STATE OF SOUTH DAKOTA

HAZARD MITIGATION PLAN

STANDARD PLAN

April 2014

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SOUTH DAKOTA HAZARD MITIGATION TEAM

AS DIRECTED BY:
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SUBMITTED TO:

FEMA

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Commonly Used Acronyms and Abbreviations

CDBG	Community Development Block Grants
DENR	South Dakota Department of Environment and Natural Resources
DMA 2000	Disaster Mitigation Act of 2000
SDDA	South Dakota Department of Agriculture
EMPG	Emergency Management Performance Grants
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
FMA	Flood Mitigation Assistance
GF&P	South Dakota Game, Fish and Parks
HMGP	Hazard Mitigation Grant Program
PDM	Pre-Disaster Mitigation Grant Program
REA	Rural Electric Association
REC	Rural Electric Cooperatives
SDOEM	South Dakota Office of Emergency Management
SHMT	State Hazard Mitigation Team
SHSGP	State Homeland Security Grant Program
USCOE	United States Corps of Engineers
USDA	United Stated Department of Agriculture
USFS	United States Forest Service

MISSION STATEMENT

The SHMT validated the following Mission Statement for the State's overall mitigation planning efforts at the SHMT / Silver Jackets mitigation planning workshop on March 14, 2013.

To reduce the impacts to
life and property from hazards
through a long term sustainable
statewide mitigation strategy
while maintaining economic vitality.

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EXECUTIVE SUMMARY

Introduction
This plan is an update of the 2011 State Multi-Hazard Mitigation Plan pursuant to the Disaster Mitigation Act of 2000 as implemented by Interim Final Rule (44 CFR Part 201) published in the Federal Register on February 26, 2002 and two Mitigation Planning Final Rules published October 31, 2007 and September 16, 2009.

This plan update is in compliance with the latest State Multi-Hazard Mitigation Planning Guidance (July 9, 2008). This plan demonstrates the State's current and future mitigation actions in an organized fashion similar to the guidance materials provided by FEMA. Section 1 demonstrates the legal authority of this plan through the Governor's adoption. Section 2 documents the planning process for developing this plan, including coordination with local mitigation planning efforts. Section 3 outlines the identified hazards South Dakota is vulnerable to and assesses the risk for each hazard on a per county basis. Section 4 details the State's mitigation strategy based on the local and state vulnerability analyses and risk assessments. Section 5 describes how the State provides funding to local governments as well as how the local assistance and project grants are prioritized. Section 6 outlines the plan maintenance process. Each section includes details on how this 2014 plan was updated from the previous 2011 plan.

Section 1 Prerequisites
The State Hazard Mitigation Team, led by the director of the South Dakota Office of Emergency Management and charged by the governor with the responsibility of implementing a statewide Hazard Mitigation Program based upon Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended), recommended that this 2014 revised and updated Multi-Hazard Mitigation Plan be adopted by the governor. Governor Dennis Daugard adopted the revised and updated 2014 State plan per the enclosed letter.

Section 2 Planning Process
On April 4, 2007, Governor M. Michael Rounds signed Executive Order 2007-07 confirming the South Dakota Hazard Mitigation Team and authorizing this team to function in compliance with the responsibilities specified in the order. The core leadership of the State Hazard Mitigation Team consists of one representative from each of the departments and offices listed in the executive order and in Table 2-1. The 2014 update planning process involved one milestone workshop of the State Hazard Mitigation Team in collaboration with the South Dakota Silver Jackets, opportunities for public input, many conference calls among team members and the contracted consulting staff, as well as, communication via e-mail and digital data sharing for review of draft materials. A summary of the meetings and collaboration is presented in Table 2-2 Summary of Planning Process.

Participants
The formation of the State Hazard Mitigation Team (SHMT) provided a convenient vehicle for coordinating the plan update with relevant state agencies. Additionally, South Dakota recently formed the Silver Jackets which includes representation from pertinent Federal Agencies interested and willing to assist with risk reduction activities. Each member of the SHMT and Silver Jackets were asked to contribute to the mitigation capabilities assessment. They also participated in the development of the updated mitigation strategy based on the updated hazard risk assessment. In addition, the Rural Electric Association remained a collaborative partner in updating this plan.

It is the State Hazard Mitigation Officer's (SHMO) responsibility to work with the local entities and support their mitigation planning efforts. Local representatives in addition to members of the public were invited to participate in the online survey, as described in Section 2.1.3- Stakeholder Involvement and given an opportunity to review and comment on the complete draft plan.

Section 3 Risk Assessment

Based on past disaster history and population and property potentially at risk (numbers and dollars), the following hazards have emerged as the greatest concern statewide and are profiled in detail in this plan. The hazard ranking was based on the overall probability and impact on the state as a whole. When examining each region of the state, the same ranking may not always apply. Section 3 details the process for developing the 2014 revised hazard prioritization and Table 0-1 presents a summary of the results. The terms "significant", "moderate", and "limited" relate to the level of planning analysis given to the particular hazard in the risk assessment process and are not meant to suggest the level of impact expected from each hazard.

Table 0-1: Hazard Ranking and Planning Consideration

Hazard Type and Ranking	Planning Consideration Based on Hazard Level
Flooding (flash, long-rain, snowmelt, and dam or levee failure)	Significant
Winter Storms	Significant
Wildfires	Significant
Drought	Significant
Tornadoes	Moderate
Wind	Moderate
Agricultural Pests and Diseases	Moderate
Hazardous Materials	Moderate
Geological Hazards (Landslide, Mudflow, Expansive Soils, Earthquake)	Limited

Using the hazard ranking and planning consideration, hazard profiles and vulnerability assessments were updated for each hazard. Vulnerability was measured using relevant factors and available data regarding past events, current development (buildings), population, and previous damage. This allows the State to review the variation of hazard vulnerability by County on a scale of "Very High", "High", and "Moderate" vulnerability.

Agricultural Pests and Diseases Hazard Summary

Agricultural hazards are divided into two categories: pests and diseases. For this plan, such events are defined as the naturally occurring infection of crops or livestock with insects, vermin, or diseases that render the crops or livestock unfit for consumption, sale or other use. South Dakota has a substantial agricultural industry and a significant infrastructure composed of related facilities and locations, so the potential for infestation of crops or livestock pose a significant risk to the economy of the state. The annual probability of occurrence for the state is 100 percent. The western portion of the state has a higher documented occurrence rate of trich and stem nematode afflictions of alfalfa crops. Counties along the river basins bore the brunt of the anthrax outbreaks in 2005. Eastern counties have higher documented rates of soybean cyst nematode, frogeye leaf spot, scab, and West Nile Virus in domestic fowl flocks. Areas with a primarily cultivated crop land use are more susceptible to crop diseases, and thus have a predicted higher probability rating than areas devoted to rangeland. Areas where wildlife interaction is more common among livestock have higher exposure probabilities to diseases like rabies and brucellosis. Recent events include several counties receiving a USDA disaster designation for losses related to insects and disease and indemnities for crop loss related to insects.

Flood Hazard Summary
FEMA flood studies provide mapping and detailed flood information for floodplains where the water body has a one percent chance of occurrence in any given year in identified special flood hazard areas (SFHAs). Smaller and more frequent damaging events occur in the state on an annual basis. Nearly every county in South Dakota is vulnerable to floods. Potential losses are highest in Minnehaha, Union, Yankton, Pennington, Codington, Lawrence and Brown counties. Floods in these counties have the potential to displace at least a thousand persons in each county. Statewide there is the potential for $1.7 billion in flood losses from the 1% annual chance flood.

Winter Storm Hazard Summary
According to the National Climatic Data Center, there were 1,042 winter storms (snow and ice events) in South Dakota between January 1993 and October 2012, and 82 extreme cold events from January 1994 to October 2012. Total property damage for these events is estimated at $130.5 million. This suggests that South Dakota experiences 55 winter storm events and $6.9 million in winter storm losses annually, as well as 4.3 extreme cold events each year. 12 deaths and 127 injuries were attributed to these events. This suggests that South Dakota can expect approximately 1 death every other year and 6 injuries each year. Based on this information, the probability that at least one winter storm will occur in South Dakota in any given year is 100 percent.

Wildfire Hazard Summary
Prior to 2010, years of drought along with extremely low percentages of normal snowpack in the Black Hills created the potential for catastrophic wildfires in South Dakota. 2011 was a wet year, but dry conditions and thus wildfire risk returned in 2012. Compounding this situation is the impact of the mountain pine beetle on pine trees in South Dakota. Most of the fire occurrence and corresponding acres burned in the Black Hills occur in Custer and Fall River Counties. There is a 100% chance that a large fire of 1,000 acres or more will occur in South Dakota in any given year. Smaller fires also have a 100% annual occurrence probability.

Drought Hazard Summary
The whole state of South Dakota is susceptible to drought, but there is a difference in how. Drought in the eastern part of the state is largely an issue for row crops. Water availability in Sioux Falls, and other areas that get their water from the Big Sioux River, is also becoming an issue as population grows. In the west, the concern is the need for water for people and rangeland. Rapid City, in the Black Hills, is also experiencing water availability issues related to growth that is exacerbated by years of below average rain and snowfall. Periods of drought can vary region by region in terms of length and severity. According to the U.S. Drought Monitor, South Dakota remains in a drought as of February 2013. The National Weather Service's Climate Prediction Center expects the drought to show some improvement in the northeastern half of the State between February 7, 2013 and April 30, 2013. Drought conditions are expected to persist in the southwestern half of the State. In 2012, the State received $838,876,036 for crop loss due to drought and $47,640,782 due to heat, for a total of $886,516,818. This contrasts sharply with the indemnity payments in 2011 and 2010, both of which were wet years.

Tornado Hazard Summary

According to the National Climatic Data Center (NCDC) Storm Events database, there were 618 tornadoes in South Dakota between 1950 and October 2012 rated as an F1 or higher. Total property damage for these events is estimated at $680 million in 2012 dollars. There were 17 deaths and 443 injuries in this time period. This number increases to 18 deaths and 452 injuries if all tornado events, including those smaller than an F1, are recorded. This suggests that South Dakota experiences 10 tornadoes of F1 intensity or greater, $10,967,741 in damages, and seven injuries each year. While every county in South Dakota is vulnerable to tornadoes, based on prior events, building exposure, population density, and past tornado damage, Minnehaha, Lincoln, Brown, and Pennington counties have the highest vulnerability to tornadoes.

Wind Hazard Summary

According to the National Climatic Data Center Storm Events database, there were 7,077 windstorm events (6,401 thunderstorm wind, 670 high wind, and 6 strong wind events) in South Dakota between 1955 and October 2012. There were nine deaths and 132 injuries in this time period. Total property and crop damage for events between 1993 (when damage figures began being kept) and 2012 is estimated at $148,541,000 in 2012 dollars. This suggests that South Dakota could experience 124 wind events, $2,605,982 in wind losses, and approximately two injuries each year. Every county in South Dakota is vulnerable to windstorms but county risks vary. Minnehaha experiences very high vulnerability to windstorms, while Pennington and Meade have a high vulnerability. The remaining counties experience moderate vulnerability to windstorms.

Hazardous Materials Hazard Summary

- According to the U.S. Department of Transportation's (DOT) Hazardous Materials Information System, South Dakota experienced 760 transportation incidents involving hazardous materials between 1971 and 2012. The total cost of damage associated with these incidents was approximately $6,537,056. This suggests that South Dakota experiences 18 transportation incidents involving hazardous materials and $159,440 in related damage each year.

- According to the U.S. Department of Transportation's Office of Pipeline Safety, there were 42 pipeline incidents in South Dakota between 1983 and 2012 (29 years). Based on this information, the probability that at least one pipeline incident will occur in South Dakota annually is 100%.

- According to the U.S. Environmental Protection Agency's Toxic Resource Inventory, 5.9 million pounds of hazardous materials were disposed of or released in South Dakota in 2011. Based on this information, there is a 100 percent probability that a fixed facility will dispose of or release a hazardous material in South Dakota each year.

Geologic Hazards Summary

Although historical landslide/mudflow/subsidence/expansive soil occurrence data is limited it can be assumed that landslides will occur occasionally in the future, typically during wet climate cycles or following heavy rains, but in limited areas of the state.

South Dakota seems to be relatively geologically stable based upon the sparse data available. However, there is potential for larger earthquakes than the magnitude 4.4 earthquake that struck the

Black Hills in 1964. The U.S. Geological Survey estimates this risk as only a 10 percent chance of exceeding a 5.1 magnitude in any one 50-year period. A HAZUS-MH annualized earthquake loss scenario was run for the entire state in the 2007 update to this plan. The results of this scenario indicate the counties with the highest building losses are Pennington ($110,000), Minnehaha ($59,000), and Lawrence ($26,000), with the remaining counties having $18,000 or less in annualized loss.

Growth and Development

Counties with growing populations and number of housing units have an increased vulnerability to hazards not defined by specific geographic areas. These hazards may include winter storms, tornadoes, wind, drought and earthquake.

Social Vulnerability

A Social Vulnerability Index (SVI) compiled by the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina measures the social vulnerability of U.S. counties to environmental hazards. The Index is based on national data sources, primarily the 2010 census, and synthesizes 30 socioeconomic variables that research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. The index can be used by the state to help determine where social vulnerability and exposure to hazards overlaps and how and where mitigation resources might best be used. South Dakota's most socially vulnerable counties are:

- Buffalo
- Todd
- Shannon*
- Jackson
- Mellette
- McPherson
- Bennett
- Ziebach
- Corson
- Fall River
- Dewey
- Charles Mix
- Bon Homme
- Roberts

*These counties are among the 10 fastest growing counties in the state. The counties of Potter, Faulk, Lyman, Gregory, Jerauld, Walworth, Douglas, Day, Hyde, Hutchinson, Tripp, Marshall, Perkins, Spink, and Edmunds also rank in the top 20 percent in the nation in terms of social vulnerability.

Building Exposure

HAZUS-MH Version 2.0 building inventory data provided the basis for measuring the number and value of buildings vulnerable to hazards. There are an estimated 406,141 buildings in South Dakota with a total building replacement value (excluding contents) of $79,488,700,000. Approximately 92 percent of the buildings (and 70 percent of the building value) are associated with residential housing. In terms of a catastrophic event, the entire building inventory could be at risk to a hazard.

State Owned Facilities

Flood

A GIS overlay analysis was performed to determine vulnerability of critical facilities to flooding. Both the latest available DFIRM (1% and 0.2% annual chance flood zones) and HAZUS-MH modeled base flood extents (in areas where DFIRM was not available) were used. The results of the 2013 analysis found 215 critical facilities potentially at risk to flooding, based on both HAZUS and DFIRM mapping. Limitations to this analysis include the number of counties with digital floodplains available, and the accuracy of the digital floodplains themselves, with the HAZUS-MH derived floodplains considered the less accurate of the two sources. This analysis does not consider if the building is elevated on fill or by other means, or flood proofed, since this detailed information is not available.

Wildfire
GIS was used to identify the critical facilities that lie within a high or moderate wildfire risk zone. A total of 481 facilities were identified statewide.

Tornadoes, Wind, Winter Storms
Eight counties were identified to have either 'very high' or 'high' vulnerability to one or more of these hazards. The number of facilities in four state facility GIS layers (State Layer, Power, Natural Gas, and Fuel) was quantified in each of these counties.

Section 4 Mitigation Strategies
Since the development of a State Hazard Mitigation Plan in 2004, South Dakota has achieved outstanding progress in reducing risk to natural hazards. Section 4.4 presents recent and overall progress accomplished through the framework of the five mitigation goals. These goals remain relevant from the 2011 Plan.

Goals:

- Reduce injuries and loss of life from natural hazards
- Reduce damage to existing and future structures within hazard areas
- Reduce the losses to critical facilities, utilities, and infrastructure from hazards
- Reduce impacts to the economy, the environment, and cultural resources from hazards
- Support and assist local / tribal mitigation capabilities and efforts

The goals are purposefully applicable to all of the identified hazards and intended to encompass all mitigation needs identified by the state as well as local communities. Many of the mitigation actions identified in the 2011 Plan remain ongoing. Section 4.8 presents the current ongoing and new mitigation actions as confirmed by the SHMT during the 2014 update process. The mitigation actions are listed in a matrix, organized by goal. The matrix includes an action number, the action priority, status, potential funding sources, the responsible department and space for noting progress as this plan is monitored.

Section 5 Local Mitigation Planning Coordination
Funding and technical assistance provided by SDOEM includes provision of funds, plan development assistance, technical assistance for developing risk assessments, G318 trainings for hazard mitigation planning, benefit/cost analysis training, and tribal planning assistance.

The State Hazard Mitigation Officer (SHMO) works with every county throughout the state to support their development of a local mitigation plan. Section 3.1 discusses the consideration of the hazards identified in the local plans. Section 4.7 discusses the common capabilities identified in the local plans. The estimated losses, where provided, were integrated into the Risk Assessment (Chapter 3 of this plan). Table 3-29 in Section 3.3 summarizes the growth and development trends identified in the local plans. The funding sources identified in the local plans are presented in Section 4.9.

The State will continue to prioritize assisting communities in maintaining FEMA approved local mitigation plans and implementing diverse mitigation projects. The information gathered in this plan is available to the local communities for use and consideration.

Section 6 Plan Maintenance Procedures
The SHMT and Silver Jackets meet regularly throughout the year and as needed following disaster events. They will review this Plan at least annually to make note of progress and items for update. With regard to implementing mitigation actions, SDOEM will continue to review applications for submittal for PDM grants. At every meeting of the SHMT, in determining funding awards, the team will review the identified priorities in comparison to the already funded projects and discuss overall mitigation progress. This will inform ongoing prioritization decisions for funding additional projects. Every three years, as required by DMA 2000, the State will submit an updated Hazard Mitigation Plan to FEMA for review and approval.

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INTRODUCTION

Purpose

The purpose of the State of South Dakota Multi-Hazard Mitigation Plan is:

1. To guide South Dakota's mitigation program to reduce the impact of or eliminate destructive effects of significant hazards to the state e.g., threats to life and property.
2. To serve as a public and private sector reference document and management tool for mitigation activities throughout South Dakota.
3. To meet the state planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Public Law 106-390, October 30, 2000 UNITED STATES CODE Title 42. THE PUBLIC HEALTH AND WELFARE CHAPTER 68. DISASTER RELIEF [As amended by Pub. L. 103-181, Pub. L. 103-337, and Pub. L. 106-390] (Pub. L. 106-390, October 30, 2000, 114 Stat. 15521575) hereafter referred to as the Disaster Mitigation Act of 2000 (DMA 2000).

FEMA published an Interim Final Rule (44 CFR Part 201) in the Federal Register on February 26, 2002 to implement the DMA 2000 planning requirements. This was followed by additional Interim Final Rules on October 1, 2002, October 28, 2002, September 13, 2004, and October 31, 2007. Two Mitigation Planning Final Rules were published on October 31, 2007 and September 16, 2009. This Plan is written in compliance with all published Rules as well as the most recent State Multi-Hazard Mitigation Planning Guidance (July 9, 2008).

Background

South Dakota's first hazard mitigation efforts took place in the late 1800's. **Hazard Mitigation** is defined as *any action taken to reduce or eliminate the long-term risk to human life and property from hazards*. The term is sometimes used in a stricter sense to mean cost-effective measures to reduce the potential for damage to a facility or facilities from a disaster event (FEMA definition).

After the 1881 flood of the Vermillion and Missouri Rivers that destroyed the town of Vermillion, the town was relocated on the bluffs behind the former town to prevent another recurrence. This marks the first recorded hazard mitigation effort by a government entity in South Dakota. During the 1950's, the U.S. Army Corp of Engineers placed levees along the Belle Fourche River in Belle Fourche and also placed flash flood containment systems in Fall River County to protect the community of Hot Springs from flash flooding. Following the 1972 Black Hills/Rapid City flood, development was prohibited from the floodway.

Hazard mitigation efforts were also conducted after the Deadwood Fire in 1959. Homestake Mining Company implemented a large Wildfire Urban Interface tree thinning project on private lands around Lead, South Dakota to protect the community from another large forest fire.

South Dakota mitigation efforts have also involved mitigation of landslides. Since 1969, the South Dakota Department of Transportation (SDDOT) has created and implemented engineering and construction methods and procedures for mitigation of landslides. Over time, these measures were copied by other states and are still in use today. South Dakota has received national recognition for their mitigation leadership.

Currently, the South Dakota Office of Emergency Management oversees hazard mitigation grant funding available through FEMA's Hazard Mitigation Assistance programs and supports local implementation of various mitigation projects. Across the State of South Dakota mitigation progress has included multiple outreach and public education campaigns, acquisition and relocation projects to reduce flood damage, drainage improvement projects, road elevation projects, vegetation management to prevent wildfire, power line burials, and much more.

The first State of South Dakota Multi-Hazard Mitigation Plan pursuant to the Disaster Mitigation Act of 2000 was completed and approved in June 2004. The SHMT continues ongoing collaboration to maintain and update this plan every three years.

Organization

This plan demonstrates the State's current and future mitigation actions in an organized fashion similar to the guidance materials provided by FEMA. The reviewer will note that the section headings and subheadings follow the organization of the Standard State Hazard Mitigation Plan Review Crosswalk. Several appendices accompany this plan. They contain technical data, meeting minutes, and other relevant information that complements the content of this plan.

Section 1 demonstrates the legal authority of this plan through the Governor's adoption. Section 2 documents the planning process for developing this plan, including coordination with local mitigation planning efforts. Section 3 outlines the identified hazards South Dakota is vulnerable to and assesses the risk for each hazard on a per county basis. Section 4 details the State's mitigation strategy based on the local and state vulnerability analyses and risk assessments. Section 5 describes how the State provides funding to local governments as well as how the local assistance and project grants are prioritized. Section 6 outlines the plan maintenance process. Each section includes details on how this 2014 plan was updated from the previous 2011 plan.

SECTION 1 PREREQUISITES

1.1 ADOPTION BY THE STATE

44 CFR Part 201 Requirement:
The plan must: • *Be formally adopted by the State prior to submittal to [FEMA] for final review and approval [and]* • *Include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11 (c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statues as required in 44 CFR 13.11 (d).*

Governor M. Michael Rounds adopted the original (developed in 2004) State of South Dakota Multi-Hazard Mitigation Plan by letter dated February 28, 2005 and also adopted the updated 2007 Plan by letter dated April 22, 2008. On April 14, 2011 Governor Dennis Daugaard adopted the subsequent 2011 Plan. These letters are included on the following pages.

The State Hazard Mitigation Team, led by the director of the South Dakota Office of Emergency Management and charged by the governor with the responsibility of implementing a statewide Hazard Mitigation Program based upon Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended), recommended that this 2014 revised and updated Multi-Hazard Mitigation Plan be adopted by the governor.

Governor Dennis Daugaard adopted the revised and updated 2014-State plan per the enclosed letter.

The State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with § 13.11 (c). As reflected in Section 6 – Plan Maintenance Procedures, the State will amend its plan whenever necessary to reflect changes in State or Federal laws and statues as required in §13.11 (d).

STATE OF SOUTH DAKOTA
M. MICHAEL ROUNDS, GOVERNOR

February 28, 2005

David Maurstad
FEMA Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267

Dear David:

On behalf of the State of South Dakota, I am proud to adopt the South Dakota Multi-Hazard Mitigation Plan. This plan clearly outlines projects that will lessen the impacts of future disaster within our great state. This plan is a great planning tool for our state's entire emergency management community and will be an asset that can be utilized for years to come with noteworthy goals to accomplish.

With the submission of the 2004 State of South Dakota's Natural Hazards Mitigation Plan, the plan is hereby approved and adopted by the state of South Dakota, Office of the Governor.

Sincerely,

M. Michael Rounds

MMR:ls

STATE CAPITOL • 500 EAST CAPITOL • PIERRE, SOUTH DAKOTA 57501-5070 • 605-773-3212

STATE OF SOUTH DAKOTA
M. MICHAEL ROUNDS, GOVERNOR

April 22, 2008

Doug Gore
FEMA Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267

Dear Doug,

On behalf of the state of South Dakota, I am proud to adopt the South Dakota Multi-Hazard Mitigation Plan. This plan clearly outlines projects that will lessen the impacts of future disasters within our state. This plan is a great planning tool for our state's entire emergency management community and will be an asset which can be utilized for years to come with noteworthy goals to accomplish.

With the submission of the state of South Dakota Multi-Hazard Mitigation Plan, the plan is hereby approved and adopted.

Sincerely,

M. Michael Rounds

MMR:ls

STATE CAPITOL • 500 EAST CAPITOL • PIERRE, SOUTH DAKOTA 57501-5070 • 605·773·3212

STATE OF SOUTH DAKOTA
DENNIS DAUGAARD, GOVERNOR

April 14, 2011

Robin Finegan
FEMA Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267

Dear Ms. Finegan:

On behalf of the State of South Dakota, I am proud to adopt the South Dakota Multi-Hazard Mitigation Plan. This plan clearly outlines projects that will lessen the impacts of future disasters within our state. This plan is a great tool for our state's entire emergency management community and will be an asset which can be utilized for years to come with noteworthy goals to accomplish.

With this submission of the State of South Dakota Multi-Hazard Mitigation Plan, the plan is hereby approved and adopted.

