $117.04
Microfilm Imaging, $312.00
Chamberlain NAPA, $71.19
Platte Implement, $624.51
Department of Revenue, $16688.01
SD Department Labor and Regulation, $35.35
SeaChange, $185.00
Lowell Swanson, $50.00
Total Oil, $5,882.06
Brooks Hardware & Auto, $193.46
Brule County Treasurer, $3,524.71
C&B Operations, LLC, $199.04
Central Dakota Times, $440.12
Chamberlain Variety, $79.99
Cozine Electric, Inc., $738.13
Double Tree Conference Center, $404.13 (void)
Doug Barnett, $4,916.00
Econo-Sign, $230.68
Heiman Fire Equipment, $125.00
Jerauld County, $5900.75
Marco, $98.00
Midstate, $607.31
Debra Morrison, $80.22
Overweg Repair, LLC, $461.92
Quill, $909.93
State of SD, BIT, $6.25
Modernization $ Preservation, $63.00
Lee Sinkie, $68.46
T-Mobile (scale), $15.00
Maxine Risty, $319.60

Buffalo County Pre-Disaster Mitigation (PDM) Plan will be held on July 5, 2022, at 12:30pm.

Motion to adjourn made by Loudner; seconded by Cable. Motion carried by all voting ayes.

Attested:

Debra L. Morrison
Buffalo County Auditor

Approved:

Lloyd Lutter, Chairman
Buffalo County Commissioner

CROW CREEK TRIBE MINUTES

APPENDIX C: History of Previous Hazard Occurrences

This appendix provides details about hazard events that have impacted Buffalo County and the Crow Creek Reservation in the past. **Table C.1** below lists all of the events since 1970 that resulted in a major disaster declaration in which Buffalo County was part of the designated area. Records from FEMA were consulted for federal assistance provided to Buffalo County and the Crow Creek Tribe following each disaster through FEMA's Public Assistance program.

Table C.1 – Major Disaster Declarations Affecting Buffalo County

Dec #	Date Disaster Declared	Type	Primary Damage Impact	Public Assistance To Buffalo County	Public Assistance To Crow Creek Tribe
257	Apr 1969	Flooding			
948	Jul 1992	Severe Storms, Tornadoes			
1045	Mar 1995	Severe Winter Storm			
1052	May 1995	Flooding			
1075	Jan 1996	Severe Winter Storm			
1156	Jan 1997	Severe Winter Storm			
1173	Apr 1997	Severe Flooding			
1375	May 2001	Severe Winter Storm		≈$10,000	
1702	May 2007	Severe Storms, Tornadoes		≈$55,000	
1774	Jul 2008	Severe Storms and Flooding	Roads, bridges	≈$85,000	
1887	Mar 2010	Severe Winter Storm	Utilities	≈$55,000	
1915	May 2010	Flooding	Roads, bridges	≈$45,000	≈$2,000
1984	May 2011	Flooding	Roads	≈$45,000	
4233	Jul 2015	Severe Storms, Tornadoes	Roads, bridges	≈$85,000	≈$455,000
4440	Jun 2019	Severe winter storms; Flooding	Roads, bridges	≈$17,000	

Sources: www.fema.gov/disasters/grid/state-tribal-government/72; www.fema.gov/data-feeds/openfema-dataset-public-assistance-funded-projects-summaries-v1

Table C.2 is a comprehensive list of the most significant hazard events from 1960 through 2020 reported for Buffalo County and those parts of Hughes and Hyde Counties included within the Crow Creek Reservation. The list is taken from the National Climatic Data Center's Storm Events Database, which is based off storm data from the National Weather Service, which in turn gets its information from a variety of sources, including county, state and federal emergency management officials, local law enforcement officials, National Weather Service damage surveys, the insurance industry, and the general public.

The Storm Events Database is useful, but it does have limitations. One problem is that records for certain hazard events, including winter storms and blizzards, only go back to the 1990s.

Another issue is that damage amounts in most cases are estimates, especially for events that impacted multiple counties. Also note that the database contains a preponderance of records from recent times. This is due to an inconsistency in data reporting over the years, and does not indicate an increase in the frequency of events affecting the county.