Sincerely,

Dennis

Dennis Daugaard

Best regards!

DD:nn

STATE CAPITOL • 500 EAST CAPITOL • PIERRE, SOUTH DAKOTA 57501-5070 • 605.773.3212

STATE OF SOUTH DAKOTA

DENNIS DAUGAARD, GOVERNOR

April 16, 2014

Tony Russell
FEMA Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-5267

Dear Mr. Russell,

On behalf of the state of South Dakota, I am proud to adopt the South Dakota Multi-Hazard Mitigation Plan. This plan clearly outlines the highest risk hazards along with the projects that will lessen the impacts of these hazards in future disasters within our state. This plan is a great tool for our state's entire emergency management community and will be an asset which can be utilized for years to come with noteworthy goals to accomplish.

The state is committed to fulfilling the mitigation goals outlined in the plan and authorizes the responsible agencies to execute their responsibilities toward mitigation actions. The state will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c). The state will amend its plan whenever necessary to reflect changes in state or federal statutes and regulations as required in 44 CFR 13.11(d).

With this submission of the state of South Dakota Multi-Hazard Mitigation Plan, the plan is hereby adopted by the state of South Dakota.

Sincerely,

Dennis Daugaard

DD:nn

SECTION 2 PLANNING PROCESS

This section details the planning process conducted during 2012-2014 to revise and update the State of South Dakota Multi-Hazard Mitigation Plan (last adopted on April 14, 2011). The planning process for this update began in November 2012, continued through adoption of the plan, and will remain in effect as the plan is regularly reviewed and updated. This process has provided and continues to provide all relevant stakeholders the opportunity to actively participate in the development/revision of this plan.

2.1 PLANNING PROCESS UPDATE

Rather than conducting several milestone meetings, as was done for the 2011 plan update, a majority of the planning process was carried out through bi-weekly conference calls led by the South Dakota Office of Emergency Management. Appropriate stakeholders were invited to participate for topics pertinent to each call. During these conference calls, the planning team stakeholder list was updated, the necessary data to update the HIRA was collected, and individual tasks for developing the updated plan were discussed and identified. The plan update process was discussed at a regular meeting of the South Dakota Silver Jackets on December 6, 2012 to enlist their support and participation.

In addition, an all day workshop was held in Pierre, South Dakota on March 14, 2013 with the State Hazard Mitigation Team and South Dakota Silver Jackets to discuss the updated HIRA and review and update the mitigation strategy, including updating goals/objectives and mitigation actions. At this workshop, each participating agency contributed to the capabilities assessment.

As was done for the 2011 plan update, the approach for receiving input from regional stakeholders was to reach out via email. This public outreach process is described in more detail below. The identified stakeholders were asked to review the 2011 plan and to provide additional information to be incorporated into this 2014 plan update through an online survey. Results of the online survey can be found in Section 2.3. A majority of responses to the survey were collected prior to the March 14th meeting and were used by the SHMT to help inform and update hazard priorities as well as validate the goals, revise the objectives, and confirm new mitigation actions.

The stakeholders were also given an opportunity to review the complete draft plan and submit comments. More information on the draft plan review can be found in Section 2.2 below.

2.2 DOCUMENTATION OF THE PLANNING PROCESS

44 CFR Part 201 Requirement:
[The State plan must include a] description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.

The South Dakota Office of Emergency Management (SDOEM) oversaw and directed the planning process required to update and revise the 2011 Plan for adoption in 2014. SDOEM staff specifically responsible for coordinating the completion of the Plan update included Jason Bauder and Nicole Prince, with oversight by Kristi Turman and Tina Titze. SDOEM contracted with a consulting team comprised of

Dewberry and AMEC for technical assistance throughout the process. Nicole Prince is the current SHMO and Marc Macy is the current NFIP Coordinator. SDOEM has gained additional staff to assist with local mitigation plan reviews as well as the processing of public assistance, PDM, and HMGP grants.

2.2.1 State Hazard Mitigation Team

On April 4, 2007, Governor M. Michael Rounds signed Executive Order 2007-07 reconfirming the importance of the South Dakota Hazard Mitigation Team and authorizing the SHMT to function in compliance with the responsibilities specified in the order. This order remained in effect for the purposes of the 2010 and 2014 planning process. The most recent executive order is included on the following pages.

STATE OF SOUTH DAKOTA
OFFICE OF THE GOVERNOR
EXECUTIVE ORDER 2007-07

WHEREAS, Major disasters which struck South Dakota during the years of 2004, 2005 and 2006 caused tremendous physical and financial damages upon the citizens and governments of this state; and,

WHEREAS, There are sufficient opportunities to reduce the impact of future natural disasters through the Hazard Mitigation Grant Program and the pre-disaster mitigation program; and,

WHEREAS, Federal disaster assistance is tied to the establishment and maintenance of an effective State Hazard Mitigation Team; and,

WHEREAS, It is in the best interest of South Dakota that this state embarks upon a long-term effort to mitigate the effects of future disaster.

IT IS, THEREFORE, BY EXECUTIVE ORDER, Directed that the South Dakota Hazard Mitigation Team be established and authorized to function in compliance with the following sections of this order:

GENERAL PROVISIONS

Section 1. The governor of South Dakota will designate at least one person from each of the following departments and offices to form the core leadership of the South Dakota Hazard Mitigation Team:

- Office of the Governor
- Department of Tourism and State Development
  Governor's Office of Economic Development
  Historical Preservation Office
- Department of Agriculture
- Department of Game, Fish and Parks
- Department of Health
- Department of Public Safety, Office of Emergency Management
- Department of Transportation
- Bureau of Administration
  Risk Management

The governor may designate additional executive and non-executive branch personnel or quasi-governmental and non-governmental personnel to serve on the South Dakota Hazard Mitigation Team as the need for their expertise and counsel arises.

Section 2. The South Dakota Hazard Mitigation Team chairperson will be the director of the South Dakota Office of Emergency Management and will be the coordinating office of the South Dakota Hazard Mitigation Team with support from all government agencies and organizations with representation on the South Dakota Hazard Mitigation Team.

Section 3. The South Dakota Hazard Mitigation Team is charged with eliminating or reducing the physical, financial and psychological impacts of natural disasters upon the governments and citizens of South Dakota by implementing a statewide Hazard Mitigation Program based upon Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended). The following are specific duties and responsibilities:

- Meet periodically to review and update the state's Multi-Hazard Mitigation Plan as needed or at least every 3 years.
- Establish statewide hazard mitigation goals and objectives.
- Establish priorities for categories of hazard mitigation projects.
- Review and evaluate hazard mitigation grant applications for funding approval within the guidelines of the state's Multi-Hazard Mitigation Plan.
- Assist in the writing, preparation, and coordination of the state's Hazard Mitigation Plan.

Section 4. The South Dakota Hazard Mitigation Team will not dissolve until this executive order is rescinded or superseded.

Section 5. This executive order supersedes Executive Order 97-14, dated October 21, 1997, which is hereby rescinded.

Dated in Pierre, South Dakota, this 4th Day of April, 2007.

M. Michael Rounds, Governor of South Dakota

STATE OF SOUTH DAKOTA GREAT SEAL 1889

ATTEST:

Chris Nelson, Secretary of State

The core leadership of the State Hazard Mitigation Team consists of one representative from each of the departments and offices listed in the executive order. In addition, representatives from the following agencies were involved in the 2014 hazard mitigation plan update:

- State Climatologist
- Department of Environmental and Natural Resources
- Department of Public Safety, Office of Homeland Security
- Rural Electric Association
- Bureau of Information and Technology
- South Dakota Silver Jackets (including representatives from FEMA Region VIII, Army Corp of Engineers (Omaha and St. Paul Districts), USGS, NWS, NRCS, US Bureau of Land Reclamation, Federal Highway Administration)

The names provided in Table 2-1 are the individuals who participated in the State Hazard Mitigation Team meetings in 2012/2013 and throughout the development of this plan.

Table 2-1 South Dakota 2014 SHMP Update Participants

Agency	Representative(s)
Office of the Governor	Dusty Johnson (new in 2014)
Department of Tourism and State Development	For the 2014 update, there is no representative from this department
Governor's Office of Economic Development	Kim Easland (new in 2014)
Historical Preservation Office	Paige Hoskinson Olson
Department of Agriculture	Kevin Fridley
Department of Game, Fish, and Parks	Leslie Petersen Randy Kittle
Department of Health	Rick LaBrie
Department of Public Safety, Office of Emergency Management	Jason Bauder Nicole Prince Tina Titze Kristi Turman Jim Poppen (new in 2014) Jack Dokken (new in 2014)
Department of Transportation	Kevin Goeden (new in 2014) Lance DeMers (new in 2014) Laurie Schultz Kevin Marton (new in 2014)
Bureau of Administration, Risk Management	Ian Paul
Department of Environment and Natural Resources	Mark Rath Kim McIntosh (new in 2014)
State Climatologist	Dennis Todey

Agency	Representative(s)
Department of Public Safety, Office of Homeland Security	James Carpenter (new in 2014) June Snyder (new in 2014)
Rural Electric Association & Representatives	Karla Steele
Silver Jackets (new in 2014)	Tina Titze
US Army Corps of Engineers, Omaha District (new in 2014)	Lowell Blankers (new in 2014)
SD Bureau of Information and Telecommunications (new in 2014)	Erik Nelson (new in 2014)

In addition to assisting in the writing, preparation, and coordination of the State of South Dakota Multi-Hazard Mitigation Plan, the specific duties and responsibilities of the State Hazard Mitigation Team include:

- meeting periodically to review and update the State of South Dakota Multi-Hazard Mitigation Plan as needed or at least every three years,
- establishing statewide hazard mitigation goals and objectives,
- establishing priorities for categories of hazard mitigation projects, and
- reviewing and evaluating hazard mitigation grant applications for funding approval within the guidelines of the State of South Dakota Multi-Hazard Mitigation Plan.

2.2.2 Collaboration

The 2012-2014 planning process involved an all day workshop with the SHMT and Silver Jackets, many conference calls among team members and the contracted consulting staff, as well as, communication via e-mail and digital data sharing to facilitate draft reviews and collection of comments. A summary of the meetings and collaboration is presented in Table 2-2.

Table 2-2 Summary of Planning Process 2014

November 5, 2012 – Kick Off Meeting
The kickoff meeting included a discussion of updating the SHMT with additional members, including the Silver Jackets, RECs, and REAs. SDOEM representatives identified how they implemented the 2011 plan, including using the plan to prioritize which mitigation projects to fund. SDOEM also stated that there were new State mitigation capabilities to add to the plan, including new programs and policies as well as new local plan updates. The FEMA recommended revisions from the 2011 plan were reviewed and discussed for incorporation into this update. SDOEM identified updated data to be incorporated into the HIRA. A plan for public involvement and outreach as well as a schedule for plan review and adoption was discussed and finalized.
December 6, 2012 – Silver Jackets Meeting
The planning process for the 2014 SHMP update was discussed as an action item during a quarterly Silver Jackets meeting. The Silver Jackets were asked to participate as both state and federal partners to the SHMT in updating the SHMP. This was agreed upon by members of the Silver Jackets team.

December 2012 - April 2013 – Local Agency and Public Online Survey
A link to the 2011 Plan and a link to an online survey were emailed to identified stakeholders and also placed on the SDOEM website for public access. Local agencies, stakeholders, and the public were invited to review the 2011 Plan and respond to the online survey. The participants and results of the survey can be found in Section 2.3.
March 13, 2013 – SHMT and Silver Jackets Workshop
A summary of the updated local hazard mitigation plan rollup and HIRA were presented to the SHMT and Silver Jackets. All members provided comments to be integrated into these sections of the plan in preparation for the public review draft. Revisions to the hazard prioritization were completed based on information from the local plan reviews and the survey results. The mission statement, goals, objectives, and actions from the 2011 plan were reviewed and updated during a collaborative round-table discussion. Handouts were disseminated to collect updated information for the State's capability assessment. The information collected was incorporated into the public review draft and circulated for review. Public outreach efforts to date were discussed as were opportunities to continue collecting public input. It was decided that the State would issue a press release when the public review draft was available for review. In addition, agencies on the SHMT and the Silver Jackets agreed to post a note on their websites announcing and linking to the public review draft.
August 22, 2013 - FEMA Preliminary Review of Risk Assessment
The Hazard Identification and Risk Assessment section was delivered to FEMA Region 8 for advance review.
September – October 18, 2013 - SHMT and Public Review of Complete Draft
The State Hazard Mitigation Team reviewed a complete draft of this plan update and submitted comments/corrections to SDOEM. Concurrently, SDOEM made the complete draft available for public review by posting the plan on the state's website and sending email notifications to stakeholders.
November 18, 2013 - FEMA Review of Complete Draft
The State Hazard Mitigation Team submitted one hard copy and one electronic copy of this plan and accompanying crosswalk to FEMA for review and conditional approval.
April 2014 - Adoption by the State of South Dakota
Per the enclosed letter, this plan has been adopted by the Governor of the State of South Dakota.
Regular conference calls
Throughout the duration of the planning process the project team (SDOEM, Dewberry, and AMEC) participated in bi-weekly conference calls. This enabled the team to update each other on progress as well as communicate data needs or questions pertaining to the update.
Project FTP Site
Dewberry provided a password protected FTP site for data sharing. SDOEM uploaded the collected data (from GIS data layers for the Risk Assessment to digital versions of the approved local plans) and Dewberry uploaded meeting documentation materials to this site as the planning process continued. All members of the SHMT and the Project Team were given access to this site to review and obtain materials relevant to the Multi-Hazard Mitigation Plan Update.

Meeting invitations, agendas, sign-in sheets, presentations, minutes, handouts, surveys used throughout the planning process, and digital communication records are provided in Appendix 2A.

2.2.3 Stakeholder Involvement

As was done for the 2011 plan update, the SHMT identified a list of stakeholders from state, regional, and local agencies to solicit input from. These stakeholders are listed in Table 2-3.
SDOEM issued email notifications inviting the stakeholders to review the 2011 SHMP and respond to an online survey. Both the 2011 plan and online survey were accessible via SDOEM's website for public access. In addition, for this plan update, a Twitter message was sent out informing followers of SDOEM that the survey was available online. The State Hazard Mitigation Officer disseminated surveys and encouraged attendees to have their commissioners, engineers, floodplain managers, mayors, and highway supervisors fill out the survey. Surveys were also disseminated at the following meetings:

- Regional meetings in Gettysburg (February 7th 2013), Watertown (February 4th 2013), Mitchell (February 6th 2013) and Chamberlain (February 14th 2013)
- G318 Local Mitigation Planning Workshop in Chamberlain (January 29th and 30th 2013)
- ASFPM Refresher Course in Chamberlain (February 12th and 13th 2013)
- SD Hydrology Conference in Rapid City (April 18th 2013)

A copy of the stakeholder survey can be found in Appendix 2B.

Table 2-3 Identified Stakeholders 2014

Stakeholder Organization	Liaison
County and Tribal Emergency Managers	Tina Titze
South Dakota Association of County Officials	email via Point of Contact
South Dakota Towns and Townships Association	Dianne Worral
South Dakota Municipal League	Yvonne Taylor
County Highway/Engineering	No email list available at this time
Floodplain Administrators	Nicole Prince
Housing Authority*	Nicole Prince
State Geologist*	Nicole Prince
Extensions*	Nicole Prince
Public Utility Commission*	Nicole Prince
Board of Regents*	Nicole Prince
Tribal Liaison from Governor's Office*	Nicole Prince
Red Cross*	Nicole Prince
Council of Governments*	Nicole Prince
Regional Coordinators*	Nicole Prince
Department of Health*	Nicole Prince
Department of Education*	Nicole Prince
VOADs*	Nicole Prince
Rural Electric Association (disseminated to all RECs)	Karla Steele
Rural Water System Association (disseminated to all RWSs)	Morris Elcock

Nicole Prince used a state government key planning contacts email list to contact the stakeholders noted with an *. Email lists were available for reaching County and Tribal Emergency Managers, the Rural Electric Cooperatives, and the Rural Water Systems. Disseminated emails and documentation of the website posting is included in Appendix 2B.

Results of the survey and summaries of the provided comments are presented below.

2.2.4 2014 Mitigation Plan Survey Responses

As discussed in Section 2.1, several categories of stakeholders were contacted for input into the planning process. This section presents the input provided by the SHMT, Rural Electric Cooperatives, Identified Stakeholders (Table 2-3), members of the public, and those who were accessed via public outreach. A copy of the online survey is provided in Appendix 2B along with complete responses.

2.2.4.1 Survey Respondents

The majority of respondents to the 2013 survey include local and state government agencies. There were significantly more responses to this survey in comparison with the surveys conducted in 2007 and 2010. A table summarizing the type of respondents is below.

Table 2-4 Survey Respondents

Agency Type	Number of Respondents
County/Local Government	86
State Agency	15
Utility Provider	6
Other *	5
Community-based Organization	3
Public Resident	2
University Extension	1
Non-Profit Organization	1

*Responses for “Other” include: K-12 Public School and Colony Schools, Church, Tribal government, South Dakota State University

2.2.4.2 Suggested Stakeholders

During the March 14, 2013 workshop, SHMT and Silver Jacket members were asked which additional stakeholders should be sent a survey and be included in the planning process. The following stakeholders were identified:

- Department of Tourism and State Development
- Department of Game, Fish and Parks
- Department of Education

The 2014 survey also asked for respondents to provide the contact information of additional organizations they believe should complete the survey. These organizations include

- SECOG
- Kingsbury County
- SD Association of Rural Water Systems
- Avera Weskota Hospital
- Buffalo Fire Department
- Canistota Fire Department
- Brookings County
- City of Armour
- Redfield Fire Department
- Lyman County Emergency Management
- Tripp County
- Farmers COOP Elevator
- Grant County Emergency Management
- City of Hot Springs
- Buffalo Regional Clinic
- City of Edgemont
- Harding County School District
- City of Oelrichs
- SDREA
- SD Home Builders
- SD Independent Insurance Agents
- Butte Electric

2 stakeholders noted that they were interested in receiving future correspondence from SDOEM regarding the 2014 Hazard Mitigation Plan Update. These respondents were emailed information about the public review draft.

2.2.4.3 Hazard Concern

The 2013 online survey asked respondents to rate the identified hazards on a scale of 1 (low threat) to 3 (high threat), indicating the level of threat each hazard presents to the operation of their organization/residence. Hazards that were not applicable were asked to be left blank. For each listed hazard, the number of responses was multiplied by the corresponding level and totaled to produce a ranking of hazard threat. Table 2-5 below shows the number of responses and the total ranking for each hazard. Winter Storms are the hazards that the respondents were most concerned with, followed by drought, severe thunderstorms, wind storms, tornadoes, and flooding.

Table 2-5 Threat of Natural Hazards on Operation of Stakeholder's Organization or Public's Residence

	Number of Responses			
Hazard	**Low Threat (1)**	**Moderate (2)**	**High (3)**	**Total Points**
Winter Storm	10	33	61	259
Drought	11	43	52	253
Severe Thunderstorms	20	45	39	227
Windstorm	21	41	41	226
Tornadoes	19	54	32	223
Flooding	29	46	32	217
Communication Failure	26	50	29	213
Hail	25	52	28	213
Power Failure	25	57	23	208
Wildland/Interface Fire	34	39	28	196
Lightning Strikes	34	51	19	193
Motor Vehicle Transportation Incidents	38	46	20	190
Transportation Incidents	38	46	20	190
Agricultural Pests and Diseases	37	42	22	187
Hazardous Materials Incidents	36	54	14	186
Structural Fires	37	50	13	176
Communications Isolation	40	46	14	174
Acquifer/Water Supply Contamination	51	40	14	173
Climate Change	53	43	10	169
Utility Mishap	49	47	6	161
Infectious Diseases / Epidemic	52	40	9	159
Fuel Shortage	55	42	5	154
Sewer Failure	57	35	8	151
Man-Made Hazards	50	44	4	150
Mass Casualty Incident	65	28	9	148
Civil Disturbances	69	28	7	146
Dam or Levee Failure	68	20	11	141
Shortage of critical materials	62	32	4	138
Natural Caused mass evacuation	73	21	7	136
Railway Incident	60	25	8	134
National Security Emergency	73	21	6	133
Hostage / Violence	75	18	7	132
Structural Failure	68	26	4	132
Explosion	71	29	1	132
Aviation Incident	75	23	3	130
Natural Gas Failure	72	23	4	130

	Number of Responses			
Hazard	**Low Threat (1)**	**Moderate (2)**	**High (3)**	**Total Points**
Technological Hazards	70	20	6	128
Bio-Terrorism	78	22	2	128
Expansive Soils	65	28	2	127
Terrorism	76	18	3	121
Subsidence	73	17	1	110
Mudflows / Debris Flows	83	9	3	110
Seasonal Population Shift	81	9	3	108
Landslides	80	11	1	105
Earthquakes	93	6	0	105
Nuclear Incident	81	9	1	102

Organizations' most prominent concerns regarding hazards

Aside from ranking the hazards, the respondents were also asked what their organization's most prominent concerns were regarding natural or human-caused hazards. The responses were:

Concerns	Number of Respondents
Loss of power and utilities	54
Providing shelter, food, and water to citizens	50
Property damage/Crop damage	48
Warning citizens of impending natural and human-caused incidents	47
Other*	10

*Responses to "Other" included:

- Travel conditions
- Providing assistance to local units of government regarding natural/human caused hazards
- Property and economic damage due to Pine Bark Beetle infestation
- Drought
- Flooding
- Wildfire
- Immediate life safety for citizens and responders
- Long term infrastructure disruption
- Resources to respond to events
- Providing transportation needs after floods and blizzards
- Loss attributed to negligence or acts of employees

Concerns regarding climate change

New for the 2014 survey, respondents were asked if climate change is a concern to them and/or their organization. Out of 107 respondents who answered this question,

- **61.2%** responded that climate change **is not** a concern.
- **38.8%** responded that climate change **is** a concern.

2.2.4.4 Risk Reduction

Actions taken to reduce risk
Respondents were asked what their organization is doing to reduce risk of damage from natural and human-caused hazards. Table 2-6 below summarizes these findings.

Table 2-6 Actions Taken to Reduce Risk from Natural and Man-Made Hazards

Action Taken to Reduce Risk from Natural and Man-Made Hazards	**Number of Respondents**
Actions to prevent or minimize property damage	57
Actions to prevent loss of life	54
Conducts outreach activities to promote awareness of relevant natural and human-caused hazards	44
Developed a continuity of operations plans to prevent business interruption	35
Implemented policies to prevent development in hazardous zones	34
Would like to learn more about how my organization can help increase resiliency	24
Other*	8

*Responses for “Other” included:

- The City of Parker utilizes the Turner County Emergency Management Office for rules/regulations and guidance for potential disaster issues.
- Belong to a number of church and community organizations where members can be alerted and called upon for assistance.
- Hospitals and clinics are ready at any moment to assist.
- Our town is in contact with the Emergency Management office in Huron, SD.
- We initiate the burn ban. We also realize that there is not a lot that can be done where extreme temperatures are concerned.
- We are required to take on line tests, attend some classes, and our County has a disaster plan.
- We work with McCook County EMS in establishing a county wide plan, use of resources, etc. for when/if something occurs.
- We are working with the County on a pre-disaster mitigation plan.
- The Office of Risk Management focuses on losses regarding State of South Dakota owned property.

Also, 85% of respondents claimed that they interact with SDOEM or other state agencies regarding mitigation actions or other projects that reduce future damage from hazard events.

Mitigation Actions Implemented in the Past 5 Years

Respondents to the survey were asked to list 3 projects implemented by their organization over the past 5 years that they consider to be the most worthwhile for reducing damages from a natural or human-caused hazard. Below is a summary of the types of projects respondents identified.

Training:

- Active shooter incidents training
- School bus tip over training
- Organize farmers to have water at field during harvest time
- Police conduct awareness programs
- FEMA pre-mitigation meetings
- Training with local fire departments and the local EM officer
- Creating the Brule/Buffalo CERT
- Offering CERT training
- Bi-annual storm spotter classes
- Monthly emergency operation group meetings and training
- StormReady
- Hazardous Materials exercises with private and public entities
- FireWise program
- Flood mitigation meetings

Utilities and Infrastructure:

- Buried power lines
- Clear pine beetle infested trees that cause damage to power lines
- Power line inspection
- Replace and harden conductors and poles
- Plowing underground through or around waterholes where power poles get damaged from water and ice
- Floodproof electric system
- Back-up generators for utilities and critical structures and universities/schools
- Floodproof sewer system components
- Waste water treatment plant and storm water updates/replacement
- New water lines
- New lagoons and line from lift station to lagoon
- Protect local roads and road reconstruction in floodplain
- Bridge replacement and culvert upgrade/repair
- Adoption of rules from FEMA regarding culverts
- Creek/River bank and

- Flood channel and drainage projects
- Diversified City's water supply
- Levee and dam improvements
- Cleaning out of storm sewer ditches
- Place rip-rap along banks to prevent erosion

Preparedness and Mitigation Planning:

- Updating the PDM/EOP/Response and Recovery Plans
- Greenway plan
- Implement POD plan and exercise every year
- High risk dam plans
- Pandemic planning activities

Land Use:

- Building code adoption
- Placing Rapid City in high hazard hail damage zone
- Adoption of new FEMA flood maps
- Reinforce floodplain ordinance
- Updated zoning regulations
- Fire restrictions
- Burn bans
- House removal in floodplain
- Adoption of NFIP and permitting

Warning and Preparedness Actions:

- Added emergency paging system
- Upgraded school, law, and ambulance communication
- 911 dispatch equipment
- Safe room
- Built community shelter
- Stockpile of sandbags
- Fencing around water tower
- Installing new warning sirens
- Upgrade of camera system at hospital, school, courthouse, and SO
- Improvements in fire department equipment
- Improvements to fire/smoke detection capability
- Developing a structural fire department
- Fuel reduction to prevent wildfire
- Upgrade mobile radios in vehicles
- State stockpile of medical supplies, equipment and medication

- Updated electronic communication enhancements including: digital radios, volunteer registry, bed availability, and patient tracking system.
- Insurance
- Public notification of weather events

Other:
- SD COOP
- Pine beetle forest mitigation
- Lions Club projects
- Loss Control Audits
- Removal of damaged trees/debris

2.2.4.5 Suggested State Support

Actions organizations can take to reduce risk to future damage

Respondents were asked to identify which projects would help them or their organization reduce risk to future damage from hazard events. The following types of projects were identified:
- Drainage
- Hazard specific exercises
- Continue to preposition SEAT planes throughout the state whenever drought conditions exist
- Debris removal and management plan for the Bad River Valley
- Storm water updates along with lift stations and blocks for return sewer
- Continue to promote CERT and organize additional training with first responder agencies
- Storm shelters near SDDC
- Security systems at schools
- New warning siren
- Drainage improvement diverting runoff from the City of Brookings to the Big Sioux River
- Replacement of James River Gate Structure
- New communication system
- Improvements to short term shelters, equip school to be a long term shelter
- Bank stabilization projects
- Continue to underground power lines
- Back-up generators
- Funding through pre-disaster mitigation, homeland security that can be used to harden facilities such as school and government buildings
- Removal of low-head dam
- Continued mitigation of MPB impact and funding for mitigation of transportation issues
- Shelters and supplies
- Electronic flood gauges on Turtle Creek
- Higher burms
- Diversion of water

- Rip-rap projects along the Big Sioux River
- ACAMS assessments
- Barrier installation on critical water systems
- Funding to complete more fuel reduction and drainage projects
- Engineer flood studies
- Acquisition of properties in flood areas
- Additional communication towers to increase coverage
- Drought Planning
- Community awareness for preparedness

2.2.5 Draft Plan Review

Beginning on September 3, 2013, the State Hazard Mitigation Team, including the Silver Jackets, reviewed a complete draft of this plan update. All SHMT members reviewed the draft plan and had no additional comments to be incorporated into the plan.

Concurrently, SDOEM made the complete draft available for public review. The plan was made available through a variety of sources:

- First, the plan was posted on the State's Department of Public Safety, Office of Emergency Management website.
- Second, a press release was issued resulting in publications by the following media: The Argus Leader, South Dakota Public Broadcasting, Dakota Broadcasting, KSFY (a local ABC news affiliate), DRG News, GoWatertown.net, KLDT (a local NBC news affiliate), Keloland Television, and KEVN Black Hills (a local Fox news affiliate).
- Third, announcements regarding the public review draft were made on Facebook and Twitter by SDOEM (378 Facebook followers and 948 Twitter followers) and the South Dakota Department of Agriculture.
- Fourth, a flyer was disseminated at the South Dakota Emergency Management Association's conference as well as the County Commissioners conference.

SDOEM distributed email notifications to identified stakeholders requesting their review and comments on the public review draft. The stakeholders included but were not limited to the following:

- Rural Electric Cooperatives
- Council of Governments
- Board of Regents
- County Commissioners
- Town and Township Association
- South Dakota Department of Public Safety and Office of Emergency Management staff
- County and Tribal Emergency Managers
- Floodplain Managers and Administrators
- Individuals who responded to the online survey and requested to be notified of the public review draft

Documentation of the distributed emails, media publications, and website postings are included in Appendix 2B. During the public review period from September 3, 2013 to October 18, 2013, comments were received from the South Dakota Animal Industry Board. These comments have been incorporated into the final plan as appropriate.

2.3 COORDINATION AMONG AGENCIES

44 CFR Part 201 Requirement:
The [state] mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, interested groups, and ….

Coordination with federal agencies:
The newly formed South Dakota Silver Jackets were active members of the 2012-2014 mitigation planning process. The Silver Jackets include representatives from federal agencies such as FEMA Region VIII, USGS, US Army Corp of Engineers, NWS, NRCS, FHA, and the US Bureau of Land Reclamation.

Coordination with state agencies:
The formation of the State Hazard Mitigation Team (SHMT) provides an appropriate vehicle for coordinating the plan update with relevant state agencies. The State Hazard Mitigation Officer (Nicole Prince) communicated regularly via e-mail and follow-up phone calls with members of the SHMT. She ensured that everyone on the SHMT was given multiple opportunities to provide input during the planning process.

Ongoing public outreach:
During the preparation of the 2007 Plan update, SDOEM began several new methods of outreach to coordinate and integrate mitigation planning throughout the state. SDOEM (with assistance from FEMA) developed a mitigation brochure to advertise the idea of mitigation planning and encourage organizations of all types to partner with SDOEM in mitigating natural hazards. This brochure was distributed at the annual state fair in Huron in August, 2007 and subsequent applicant briefings. SDOEM continues to use this brochure in ongoing outreach efforts.

In addition, SDOEM has continued to partner with the Department of Health on their "bReady" campaign to educate the public on preparedness measures. A guidebook, brochures, and information available to the public as part of this campaign can be found at http://www.breadysd.com/. The Department of Health advertises this website and publicizes the campaign to schools, daycares, nursing homes, and at every meeting and exercise they operate (i.e. training exercises for the pandemic flu).

Since 2007, SDOEM has continued to use these outreach materials along with several additional outreach campaigns. Current and ongoing campaigns and efforts to improve public outreach include:

- b Ready,
- South Dakota Disaster Kits,
- Extension Disaster e Network (EDEN)
- Community Wildfire Protection Plans
- Rangeland Insurance (cropland insurance is strong)
- Winter weather and severe weather preparedness guides

- Twitter announcements for severe weather
- School safety sessions
- Safety classes through Extension
- Partnership with the Public Utility Commission One Call system
- Information on local warning sirens
- NFIP flood insurance promotion through meetings and ad campaigns. NFIP Coordinator provides information to communities that do not participate in the NFIP. For those that do participate, the NFIP Coordinator assists with the development of mitigation plans.
- Encourages floodplain ordinances / policies for local governments

Other state agencies also conduct preparedness and mitigation outreach. These agencies and some of their relevant public outreach campaigns are listed below.

- Department of Transportation: Buckle Up, Save it For Later, Give ‘em a Brake, Don’t Crowd the Plow, temperature warnings, highways construction and hazard notification press releases, safetravelusa.com, 511 Travel Information
- Department of Agriculture: Drought education, wildfire prevention
- Department of Public Health: Flu campaign
- National Weather Service: Flood safety
- Rural Electric Cooperatives: Electrical safety literature, outreach materials, and public service announcements.
- State Historic Preservation Office: Public Education on historic property mitigation
- Drought Task Force: provides a forum for community members affected by drought in which they can ask questions and obtain information.

In addition, SDOEM continues to provide mitigation materials at their State Fair booth annually. A severe weather preparedness week is funded through EMPG. This includes a package of information that goes to schools, local emergency managers, daycares, assisted living centers, and nursing homes. Safe room information is also disseminated from the hazard mitigation office to local emergency managers and floodplain administrators.

SECTION 3 RISK ASSESSMENT

The risk assessment lays the foundation for the South Dakota Multi-Hazard Mitigation Plan. It sets the stage for identifying mitigation goals and activities to help the state become disaster resilient and keep South Dakota residents safe. The major components of this risk assessment include a hazard identification/analysis and a vulnerability analysis that answer the following questions: What are the hazards that could affect South Dakota? What can happen as a result of those hazards? How likely is each of the possible outcomes? When the possible outcomes occur, what are the likely consequences and losses, and how does this vary across the state? This section attempts to answer these questions on a hazard by hazard basis based on best available data.

The Federal Emergency Management Agency (FEMA) 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**—Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from hazards.

3.1 IDENTIFYING HAZARDS

44 CFR Part 201 Requirement:
[The State risk assessment shall include an] overview of the type…of all natural hazards that can affect the State…

The following resources were used to identify hazards that may affect the State of South Dakota:

- Federal disaster/emergency declarations (see Table 3-4)
- State Hazard Mitigation Team and South Dakota Silver Jackets members
- Local hazard mitigation plans covering all 66 counties and 2 tribal governments
- Public input via an online survey
- FEMA's Multi-Hazard Identification and Risk Assessment
- HAZUS-MH (see Sections 3.3–3.5)

3.1.1 Geography

The geography and climate of South Dakota are central to the hazards that affect the state. The following information is directly from NetState.com.

- **Longitude/Latitude**—Longitude: 97° 28’ 33"W to 104° 3’W/Latitude: 42° 29’ 30"N to 45° 56’N
- **Length x Width**—South Dakota is about 380 miles long and 210 miles wide.
- **Geographic Center**—The geographic center of South Dakota is located in Hughes County, 8 miles NE of Pierre (Longitude: 100° 28.7' W, Latitude: 44° 24.1' N).
- **Borders**—South Dakota is bordered by North Dakota on the north and by Nebraska on the south. On the east, South Dakota is bordered by Minnesota and Iowa. On the west, South Dakota is bordered by Montana and Wyoming.
- **Total Area**—South Dakota covers 77,121 square miles, making it the 17th largest of the 50 states.
- **Land Area**—75,898 square miles of South Dakota are land areas.
- **Water Area**—1,224 square miles of South Dakota is covered by water.
- **Highest Point**—The highest point in South Dakota is Harney Peak at 7,242 feet above sea level.
- **Lowest Point**—The lowest point in South Dakota is Big Stone Lake at 966 feet above sea level.
- **Mean Elevation**—The Mean Elevation of the state of South Dakota is 2,200 feet above sea level.
- **Major Rivers**—Cheyenne River, Missouri River, James River, White River, Big Sioux River
- **Major Lakes**—Lake Oahe, Lake Francis Case, Lewis and Clark Lake

The Missouri River runs through the central part of South Dakota. To the east of the river, low hills and lakes formed by glaciers are now fertile farms. To the west of the Missouri River, the land consists of deep canyons and rolling plains.

South Dakota is comprised of four major land regions; the Drift Prairie, the Dissected Till Plains, the Great Plains, and the Black Hills.

The **Drift Prairie** covers most of eastern South Dakota. This is the land of low hills and glacial lakes. This area was called Coteau des Prairies (Prairie Hills) by early French traders. In the north, the Coteau des Prairies is bordered on the east by the Minnesota River Valley and on the west by the James River Basin. The James River Basin is mostly flat, following the flow of the James River through South Dakota from north to south.

The **Dissected Till Plains** lie in the southeastern corner of South Dakota. This area of rolling hills is crisscrossed by many streams.

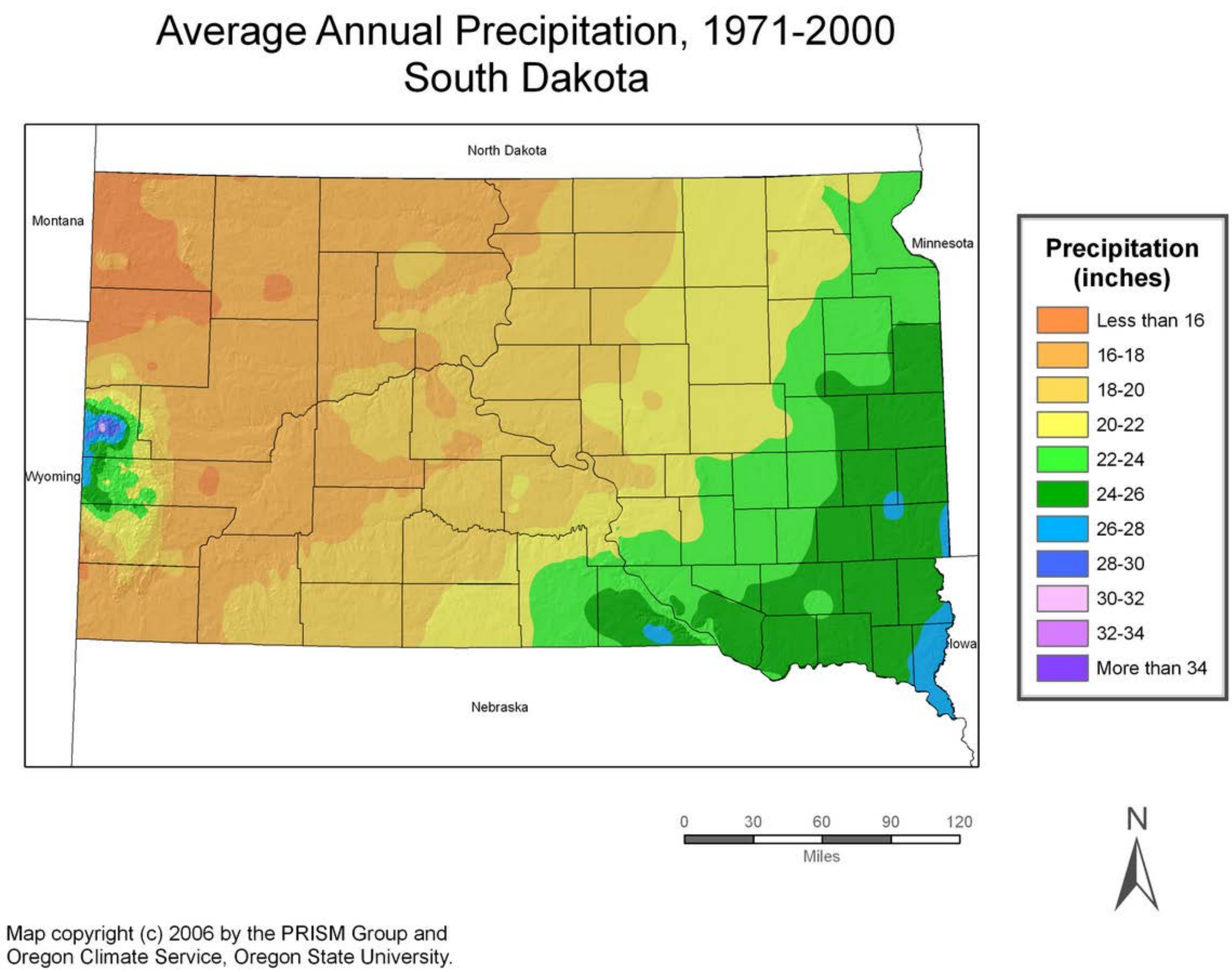
The **Great Plains** cover most of the western two thirds of South Dakota. The Coteau de Missouri hills and valleys lie between the James River Basin of the drift prairie and the Missouri River. West of the Missouri River the landscape becomes more rugged and consists of rolling hills, plains, canyons, and steep flat-topped hills called buttes. These buttes sometimes rise 400 to 600 feet above the plains. In the south, east of the Black Hills, lie the South Dakota Badlands. Badlands National Park is located here.

The **Black Hills** are in the southwestern part of South Dakota and extend into Wyoming. This range of low mountains covers 6,000 square miles with mountains that rise from 2,000 to 4,000 feet high. The highest point in South Dakota, Harney Peak (7,242 feet above sea level), is in the Black Hills. The Black Hills are rich in minerals such as gold, silver, copper, and lead.

3.1.2 Climate

- **Highest Temperature**—The highest temperature recorded in South Dakota is 120°F. This record high was recorded on July 5, 1936 at Gann Valley, and tied on July16, 2006 in Usta.
- **Lowest Temperature**—The lowest temperature in South Dakota, -58°F, was recorded on February 17, 1936 at McIntosh.
- **Average Temperature**—Monthly average temperatures range from a high of 86.5°F degrees to a low of 1.9°F degrees.
- **Climate**—Average yearly precipitation for South Dakota, from 1971 to 2000, is shown in Figure 3-1.

Figure 3-1 South Dakota's Average Annual Precipitation



3.1.3 Selecting Hazards

Based on past disaster history and population and property potentially at risk (numbers and dollars), the following hazards have emerged as the greatest concern statewide and are profiled in detail in this plan:

- Agricultural Pests and Diseases
- Drought
- Floods (flash, long-rain, snowmelt, and dam failure or levee failure floods)
- Geological Hazards (Landslides, Mudflows, Expansive Soils, Subsidence, and Earthquakes)
- Hazardous Materials
- Tornadoes
- Wildfires
- Windstorm
- Winter Storm

During the 2014 plan update, the State Hazard Mitigation Team (SHMT) reexamined these hazards that threaten South Dakota. No changes were made to the list of hazards from the 2011 plan update. During the 2014 plan update process, the SHMT discussed adding a hazard profile for Summer Storms to align with local plans. While flooding from severe thunderstorms is addressed in the flood hazard profile, this hazard profile would include hail, lightning and possibly micro-burst wind events. The SHMT recommended that Summer Storms should be added as a new hazard profile during the next plan update.

The following natural hazards are not included in this analysis because they do not threaten South Dakota: avalanches, coastal erosion, coastal storms, hurricanes, tsunamis, and volcanoes. While extreme heat, extreme cold, and hailstorms are recognized as hazards in South Dakota, their impacts tend to be limited and do not tax state resources or result in presidential disaster declarations; so they are not addressed as stand-alone hazards in this plan. Impacts from these hazards are addressed in appropriate hazard elements. The state does recognize that these hazards, particularly hailstorms, can inflict damages at the local level, but often the resulting property and agricultural losses are covered by insurance.

3.1.4 Non-Natural Hazards

The State Hazard Mitigation Team determined not to include human-caused and technological hazards in this plan. The State's Threat and Hazard Identification and Risk Analysis (THIRA), developed in 2012, is an all hazards risk assessment that analyzes the State's capabilities toward addressing natural, human-caused, and technological hazards. The THIRA was developed in compliance with the US Department of Homeland Security Comprehensive Preparedness Guide 201 by a committee lead by the State's Office of Homeland Security. The THIRA includes hazard profiles for the most pertinent human-caused and technological hazards intended to supplement the natural hazards profiled within this Multi-Hazard Mitigation Plan. Further information regarding the THIRA may be obtained by contacting the State's Office of Homeland Security.

3.1.5 Prioritizing Hazards

A similar hazard ranking exercise as used in the previous plan update was used by the State Hazard Mitigation Team to validate and rank the hazards for this 2014 plan. The ranking methodology for this plan update was modified to include local plans and survey results. The hazards of greatest significance were identified to be flooding, winter storms, wildfires, and drought. Tornadoes, wind, and agricultural pests and diseases were ranked as moderate. Tornadoes, ranked as significant in the 2011 plan update, were found to be moderate for this update. Geological hazards, including earthquake, were also downgraded from moderate in 2011 and ranked as a limited hazard in 2014.

Prioritization of the hazards that threaten the state was based on four factors: probability, potential impact, consideration in local hazard mitigation plans, and survey input. The likely geographical extent of the affected area, primary impacts of the event, and related secondary impacts all factor into the overall potential impact. While primary impacts are a direct result of the hazard, secondary impacts can only arise subsequent to a primary impact. For example, a primary impact of a flood event may be road damage due to submerged pavement or eroded surface. A possible secondary impact in these circumstances would be restricted access of emergency vehicles to citizens in a particular area due to the road closure.

A formula was developed to assign a value for probability and impact for each of the hazards considered. The probability of each hazard was determined by assigning a level, from 1 to 4, based on the likelihood of occurrence (which is based on historical data). Similarly, levels from 1 to 4 were assigned to each of the three impact factors mentioned above. Probability and impact factor levels assigned to each hazard were each then multiplied by an importance factor.

To incorporate the consideration of these hazards in local plans, the number of local plans that included the hazard was divided by 68 (total local and tribal plans within the State) and multiplied by 10 to create a Local Plans Score on a scale of 0 -10.

Survey respondents rated the hazards on a scale of 1 – 3. The average rating was divided by 3 and multiplied by 10 to create a Survey Score on a scale of 1-10.

The total hazard ranking score was calculated as follows:

[(Probability x 2) x [(Affected Area x 0.8) + (Primary Impact x 0.7) + (Secondary Impacts x 0.5)]] + Local Plans Score + Survey Score

Based on the total calculated score, the hazards were separated into three categories that describe the relative risk level they pose to the state: significant, moderate, and limited. These terms relate to the level of planning analysis to be given to the particular hazard in the risk assessment process and are not meant to suggest that a hazard would have only limited impact. In order to focus on the most critical hazards, those assigned a level of significant or moderate were given more extensive attention in the remainder of this analysis (e.g., quantitative analysis or loss estimation), while those with a limited planning consideration were addressed in more general or qualitative ways.

The hazard ranking was based on the overall probability and impact on the state as a whole. When examining various regions of the state, the same ranking does not always apply. Table 3-1 summarizes the ranking established by the state using the method described above.

Table 3-1 Hazard Ranking and Planning Consideration

Hazard Type and Ranking		Planning Consideration Based on Hazard Level
1	Flooding (flash, long-rain, snowmelt, and dam or levee failure)	Significant
1	Winter Storms	Significant
2	Wildfires	Significant
3	Drought	Significant
4	Tornadoes	Moderate
5	Wind	Moderate
6	Agricultural Pests and Diseases	Moderate
7	Hazardous Materials	Moderate
8	Geological Hazards (Landslide, Mudflow, Expansive Soils, Earthquake)	Limited

A Hazard Identification and Ranking Worksheet is included on the following page and contains the calculations and formulas utilized during the 2014 update.

Table 3-2 Hazard Ranking Worksheet – South Dakota

Hazard Type	Probability	Impact			Local Plans	Survey Rating	Local Plans Score	Survey Score	Total Score	Hazard Planning Consideration
		Affected Area	Primary Impact	Secondary Impacts						
FLOODING	4	4	2	3	66	1.73	9.71	5.75	64.26	**Significant**
Flooding					66	2.03				
Dam Failure*					16	1.42				
WINTER STORMS	4	4	2	3	67	2.49	9.85	8.30	66.95	**Significant**
WILDFIRES	4	2	4	3	59	1.94	8.68	6.47	62.34	**Significant**
DROUGHT (including Extreme Heat)	4	3	2	4	45	2.39	6.62	7.97	60.98	**Significant**
TORNADOES	4	1	4	4	43	2.12	6.32	7.07	58.19	**Moderate**
WIND	4	2	2	2	28	2.19	4.12	7.30	43.42	**Moderate**
AGRICULTURAL PESTS/DISEASES	3	3	1	4	3	1.85	0.44	6.17	37.21	**Moderate**
HAZARDOUS MATERIALS*	4	1	1	3	41	1.79	6.03	5.97	36.00	**Moderate**
GEOLOGICAL HAZARDS	3	2	1	2	15	1.18	2.21	3.92	25.92	**Limited**
Earthquake	2	1	1	1	15	1.06				
Expansive Soils	3	UNK	UNK	UNK	1	1.34				
Landslides					13	1.14				
Mudflow					13	1.16				

Table 3-3 Hazard Ranking Legend

Probability	**Importance**	**2.0**
Based on estimated likelihood of occurrence from historical data		Score
Unlikely (Less than 1% probability in next 100 years or has a recurrence interval of greater than every 100 years.)		1
Somewhat Likely (Between 1 and 10% probability in next year or has a recurrence interval of 11 to 100 years.)		2
Likely (Between 10 and 100% probability in next year or has a recurrence interval of 10 years or less.)		3
Highly Likely (Near 100% probability in next year or happens every year.)		4

Affected Area	**Importance**	**0.8**
Based on size of geographical area of community affected by hazard		Score
Isolated		1
Small		2
Medium		3
Large		4

Primary Impact	**Importance**	**0.7**
Based on percentage of damage to typical facility in community		Score
Negligible - less than 10% damage		1
Limited - between 10% and 25% damage		2
Critical - between 25% and 50% damage		3
Catastrophic - more than 50% damage		4

Secondary Impacts	**Importance**	**0.5**
Based on estimated secondary impacts to community at large considering economic impacts, health impacts, and crop losses		Score
Negligible - no loss of function, downtime, and/or evacuations		1
Limited - minimal loss of function, downtime, and/or evacuations		2
Moderate - some loss of function, downtime, and/or evacuations		3
High - major loss of function, downtime, and/or evacuations		4

Local Plans Score	**Importance**	**1.0**
Local Plans Score = (# of plans / 68) x 10 where:		
# of plans includes local and tribal plans within South Dakota that identified the hazard		

Survey Score	**Importance**	**1.0**
Survey Score = (Survey Rating / 3) x 10 where:		
Survey Rating is the average rating of concern based on a scale of 1 (low concern) to 3 (high concern) compiled from the survey responses.		