The table includes the following information about the events:

- Date - multiple events may be shown for a single day because a storm system may contain many specific storm events affecting different locations.
- Type of event.
- Descriptive information - details are provided for some of the more noteworthy events back to the 1990s.
- Magnitude - the magnitude of tornadoes, hail, thunderstorm winds, and high wind events is given. For events occurring since 2000 the speed is represented by either the highest measured wind gust (M) or the highest estimated wind gust (E). Note that speeds are shown in knots - multiply figure by 1.15 to get approximate speed in miles per hour.
- Property and crop damage - the National Weather Service uses all available data from the sources identified above in compiling the damage amounts, but the figures should be considered as broad estimates. In many cases, damage amounts are unknown.

Table C.2 – Significant Hazard Events in Buffalo County and the Crow Creek Reservation

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
5/8/1965	Tornado	Two injuries occurred.			
5/5/1969	Hail		1.75 in.		
7/3/1971	Tornado		F0	25	
5/24/1972	Tornado		F0		
7/3/1973	Hail		1.75 in.		
5/19/1974	Thunderstorm Wind				
6/20/1975	Thunderstorm Wind		69 kts.		
5/16/1977	Hail		0.75 in.		
8/27/1979	Hail		1.00 in.		
5/20/1982	Tornado		F1		
7/12/1984	Hail		0.75 in.		
5/28/1985	Tornado		F0		
8/21/1985	Hail		1.75 in.		
8/29/1985	Hail		1.75 in.		
8/29/1985	Hail		1.75 in.		
7/25/1986	Hail		2.75 in.		

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
7/28/1986	Hail		4.00 in.		
7/6/1987	Tornado		F0		
7/6/1987	Tornado		F0		
7/6/1987	Hail		2.75 in.		
7/6/1987	Hail		2.50 in.		
7/6/1987	Thunderstorm Wind		60 kts.		
7/6/1987	Tornado		F0		
7/6/1987	Tornado		F0		
7/6/1987	Tornado		F0		
5/25/1988	Hail		1.75 in.		
7/23/1988	Tornado	The tornado touched down approximately one mile west of Stephan. No damage was reported.	F0		
6/16/1992	Tornado	Eight injuries occurred.	F3	25,000	
6/16/1992	Hail		2.75 in.		
1/17/1996	Blizzard	A blizzard spread across the area from the west. Snow 3 to 12 inches deep was accompanied by 50 to 60 mph winds and very cold temperatures. The wind chill dropped to around -70. Roads and many businesses and schools were shut down. The total destruction of at least 3 homes by fire was due in part to the inability of firefighters to travel across blocked roads. Several accidents occurred and other vehicles slid into ditches or became stranded.			
1/24/1996	Heavy Snow				
1/28/1996	Extreme cold				
2/1/1996	Extreme cold				
2/10/1996	High Wind		57 kts.		
2/26/1996	Heavy Snow	Five inches of snow was recorded near Stephan. Along with the snow came strong cold north winds of 15 to 30 mph, creating near blizzard conditions at times. Wind chills were 20 below to 40 below.			
3/24/1996	Blizzard	Snow accumulating 3 to 8 inches was accompanied by winds over 50 mph at times, producing widespread whiteout conditions. Numerous vehicles slid into ditches and many people were stranded in vehicles. There were some rollovers and other accidents.			
4/24/1996	High Wind		56 kts.		
4/25/1996	High Wind		60 kts.		
10/29/1996	High Wind		58 kts.		
11/16/1996	Heavy Snow				
11/19/1996	Winter Storm				
12/14/1996	Heavy Snow				
12/16/1996	Blizzard				
1/3/1997	Winter Storm				
1/9/1997	Blizzard				