Total Score = (Probability x Impact) + Local Plans Score +Survey Score, where:
Probability = (Probability Score x Importance)
Impact = (Affected Area + Primary Impact + Secondary Impacts), where:
Affected Area = Affected Area Score x Importance
Primary Impact = Primary Impact Score x Importance
Secondary Impacts = Secondary Impacts Score x Importance

Hazard Planning Consideration	**Total Score Range**
Limited	0 - 30
Moderate	30.1 - 60
Significant	60.1 - 90

As shown in the Hazard Ranking Worksheet, the majority of the local plans identified hazards consistently with those prioritized by the SHMT. Several additional hazards were identified by the local plans. Documentation of these hazards followed by the number of plans that identified each hazard is listed here for future reference by the State Hazard Mitigation Team, should these hazards become a statewide concern. While these are not explicitly profiled in this plan, the State Hazard Mitigation Team and the State Hazard Mitigation Officer will use this information to continue working with the local communities to understand the concerns these hazards pose, how they are in part already addressed by the state plan, and how they can be mitigated:

- Summer Storms (30)
- Hail (23)
- Civil Disturbances (22)
- Thunderstorms (20)
- Urban Fire (19)
- Mass Casualty Incident (18)
- Infectious Disease/Epidemic (17)
- Ice Storms (15) (see winter storms)
- Aviation Incident (15)
- Lightning Strike (13)

It must be noted that 37 of the 66 counties and 2 tribal governments identified terrorism as a risk. The State Hazard Mitigation Team recognizes this risk and feels that on a statewide level, terrorism is being mitigated to the best of their ability by the South Dakota Office of Homeland Security. As described above, the State's 2012 THIRA is the appropriate vehicle for addressing the measures being taken in South Dakota to fight terrorism and other human-caused and technological hazards, such as civil disturbances and mass casualty incidents listed above.

3.1.6 Presidential Declarations

Table 3-4 summarizes presidential disaster declarations, fire management assistance declarations, and emergency declarations for South Dakota since 1954. Forty-three presidential declarations in this 59-year period indicate that roughly every two years a disaster is declared. Since the early 1990's the state has had a presidential declaration on nearly an annual basis. From May 2008 to November 2013, South Dakota received sixteen Presidential Disaster Declarations.

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Table 3-4 Presidential Declarations

Declaration Number	Declaration Date	Incident Period Start	Incident Period End	Cost Share % (Federal/State)	Counties (#)	Disaster Type	FEMA Disaster Relief Costs[1] (federal share)
Major Disaster Declarations							
FEMA-4155-DR	11/8/2013	10/3/2013	10/16/2013	75/25	14 Counties	Severe Winter Storm, Snowstorm, and Flooding	$37,800,000
FEMA-4137-DR	8/2/2013	6/19/2013	6/29/2013	75/25	7 Counties	Tornadoes, Severe Storm, Flooding	$1,700,000
FEMA-4125-DR	6/28/2013	5/24/2013	5/31/2013	75/25	5 Counties	Tornadoes, Severe Storm, Flooding	$1,400,000
FEMA-4115-DR	5/10/2013	4/8/2013	4/10/2013	75/25	7 counties	Severe Winter Storm and Snowstorm	Unknown
FEMA-1984-DR	5/13/2011	3/11/2011	7/22/2011	75/25	28 Counties	Severe Storms and Flooding	$47,643,032
FEMA-1947-DR	11/2/2010	9/22/2010	9/23/2010	75/25	4 Counties (including 1 reservation within designated counties)	Severe Storms and Flooding	$1,067,415*
FEMA-1938-DR	9/23/2010	7/21/2010	7/30/2010	75/25	12 Counties	Severe Storms and Flooding	$4,551,087*

Declaration Number	Declaration Date	Incident Period Start	Incident Period End	Cost Share % (Federal/State)	Counties (#)	Disaster Type	FEMA Disaster Relief Costs[1] (federal share)
FEMA-1929-DR	7/29/2010	07/16/2004	07/24/2010	75/25	3 Counties (including 1 reservation within designated counties)	Severe Storms, Tornadoes, and Flooding	$725,128*
FEMA-1915-DR	5/13/2010	3/10/ 2010	Ongoing	75/25	31 Counties	Flooding	$21,845,581*
FEMA-1914-DR	5/13/2010	4/2/2010	Ongoing	75/25	3 Counties	Severe Winter Storm	$2,166,739*
FEMA-1887-DR	3/10/2010	1/20/2010	Ongoing	75/25	29 Counties (including 3 reservations within designated counties)	Severe Winter Storm	$56,292,035*
FEMA-1886-DR	3/9/2010	12/23/2009	Ongoing	75/25	12 Counties (including 2 reservations within designated counties)	Severe Winter Storm and Snowstorm	$866,846*

Declaration Number	Declaration Date	Incident Period Start	Incident Period End	Cost Share % (Federal/State)	Counties (#)	Disaster Type	FEMA Disaster Relief Costs[1] (federal share)
FEMA-1844-DR	06/16/2009	03/11/2009	07/06/2009	75/25	14 counties (including 2 reservations within designated counties and extending into North Dakota)	Severe Storms and Flooding	$5,222,817*
FEMA-1811-DR	12/12/2008	11/05/2008	11/07/2008	75/25	13 counties (including four reservations within designated counties)	Severe winter storm and record and near record snow	$5,825,275*
FEMA-1774-DR	07/02/2008	06/02/2008	06/12/2008	75/25	26 counties (including portions of 3 reservations within designated counties)	Severe storms and flooding	$4,716,310*
FEMA-1759-DR	05/22/2008	05/01/2008	05/02/2008	75/25	6 counties	Severe winter storm and record and near record snow	$7,826,996*

Declaration Number	Declaration Date	Incident Period Start	Incident Period End	Cost Share % (Federal/State)	Counties (#)	Disaster Type	FEMA Disaster Relief Costs[1] (federal share)
FEMA-1702-DR	5/22/2007	5/4/2007	6/8/2007	75/25	24 counties (including 3 reservations within designated counties)	Severe Storms, Tornadoes, and Flooding	$8,373,536[2]
FEMA-1647-DR	6/5/2006	4/18/2006	4/20/2006	75/15/10 state	6 counties	Severe Winter Storm	$4,000,000[2]
FEMA-1620-DR	12/20/2005	11/27/2005	11/29/2005	75/15/10 state	26 counties	Severe Winter Storm	$28,000,000[2]
FEMA-1596-DR	7/22/2005	6/7/2005	6/8/2005	75/15/10 state	7 counties	Severe Storm (wind)	$840,159
FEMA-1531-DR	7/20/2004	5/28/2004	6/16/2004	75/15/10 state	9 counties, 1 reservation	Severe Storms and Flooding	$2,094,155
FEMA-1375-DR	5/17/2001	3/1/2001	4/30/2001	75/25	24 counties	Severe Storms (flooding)	$9,919,599
FEMA-1330-DR	5/19/2000	4/18/2000	4/20/2000	75/25	7 counties	Winter Storm	$2,877,023
FEMA-1280-DR	6/9/1999	6/4/1999	6/18/1999	75/25	2 counties	Severe Storms, Flooding, and Tornadoes	$17,848,761
FEMA-1218-DR	6/1/1998	3/9/1998	3/12/1998	75/25	9 counties	Flooding, Severe Storms, and Tornadoes	$15,953,312
FEMA-1173-DR	4/7/1997	2/3/1997	5/24/1997	100 (A&B) 90/10 (C–G)	66 counties	Severe Storms, Flooding (high winds)	$82,490,180
FEMA-1161-DR	2/28/1997	11/13/1996	11/26/1996	75/25	10 counties	Severe Winter Storms	$2,526,209
FEMA-1156-DR	1/10/1997	1/3/1997	1/31/1997	75/25	66 counties	Severe Winter Storms/Blizzards	$18,431,301
FEMA-1075-DR	1/5/1996	10/22/1995	10/24/1995	75/25	26 counties	Ice Storms	$12,431,366

Declaration Number	Declaration Date	Incident Period Start	Incident Period End	Cost Share % (Federal/State)	Counties (#)	Disaster Type	FEMA Disaster Relief Costs[1] (federal share)
FEMA-1052-DR	5/26/1995	3/1/1995	6/20/1995	75/25	52 counties	Severe Storms, Flooding	$33,866,882
FEMA-1045-DR	3/14/1995	1/13/1995	2/10/1995	75/25	21 counties	Severe Winter Storms	$3,627,131
FEMA-1031-DR	6/21/1994	3/1/1994	7/29/1994	75/25	21 counties	Severe Storm, Flooding.	$7,789,915
FEMA-999-DR	7/19/1993	5/6/1993	6/10/1993	90/10	39 counties	Flooding, Severe Storms, Tornadoes	$50,202,256
FEMA-948-DR	7/2/1992	6/13/1992	6/23/1992	75/25	9 counties	Flooding, Severe Storms, Tornadoes (high winds)	$1,669,825
FEMA-764-DR	5/3/1986	n/a	n/a	n/a	25 counties	Severe Storms, Flooding	$4,893,611
FEMA-717-DR	7/19/1984	n/a	n/a	n/a	9 counties	Severe Storms, Flooding	$4,216,001
FEMA-511-DR	6/25/1976	n/a	n/a	n/a	4 counties	Flash Flooding, Mudslides	$4,439,769
FEMA-336-DR	6/10/1972	n/a	n/a	n/a	4 counties	Heavy Rains, Flooding	$111,907,010
FEMA-257-DR	4/18/1969	n/a	n/a	n/a	26 counties	Flooding	$4,369,737
FEMA-197-DR	5/26/1965	n/a	n/a	n/a	4 counties	Flooding	$3,771,780
FEMA-132-DR	7/27/1962	n/a	n/a	n/a	23 counties	Floods, Tornadoes	$3,652,937
FEMA-99-DR	4/8/1960	n/a	n/a	n/a	16 counties	Floods	$933,934
FEMA-20-DR	7/31/1954	n/a	n/a	n/a	2 counties	Floods	$252,255
Emergency Declarations							
FEMA-3234-EM	9/10/2005	n/a	n/a	n/a	All counties	Hurricane Katrina Evacuation	n/a
FEMA-3015-EM	6/17/1976	n/a	n/a	n/a	n/a	Drought	n/a

Declaration Number	Declaration Date	Incident Period Start	Incident Period End	Cost Share % (Federal/State)	Counties (#)	Disaster Type	FEMA Disaster Relief Costs[1] (federal share)
Fire Management Assistance Declarations							
FEMA-5010-FM	9/1/2012	8/31/2012	9/2/2012	75/25	Shannon	Wellnitz Fire	Unknown
FEMA-2996-FM	7/20/2012	7/20/2012	7/20/2012	75/25	Custer	Myrtle Fire	Unknown
FEMA-2716-FSA	7/21/2007	7/21/2007	7/31/2007	75/25	Lawrence	Boxelder Fire	n/a
FEMA-2710-FSA	7/8/2007	7/7/2007	7/20/2007	75/25	Fall River	Alabaugh Canyon Fire	$2,659,373
FEMA-2658-FSA	7/27/2006	7/27/2006	8/7/2006	75/25	Meade	East Ridge Fire	$1,973,107
FEMA-2569-FSA	7/16/2005	7/16/2005	7/17/2005	75/25	Pennington	Skyline #2 Fire	$18,975
FEMA-2565-FSA	7/10/2005	7/9/2005	7/19/2005	75/25	Meade	Ricco Fire	$573,581
FEMA-2513-FSA	11/20/2003	11/20/2003	11/21/2003	75/25	Pennington	Mill Road Fire	$62,852
FEMA- 2458-FSA	8/18/2002	8/16/2002	8/29/2002	75/25	Pennington	Battle Creek Fire	$1,816,503
FEMA-2434-FSA	6/29/2002	6/29/2002	7/17/2002	75/25	Lawrence	Grizzly Gulch Fire	n/a
FEMA-2369-FSA	7/31/2001	7/30/2001	8/8/2001	70/30	Custer	Elk Mountain Fire	$293,000
FEMA-2324-FSA	8/25/2000	8/24/2000	9/25/2000	100	Custer	Jasper Fire	$2,500,000
FEMA-2319-FSA	8/13/2000	8/11/2000	8/20/2000	70/30	Fall River	Flagpole Fire	$1,750,000
FEMA-2109-FSA	8/16/1994	n/a	n/a	n/a	Meade	Stagebarn Canyon Fire	n/a
FEMA-2076-FSA	9/14/1990	n/a	n/a	n/a	Custer	Swedlund Fire	n/a
FEMA-2068-FSA	7/26/1988	n/a	n/a	n/a	Pennington	West Berry Trail Fire	n/a
FEMA-2061-FSA	7/22/1987	n/a	n/a	n/a	Fall River	Battle Mountain Fire	n/a
FEMA-2057-FSA	7/15/1985	n/a	n/a	n/a	Fall River	Flint Hill Fire	n/a
FEMA-2056-FSA	7/15/1985	n/a	n/a	n/a	Fall River	Seven Sisters Fire	n/a
FEMA-2017-FSA	7/29/1975	n/a	n/a	n/a	Custer	Custer State Park	n/a
FEMA-2016-FSA	7/8/1974	n/a	n/a	n/a	Custer	Argle & Booms Canyon	n/a

Sources: Federal Emergency Management Agency, South Dakota Office of Emergency Management, Public Entity Risk Institute

Notes:

[1]Costs include Public Assistance, Individual Assistance, and mitigation and are in constant 2006 dollars (with the exception disasters post-2006, which are year of event dollars). Fire costs are from the state, represent total outlays, and are not adjusted for inflation (with the exception of FEMA-2710-FSA, which is from InciWeb).

[2]Projects are not closed; costs are estimates from the state (FEMA-1702-DR is public assistance only).
*Includes Public Assistance only

3.1.7 Probability of Future Events

Predicting probability of future events is estimated by looking at the number of past damaging events, where possible (e.g. declared disasters), or using scientific estimates where available. Using the South Dakota information provided and the process as discussed in this section, one can conclude that it is probable that flooding, severe winter storms, tornadoes, wildfires, landslides/mudflows, and earthquakes will continue to occur in the future much as they have in the past. Some hazards are more likely to occur and cause more damage than others. This is discussed in more detail in the following hazard profiles.

3.1.7.1 Reducing Damage from Future Events

What could reduce damage from future events? One way is to continue the process of identifying and implementing good mitigation measures that protect people and property. If people and property are not impacted by a hazard event when one occurs, then their vulnerability has been reduced. Hazard events will still occur, but people and property may not be impacted because they may no longer be vulnerable to the threat. The best example of this is when structures on repetitive flood loss properties are removed from the path of potential floods. Moving the structures reduces the potential risk to life and property. Therefore, lives and property are less vulnerable to the threat of flooding and loss of life and property is less probable.

3.1.7.2 Climate Change Exacerbation

The intensity and frequency associated with the hazards profiled in this plan are largely based on historic events. Climate change has the potential to alter the nature and frequency of hazard events in the future. A report on Global Climate Change Impacts in the United States was released by the U.S. Global Change Research Program (USGCRP 2009) in 2009 and summarizes the science of climate change and the impacts of climate change on the United States, now and in the future. The report discusses climate-related impacts for various societal and environmental sectors and regions across the nation. South Dakota lies within the Great Plains region. The science summarized in the report points to increasing mean temperatures in the Great Plains. This will lead to increased evaporation and drought frequency, which will compound water scarcity problems. Less frequent, but more intense, rainfalls could exacerbate flooding. A 2013 report ‘The Impact of Climate Change and Population Growth on the National Flood Insurance Program Through 2100’ (AECOM 2013) suggests that special flood hazard areas will increase nationally, on average, by 40%-50% by 2100. Future updates to this plan should investigate further how climate change may alter hazard frequency and intensity.

3.2 PROFILING HAZARDS

44 CFR Part 201 Requirement:
[The State risk assessment shall include an overview of the] location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate…

Hazard profiles include information on past events as well as the probability of future occurrences, expected magnitude and severity of impacts to determine relative levels of risk throughout the state. Information for the hazard profiles and at-risk facilities came from a variety of sources and organizations, including, but not limited to, the following:

- South Dakota Agencies and Departments
  - Office of Emergency Management
  - South Dakota Department of Environment and Natural Resources
  - South Dakota Department of Agriculture
    - Division of Wildland Fire Suppression
  - South Dakota Animal Industry Board
  - South Dakota Department of Health
  - South Dakota Office of Homeland Security
  - Northern State University, Aberdeen, South Dakota
  - South Dakota State University, Brookings, South Dakota
- Federal Emergency Management Agency
  - FEMA Region VIII
  - HAZUS-MH
- Public Entity Risk Institute
- University of South Carolina Hazards and Vulnerability Research Institute
  - Spatial Hazard Events and Losses Database for the United States (SHELDUS)
  - Social Vulnerability Index for the United States
- National Oceanic and Atmospheric Administration
  - National Climactic Data Center
  - National Weather Service
- U.S. Department of Agriculture Risk Management Agency
- Federal Wildland Fire Occurrence Database
- University of Wisconsin-Madison Spatial Analysis for conservation and Sustainability (SILVIS) Lab
- U.S. Army Corps of Engineers
- U.S. Geological Survey
- Literature and written and oral communications from state and national hazard experts
- Input given at stakeholder meetings during the 2014 update process

3.2.1 2014 Update Highlights

During the 2014 update all hazard profiles were updated with recent hazard events since the last plan update. The drought, winter storm, and agricultural disease chapters were enhanced with additional analysis on livestock and crop loss data. Tornado, wind, and winter storm data was obtained and integrated from NCDC database and year of damage dollar losses inflated to 2012 dollars and used to update the vulnerability assessment by county. New wildland urban interface data was obtained from the University of Wisconsin and the Federal Wildland Fire Occurrence database to update the wildland fire hazard profile. The flood vulnerability section was enhanced with an analysis of average annualized loss based on a nationwide FEMA study and revised GIS analysis using available DFIRMs. The state has been impacted by several disasters since 2011 including severe flooding, winter storm, and drought. The losses from these disasters have been summarized, including an analysis of the types and amounts of disaster expenditures where available. South Dakota has funded several mitigation projects with FEMA funds. Projects such as power line burial projects have been summarized and compared to high-risk counties for wind, winter storm, and tornado as an indication of progress towards reducing exposure to these hazards and further refinement of vulnerabilities related to Rural Electric Cooperatives. Table 3-5 highlights some of the changes made to the hazard identification and risk assessment.

Table 3-5 Summary of Changes Made to Hazard Identification and Risk Assessment in 2013

2013-2014 Hazard Name	Change from 2011 plan
Floods	Added average annualized loss data, DFIRM analysis updated, incorporated Black Hills paleoflood study findings
Drought	Developed additional analysis of crop losses due to drought
Wildfire	Obtained new SILVIS data, incorporated vulnerability information from local CWPPs, obtained new Federal Wildland Fire Occurrence data
Windstorm, Tornado, Winter Storm	Updated with NCDC data; inflated $ losses to 2012; added tornado probability map.
Winter Storm	Developed additional analysis of livestock and crop losses due to winter weather
Agricultural Diseases and Pests	Developed additional analysis of livestock and crop losses due to pests and disease

3.2.2 Agricultural Pests and Diseases

3.2.2.1 Description

Agriculture is South Dakota's prime industry, contributing $20.9 billion dollars to, or 20% of, the state's economy each year. In addition, agriculture and its associated industries employ over 80,000 South Dakotans. As of 2011, the State had 31,300 farms over 43,650,000 acres of farmland, for an average farm size of 1,395 acres. The state boasts 46,000 producers on 31,500 farms, ninety-eight percent of which are family owned and operated, and over 2,500 farms have been in the same family for more than 100 years. South Dakota's agricultural history dates back to the nineteenth century, when homesteaders used a mule and moldboard plow to break the thick prairie sod. Currently, in the twenty-first century, crop production has increased as farmers embrace new technologies, better hybrids, and more efficient land-use practices. More than 19 million acres of the state is cropland and 23 million acres are devoted to pastureland. South Dakota consistently ranks in the top ten for production of several crops, including (in order of 2010 national ranking): alfalfa, flaxseed, sunflowers, oats, wheat, ethanol, hay, corn, and soybeans. Livestock production in South Dakota also ranks high in the nation, with bison and pheasant production receiving a 2010 national ranking of 1. Beef has the greatest economic impact in South Dakota's livestock industry, contributing $2.79 billion dollars to the state's economy.

Agricultural hazards are divided into two categories: pests and diseases. For this plan, such events are defined as the naturally occurring infection of crops or livestock with insects, vermin, or diseases that render the crops or livestock unfit for consumption, sale, or other use. South Dakota has a substantial agricultural industry and a significant infrastructure composed of related facilities and locations, so the potential for infestation of crops or livestock pose a significant risk to the economy of the state. In order to profile each element adequately, this hazard profile focuses on events that primarily affect livestock (primarily disease) and crops (disease and pests). In some cases, pests may also serve as the vector of disease for livestock. For clarity, the profile examines livestock and crop impacts separately, following the same evaluation criteria of location, past events, and probability demonstrated in other profiles.

Small losses caused by agricultural pests and diseases are normal for South Dakota farmers and ranchers. Concerns arise when the level of an infestation escalates suddenly and overwhelms normal control efforts, a new type of infestation occurs, diseases decimate animal populations, or when diseases pose a risk to humans. The levels and types of such events vary based on many factors, including cycles of heavy rains and drought, feeding practices, cross contamination or exposure, or inadequate infection control measures.

While Zoonotic diseases (those transmissible between humans and animals or via an animal vector) are a concern, those events are best addressed in a pandemic or contagious disease plan, in order to address the variability and magnitude the events entail. The control of insects and rodents partially addresses the mitigation of Zoonotic disease, but for the purposes of this plan, that is an extra factor, rather than a primary focus. This hazard profile focuses on the diseases which impact the population of domesticated livestock or crops, which in turn damages the economic return on these valuable assets.

The following evaluation of crop hazards is reproduced from the Plant Sciences at South Dakota State University website discussing crop production problems:

> Farmers endure a number of problems during the growing season which can curtail yield. Some of these problems occur because best management practices are not applied. The lack of a good stand, crop-nutrient deficiencies, insect infestations, weed population increases, poor field drainage, and salinity problems can to some degree be managed. However, there are some weather related natural events that are beyond the farmer's control. High humidity and strong southerly breezes can carry windborne pathogens from Mexico and the southern states to infect crops. Violent storms from May to August can bring hail that can reduce crop yield potential or damage crops beyond recovery. Lack of timely precipitation can wither crops and reduce yields. Late frost in the spring can kill crops and early frost in the fall can curtail the grain filling period of fall harvested crops.[1]

Weeds that infest fields may cause problems during harvest. The weeds may clog small-medium size combines, so alternative harvesting techniques are required. The cut-and-swathing technique is not preferable as it may encourage grain loss and requires a greater investment of time and/or manpower.[2]

Rodent infestations threaten crops, which is one of the primary industries in the planning area. Mice, rabbits, and other pests damage crops in all stages of the production process. Young plants are vulnerable to the rodents who feed on them. Harvested and stored crops may be contaminated by rodents burrowing into storage units, either to feed on the materials or create nests during winter months, or become contaminated by fecal matter. The nature of such infestations makes tracking statistical data nearly impossible. Variables include the geographic distribution of the rodents and the crops, the number of rodents in the area, the presence and proliferation of natural predators, and the reproduction rates relative to the amount of natural food resources available. As such, while this is an acknowledged element of the agricultural hazards, it is not a primary focus in this profile.

Insect plagues also cause significant damage to crops in South Dakota. The last major grasshopper infestation in the United States occurred in the 1930s. Following this disaster, it was decided that local control of grasshopper outbreaks was insufficient and that regional coordination was required. The 1934 Congress charged the U.S. Department of Agriculture (USDA) with controlling grasshoppers on federal rangeland. Later, in 1987, the Animal and Plant Health Inspection Service (APHIS), which is part of the USDA, created the Grasshopper Integrated Pest Management (GHIPM) Project to develop new technologies for managing grasshopper populations. Subsequent grasshopper infestations in the 1950s, 1980s, and 2000s further underscore the importance of mitigating this insect-driven hazard. Similar insect hazards include locusts, aphids, and bark beetle plagues. In 2012, Campbell, Corson, Harding, and Perkins counties all received USDA disaster designations involving insects and disease (S3467). In early March 2010, USDA designated Ziebach County as a primary natural disaster area due to weather and grasshopper problems in 2009. Federal disaster assistance, such as low-interest emergency loans, is available for producers in Ziebach and the contiguous counties of Corson, Haakon, Pennington, Stanley, Dewey, Meade, and Perkins.

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[1] http://plantsci.sdstate.edu/woodardh/Soils_and_Ag/Eastern/Crop_Production_Problems/crop_production_problems.htm

[2] http://plantsci.sdstate.edu/woodardh/Soils_and_Ag/Eastern/Crop_Descriptions/crop_desciptions.htm

3.2.2.2 Location

Since diseases and pests are profiled in a compilation, instead of examining each potential hazard individually, the geographic location of the hazards is somewhat general. It is recognized that the individual occurrences of the hazards contained in this profile will exert unequal pressures and impacts. In general, it is important to know where the hazards *may* occur in order to determine the severity of the hazard when compared to other hazards in this plan. Specific vulnerabilities may be best addressed in county or local mitigation plans.

Livestock diseases are possible anywhere that livestock are present. 23,025,294 acres in South Dakota are devoted to pastureland, which accounts for 47.4% of the total land area of the state. Pastureland is primarily located in bands that stretch from north to south in the eastern half of the state, and in the grasslands that dominate the western area of the state. In Figure 3-2, pastureland areas are indicated in yellow, while grasslands are indicated in beige. The potential for disease transmission is higher in areas with greater livestock densities. The State Hazard Mitigation Team may consider incorporating livestock density information in future updates to this plan to better evaluate the most vulnerable areas of risk. Graphically depicting the areas within the State that have higher densities of livestock may help to visualize the risk and develop specific risk reduction measure for those areas.

Similarly, crop diseases are possible in any cultivated cropland environment. While some crop varieties are engineered for resistance to specific diseases or pests, the overall location of any pest or disease hazard corresponds to the cropland extent in the state. Specific variances to general distributions are noted in Table 3-7 and Table 3-8. 19,095,318 acres in South Dakota are designated as cropland, which accounts for 39.3% of the total land area of the state.

Cultivated crops are more prevalent in the eastern half of the state, though significant areas of cropland interspersed with grasslands also exist in the west. In Figure 3-2, these areas are indicated by brown shading.

Rodents such as mice, rats, and rabbits, are found across the entire planning region, as are insects. The presence of the rodents and insects is a consistent feature, with normal population density flows following the seasonal patterns. However, when density of these populations exceeds the capacity of the ecosystem, agricultural industries such as crops and the health of livestock are threatened. As discussed above, the ability to model these trends is difficult and inconsistent.

Grasshoppers are a historical insect hazard impacting agricultural production of crops. Figure 3-3 shows the adult grasshopper density for South Dakota measured in September 2012. While the map indicates that the majority of the density ratings are in western South Dakota, outside of the majority of cultivated cropland, this is due to the fact that the USDA does not survey in the eastern part of the State.

The impacts of grasshoppers on cattle have also been significant. Campbell, Corson, Harding, and Perkins counties received USDA disaster designations for losses related to insects and disease (S3467) in 2012. In that same year, 30 counties received a total of $702,633 in indemnities for crop loss related to insects. 22 counties received $184,810 in insect-related indemnities in 2011, and 27 counties received $927,938 in insect-related indemnities in 2010. The crop losses in all three years included forage used to feed livestock. The prediction for 2009, based on the density ratings, indicated that food supplies for cattle in the western portion of the state would be severely impacted by the grasshoppers. This prediction was proven accurate in 2010, when the State was approved for pasture grazing loss assistance under the Emergency Livestock Assistance Program (ELAP) as a result of the grasshopper infestation during the 2009 grazing season.[3] South Dakota, specifically Ziebach County, was named in USDA Secretarial Disaster Declaration S2916 for damages done by grasshoppers. Figure 3-4 predicts the grasshopper hazard for 2012 for the western United States (outbreaks have historically occurred in the 17 states that lie west of the 100th meridian[4]), including South Dakota.

[3] USDA. Farm Service Agency. http://www.fsa.usda.gov/FSA/newsReleases?mystate=sd&area=stnewsroom&subject=stnr&topic=landing&newstype=stnewsrel&type=detail&item=stnr_sd_20100408_rel_007.html

[4] USDA APHIS. http://www.aphis.usda.gov/plant_health/plant_pest_info/grasshopper/index.shtml

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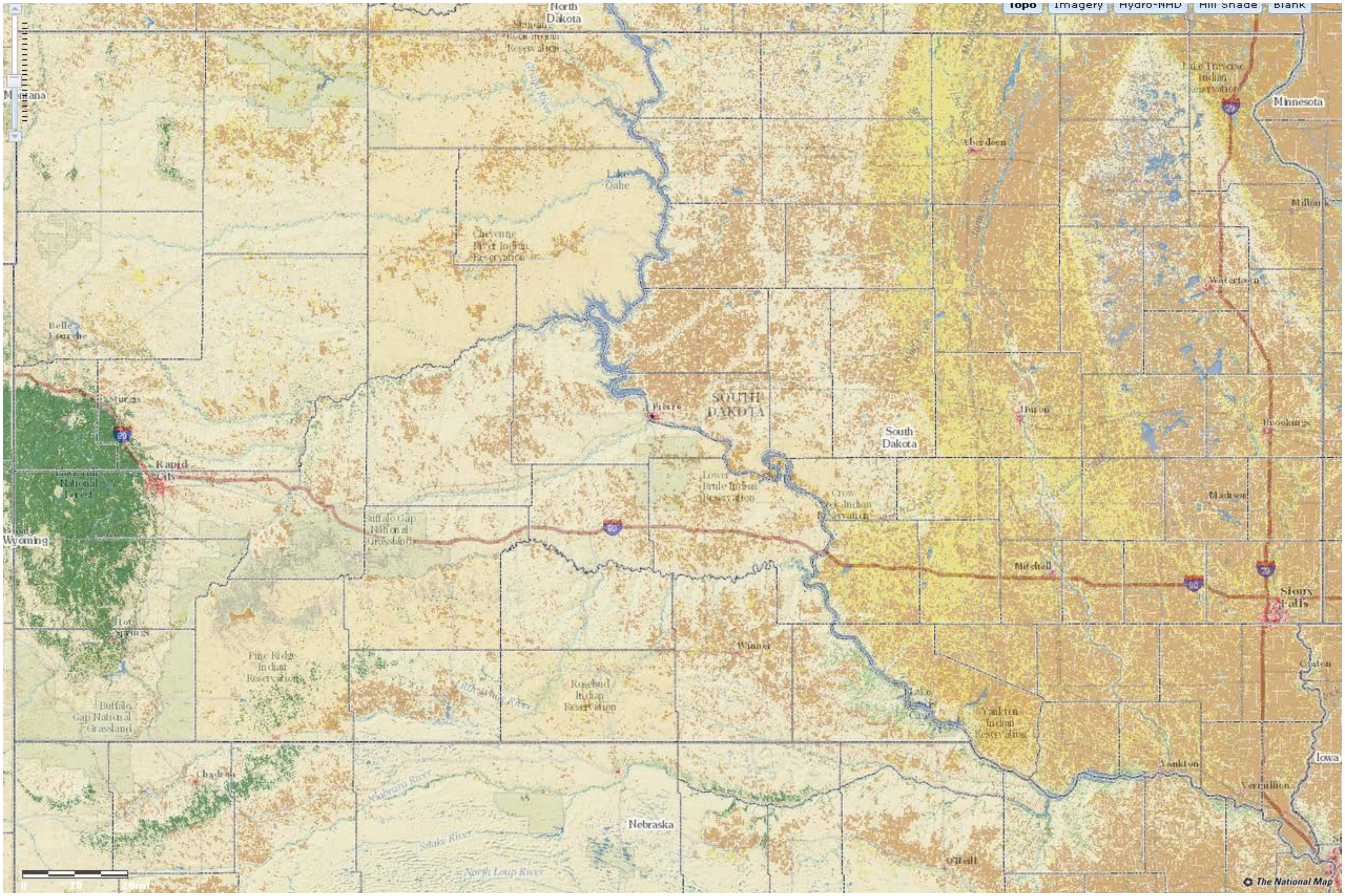
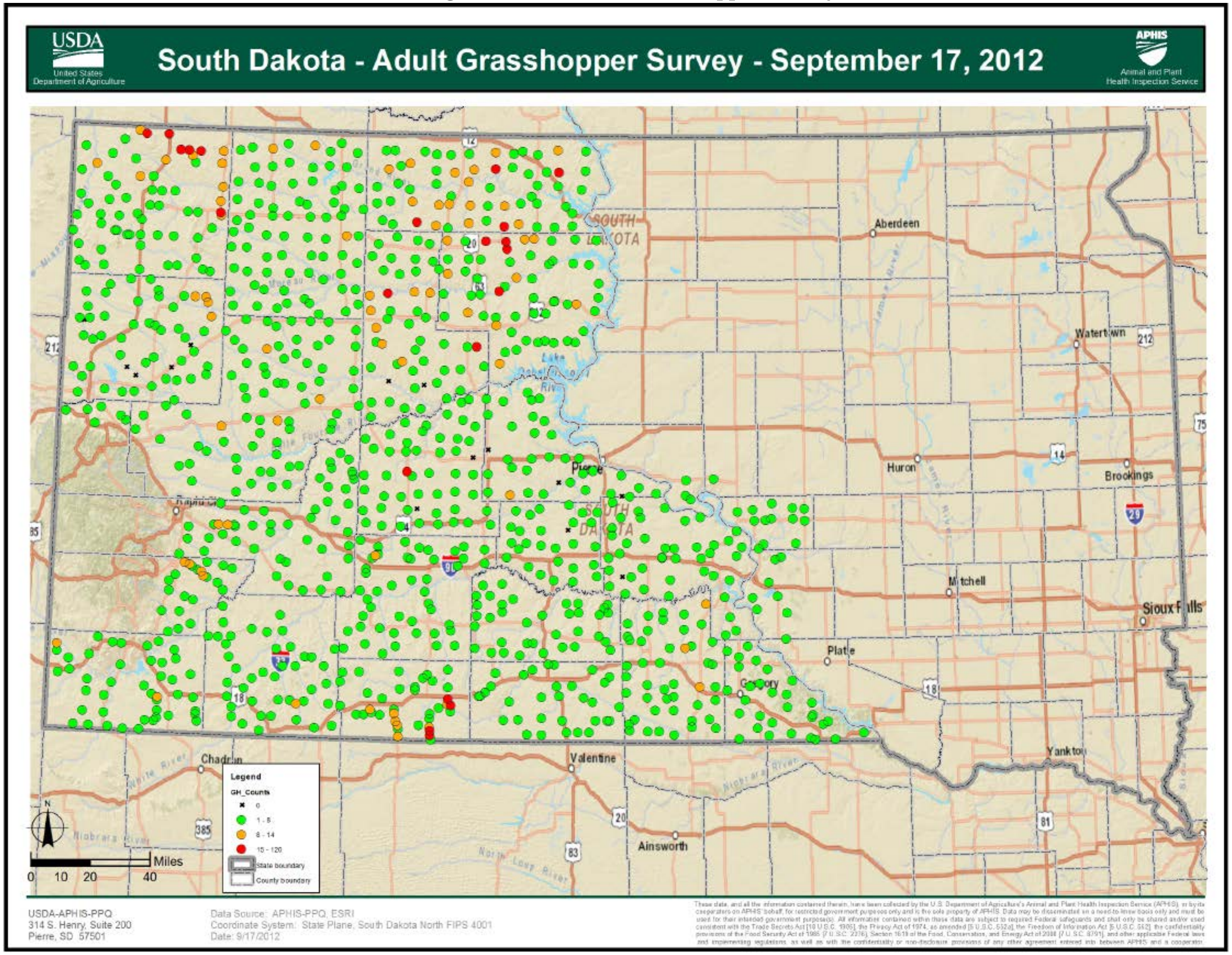
Figure 3-2 Land Cover in South Dakota



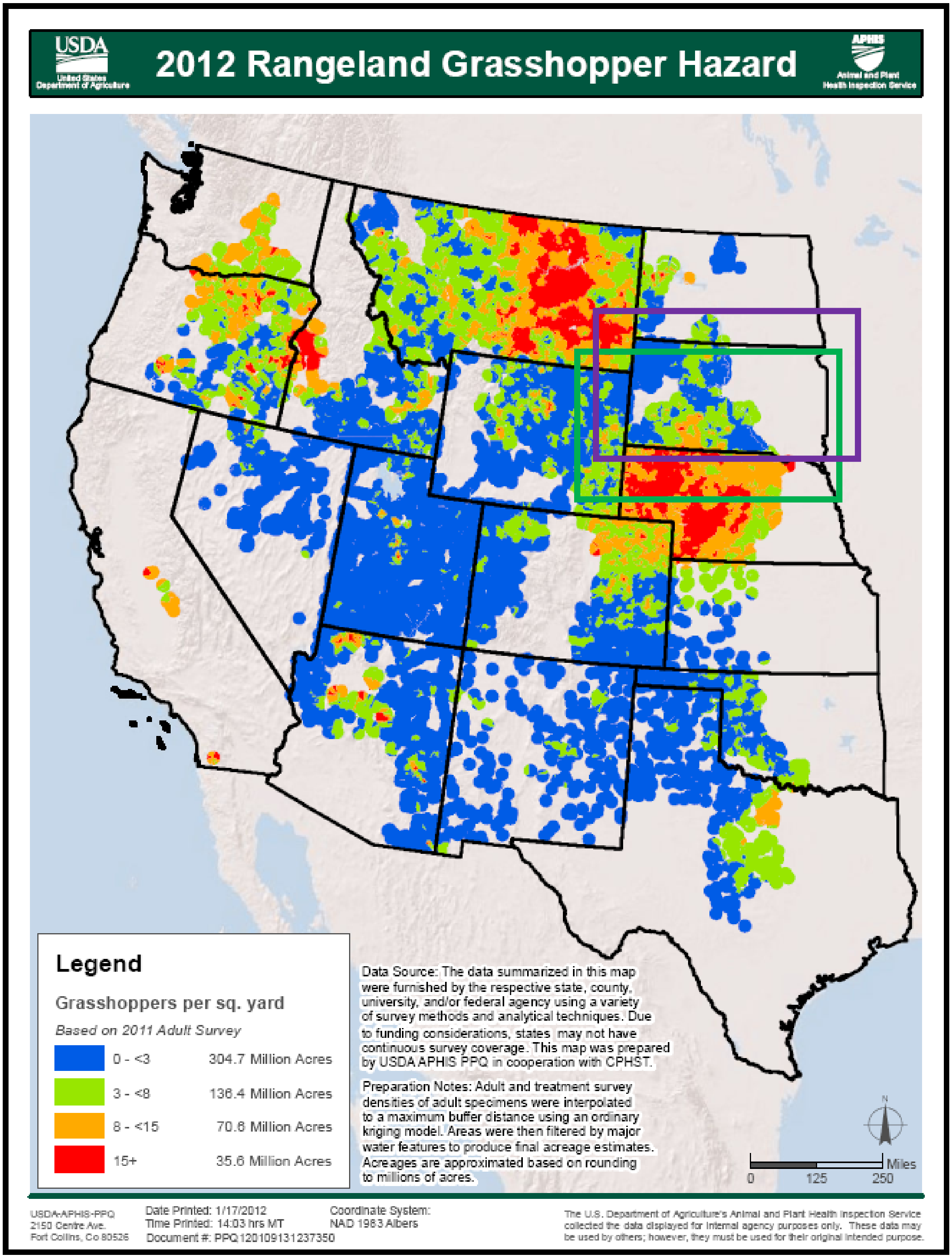
Source: The National Map Seamless Server hosted by the USGS, using NLCD 2006 Land Cover data.

Figure 3-3 2012 Adult Grasshopper Density for South Dakota



Source: USDA, South Dakota Department of Agriculture

Figure 3-4 South Dakota Grasshopper Hazard



Source: USDA APHIS

3.2.2.3 Past Events

Past events are detailed differently in this section compared to other hazard profiles. While previous occurrences are listed, where applicable, it is also important to recognize the potential devastating diseases or pests for which the State constantly monitors. The use of vaccines (in livestock) and fungicides, pesticides or resistant seeds have mitigated some previously severe hazards. Other potentially devastating hazards have not yet appeared in South Dakota and appropriate preventative measures are in place to help inhibit their introduction. As such, monitored diseases or infestations are as equally important as known events.

The South Dakota Animal Industry Board maintains a "List of Reportable and Quarantinable Diseases" (Table 3-6) that is reviewed and updated annually. Criteria for the inclusion of a disease on the list include those with high morbidity and mortality, zoonosis potential, economic impact, and industry importance. In addition, the figures below list both crop and livestock diseases that could infect South Dakota agricultural products.

Figure 3-5 Health and Human Services and US Department of Agriculture Select Agents and Toxins

HHS AND USDA SELECT AGENTS AND TOXINS
7 CFR Part 331, 9 CFR Part 121, and 42 CFR Part 73

HHS SELECT AGENTS AND TOXINS
Abrin
Botulinum neurotoxins
Botulinum neurotoxin producing species of *Clostridium*
Cercopithecine herpesvirus 1 (Herpes B virus)
Clostridium perfringens epsilon toxin
Coccidioides posadasii/Coccidioides immitis
Conotoxins
Coxiella burnetii
Crimean-Congo haemorrhagic fever virus
Diacetoxyscirpenol
Eastern Equine Encephalitis virus
Ebola virus
Francisella tularensis
Lassa fever virus
Marburg virus
Monkeypox virus
Reconstructed replication competent forms of the 1918 pandemic influenza virus containing any portion of the coding regions of all eight gene segments (Reconstructed 1918 Influenza virus)
Ricin
Rickettsia prowazekii
Rickettsia rickettsii
Saxitoxin
Shiga-like ribosome inactivating proteins
Shigatoxin
South American Haemorrhagic Fever viruses
- Flexal
- Guanarito
- Junin
- Machupo
- Sabia

Staphylococcal enterotoxins
T-2 toxin
Tetrodotoxin
Tick-borne encephalitis complex (flavi) viruses
- Central European Tick-borne encephalitis
- Far Eastern Tick-borne encephalitis
- Kyasanur Forest disease
- Omsk Hemorrhagic Fever
- Russian Spring and Summer encephalitis

Variola major virus (Smallpox virus)
Variola minor virus (Alastrim)
Yersinia pestis

OVERLAP SELECT AGENTS AND TOXINS
Bacillus anthracis
Brucella abortus
Brucella melitensis
Brucella suis
Burkholderia mallei (formerly *Pseudomonas mallei*)
Burkholderia pseudomallei (formerly *Pseudomonas pseudomallei*)
Hendra virus
Nipah virus
Rift Valley fever virus
Venezuelan Equine Encephalitis virus

USDA SELECT AGENTS AND TOXINS
African horse sickness virus
African swine fever virus
Akabane virus
Avian influenza virus (highly pathogenic)
Bluetongue virus (exotic)
Bovine spongiform encephalopathy agent
Camel pox virus
Classical swine fever virus
Ehrlichia ruminantium (Heartwater)
Foot-and-mouth disease virus
Goat pox virus
Japanese encephalitis virus
Lumpy skin disease virus
Malignant catarrhal fever virus (Alcelaphine herpesvirus type 1)
Menangle virus
Mycoplasma capricolum subspecies *capripneumoniae* (contagious caprine pleuropneumonia)
Mycoplasma mycoides subspecies *mycoides* small colony (*Mmm*SC) (contagious bovine pleuropneumonia)
Peste des petits ruminants virus
Rinderpest virus
Sheep pox virus
Swine vesicular disease virus
Vesicular stomatitis virus (exotic): Indiana subtypes VSV-IN2, VSV-IN3
Virulent Newcastle disease virus[1]

USDA PLANT PROTECTION AND QUARANTINE (PPQ) SELECT AGENTS AND TOXINS
Peronosclerospora philippinensis (*Peronosclerospora sacchari*)
Phoma glycinicola (formerly *Pyrenochaeta glycines*)
Ralstonia solanacearum race 3, biovar 2
Rathayibacter toxicus
Sclerophthora rayssiae var zeae
Synchytrium endobioticum
Xanthomonas oryzae
Xylella fastidiosa (citrus variegated chlorosis strain)

11/17/2008

[1] A virulent Newcastle disease virus (avian paramyxovirus serotype 1) has an intracerebral pathogenicity index in day-old chicks (Gallus gallus) of 0.7 or greater or has an amino acid sequence at the fusion (F) protein cleavage site that is consistent with virulent strains of Newcastle disease virus. A failure to detect a cleavage site that is consistent with virulent strains does not confirm the absence of a virulent virus.

Source: National Select Agent Registry, http://www.selectagents.gov/Select%20Agents%20and%20Toxins%20List.html

Figure 3-6 Animal and Plant Health Inspection Service Most Damaging Animal Diseases

	Disease	Animal Species Affected	Public Health Threat?
1	Highly Pathogenic Avian Influenza (HPAI)	Poultry	Yes, may be lethal
2	Foot-and-Mouth disease (FMD)	Cattle, swine, sheep, and other cloven-hoofed livestock	No
3	Rift Valley fever	Cattle, sheep	Yes, may be lethal
4	Exotic Newcastle disease	Poultry	Yes, minor effects
5	Nipah and Hendra viruses	Swine (Nipah), horses (Hendra)	Yes, may be lethal
6	Classical swine fever	Swine	No
7	African swine fever	Swine	No
8	Bovine spongiform encephalopathy agent	Cattle	Suspected
9	Rinderpest	Cattle, sheep	No
10	Japanese encephalitis	Swine, equine	Yes, may be lethal
11	African horse sickness	Equine	No
12	Venezuelan equine encephalitis	Equine	Yes, may be lethal
13	Contagious bovine pleuropneumonia	Cattle	No
14	Ehrlichia ruminantium (Heartwater)	Cattle, sheep, goats	No
15	Eastern equine encephalitis	Equine	Yes, may be lethal
16	Coxiella burnetii	Cattle, sheep, goats	Yes, may be lethal
17	Akabane	Cattle, sheep, goats	No

Source: USDA, http://www.aphis.usda.gov/animal_health/emergency_management/nvs.shtml

There are many common crop diseases that impact the production, yield, and overall quality of harvests. Some crops are sold as a commodity, while others are used to support the livestock industry. As with livestock disease, tracking every occurrence is unwieldy because, to some level, crop disease is omnipresent. This section (Table 3-7 and Table 3-8) shows the occurrence rate of common crop hazards for the top commodities groups grown in South Dakota- that is, small grains, oilseeds, dry beans and dry peas (ranked 9th in the nation for value of sales), corn for grain (ranked 7th in the nation for production in 2010), soybeans (ranked 8th in the nation for production in 2010), sunflowers (ranked 2nd in the nation for production in 2010), and forage (ranked 3rd in the nation for production). Note that commodities are grouped by disease vulnerability, rather than by commodities group. The information is drawn from an issue of "Extension Extra" published by the College of Agricultural and Biological Sciences at the South Dakota State University, which discusses the recognition and management of common crop diseases in South Dakota.[5] Additional information was obtained from news sources and the USDA for events post-2009.

Some highlights of the events listed below, or events of particular significance, include:

[5] http://sdces.sdstate.edu/ces_website/hit_counter.cfm?item=ExEx8005&id=1246

- Campbell, Corson, Harding, and Perkins counties received USDA disaster designations for losses related to insects and disease (S3467) in 2012. In that same year, 30 counties received a total of $702,633 in indemnities for crop loss related to insects. 22 counties received $184,810 in insect-related indemnities in 2011, and 27 counties received $927,938 in insect-related indemnities in 2010. The crop losses in all three years included forage used to feed livestock.
- Several counties also received indemnities for crop losses related to plant disease between 2010 and 2012. 12 counties received $62,183 in 2012, 38 counties received $3,303,117 in 2011, and 16 counties received $572,831 in 2010. Impacted crops included wheat, corn, soybeans, oats, dry peas, sunflowers, forage, and "other" not specified. The specific plant diseases that caused these losses were not identified in the Risk Management Agency data.
- The USDA produced a "Cattle Death Loss" report in 2011 which detailed the number of cattle and calves lost to various causes (predator and non-predator) in each state in 2010. A total of 68,000 head of cattle and 90,000 calves died in South Dakota in 2010. 12.6% (8,568 head) of cattle losses were attributed to digestive problems, 31.1% (21,148 head) to respiratory problems, and 5.2% (3,536 head) to other unspecified diseases. 12.8% (11,520 head) of calf losses were related to digestive problems, 29.2% (26,280 head) to respiratory problems, and 0.9% (810) to other unspecified diseases. Additional details were not available on the specific nature of the digestive and respiratory problems. At a value of $1,133 per head for cattle and $381 per head for calves, South Dakota's cattle industry losses in 2010 totaled $52,384,926 due to respiratory, digestive, and other diseases. (Weather-related cattle and calf losses are discussed in the *Winter Storm* hazard profile.)
- The USDA "Cattle Death Loss" report comes out approximately every five years, but previous reports for 2005 and 2000 organized data by region rather than state. The 1995 and 1991 reports are organized by state and can be compared to the 2011 report. The 1995 report indicates that a total of 59,600 cattle and 162,600 calves were lost in 1995. Of the 59,600 total cattle deaths, 6,800 were lost to digestive problems and 14,300 to respiratory problems. Of the 162,600 total calf deaths, 37,000 died from digestive problems and 30,000 were lost to respiratory problems. In 1991, cattle and calf losses totaled 55,000 head and 110,000 head respectively. Digestive problems killed 8,100 cattle and 33,400 calves. Respiratory problems killed 16,500 cattle and 31,300 calves. "Other diseases" was not listed as a category in 1995 or 1991. Total dollar value per head was not provided in the 1995 and 1991 reports.
- In January 2011, the USDA designated Jackson and Todd counties as natural disaster areas due to the ongoing grasshopper infestation that began in June 2010. Designated contiguous counties included Bennett, Jones, Pennington, Tripp, Haakon, Mellette, and Shannon.
- In April 2010, the State was approved for pasture grazing loss assistance under the Emergency Livestock Assistance Program (ELAP) due to the 2009 grasshopper infestation.
- In 2009, the State experienced combined effects of severe storms with hail, high wind, flooding, and grasshopper infestation in 35 counties. This led to the release of USDA Secretarial Disaster S2916.
- In 2005, the state experienced an unusually high outbreak of anthrax, with 56 positively confirmed cases in 18 counties.
- The highest number of Trichomoniasis (trich) cases occurred in FY 2005, with 45 positive cases in 11 counties. However, according to the State's Animal Industry Board, trich cases have steadily decreased since 2005 when regulations were put in place as a control method.
- Asian soybean rust is still not documented and confirmed in the state, but extensive scouting efforts are underway, particularly in the southeast counties.