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
1/15/1997	Blizzard				
2/3/1997	Winter Storm				
3/21/1997	Flood				
4/1/1997	Flood				
4/4/1997	Blizzard				
5/1/1997	Flood				
6/19/1997	Hail		1.75 in.		
3/6/1998	Heavy Snow	Six inches of snow was recorded at Stephan.			
6/10/1998	Hail		1.75 in.		
6/10/1998	Flash Flood	Two to 3 inches of rain falling in a short time period caused flash flooding on Crow Creek southwest of Gann Valley. Some dams and roads were washed out.			
7/5/1998	Thunderstorm Wind		65 kts.		
11/9/1998	Blizzard				
5/6/1999	High Wind		50 kts.		
5/9/1999	Thunderstorm Wind		70 kts.		
6/5/1999	Thunderstorm Wind		61 kts.		
7/15/1999	Thunderstorm Wind		71 kts.		
4/5/2000	High Wind		52 kts. E		
4/19/2000	High Wind		50 kts. E		
6/14/2000	High Wind		52 kts. E		
11/7/2000	Blizzard				
11/11/2000	Winter Storm				
12/16/2000	Blizzard				
12/28/2000	Blizzard				
1/13/2001	Heavy Snow				
1/29/2001	Winter Storm				
2/7/2001	Winter Storm				
2/24/2001	Winter Storm				
4/22/2001	Winter Storm				
11/26/2001	Winter Storm				
2/11/2002	High Wind		53 kts. E		
3/14/2002	Winter Storm				
4/23/2002	High Wind		50 kts. E		
6/1/2002	Drought				
6/22/2002	Thunderstorm Wind	Occurred 3 miles SE of Stephan.	56 kts.		
8/8/2002	Hail	Occurred 2 miles NW of Stephan.	1.75 in.		
8/17/2002	High Wind		50 kts. E		

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
1/15/2003	Heavy Snow				
11/3/2003	Heavy Snow				
5/19/2004	Hail	Occurred 1 mile NE of Stephan.	1.75 in.		
8/1/2004	Thunderstorm Wind		61 kts. E		
8/3/2004	Thunderstorm Wind		70 kts. E		
3/10/2005	High Wind		50 kts. E		
6/6/2005	Thunderstorm Wind		61 kts. E		
9/18/2005	Hail		1.75 in.		
9/18/2005	Hail		1.50 in.		
11/8/2005	High Wind		52 kts. M		
11/27/2005	Blizzard				
3/20/2006	Winter Storm				
6/1/2006	Drought				
7/1/2006	Drought				
7/15/2006	Excessive Heat				
7/28/2006	Excessive Heat				
8/1/2006	Drought				
9/1/2006	Drought				
12/30/2006	Heavy Snow				
1/8/2007	High Wind		50 kts. E		
3/2/2007	Blizzard				
4/3/2007	Extreme cold				
5/5/2007	Flash Flood				
5/6/2007	Flood				
6/12/2007	Flash Flood				
6/21/2007	Hail		1.75 in.		
6/21/2007	Tornado	A funnel cloud was spotted 7 miles north of Stephan.	EF0		
1/29/2008	Extreme cold				
4/10/2008	Blizzard				
4/25/2008	Winter Storm				
11/6/2008	Blizzard				
12/13/2008	Blizzard				
12/14/2008	Extreme cold				
12/21/2008	Extreme cold				
1/11/2009	Blizzard				
3/30/2009	Blizzard	A major winter storm moved across the Northern Rockies and into the Northern Plains producing from 2 to 22 inches of snowfall along with widespread blizzard conditions. Most area			

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
		schools and events were canceled. Travel was extremely difficult and not advised.			
4/4/2009	Winter Storm				
7/14/2009	Flash Flood				
12/23/2009	Blizzard	Prolonged snowfall produced heavy accumulations over southeast South Dakota, ranging up to over 20 inches in several areas. The snowfall took place from two days before to the day after Christmas. The snowfall was accompanied by increasing north to northwest winds which caused widespread blizzard conditions on Christmas day and the start of the next day.			
1/6/2010	Blizzard				
1/7/2010	Extreme cold	Persistent north/northwest winds combined with very cold air to produce wind chill values that dropped to 35 below zero.			
1/22/2010	Winter Storm				
5/24/2010	Hail		1.75 in.		
5/31/2010	Hail		1.25 in.		
6/10/2010	Hail		1.75 in.		
6/23/2010	Flash Flood	A two-hundred foot section of road near Gann Valley was washed out due to flash flooding. A few county roads were flooded for a few hours north of Stephan.		25	
7/3/2010	Thunderstorm Wind		61 kts. E		
12/30/2010	Blizzard				
12/31/2010	Blizzard	Snowfall of 6 to 10 inches and winds gusting to over 40 mph produced widespread blizzard conditions. Roads were closed and many businesses were forced to close as travel became difficult to impossible.			
1/1/2011	Blizzard				
2/2/2011	Extreme cold	North/northwest winds averaging 15 to 30 mph combined with temperatures dropping below zero to produce wind chills of 35 to 40 below zero.			
2/20/2011	Blizzard				
3/15/2011	Flood	Deep and expansive snow pack across the area began to melt, causing widespread flooding in central and northeast South Dakota beginning in mid March. Many roads, along with countless acres of crop and pastureland, were flooded. Roads, culverts, and bridges were damaged across the region, and many roads were washed out or closed. Many homes were threatened, with some surrounded by water. The damage estimates were from 4.5 to 5 million dollars for the area.			
4/1/2011	Flood	Snowmelt flooding continued across much of central South Dakota as the rest of the snowpack melted into early April. Total damage estimates were from 4.5 to 5 million dollars for the area. The flooding diminished starting in May.			
4/14/2011	Winter Storm				
4/30/2011	High Wind		52 kts. E		
6/20/2011	Flash Flood	Very heavy rains of up to 7 inches brought flash flooding across Buffalo County. BIA Highway 4 was closed from Highway 50 to Fort Thompson. Several roads were washed out. Some evacuations took place. Several homes were also flooded near the casino.			
6/20/2011	Flood				