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Table 3-6 South Dakota List of Reportable and Quarantinable Diseases

All Species	Reportable	Quarantinable
Any foreign animal disease	X	X
Anaplasmosis	X	
Anthrax	X	X
Any disease associated with food borne illness	X	
Any new emerging disease (Syndromes)	X	
Avian Chlamydophilosis (Ornithosis – Psittacosis)	X	X
Avian Encephalomyelitis (Infectious Encephalomyelitis)	X	X
Avian Infectious Bronchitis	X	.
Avian Infectious Laryngotracheitis	X	
Avian Influenza	X	X
Avian Metapneumovirus (Turkey rhinotracheitis)	X	
Babesiosis	X	
Blastomycosis	X	
Bluetongue	X	
BLV (Enzootic Bovine Leukosis)	X	
Bovine Papular Stomatitis	X	
Bovine Viral Diarrhea	X	
Bovine Spongiform Encephalophathy	X	X
Brucellosis caused by B. abortus, B. melitensis, B. suis, and B. ovis	X	X
Brucellosis caused by B. canis	X	
Campylobacteriosis (campylobacter fetus veneralis)	X	
Caprine Arthritis/Encephalitis	X	
Canine Ehrlichiosis	X	
Caseous Lymphadenitis	X	
Chronic Wasting Disease (Cervids)	X	X

All Species	Reportable	Quarantinable
Contagious Agalactia (Mycoplasma spp.)	X	
Contagious Caprine Pleuropneumonia	X	X
Contagious Equine Metritis	X	X
Cryptosporidiosis	X	
Cysticercosis (metacestode stage of Taenia saginata or Taenia solium)	X	
Dermatophilosis	X	
Diphtheria (Corynebacterium diphtheria)	X	
Duck Viral Enteritis (Duck Plague)	X	
Duck Viral Hepatitis	X	
Enzootic Abortion of Ewes (Chlamydophila)	X	
Epizootic Hemorrhagic Disease (EHD)	X	
Equine Encephalomyelitis (Eastern & Western)	X	
Equine Encephalomyelitis (Venezuelan)	X	
EHV-1 associated diseases (respiratory, abortion, neurologic/EHM)	X	
Equine Infectious Anemia (EIA)	X	X
Equine Influenza (Type A)	X	
Equine Rhinopneumonitis	X	
Equine Viral Arteritis	X	
Fowl Cholera (Pasteurella multocida)	X	
Fowl Pox	X	
Fowl Typhoid	X	X
Glanders	X	
Giardiasis	X	

All Species	Reportable	Quarantinable
Hemorrhagic Septicemia (Pasteurella multocida) serotypes B/Asian and E/African	X	
Herpesvirus of Salmonids	X	
Histoplasmosis	X	
Hydatid Disease (Echinococcus granulosus or Echinocossus multilocularis)	X	
Infectious Bursal Disease	X	
Infectious Hematopoietic Necrosis	X	
Infectious Bovine Rhinotracheitis (IBR-IPV)	X	
Leishmaniasis	X	
Leptospirosis	X	
Listeriosis	X	
Lyme Disease (Borrelia burgdorferi)	X	
Maedi-Visna (Ovine Progressive Pneumonia)	X	
Malignant Catarrhal Fever	X	
Marek's Disease	X	
Mycoplasma gallisepticum (MG)	X	
Mycoplasma synoviae (MS)	X	
New and Old World Screwworm Myiasis	X	X
Newcastle Disease	X	X
Ovine Pulmonary Adenomatosis	X	
Paramyxovirus (2-9)	X	
Paratuberculosis (Johne's disease)	X	
Plague (Yersinia pestis)	X	X
Porcine Epidemic Diarrhea Virus (PEDV)	X	
Porcine Reproductive and Respiratory Syndrome (PRRS)	X	
Potomac Horse Fever	X	

All Species	Reportable	Quarantinable
Pseudorabies	X	X
Pullorum Disease	X	X
Q-fever (Coxiella burnetii)	X	
Rabies	X	X
Rabbit Hemorrhagic Disease	X	X
Rocky Mountain Spotted Fever	X	
Salmonellosis (S. abortus ovis)	X	
Salmonellosis (Salmonella enteriditis)	X	
Salmonellosis (Salmonella Newport MDR – Ampc)	X	
Salmonellosis (Salmonella typhimurium)	X	
Scabies	X	X
Scrapie	X	X
Spring Viremia of Carp	X	
Swine Vesicular Disease	X	X
Toxic Substance Contamination	X	
Toxoplasmosis	X	
Transmissible Gastroenteritis	X	
Transmissible Spongiform Encephalopathy (Feline & Mink)	X	X
Trichinosis (Trichinellosis)	X	
Trichomoniasis	X	
Tuberculosis	X	X
Tuberculosis (Avian)	X	
Tularemia (Francisella tularensis)	X	
Vesicular Exanthema	X	X
Vesicular Stomatitis	X	X
Viral Hemorrhagic Septicemia	X	
West Nile Virus (flavivirus)	X	

Source: South Dakota Animal Industry Board Website http://aib.sd.gov/pdf/2013%20JULY.pdf

Table 3-7 Small Grains

Disease	Winter Wheat	Spring Wheat	Barley	Oats	Rye	Occurrence
Barley Yellow Dwarf (Red Leaf of Oats)	X	X	X	X		Common
Common Root Rot	X	X	X	X	X	Widespread
Covered Smut & Common Bunt	X	X	X	X	X	Fairly Common
Dryland Root & Crown Rot	X	X	X	X	X	Widespread, most serious on winter wheat
Leaf Rust	X	X	X	X		Widespread
Loose Smut	X	X	X	X		Common (>2% In Given Field)
Scab (Fusarium Head Blight)	X	X	X	X	X	East River Counties: Common West River Counties: Rare
Stem Rust	X	X	X	X	X	Rare
Stripe Rust	X	X				Frequent, Severity Varies By Year
Take All	X					Rare
Tan Spot, Septoria Leaf Blotch & Other Leaf Spot Diseases	X	X	X	X		Widespread
Vomitoxin	X	X	X	X	X	Fairly Common
Wheat Streak Mosaic	X	X				Frequent

Table 3-8 Sunflowers, Oilseeds, Dry Beans, Dry Peas and Soybeans, Corn, Alfalfa and Flax

Disease	Sun-flowers	Canola	Safflower	Field Pea	Chick-pea	Lentil	Dry Bean	Soy-beans	Corn	Alfalfa	Flax	Occurrence
Alternaria Leaf &Stem Spot, Leaf Blight	X		X*									Annually in late summer *common
Anthracnose						X	X		X*	X	X*	Rare *Occasional
Apical Chlorosis	X											Infrequent
Ascochyta Blight					X	X						Common
Asian Soybean Rust								X				Not yet reported in the state
Aster Yellows		X									X	Infrequent, no control

Disease	Sun-flowers	Canola	Safflower	Field Pea	Chick-pea	Lentil	Dry Bean	Soy-beans	Corn	Alfalfa	Flax	Occurrence
Bacterial Blight & Wilt[$]				X			X*	X		X[$]		Widespread, *Occasional [$]Rare
Bean Pod Mottle								X				Widespread
Black Leg		X										Common
Blackspot		X										Common, no control
Brown Spot								X				Widespread
Brown Stem Rot (BSR)								X				Occasional
Charcoal Rot								X				Occasional, extreme southeast counties
Common Leaf Spot										X		Common
Damping-Off			X						X	X		Common
Downy Mildew	X							X				Common
Eyespot									X			Occasional
Frogeye Leaf Spot								X				Rare in state, observed in extreme southeast counties
Fusarium Root Rot and Wilt[$]				X	X	X	X	X		X[$*]	X[$*]	Occasional *Common
Goss's Bacterial Wilt & Blight									X			Rare
Gray Leaf Spot									X			Fairly common
Holcus Spot									X			Annual in early summer
Maize Dwarf Mosaic									X			Common, typically low incidence
Northern Stem Canker								X				Frequent
Nothern Corn Leaf Blight									X			Occasional
Pasmo											X	Occasional
Phoma Black Stem	X											Annually in late summer
Phomopsis Stem Canker	X											Annually in late summer

Disease	Sun-flowers	Canola	Safflower	Field Pea	Chick-pea	Lentil	Dry Bean	Soy-beans	Corn	Alfalfa	Flax	Occurrence
Pod & Stem Blight								X				Widespread
Pythium Damping Off & Seed Decay				X	X	X	X	X		X		Widespread
Pytophthora Root & Stem Rot								X		X*		Widespread *Fairly Common
Rhizoctonia Seedling Blight[$] & Root Rot								X			X[$*]	Widespread *Common
Root & Crown Rot Complex										X		Common
Sclerotinia Wilt, Stalk Rot & Head Rot	X											Annually in late summer
Soybean Cyst Nematode								X				Widespread in south-eastern counties, scattered in other areas
Soybean Mosaic								X				Rare
Spring Black Stem & Leaf Spot										X		Widespread
Stalk Rot Complex									X			Annual in fall
Stem Nematode										X		Rare, restricted to western counties
Sudden death syndrome (SDS)								X				Rare: only in Clay County
Summer Black Stem & Leaf Spot										X		Common
Verticillium Wilt										X		Common
White Mold		X	X	X	X	X	X					Common

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3.2.2.4 Probability

To some extent, the probability of these events is guaranteed on an annual basis, particularly when evaluated on a statewide scale. The determination of probability becomes most valuable when areas of particular occurrence rates, or when events of unusual severity, are recorded. Many times, extreme events are documented concurrently with other hazard event occurrences, such as the outbreak of high anthrax levels in 2005, which was attributed to drought, the grasshopper plagues of the 1930s, also attributed to drought, or the recurrence of certain crop molds which correspond to unusually wet growing periods.

If the general annual probability of occurrence for the state, overall, is near 100%, some general probabilities for regions or specific counties may also be drawn.

In general, the western portion of the state (counties lying to the west of the Missouri River) have had a higher documented occurrence rate of Trichomaniasis and stem nematode afflictions of alfalfa crops. Counties along the river basins bore the brunt of the anthrax outbreaks in 2005. Eastern counties have higher documented rates of the soybean cyst nematode, frogeye leaf spot, scab, and West Nile Virus in domestic fowl flocks. According to the State's Animal Industry Board, West Nile Virus is not noted to be an issue for other poultry industries in South Dakota, such as turkey growers, table egg layers, or pheasant producers. The State Hazard Mitigation Team may consider evaluating livestock densities by county to analyze the types of livestock diseases that each county may be susceptible to as part of future mitigation planning efforts. Areas with a primarily cultivated crop land use are more susceptible to crop diseases, and thus have a predicted higher probability rating than areas devoted to rangeland.

A South Dakota State University Extension entomologist said that "based on the high grasshopper count late last summer (2009), there is potential for another year of grasshopper infestation in counties in western South Dakota" (see Figure 3-4). This prediction was accurate; grasshopper infestations continued to plague South Dakota in 2010. Dangerously high levels of grasshopper populations seem to follow a cycle of 7 to 10 years. Drought or periods of higher-than-average temperatures, particularly in the winter, increase the severity of grasshopper population numbers, because more eggs survive to hatch. Based on historical data, South Dakota has experienced four grasshopper plagues in 123 years (1887 to 2010) for an annual chance of 3.2%. Smaller infestations, which still exert significant economic impact, may be predicted at the cycle of ten years, or a 10% annual chance.

3.2.3 Flood

3.2.3.1 Description

Throughout the United States, flooding is recognized as the most prominent disaster-producing phenomenon, generating annual losses in the billions of dollars. Floods are among the most serious, devastating, and costly natural hazards that affect South Dakota. The greatest impact of these phenomena has been to the eastern half of the state, principally, the Big Sioux, Vermillion, and James River basins, which have recurring problems.

The following is extracted from "Flooding in South Dakota," a fact sheet written by Stan F. Pence from the South Dakota Department of Environment and Natural Resources.

3.2.3.1.1 What Is a Flood?

A flood occurs when water rises to flow over land that is normally dry. Floods happen in low-lying areas, such as valley bottoms, lake basins, and coastal areas. In South Dakota, flooding occurs mainly in valley bottoms, deep canyons, and lake basins when the amount of water moving through a river, or entering a lake, is so great that the natural or artificial banks can no longer contain all of the water. Therefore, the water overflows the banks of the river or lake and spreads out onto low-lying areas that are not normally covered with water.

3.2.3.1.2 What Causes A Flood?

In South Dakota, there are two main climatological 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 the banks of the river or lake, causing flooding. The size of the flood is commonly influenced by such factors as the intensity of the rainfall, length of the rainfall, melting rate of the snow, and the infiltration rate of the water into the ground.

In addition to climatological reasons for flooding in South Dakota, floods can also result from the failure of dams. Dam failure can result from defective construction or a poor foundation. Many small dams in South Dakota fail because their spillway is not big enough. Often, failure occurs as a result of extremely heavy rainfall that causes a large increase in the amount of water held by the dam. This increase in water behind the dam could place more stress (pressure) on the dam than it was designed to handle, causing the dam to fail.

3.2.3.1.3 What Types of Floods Occur in South Dakota?

Four types of floods can occur in South Dakota. The first type is commonly called a flash flood. A flash flood is the result of several inches or more of rain falling in a very short period of time, often tens of minutes. This high intensity rainfall is commonly caused by powerful thunderstorms that cover a small geographic area. Because so much water is falling onto the ground very rapidly, there is little time for the water to soak in, and most of the water runs off into nearby rivers or lakes. The flood that occurs as a result of this runoff happens very rapidly, hence the term “flash.” This type of flood is generally very destructive, affecting a fairly small, localized area, commonly several tens of square miles or less. The flash flood often ends almost as quickly as it started. Probably the best-known flash flood in South Dakota occurred when Rapid Creek left its banks on June 9, 1972, in Rapid City. Fifteen inches of rain that fell in less than 6 hours caused the flooding. This flood was devastating both in terms of loss of human life and property damage. Two hundred thirty-eight people lost their lives in this flood and about $150 million (in 1972 dollars) of property damage occurred.

The second type of flooding is sometimes termed the long-rain flood, and is the most common cause of major flooding. This type of flood results after several days or even weeks of fairly low-intensity rainfall over a widespread area, often hundreds of square miles. As a result, the ground becomes "water logged," and the water can no longer infiltrate into the ground; therefore, the water begins to flow toward rivers or lakes. The flooding that can result is often widespread, covering hundreds of square miles, and can last for several days or many weeks. Much of the flooding that occurred in eastern South Dakota during the summer of 1993 was this type of flooding.

The third type of flood in South Dakota is the result of melting snow in the spring. This type has characteristics that are almost a combination of the flash flood and long-rain flood. The area covered by this type of flood 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. The flooding can be made worse if the ground remains frozen while the snow is melting; this causes all of the melt water to run off to nearby rivers and lakes rather than infiltrate into the ground.

Some of the largest floods that have occurred in South Dakota were the result of melting snow and ice. These large floods have occurred along the entire length of the Missouri River. The Great Flood of 1881 is probably the most well known of all the floods to take place in South Dakota. Ice jams on the river caused the flooding to become extremely devastating, destroying large amounts of property and causing many lives to be lost. Towns such as Yankton, Vermillion, Burbank, Meckling, and Pierre were all severely damaged by the flooding.

The fourth type of flood results from the failure of dams or levees. The four largest dams in South Dakota—Oahe at Pierre, Big Bend at Fort Thompson, Fort Randall at Pickstown, and Gavins Point at Yankton—are all located on the Missouri River. Large dams in the Black Hills are the Deerfield, Pactola, Sheridan, and Angostura dams. If any of these large dams were to fail, flood damage could be very great. Fortunately, all of these dams are considered to be properly constructed and have been designed to hold back very large amounts of water; therefore, they are considered to be very safe, and the likelihood of failure is extremely small. Except for these Missouri and Black Hills dams, the majority of the dams in South Dakota are very small, and if they were to fail, flooding would likely be minimal. Levees protect many areas in South Dakota; however, many of these levees protect small areas from flooding (see Figure 3-10).

Further information regarding dam and levee failure and other flooding risk in South Dakota follows.

3.2.3.2 Dam Failure

South Dakota has approximately 2,500 dams in the National Inventory of Dams (see Figure 3-9 in Location section below). The state defines a dam as follows: “a structure is a dam if the height to the dam crest is greater than or equal to 25 feet and the storage at the dam crest (not at the spillway elevation) is greater than 15 acre feet or if the height to the dam crest is greater than 6 feet and the storage at the dam crest (not at the spillway elevation) is greater than or equal to 50 acre feet. The height of the dam is the difference in elevation between the natural bed of the watercourse or the lowest point on the toe of the dam, whichever is lower, and the crest elevation of the dam.”

Of the roughly 2,500 dams, approximately 80 are high hazard dams. Sixty five of these high hazard dams, of which 44 are state regulated, have emergency action plans. This is an improvement since 2007, when 21 dams had no emergency action plan. All high hazard dams are required to have emergency action plans. Of the total dams, approximately 155 are significant hazard dams. Because of South Dakota’s low population and low density, most of the state’s dams are low hazard dams. In *Federal Guidelines for Dam Safety: Hazard Potential Classification Systems for Dams* (FEMA 2004), dams are classified as follows:

- **Low Hazard Potential**—Dams assigned the low hazard potential classification are those where failure or mis-operation result in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
- **Significant Hazard Potential**—Dams assigned the significant hazard potential classification are those dams where failure or mis-operation result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- **High Hazard Potential**—Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life as well as economic, environmental, and lifeline losses.

Figure 3-7 Rushing water at a dam in Butte County during 2008 flooding

3.2.3.3 Levee Failure

In addition to these dams, South Dakota also has levees that pose flood risks. Levees are earth embankments constructed along rivers and coastlines to protect adjacent lands from flooding. Floodwalls are concrete structures, often components of levee systems, designed for urban areas where there is insufficient room for earthen levees. When levees and floodwalls and their appurtenant structures are stressed beyond their capabilities to withstand floods, levee failure can result in loss of life and injuries as well as damages to property, the environment, and the economy. In South Dakota, there are numerous levees ranging from small agricultural levees that protect farmland from high-frequency flooding to large urban levees that protect people and property from larger-less frequent flooding events such as the 100-year and 500-year flood levels. For purposes of this discussion, levee failure will refer to both overtopping and breach of a levee as defined in the FEMA's Publication ―*So You Live Behind a Levee* (http://content.asce.org/ASCELeveeGuide.html).

- **Overtopping** occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.
- **Breaching -** A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

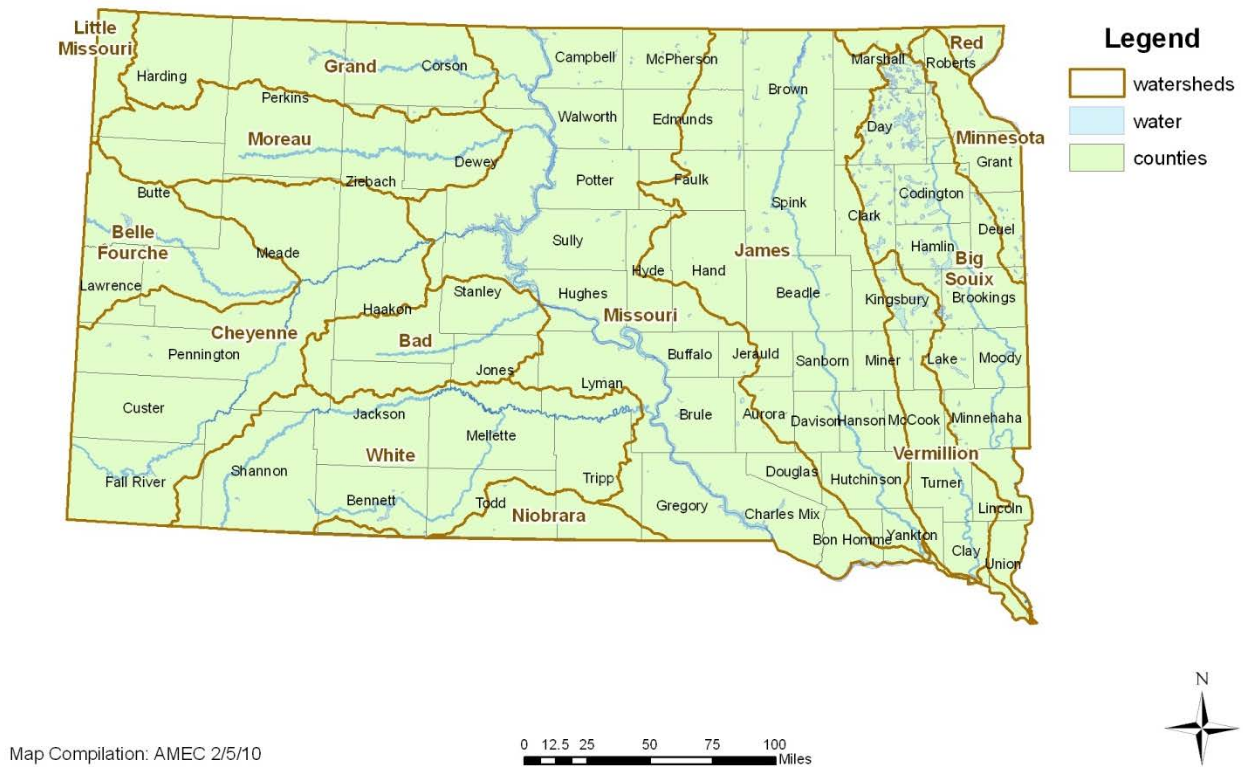
3.2.3.4 Location

According to the National Oceanic and Atmospheric Administration National Weather Service, flash floods are the deadliest natural disaster in South Dakota. They are caused by stationary or slow-moving thunderstorms that produce heavy rain over a small area. The Black Hills are especially vulnerable to flash floods, where steep terrain and narrow canyons can funnel heavy rain into small creeks and dry ravines, turning them into raging walls of water. Even on the prairie, normally dry draws and low spots can fill with rushing water during very heavy rain.

Critical to the mission of disaster identification and risk assessment is the ability to statistically log and compare various types of flood and demographic data. Through the use of modern GIS technologies, multiple analyses of structures, historical sites, city boundaries, airports, and schools can be performed and then compared to the floodplains in which they are located. Based on numbers of people and property at risk, i.e., the vulnerability of people and property at risk, the South Dakota Office of Emergency Management has determined that the cities of Aberdeen, Pierre, Rapid City, Sioux Falls, and Watertown are at the greatest risk from flood events.

South Dakota is divided into 14 river drainage basins (See Figure 3-8). These basins extend beyond the political boundary of the state. Although not discussed or included in this plan, an interstate understanding of water policy is required to fully analyze and comprehend South Dakota water systems.

Figure 3-8 Drainage Basins of South Dakota



Source: USDA Natural Conservation Resources Service South Dakota (www.sdconservation.org/files/SDWatershedsQ.pdf)

3.2.3.4.1 Missouri River Basin

The following description of the Missouri River Basin is from Microsoft Encarta Online Encyclopedia:

> Considered as a separate river, the Missouri is the longest in the United States. In combination with the Mississippi River into which it flows at St. Louis, it is the longest river system in the United States. The river begins where the Gallatin River, Jefferson River, and Madison River come together in the foothills of the Rockies in Montana. It flows through Montana, North Dakota, and South Dakota before forming the boundary between Iowa and Nebraska. It forms the extreme northeast border of Kansas before turning almost due east through the state of Missouri.
>
> South Dakota is drained almost entirely by the Missouri River and its tributaries. The only sections that are not lie in the extreme northeast and northwest. The Missouri flows southward and then southeastward across the state, in a deep, wide channel. It forms part of the South Dakota–Nebraska state line. Much of the South Dakota section of the river is now made up of a chain of four reservoirs impounded by large dams. These dams include Fort Randall, Gavins Point, Big Bend, and Oahe dams which were built for flood control and to provide water for irrigation and the generation of hydroelectricity. Lake Oahe is formed by Oahe Dam at Pierre. The James River, the Vermillion River, and the Big Sioux River, all in the eastern half of the state, flow southward in roughly parallel courses to join the Missouri. In the western part of the state the Grand, Moreau, Cheyenne, Bad, and White rivers flow generally eastward to join the Missouri.

South Dakota cities on the river include Pierre, Mobridge, Oacoma, Chamberlain, Pickstown, Fort Thompson, Ft. Pierre, Springfield, Yankton, and Lower Brule. The interstate effects of water policy are evident in the capital city of Pierre, where national policy objectives produce an ever-rising Missouri River to offset flooding in down river states.

The largest natural lake in South Dakota is Lake Thompson in the east-central part of the state. Other natural lakes of significant size in South Dakota are lakes Traverse and Big Stone, both in the northeastern corner of the state. In addition, there is the Waubay Lakes Chain and adjoining closed basins (discussed further in this section) located in the northeastern part of the state, which have continuous ongoing flooding issues. Numerous small lakes and sloughs dot the landscape of northeastern South Dakota, as well. The largest lakes are the reservoirs behind dams on the Missouri River, all of which were constructed as part of the Missouri River Basin Project.