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
7/15/2011	Excessive Heat				
9/20/2011	High Wind		50 kts. E		
2/23/2012	Heavy Snow				
2/29/2012	Blizzard				
4/15/2012	High Wind		50 kts. E		
6/13/2012	Hail		1.75 in.		
6/13/2012	Hail		1.75 in.		
7/12/2012	Hail		1.25 in.		
7/20/2012	Hail		1.50 in.		
7/24/2012	Drought				
8/1/2012	Drought	Drought was generally listed as severe to extreme for the area, and was being compared to the worst of the dust bowl years, though not yet over as long a time period. Stress on crops continued, even though August was less hot than July. Crop damage was quite evident. Many local governments had water use restrictions in place.			
9/1/2012	Drought	Drought conditions continued over all of southeast South Dakota. Rainfall for the month varied from around half to less than a quarter of normal. Stress on crops that prevailed over the growing season became even more evident with the start of harvest. Local governments continued to use water use restrictions in an effort to prevent serious water supply problems.			
10/18/2012	High Wind		53 kts. M		
11/1/2012	Drought	Drought conditions continued over all of southeast South Dakota in November.			
12/1/2012	Drought	Drought conditions continued over all of southeast South Dakota in December. Although precipitation was generally normal to above normal, the amount of excess over the low winter normals was not enough to relieve the dry conditions. The effects of the drought on farmers and ranchers continued. Hunting was also affected, with low pheasant numbers, and disease in the deer population.			
12/8/2012	Winter Storm				
1/1/2013	Drought				
2/1/2013	Drought				
2/10/2013	Blizzard	Variable snowfall of 2 to 8 inches, northwest winds gusting to 45 mph, and snow cover existing before the storm in part of the area, produced blizzard conditions with visibilities below a quarter mile in blowing snow in many areas. The low visibilities and drifting snow forced some businesses to close, and also forced several school closings on Monday February 11th.			
3/1/2013	Drought				
4/1/2013	Drought				
4/8/2013	Winter Storm				
5/1/2013	Drought				
12/3/2013	Winter Storm	Snow, heavy in areas, accumulated up to 8 inches from the evening of December 3rd through the afternoon of December			

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
		4th. Difficult travel conditions forced delayed openings or early closings of some schools and businesses on December 4th.			
12/6/2013	Extreme cold				
12/7/2013	Extreme cold				
1/5/2014	Extreme cold				
1/16/2014	High Wind		52 kts. E		
1/26/2014	High Wind		52 kts. E		
3/1/2014	Extreme cold				
3/31/2014	Blizzard				
6/18/2014	Tornado	A tornado developed in Buffalo county and grew in size to a quarter mile wide as it tracked northeast for two miles before dissipating. It then touched down east of Stephan damaging two homes. As the tornado continued north, a tree grove suffered extensive damage with numerous trees being topped and large branches broken off.	EF1		
6/18/2014	Thunderstorm Wind		52 kts. E		
3/3/2015	Blizzard				
6/20/2015	Thunderstorm Wind	One-hundred mph winds or higher destroyed several homes, flipped many campers, and downed power lines and trees. Several trees fell onto homes. One man died in a trailer home that was flipped.	87 kts. EG		
6/20/2015	Thunderstorm Wind		87 kts. EG		
7/1/2015	Hail	Large hail near Stephan damaged crops and caused cattle to stampede.	1.25 in.		
8/9/2015	Hail		1.00 in.		
10/12/2015	High Wind		52 kts. EG		
11/18/2015	High Wind		52 kts. EG		
11/30/2015	Heavy Snow				
12/25/2015	Winter Storm				
1/17/2016	Extreme Cold				
2/19/2016	High Wind		54 kts. MG		
5/26/2016	Hail		1.00 in.		
7/6/2016	Thunderstorm Wind		56 kts. EG		
7/16/2016	Thunderstorm Wind		52 kts. MG		
7/19/2016	Excessive Heat				
8/4/2016	Thunderstorm Wind		55 kts. MG		
12/16/2016	Heavy Snow				
12/18/2016	Extreme Cold				
12/25/2016	High Wind		52 kts. MG		
1/24/2017	Heavy Snow				
6/6/2017	Drought				
6/11/2017	Hail		1.00 in.		

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
6/13/2017	Hail		1.00 in.		
6/22/2017	Thunderstorm Wind		52 kts. EG		
7/1/2017	Drought				
7/4/2017	Thunderstorm Wind		70 kts. EG		
8/1/2017	Drought				
9/1/2017	Drought				
12/4/2017	Blizzard				
12/26/2017	Extreme Cold				
12/30/2017	Extreme Cold				
2/8/2018	Heavy Snow				
2/18/2018	Heavy Snow				
3/5/2018	Blizzard				
3/16/2018	Winter Storm				
4/13/2018	Blizzard	Life threatening conditions developed, as a mix of rain, sleet and snow changed to all snow. Brutal winds gusting as high as 40 mph whipped visibility to less than a quarter mile at times. Businesses and schools were closed. Travel was not recommended for a two day period. Total snowfall of 14 inches was measured at Gann Valley.			
6/5/2018	High Wind		52 kts. MG		
6/27/2018	Thunderstorm Wind		54 kts. MG		
1/27/2019	High Wind		56 kts. EG		
3/2/2019	Extreme Cold				
3/13/2019	Blizzard				
4/11/2019	Blizzard				
3/25/2019	Flood				
4/1/2019	Flood	The continuation of snowmelt from a much above normal snowfall winter combined with a historic heavy snow/blizzard in mid-April resulted in widespread flooding across central South Dakota. Countless roads along with thousands of acres of cropland were flooded throughout April. Impacts include damaged roads, culverts, and bridges, and livestock, homes, and businesses were affected. Delayed planting resulted across all of the region as well. Cattle and calves were stressed by the cold and wet pattern, as the mud and cold caused some sickness with the livestock. Flooded roads made it difficult for many farmers or ranchers to get to their fields or livestock. The wet pattern along with the flooding continued into May, further delaying planting across the region		17	
5/1/2019	Flood				
6/1/2019	Flood	Spring snowmelt and heavy rain flooding from March, April, and May continued into June, which combined with above normal June rainfall resulted in thousands of acres of crops damaged or unplanted across central and northeast South Dakota.			984
7/17/2019	Thunderstorm Wind		56 kts. MG		
7/20/2019	Thunderstorm Wind		56 kts. MG		

Date	Event Type	Event Description	Mag	Prop Damage ($1,000s)	Crop Damage ($1,000s)
7/21/2019	Funnel Cloud				
11/29/2019	Winter Storm				
12/1/2019	Winter Storm				
1/17/2020	Blizzard				
2/12/2020	Blizzard				
6/17/2020	Thunderstorm Wind		56 kts. MG		
6/20/2020	Thunderstorm Wind		61 kts. EG		
6/25/2020	Hail		1.00 in.		
7/5/2020	Thunderstorm Wind		63 kts. MG		
8/8/2020	Thunderstorm Wind		67 kts. MG		
8/30/2020	Hail		1.00 in.		
10/31/2020	High Wind		51 kts. MG		

Source: National Climatic Data Center's Storm Events Database

APPENDIX D: Community Assets

Following is a list of important community facilities and assets within the county, including those that would play a critical role in helping the community prepare for and respond to a hazard event. Sites with significant cultural and/or sacred importance to the Crow Creek Tribe are included here (the sites are not shown on the maps for this plan, as the information is considered to be sensitive).