3.2.3.4.2 Big Sioux River Basin

The Big Sioux River Basin is the eastern most major river pattern in South Dakota. It is formed within a topographic feature known as the Coteau de Prairie Highlands. This glacial formed feature rises about 800 feet above the bordering Red River lowlands of Minnesota. It is also bordered on the west by the James River lowland. The Coteau has what is known as a flatiron shape lying in a general northwest to southeast direction. It is about 200 miles long and 80 miles wide at the widest point. It has a variation in elevation from 2,050 feet at the highest point to 1,090 feet at the lowest point.

The northern part of the Coteau has geologically developed features of potholes, sloughs, and lakes. During periods of low precipitation, these features tend to hold backwater and do not contribute to the drainage of the Big Sioux River. Conversely, during wet years, this area can accumulate enough moisture to greatly increase the water supply to the drainage basin. There are about 1,970 square miles of land within the basin that is designated as noncontributing to the drainage system. The portion of the basin that does contribute to the Big Sioux River is about 7,280 square miles. A total of 4,280 square miles of is located in South Dakota

The headwaters for the Big Sioux River are found in the Coteau Lake Region of Roberts and Day counties. The river flows in a southerly direction to its junction with the Missouri River near Sioux City, Iowa. The variation in elevation from the headwaters to the mouth greatly influences the movement of water through the basin. The elevation decreases from 1,826 feet near Waubay to 1,281 at Sioux Falls. The Granite Falls formation of Sioux Falls has a 100-foot drop in elevation. Below the falls, the elevation varies from 1,281 feet to 1,098 feet at the river’s mouth near Sioux City, Iowa.

Associated with the elevation is the slope profile of the river. The slope varies from 1.83 feet per mile near Watertown, 1.50 feet per mile at Sioux Falls, and 0.5 feet per mile at the junction with the Missouri River. The Big Sioux River has a steeper gradient than the James or Vermillion rivers. This steep slope causes water to move quickly down the drainage system and thus shortens the time of peak flooding in any given portion of the basin.

3.2.3.4.3 James River Basin

The James River Basin is the largest of the East River Basin Systems. It is bordered on the east by highlands of the Coteau de Prairie and on the west by the high ground of the Coteau de Missouri. The valley is a nearly flat stretch of land about 216 miles long and averaging 60 miles wide. It is only in the southern portion that the topography becomes steeper. There is little variance in the elevation of the basin. At Columbia, where the river basin forms in South Dakota, the elevation is 1,290 feet. At the southern terminus of the basin near Yankton, the elevation is 1,162 feet.

The James River drainage area encompasses all or part of 23 counties. It drains 12,609 square miles or over eight million acres of land in South Dakota. This represents 16.3 percent of the total land in the state. The river valley is about 400 miles long, 25 to 75 feet deep, and varies in width from a few hundred feet to three miles. The slope of the valley is .493 feet per mile and the average slope of the river is .280 feet per mile.

There are seventeen contributing streams within the James River Valley. These streams drain 10,606 square miles. The majority of the basin lacks good drainage features. This is due to the slight variance in elevation and limited slope of the river. Much of its drainage is noncontributing and remains in small swales and basins.

3.2.3.4.4 Vermillion River Basin

The Vermillion River Basin is the smallest of the East River systems. It has its headwaters in the lake country of Kingsbury County. The river flows through McCook, Turner, and Clay counties to join with the Missouri River near Burbank, South Dakota. The west branch originates in Miner County and connects with the main stem near Parker in Turner County.

The Vermillion River Basin is formed in the Dakota Valley or what is more commonly called the James River Lowland. This area is more than 200 miles long and about 60 miles wide and occupies a portion of the lower half of the basin. The gradient of this river system is approximately 400 feet throughout the length of the river. The east branch elevation is 1,518 feet and the elevation near Vermillion is 1,119 feet. The slope profile is approximately four feet per mile.

The drainage system is supplied with water from both the east and west portion of the basin. The major tributaries are the Little Vermillion River, Turkey Ridge Creek, and Saddle Creek. There are also a number of very small tributaries contributing to its drainage pattern.

3.2.3.4.5 Black Hills Region

The western most drainage system is found in the Black Hills region. The Black Hills lie within the states of Wyoming and South Dakota with the majority in western South Dakota. The region is 125 miles long and 60 miles wide. The general shape of the Black Hills is elliptical. This formation presents a startling contrast to the surrounding topography. Its eastern side rises from the prairie to a height from 2,600 to 3,500 feet. The western part of the Black Hills varies in elevation from 3,500 to 7,200 feet at Harney Peak.

The major drainage creeks of Alkali, Battle, Bear Butte, Beaver, Box Elder, Elk, French, Rapid, Spearfish, Spring, and Whitewood are all capable of causing heavy flooding and flood-related damage. These eleven creeks drain about 7,500 square miles of land.

3.2.3.4.6 Waubay Lakes Chain and Adjoining Closed Basins

The Waubay Lakes Chain is part of a 409 square mile closed basin area in the Big Sioux River Basin in northeastern South Dakota (mostly in Day County). The 10 major lakes in this chain are glacial in origin and include Bitter Lake, Blue Dog Lake, Enemy Swim Lake, Hillebrands Lake, Minnewasta Lake, Pickerel Lake, Rush Lake, Spring Lake, Swan Pond, and Waubay Lake. In closed basins, under most circumstances, water does not have a direct drainage path to a river outside the closed basin and the water would have to evaporate into the atmosphere for lake levels to recede. The northeastern area of South Dakota is much like a giant bathtub. Water fills the basin until it overflows the sides. Because the area is atop a flat area of high ground, the sides of the tub are higher than the normal drainage routes (e.g., the Big Sioux and the James Rivers), leaving the accumulated runoff without a natural outlet.

Rising waters have inundated portions of Day County and the surrounding areas in the past. Significant increases in lake levels within the Waubay Lakes Chain have occurred mainly due to greater-than-normal precipitation along with less-than-normal evaporation. Several presidential declarations allowed for funding to be used to address the immediate problems of inundated roads and structures for emergency access purposes. As of 1999, the federal government had spent over $71 million in northeastern South Dakota for response and recovery efforts and emergency measures. However, because a major storm event or flash flood did not cause the damage (it was caused by an accumulation of annual runoff and a lack of evaporation), established FEMA disaster programs could not adequately address the situation.

Rising water levels in the Waubay Lakes Chain have resulted in substantial damage to public and private properties in the basin. Numerous public roads and highways have been damaged or closed because of high water, and some have been raised at great cost. Many parks and recreational facilities have been adversely affected as well. The available data show that the greatest impacts from flooding have been to agriculture and transportation.

In September 1998, FEMA issued a mission assignment to the U.S. Geological Survey to provide oversight, coordination, and hydrologic expertise for a study of the Waubay Lakes Chain and the adjoining closed basins. This study, including pertinent maps, is on file with the SDOEM and FEMA Region VIII. The U.S. Army Corps of Engineers also provided technical expertise and analysis for the study as well as possible structural mitigation solutions. The Natural Resource Conservation Service provided soils data.

This study found that from 1991 until the report was published in 1999, the Waubay Lakes Chain experienced a wet climatic period that can be expected to occur less than once every 100 years, on average. Due to periods of above normal precipitation and below normal evaporation, significant increases in lake levels and inundation areas within closed basins in northeastern South Dakota have been observed.

In the Waubay Lakes Chain, the lake levels for Bitter, Hillebrands, Minnewasta, Rush, Spring, and Waubay lakes and Swan Pond have significantly increased. The total surface area of the ten major lakes increased by 74 percent between 1991 and 1998. The water levels for Bitter, Hillebrands, Spring, and

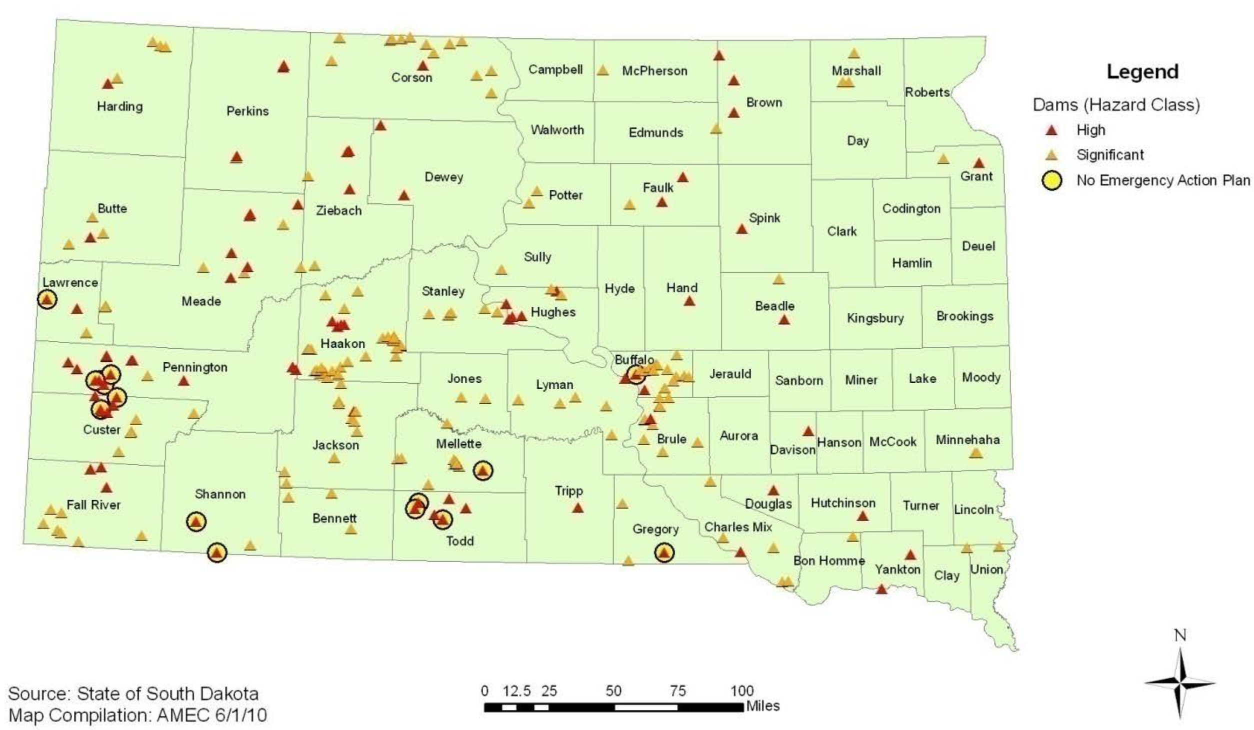
Waubay lakes and Swan Pond increased between 15 and 18 feet from 1991 to 1998. Blue Dog, Enemy Swim, and Pickerel lakes have concrete weir outlet structures and experienced lake level increases of 2.7, 1.8, and 0.1 feet respectively between fall 1991 and fall 1998. Minnewasta and Rush lakes experienced lake level increases of 9.2 feet and 3.9 feet respectively.

At the time the study was published, the U.S. Army Corps of Engineers' hydrologic model simulation suggested that flooding problems would persist in the region for the next few years, regardless of whether the climate was wet or dry. As of 2007 problems continue. It would take at least a decade of drought similar to that experienced in the 1930s to return the lakes to pre-1992 conditions. If relatively wet climate conditions persist, the lakes would continue to climb until Bitter, Blue Dog, Rush, and Waubay lakes form a single lake that will inundate over 60,000 acres and the natural drainage divide south of Bitter Lake could overflow and spill to the Big Sioux River. This scenario, however, would require nearly 15 years of wet conditions.

3.2.3.4.7 South Dakota Dams

As mentioned previously, the four largest dams in South Dakota are Oahe at Pierre, Big Bend at Fort Thompson, Fort Randall at Pickstown, and Gavins Point at Yankton. These are U.S. Army Corps of Engineers Dams on the Missouri River. Large dams in the Black Hills are the U.S. Department of the Interior Bureau of Reclamation's (BOR) Deerfield, Pactola, and Angostura dams and the U.S. Forest Service's Sheridan Lake dam. Shadehill Reservoir, while not in the Black Hills, is a significant BOR dam which stores water for irrigation (6,700 acres) and flood control purposes. Figure 3-9 shows the locations of the high and significant hazard dams in South Dakota.

Figure 3-9 South Dakota High and Significant Hazard Dams



More specific location information is in the following section on past events and Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction.

3.2.3.4.8 South Dakota Levees

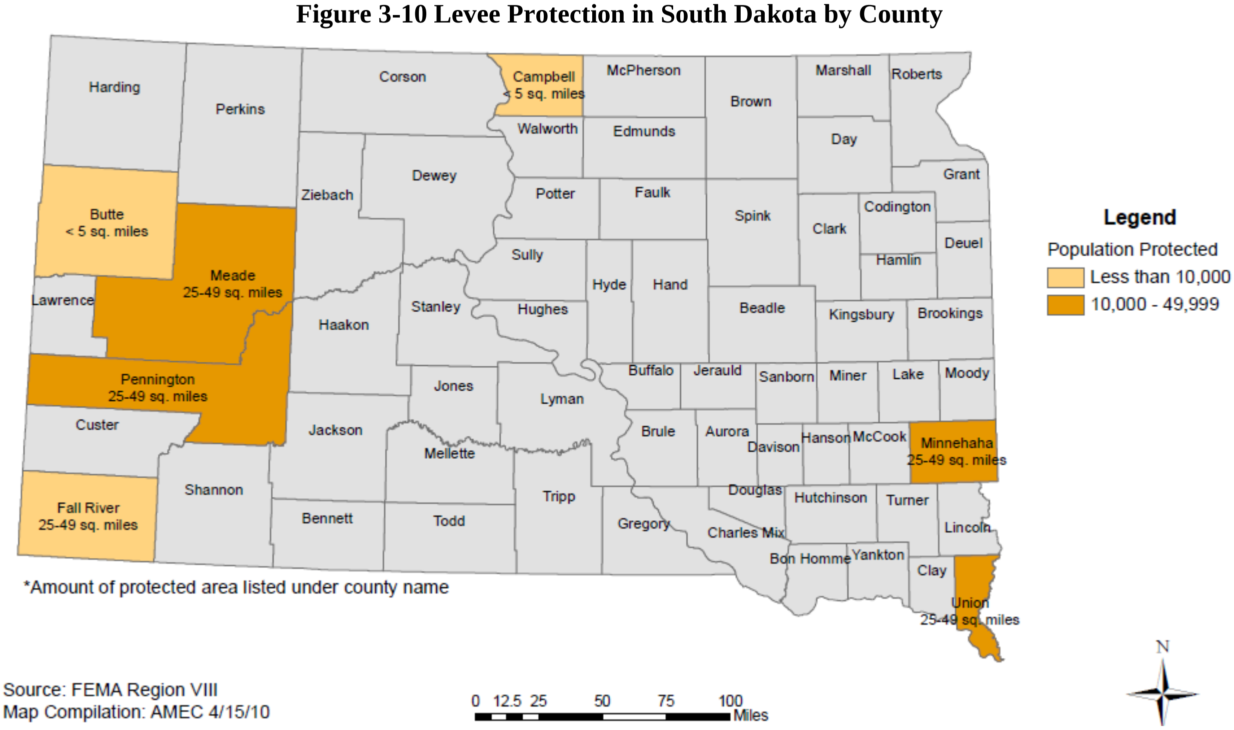
As mentioned previously, South Dakota contains numerous levees ranging from small agricultural levees that protect farmland from high-frequency flooding to urban levees protecting large urban populations and property from larger-less frequent flooding events such as the 100-year and 500-year flood levels. Table 3-9 shows the location of levees that were federally constructed, but are locally operated and maintained, as well as detail about each levee. These are also graphically depicted on Figure 3-10. The following table is not a comprehensive inventory of levees in the State. The SHMT noted that there are several levees along the James River in Spink and Brown counties that are not certified and frequently overtopped. Although these are not represented in the FEMA database of levees, the James River Water Development District (JRWDD) commissioned a LiDAR survey of the floodplain and now maintains GIS data of all of the levee locations along the James River. This information is being used by the JRWDD to identify specific mitigation actions within the watershed. JRWDD and Brown County are exploring opportunities to commission LiDAR for the entire county.

Table 3-9 Levees by County in South Dakota

County	City	System Name	Construction Completion Date	Inspection Rating	Last Routine Inspection Date
Brown	City of Aberdeen	Aberdeen - Moccasin Creek RB	-	Unacceptable	5/3/2011
Butte	City of Belle Fourche	Belle Fourche RB	6/1/1938	Minimally acceptable	8/17/2009
Campbell	Town of Herreid	Herreid - Spring Creek RB	10/19/1953	Minimally acceptable	5/4/2011
Fall River	City of Hot Springs	Hot Springs - Fall River Channel West System	7/25/1949	Minimally acceptable	8/25/2010
Fall River	City of Hot Springs	Hot Springs - Fall River Channel East System	7/25/1949	Minimally acceptable	8/25/2010
Lincoln, Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux RB and Skunk Creek RB	1/1/1961	Minimally acceptable	8/10/2010
Meade	City of Sturgis	Sturgis - Deadman Gulch RB	6/26/1980	Minimally acceptable	9/27/2010
Minnehaha	City of Sioux Falls	Sioux Falls - Diversion Channel LB - South	1/1/1961	Unacceptable	8/11/2009

County	City	System Name	Construction Completion Date	Inspection Rating	Last Routine Inspection Date
Minnehaha	City of Sioux Falls	Sioux Falls - Diversion Channel LB - North	1/1/1961	Minimally acceptable	8/10/2010
Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux RB and Skunk Creek LB	1/1/1961	Minimally acceptable	8/10/2010
Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux RB	1/1/1961	Minimally acceptable	8/10/2010
Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux LB and Diversion Channel RB	1/1/1961	Minimally acceptable	8/10/2010
Pennington	City of Rapid City	Rapid City - Rapid Creek RB	11/26/1978	Minimally acceptable	9/28/2010
Union	City of North Sioux City	North Sioux City - Union County - Big Sioux River RB	10/20/1981	Minimally acceptable	7/14/2010

Figure 3-10 Levee Protection in South Dakota by County



3.2.3.5 Past Events

According to the National Climatic Data Center Storm Events database, there were 1,184 floods in South Dakota between 1993 and October 2012. Total property and crop damage for these events is estimated at $294.6 million in 2012 dollars. This suggests that South Dakota experiences 62.3 floods and $15.5 million in flood losses (property and crop) annually. There were five deaths and five injuries during this time period. Table 3-10 describes some of the floods that have occurred in South Dakota. See Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction for more information about how floods affect individual counties.

Figure 3-11 Rural homes surrounded by water, Aberdeen, South Dakota, 2007. Flooding resulted in a Presidential Disaster Declaration.

South Dakota is remarkable in that as early as the late 1800s, flood mitigation efforts were pursued and implemented. The first effort was after the 1881 flood of the Vermillion and Missouri rivers that wiped out the town of Vermillion. The town was relocated on the bluffs behind the former town to prevent another recurrence. This was the first recorded hazard mitigation effort by a government entity in South Dakota and possibly the nation.

The second effort followed the 1972 Black Hills/Rapid City flood. This flood stands out in South Dakota history as the deadliest and most expensive in terms of damage. Following the flood, Rapid City refused to allow rebuilding in the floodway, effectively launching federal government efforts to create a hazard mitigation program.

While there have been failures of low hazard dams in recent years, no deaths or injuries were reported, and property damage was minimal. The only significant failures of high hazard dams are the breach of Canyon Lake Dam in 1972 (Rapid City flood) and the failure of Menno Dam in 1984 (see event descriptions below). Rose Hill Dam in Hand county failed in 2010 due to heavy rains. Two people were stranded, hanging from a tree as floodwaters rushed passed, until first responders were able to rescue them.

Table 3-10 Significant South Dakota Flood Events

Date	Comments
May 5, 2012	Thunderstorms produced large hail, damaging winds, and flash flooding in southeast South Dakota, near and north of Interstate 90, during the evening of May 5th. The flash flooding continued past midnight on May 6th. Heavy rainfall of up to 6 inches caused flash flooding of numerous roads, parks, fields, other low areas, and buildings including homes. At least 90 homes were heavily damaged in Madison by the flooding, including at least two with basement walls washed out. A basement wall of a dentist's business was also washed out, and the basement flooded with 9 feet of water. Numerous personal possessions in flooded homes and businesses were destroyed. The flash flooding included Memorial Creek, and there was a fatality when an out of state visitor drowned attempting to cross the flooded creek. While this fatality and most of the damage was in Madison, many rural roads and fields were flooded in the area, and east to near the town of Wentworth.
March 11 – July 22, 2011	**Severe Storms and Flooding (FEMA-1984-DR)** A deep and expansive snow pack across the area began to melt bringing many areas of flooding to central and northeast South Dakota beginning in mid-March and continuing into early April. Many roads along with countless acres of crop and pastureland remained flooded. Roads, culverts, and bridges were damaged across the region. Several roads were washed out with many closed. Many homes were threatened with some surrounded by water. Rising lake levels in northeast South Dakota also threatened and flooded many homes. Many people had to use four-wheelers to get to their homes. A Presidential Disaster was declared for all of the counties due to the flooding damage. The total damage estimates, including March, were from 4.5 to 5 million dollars for the area. High water and groundwater levels resulting from record precipitation in the previous year contributed to the slowness of any improvement in the flooding situation until the spring. The flooding diminished across much of the area into May. Flash flooding events began in May and continued through July. Heavy rains and thunderstorms produced flash floods around the State. Storms dropped several inches of rain over the already saturated soils in a matter of hours.
September 22-23, 2010	Persistent thunderstorms developed in the late morning over southeast South Dakota and continued through the afternoon and evening. All of the storms through early afternoon produced large hail, with one report of damaging wind gusts. Large hail, heavy rain, and flash flooding were noted during the evening. Some of the flash flooding continued through the night and next day as flooding.
July 21-30, 2010	**Flooding (FEMA-2328-DR)** A powerful storm dumped heavy rain causing flash flooding in South Dakota. As

Date	Comments
	much as nine inches of rain fell in the southeastern part of the state, flooding homes and neighborhoods. The heavy rain also forced Sioux Falls officials to discharge untreated wastewater into the Big Sioux River. The storms in late-July affected counties where soils already were saturated and roads, bridges and culverts had been damaged from the earlier flooding and storms. Rain gauge readings ranged from 3.69 inches to 4.15 inches. The National Weather Service says the previous July 21 record at Mitchell was 2.32 inches in 1907. Total damage to public infrastructure in those counties is estimated to be more than $4 million from heavy rains and severe storms during the period between July 21 and July 30, 2010.
March 10, 2010	**Flooding (FEMA-1915-DR)** Floodwaters closed roads, filled basements, and soaked agricultural fields in southeastern South Dakota in late March 2010. A combination of snowmelt, ice jams, and heavy rains drove the Vermillion, Big Sioux, and James Rivers over their banks. Some residents described the flooding as the worst in living memory, according to the Associated Press. This event also resulted in a presidential disaster declaration.
April, 2009 through June 2009	March flooding of the James River continued throughout April. The James River went above flood stage at Redfield on April 18th and continued through the end of the month. The James River at Redfield rose to 25.7 feet on April 30th, almost 6 feet above the flood stage of 20 feet. The James River from Columbia to Ashton was from 6 to as much as 10 feet above flood stage throughout the month. The James River continued to cause major issues throughout Brown and Spink counties for roads, fields, cropland, along with some homes. State Highway 34 was closed for about two weeks at the state border near Hecla. The flooding washed away the highway base. The James River west of Hecla became a 3 mile wide lake. Some people near Hecla said this was the highest the James River had been near Hecla in several decades. The high water forced the evacuation of people from two homes near Hecla. Many roads along the James River throughout Brown and Spink counties were closed. Also, several bridges along the river were overtopped. Many outbuildings along the river were flooded and damaged with over 100 livestock deaths attributed to the flooding. At the Sand Lake National Wildlife Refuge, both the Sand and Mud Lakes hit record levels on the morning of April 17th. Sand Lake's elevation was 1,292.58 feet, breaking the previous record of 1,292.39 feet in 1997. Mud Lake's elevation was 1,293.36 feet, breaking the previous record of 1,293.29 feet. The elevation of the river remained above flood levels through June though waters began receding in early June. This event also resulted in a presidential disaster declaration.
March 20, 2009	Rapid snowmelt and ice jamming caused the Elm River near Westport to rise above flood stage on March 20th. The Elm River reached an all time record level of 22.69 feet on March 25th almost 9 feet above flood stage. The previous record was 22.11 feet set on Apri1 10th, 1969. The flood stage for the Elm River at Westport is 14 feet. The city of Westport was evacuated with the flood waters causing damage to many homes and roads in and around Westport. Also, many other roads and agricultural and pastureland along the river were flooded. The Elm River slowly receded and fell below flood stage on March 30th. The flood waters from the Elm River flowed south and into the northern portion of Moccasin Creek. Subsequently, the Moccasin Creek rose as the water flowed south into the city of Aberdeen. Flooding became a concern for Aberdeen and for areas along the creek north of Aberdeen. The Governor signed an emergency declaration which allowed the state