Government Offices

- Buffalo County Courthouse, Gann Valley
- Crow Creek Tribal administration building, Fort Thompson
- U.S. Army Corps of Engineers, Fort Thompson

Emergency Response

- Buffalo County Emergency Management Office, Chamberlain
- Crow Creek Emergency Management Office, Fort Thompson
- Fort Thompson Fire Department
- Gann Valley Fire Department

Medical facilities

- Indian Health Service clinic, Fort Thompson

Educational Facilities

- Crow Creek Tribal School, Stephan

Important Businesses

- Lode Star Casino, Fort Thompson

Cultural/Sacred Sites

- Fort Thompson Archeological District, Fort Thompson (12,850 acres)
- Fort Thompson Mounds, Fort Thompson (50 structures, 191 acres)
- Talking Crow Archeological Site, Fort Thompson (123 acres)
- Archeological Site, near Stephan

Shelters

- Disaster relief shelters are located in Fort Thompson, Gann Valley, and Stephan (see page 19).
- Public facilities that can provide emergency shelter from severe weather are located in Fort Thompson, Gann Valley, and Stephan (see page 22).

Notification

- Warning sirens are located in Fort Thompson, Big Bend, Crow Creek, and Stephan.

APPENDIX E: References

PRINT REFERENCES

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- Buffalo County Hazardous Materials Plan. Planning & Development District III. 2003.
- Central Electric Cooperative Construction Work Plan.
- Emergency Action Plan, Big Bend Dam, Fort Thompson, South Dakota. U.S. Army Corps of Engineers, Omaha District. 2010.
- Big Bend Dam Inundation Study. U.S. Army Corps of Engineers, Omaha District. Jan 2015.
- Flood Repairs at Missouri River Mainstem Dam Projects & Bank Stabilization along the Missouri River. U.S. Army Corps of Engineers. Sept 2013.
- Electrical Transmission and Distribution Mitigation: Loss Avoidance Study Nebraska and Kansas FEMA-1674-DR-KS and FEMA-1675-DR-NE. Federal Emergency Management Agency. 2008.
- Local Mitigation Planning Handbook. FEMA. March 2013.
- Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. FEMA. January 2013.
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- South Dakota Drought Mitigation Plan. South Dakota Drought Task Force/South Dakota Office of Emergency Management. 2015.
- South Dakota's Five-Year Floodplain Management Work Plan. South Dakota Office of Emergency Management. 2005.
- South Dakota Electric Cooperatives Mutual Aid Plan. South Dakota Rural Electric Association. 2008.

ELECTRONIC REFERENCES

- Census data: data.census.gov/cedsci/profile
- Land cover information: www.mrlc.gov/index.php
- Climate extremes: www.weather.gov/fsd/climatearchive
- Major disaster declarations and emergency declarations in South Dakota: www.fema.gov/disasters/grid/state-tribal-government/
- Public assistance amounts following declared disasters: www.fema.gov/data-feeds/openfema-dataset-public-assistance-funded-projects-summaries-v1
- Storm event records: www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=46,SOUTHDAKOTA
- Crop loss records: www.rma.usda.gov/data/cause.html
- Flood insurance information: www.fema.gov/policy-claim-statistics-flood-insurance
- National Flood Insurance Program participation: www.fema.gov/cis/SD.html
- Flood risk: floodfactor.com
- 2019 flooding impact: fb.org/market-intel/prevent-plantings-set-record-in-2019-at-20-million-acres
- Drought impact: droughtreporter.unl.edu/map/
- Wildfire vulnerability: silvis.forest.wisc.edu/data/wui-change/
- Earthquake history in South Dakota: www.sdgs.usd.edu/publications/maps/earthquakes/earthquakes.htm
- Earthquake magnitude: en.wikipedia.org/wiki/Richter_magnitude_scale
- Landslide information: landslides.usgs.gov/hazards/nationalmap/
- Social vulnerability: artsandsciences.sc.edu/geog/hvri/sovi%C2%AE-0