Date	Comments
	to help with flood response efforts, including sending 50,000 sandbags to the area. Also, the National Guard was activated to move a variety of heavy equipment. Some sandbagging and a falling Elm River kept the Moccasin Creek from causing any significant flooding in and north of Aberdeen. Although, some township and county roads were flooded from the creek.
June 1 – June 6, 2008	A series of intense storms impacted more than twenty counties across the state over a period of five days, incurring several million dollars worth of damage and causing flash flooding, hail and wind damages to livestock, wildlife, property and cropland, and resulting in a presidential disaster declaration. Periodic flash flooding continued for another four days, incurring several hundred thousand dollars more of damage. **Figure 3-12 Water washes out a road in Butte County during 2008 flooding** 
August 17, 2007	An intense summer thunderstorm dropped rainfall in the foothills of the Black Hills ranging from four to seven inches that caused flash flooding in and around Hermosa. The flash flooding resulted in widespread catastrophic damage to homes and businesses. Some houses were moved off their foundations and destroyed; other homes and businesses received significant flood damage. Critical utilities were also nonfunctional.
May–June 2007	**Severe Storms, Tornadoes, and Flooding (FEMA-1702-DR)** Flooding brought on by record-setting rainfall on May 4 and 5 caused widespread damage to homes, businesses, farmland, infrastructure, and utilities across eastern South Dakota. Houses were destroyed; with basement walls collapsing, and critical utilities were nonfunctional. Thousands of acres of farmland were flooded that could not be planted, resulting in financial impacts to the individual operations as well as businesses dependant on the farming community. State and local governments also sustained damage to infrastructure. Flooding along the James River in Yankton County exposed URD cable. The Bon Homme Yankton Electric

Date	Comments
	Association was forced to relocate the cable. Additionally, the flooding shut down one irrigation system for the entire summer. The Association's emergency repair and restoration costs were estimated at $20,023. www.state.sd.us/news/showDoc.aspx?i=8468 www.state.sd.us/news/showDoc.aspx?i=8437 **Figure 3-13 National Guard and Department of Game, Fish and Parks discuss response efforts to help flooded residents in 2007** 
May–June 2004	**Severe Storms and Flooding (FEMA-1531-DR)** Thunderstorms developed from northern Turner County to western Yankton County on May 29. These storms produced large hail and strong winds across the area and saw very little movement over an eight-hour period. As a result, three to six inches of rain fell in portions of Yankton, Turner, and Minnehaha counties, including Sioux Falls and the towns of Parker, Hartford, Crooks, and Marion. Urban flooding resulted with rapid runoff from streets across Sioux Falls. Willow Creek in Crooks and Skunk Creek in Hartford rose several feet in only a couple of hours. In western Sioux Falls, Skunk Creek reached its highest level in 20 years. River flooding continued the following two days. On June 16, strong thunderstorms developed in western Sioux Falls and moved east. As the storms moved east, new storms developed just west of Sioux Falls, resulting in repeated episodes of heavy rain in the Sioux Falls metropolitan area. Rainfall amounts were similar to May 29, but the rate of rainfall was much higher. Over two inches of rain fell in one hour at the Sioux Falls airport, and multiple locations around the city received more than three inches of rain in two hours. The highest amount of rainfall reported in Sioux Falls was 7.79 inches. There were numerous reports of three to six inches across the city. The large amount of rainfall

Date	Comments
	in a short period of time produced excessive runoff across the city and Skunk Creek and the Big Sioux River rose rapidly as a result. At the time, the 31 days up to and including June 16 marked the wettest 31 day period on record for Sioux Falls (12.74 inches at Joe Foss Field). Source: NWS Sioux Falls
April 2001	**Severe Storms (Flooding) (FEMA-1375-DR)** This presidentially declared disaster was precipitated by an onset of flooding that began during a spring thaw in early March 2001. On April 6, a series of rainstorms that dropped from two to six inches of rain resulted in flooding of the James, Vermillion, and Big Sioux rivers. According to the National Weather Service, the James River, at Huron, reached its highest crest of 18.1 feet (flood stage of 11 feet) on April 10, the second highest crest on record. On April 11, a second similar weather system produced more heavy rains in the Aberdeen, Huron, Watertown, and Brookings areas. Flooding of the James River occurred in and around Huron and Mitchell. The west fork of the Vermillion River caused flooding around Parker and Centerville. The Big Sioux River flooded in and around Watertown, Dells Falls, and Sioux Falls. At Mitchell, the James River reached its highest crest of 21 feet (flood stage of 14 feet) on April 11, the second highest crest on record according to the National Weather Service. Peak crests on the Vermillion and West Vermillion rivers were two to four feet above flood stage. The Big Sioux River in Sioux Falls crested at 22 feet (flood stage of 16 feet) on April 24. A third major system passed through South Dakota on April 21-22. The Black Hills, in the western part of the State, received up to 22 inches of heavy wet snow and the eastern portion of the state received 4-8 inches. Beadle, Brookings, Brown, Buffalo, Clark, Codington, Day, Deuel, Edmunds, Grant, Gregory, Hamlin, Hanson, Jerauld, Kingsbury, Marshall, Mellette, Moody, Roberts, Sanborn, Spink, Todd, Turner, and Tripp counties were included in the disaster declaration. The major impact was to public infrastructure. Due to ice and wind damage to utility poles and lines, electrical services to some areas were interrupted. Numerous bridges and roads were impacted as well. There was damage to county and township roads in the eastern and northeastern portion of the state that had previously not been affected by floodwater. Some of the damaged roads included school bus, mail, and farm-to-market routes. Travel on these roadways involved significant risk. Several roads were temporarily impassable, requiring residents to travel greater distances because of detours. Many farmers were unable to access their fields to begin spring planting. In Mellette County, ice jam fluctuations substantially damaged a bridge, which caused the county to close the bridge to through traffic, resulting in a 40-mile detour for residents needing to cross the White River. This disaster also heavily impacted South Dakota's agricultural and livestock community.
February–May 1997	**Severe Storms/Flooding (FEMA-1173-DR)** This disaster had its roots in past flooding events. Beginning in 1992, the state had a series of weather-related events of sufficient magnitude and impact to warrant

Date	Comments
	eight presidential disaster declarations prior to this event; five for flooding, four for ice/snow; and one for just snow. These events kept the water table saturated, which prevented much of the winter snow melt and the spring/summer rains from soaking into the ground, thus contributing to flooding. The first significant winter storm of 1996 hit the eastern part of the state in mid-November, dumping up to 10 inches of snow across the northeast and producing a major ice storm with widespread damage across the southeast (see Winter Storms). In 1997, major winter storms were fairly frequent throughout January with several blizzards, mostly in the northeast part of the state (see Winter Storms). From mid-November to mid-February, the general weather across the eastern part of the state was cold and wet with below normal temperatures (in excess of 30°F below zero) and record-setting above normal snowfall. The persistent cold greatly limited snowmelt between storms, allowing up to 48 inches of snow to accumulate across much of the northeastern part of the state. Mid-February snow depths elsewhere across eastern South Dakota ranged from 10 to 24 inches. The National Weather Service snow water equivalent measurements of February 12 ranged from approximately two inches near the Missouri River to over six inches in Marshall County. Snow water equivalent values from 4 to 5 ½ inches were common over the central and northern portions of the James and Big Sioux river basins. Seasonably cool and relatively dry weather prevailed across the eastern part of the state from mid-February to early April. An early April blizzard added to the remaining snow pack, which gradually melted south to north by the end of April. Heavy rain and snowstorms in April, compounded by severe winter blizzards and existing saturated soil conditions, resulted in persistent flooding throughout the state. Many people were evacuated from their homes and farms, while others had limited or no access or escape. Heavy snowmelt and pounding rains turned prairie potholes into lakes, pushed people from their homes, and prevented farmers from planting thousands of acres of land. The James River Water Development District estimated that five years of flooding destroyed or severely damaged approximately 75 percent of the forested areas in the James River Valley. Riverine flooding destroyed or damaged many homes and businesses, impacted water and sewage treatment plants, and damaged or destroyed many roads and bridges. All counties were included in the presidential disaster declaration. This flood caused approximately $82.5 million in damage (2006 dollars) and two deaths.
March–May 1995	**Severe Storms, Flooding (FEMA-1052-DR)** The entire state had above normal precipitation between January and May, ranging from about one to two inches above normal in the southwest to five to nine inches above normal in the east. This is up to 200 percent of normal. Many official reporting stations, including Huron, Mitchell, and Sioux Falls, experienced their all-time wettest springs on record. Most damage to public facilities 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 or unusable due to high groundwater saturation of the subgrade, causing interruption of emergency services. Damage to power transmission and distribution facilities owned by rural electric cooperatives was also reported.

Date	Comments
	Preliminary damage surveys identified over 3,000 homes with some type of damage. The vast majority of damage was from one to three inches of groundwater seepage into basements. In many areas, the water table rose to near land surface levels, saturating septic drain fields and preventing proper treatment of residential sewage. Preliminary damage surveys estimated $9.3 million in damage to infrastructure of public facilities. Roads and Bridges and Utilities incurred the most damage with almost $5.7 million and $2.6 million in estimated damages, respectively. Federal aid system roads received $7.1 million in damage.
March–July 1994	**Severe Storm/Flooding (FEMA-1031-DR)** Flooding in northeastern South Dakota began in mid-February 1994, as a result of very high residual groundwater tables from 1993's extremely high levels of precipitation (snow and rain) and rapid melting of the snowpack. Flooding continued into late March 1994 and then subsided. Rain continued throughout the spring and summer months, but the remainder of the snowmelt was gradual and did not significantly contribute to flooding. On July 6, a significant storm system passed through central and northeastern South Dakota. Severe winds caused damage in the Pierre area, and the town of Milbank in Grant County received approximately six inches of rain in a two to three hours. The thunderstorm in Milbank caused the town's storm and sanitary sewer systems to overload and water backed into basements of several homes. Damage was estimated at approximately $4 million. The vast majority of damage was to county and township roads (which had significantly deteriorated because of saturation from near ground-level water tables), culverts, and bridges. Many roads remain under water, as once-small (or dry) glacial lakes with no drainage outlets, grow in size and encroach upon nearby roadways. In 1995, total damages were estimated to be $36.5 million.
March–September 1993	**Flooding, Severe Storms, Tornadoes (FEMA-999-DR)** Early and rapid snowmelt resulted in localized flooding along portions of the three eastern river basins. Major problems began in May when severe weather spawned tornadoes and floods in five eastern counties, injuring 12 and killing 1. Heavy rains continued throughout May, June, and July, which included a 6.5 inch deluge in Sioux Falls on May 23 that backed up sewage into 190 basements and damaged city streets. By the end of June, the Big Sioux River was over a mile wide in places, flooding many communities along its banks. During early July, the swollen Vermillion and James rivers inundated thousands of acres of farmland and surrounding communities. Heavy July rains developed flash flood torrents on small drainages in Madison and Yankton, while rising lake levels flooded numerous communities on lake shores. Overall, the disaster heavily impacted 39 counties in South Dakota, over half the state, and contributed to four deaths, approximately $2 million damage to business, $12 million damage to public facilities, $10 million to private residences, and $204 million to agriculture. Federal aid system roads received $3 million.
June 1992	**Flooding, Severe Storm, Tornadoes (FEMA-948-DR)** On June 13 and 14, a major spring storm resulted in severe weather in Harding County. Golf ball size hail and 10 ½ inches of rain occurred in a three-hour time span. Crops were destroyed and over 500 sheep were killed. On the afternoon and evening of the June 16, several violent thunderstorms (super cells) produced large amounts of rain and several large, damaging tornadoes. Heavy rain was experienced in the Davison, Miner, Kingsbury, Lyman, Buffalo, Moody, Brookings, Deuel, Minnehaha, and Hamlin counties. The heavy rains occurred in

Date	Comments
	an area already saturated by previous rains. Over a two to three day period, 15 to 20 inches of rain fell in the Clear Lake/Watertown area resulting in widespread flooding of the Big Sioux River. The rains subsided late in the week. Some flooding was experienced by South Dakotans as far south as Sioux Falls.
May 1986	**Severe Storms, Flooding (FEMA-764-DR)** The above average fall rains and heavy winter storms during 1985-86 created a condition of supersaturated ground and record water levels in the lakes and Big Sioux River Basin in the northeast part of the state. The snowmelt run-off into the numerous lakes forced the already full lakes to overflow and seriously impact residences, cottages, resort business, and agribusiness. A severe winter storm covered the entire state the week of April 14, adding one to three inches of precipitation to the area. Flood damage was estimated at approximately $25.9 million, $20.6 million of which was to agriculture.
Spring 1984	**Severe Storms, Flooding (FEMA-717-DR)** The winter of 1983-84 was the third snowiest on record (75 inches of snow at Sioux Falls). The heaviest snows occurred in November 1983 and in March 1984. Severe snowmelt flooding began March 20 and after the fourth wettest April on record, caused near record flooding on the Big Sioux, Vermillion, and lower James rivers in April. These rivers did not go below flood stage until the end of April. Numerous reports of water damage were recorded in the communities of Mt. Vernon, Parkston, Tabor, and Volin. June was the wettest June on record in southeast South Dakota and was the sixth wettest month on record at Sioux Falls. Between June 4 and June 22, many large storms crossed the region and dumped approximately 30 inches of rain, which caused repeated flash floods. Numerous roads and bridges were heavily damaged. Many areas had severe urban flooding, because sewers and storm drains were unable to handle the load. As a result, many basement walls collapsed. The Lake Menno Dam (Hutchinson County) collapsed on June 12, killing 450 hogs, destroying one car and damaging two, moving a farmhouse 75 feet off its foundation, scattering and destroying farm machinery, and completely sweeping away grain bins. On June 16, three feet of water was flowing through downtown Davis (Turner County). Vermillion Lake Dam (McCook County) and many smaller dams sustained severe erosion. The Fulton Lake Dam (Hanson County) was severely weakened and in imminent danger of failing, but held. On June 18, a train was derailed at Parker (Turner County) due to washed out tracks. On June 20, Lake Dimock Dam (Hutchinson County) gave way, destroying the dam and causing flooding in Milltown. A 400-yard sandbag dike saved the Lake Carthage Dam (Miner County) from destruction. Widespread flash flooding caused severe erosion; washed out or weakened many roads, bridges, and culverts; and washed away crops in low lying areas. Many small stock dams collapsed, washing out roads, bridges, and culverts beneath them. In Mt. Vernon (Davison County), there was three to four feet of water in homes. Twenty homes were evacuated along Dry Run Creek in Mitchell (Davison County). Sewage was five to six feet deep in parts of Mitchell.

Date	Comments
	Estimates by the U.S. Geological Survey place the flooding on the Big Sioux River drainage at about a 10 to 30 year recurrence interval, the Vermillion River at about a 100–500 year recurrence interval, and the lower James River at about a 100–300 year recurrence interval. By June 22, over one million acres of cropland in the region were under water. Total damage was estimated at $289 million.
Spring 1983	The winter of 1982–83 was the fourth snowiest on record and led to severe snowmelt flooding on the lower Big Sioux and Vermillion rivers from late February to mid March (March '83 was the fifth wettest on record). Heavy rains through April and into early May prolonged flooding and high stages on these rivers through the middle of May. Very heavy rains again in mid and late June caused flash flooding in the area and again caused severe flooding on the lower Big Sioux River and near record flooding on the lower Vermillion River. The flash flooding in June caused widespread erosion and crop damage and there was severe agricultural land flooding on the mainstems of the lower Big Sioux and Vermillion rivers.
Spring 1979	Big Sioux River—A minor flood in North Sioux City was caused by an ice jam. Lake Kampeska—A minor flood affected property on the lake shore.
June 1976	**Flash Flooding, Mudslides (FEMA-511-DR)** In a 24-hour period on June 13-14, 3 to 10 inches of rain fell in the northern Black Hills. And additional two to three inches of rain plus heavy snow was recorded over this area on the June 15 and 16. The run-off from this precipitation did considerable damage in the counties of Lawrence, Meade, Butte, and Harding. Physical structures, streets, roads, sewers, and water systems sustained about $1.5 million in damage. Deadwood, Spearfish, Belle Fourche, Sturgis, and Galena received most of this damage. Throughout the region, a number of bridges and culverts were washed out and many of the roads suffered water erosion. Debris damage was not as great as in 1972, however, there was considerable movement of rocks and gravel. There was also a problem with mudslides and landslides. One death resulted from this flood.
June 1972	**Heavy Rains, Flooding (FEMA-336-DR)** On June 9-10, 1972, extremely heavy rains over the eastern Black Hills of South Dakota produced record floods on Rapid Creek and other streams in the area. Scattered showers had occurred throughout the Black Hills area on several days prior to the heavy rains that began on June 9. Near Pactola Dam, these earlier showers left the soil saturated, which increased the amount of runoff for the flood of June 9-10. Rainfall began in the Black Hills area on the afternoon of June 9, when a group of almost-stationary thunderstorms formed over the eastern Black Hills. Precipitation totals for June 9-10 ranged from 4 inches to more than 12 inches in the Rapid Creek watershed between Pactola Dam and Rapid City. In the Boxelder Creek watershed, 15 inches of rain during a six-hour period was measured at Nemo. The heaviest rainfall averaged about four times the six-hour amounts that are to be expected once every 100 years in the area. The resulting runoff produced record floods (highest peak flows recorded) along Battle, Spring, Rapid, and Boxelder creeks. Smaller floods also occurred along Elk

Date	Comments
	Creek and Bear Butte Creek. The floods struck quickly and forcefully, but they did not last long nor did they make much impact farther downstream in the basins. Nonetheless, the Black Hills region sustained millions of dollars of damage to roads, streets, and bridges (very few bridges were left standing). Rapid City—Evacuation of residents along Rapid Creek was ordered by 10:15 p.m. Flood and debris-laden water flowed into Canyon Lake and clogged the dam's chute spillway. This caused a 300-foot breach in the dam and sent a wall of water and debris pouring down on residents below the dam. The effect of this dam failure on the subsequent flood wave into urban Rapid City has been difficult to assess because the amount of water coming down Rapid Creek and several tributaries (accounting for 86 percent of the peak flow) far overshadowed the amount of water in the small lake. The peak flow was carried through Rapid City via Rapid Creek at about midnight on June 9, while many people were asleep and unaware of the impending flood. The stage of Rapid Creek (measured above Canyon Lake) rose more than 13 feet in five hours during the flood. The toll of the flood-produced carnage was staggering. At least 238 people died (including 5 listed as missing and presumed dead). Thousands of people barely escaped death and hundreds of people were forced to climb, stand, or cling to objects which saved them from being swept away. Property damage exceeded $79 million. 436 houses were destroyed and 930 houses damaged. 710 mobile homes were either damaged or destroyed. 36 businesses were wiped out and 236 more sustained damage. About 5,000 cars were reported lost to the flood. Keystone—Motels, shops, bars, and restaurants, which cater to tourists were either damaged or destroyed. Many campgrounds located along the creeks were washed away. At least 10 campers died. Total damage was set at $1.4 million. Black Hawk and Box Elder—These cities incurred $2 million in damage as the flood destroyed or damaged 75 homes and 180 mobile homes along Box Elder Creek. Sturgis—Sturgis sustained over half a million dollars in damage; 275 houses and 25 businesses were affected.
Spring 1969	**Flooding (FEMA-257-DR)** Big Sioux River—This flood surpassed the flood of 1881 in magnitude with water discharge rates more than twice those of 1962. It resulted from a large buildup of snow. Snow fell in December (1968) in normal amounts, but the accumulations for January and February set a record. The temperatures during March were below the seasonal average, so little run-off occurred. The entire basin was ice free by April 6. The upper part of the basin received an inch of rain on April 7 and compounded the flood. One-eighth of Watertown was under water. Dempster, Estelline, and Castlewood had flood damage as did the lower portion of Dell Rapids. Fifty families were evacuated from Moody County, and fifty people had to be removed from Renner. Sioux Falls was more fortunate as they had developed a flood control system, which was credited with preventing more than $12 million in flood damage.

Date	Comments
	Vermillion River—This flood was greater than the 1962 flood. The town of Centerville was surrounded by water. Within the town, the sewers backed up and the disposal plant was flooded. In the surrounding country, the damage was about the same as in the previous floods. Three bridges were washed out and numerous roads damaged. 450 feet of one highway was completely washed away. The dike system did not contain the water and the lowlands flooded. The U.S. Geological Survey placed the damage to the basin at $1 million. James River—The river was in flood during all of April. The creeks in the lower portion of the basin started flooding early in the month. Their discharge of water started breaking up ice on the main stem of the James. The massive flow of the smaller tributaries caused a backing up of water along the James and increased the problem of flooding. Huron recorded a flood crest of 16.7 feet, almost one foot higher than registered in the previous 30 years. In that area, damage was estimated at $750,000. In the northern part of the state, Moccasin Creek flooded from water coming out of Richmond Lake. This caused some flooding in Aberdeen, as well as extensive flooding in the surrounding countryside. Total damage to the basin was over $16 million. Most of the damage was incurred by farm land, bridges, and roads.
May 18, 1965	**Flooding (FEMA-197-DR)** Black Hills—Flash flooding brought widespread damage to Deadwood, Spearfish, and Sturgis. Heavy snows in excess of 30 inches and 7 inches of rain triggered an avalanche of water shooting down the creeks and gullies. Some houses were swept away in the Spearfish-Sturgis area while others sustained major damage. One resident whose home was near a creek lost everything. He reportedly had a 70 ton concrete retaining wall between the house and the creek—this was completely washed away. Flood damage to the Black Hills area was estimated at over $2 million.
Summer 1962	**Flooding, Tornadoes (FEMA-132-DR)** Black Hills—A summer storm dumped more than three inches of rain on Rapid City. The resulting damage: 120 mobile homes, 2 motels, and over 400 homes had water damage. Bridges, roads, sewer systems, streets, and recreation areas along Rapid Creek were also damaged. Total damage to Rapid City alone was over $800,000. Sturgis, Deadwood, and Whitewood received extensive damage to roads and bridges. Road equipment lost during this flood was estimated at $200,000.
Spring 1962	Big Sioux River—Snow and ice were the cause of the devastation. Ice jams were a serious problem as they held back the run-off. From Brookings to Sioux Falls, ice caused problems. Flandreau and Renner also had flooding because of the ice. Farther north, flooding also occurred. Watertown received flooding from Willow Creek, Lake Kampeska, and the Big Sioux River. The U.S. Army Corps of Engineers estimated damage by the Big Sioux River to be $2.5 million. The interstate bridge near Sioux City collapsed—replacement cost was $600,000. Vermillion River—One of the worst for the southern segment of the basin. This flood resulted from snow melt and ice buildup. The towns of Centerville and Davis reported minor flooding. The majority of the flooding impacted the farm country.

Date	Comments
	Thousands of acres of land were submerged. The highway system received heavy damage. Five bridges in Turner County were washed out and many roads were closed. The damage to the roads and bridges was estimated at $60,000.
April 1960	**Floods (FEMA-99-DR)** Vermillion River—Between 10 and 15 thousand acres were flooded when the dikes were unable to retain the rapid run-off. Many fences were destroyed due to ice and debris pile up. Also, county road systems were damaged due to erosion. The town of Davis received about one foot of water.
March 1960	Big Sioux River—Flooding occurred from the Brookings area south to the junction with the Missouri. Deer Creek and Medary Creek caused flooding in Aurora. Bruce and Sioux Falls also experienced flooding. Damage was heavy and estimated at $2.3 million. Approximately half of this was incurred in the lower basin. About 86,000 acres of land were flooded, and 41,000 of these were between Sioux Falls and Sioux City. James River—The U.S. Geological Survey reported that severe flooding occurred north of Huron with flood water lingering in the area. Tributaries in the Mitchell area also presented flood problems. Pony Creek, which flows through Parkston, rose to flood stage in three hours. People living along its banks had to be evacuated. A number of culverts and bridges in the town were jammed with debris. North of Mitchell, Dry Run Creek flooded, causing at least five families to be evacuated.
June 17, 1957	General Comments: Rated as a 10 to greater than a 100-year event. Five deaths. Attributed solely to rain. Big Sioux River—An estimated seven inches of rain fell in the Flandreau and Sioux Falls area. The Skunk and Marne creeks as well as the Big Sioux River were in flood stage. The towns of Flandreau, Egan, Baltic, Trent, Sioux Falls, and Canton were all impacted by the flood. Sioux Falls had flood damage to the north and southern parts of town as well as heavy flooding in the business district along the river. Damage was estimated to be over $1 million in the city and $4 million over all. Of this amount, $980,000 was sustained in the southern half of the Big Sioux River Basin—over 62,000 acres of land were flooded. Families were forced from their homes, and many of the houses were flooded. Most of the crops in the area were destroyed by the water and there was little or no chance to replant because of the short growing season. Vermillion River—The sudden rain that fell during the middle of June dropped between three and eight inches of precipitation throughout Turkey Ridge Creek and the Vermillion River north of Centerville. The citizens and National Guard filled sandbags to be used in and around Centerville. An estimated 50,000 sandbags were placed on the lowland dike system south of the town to help contain the water. An estimated 80 square miles were flooded. James River—The southern portion of the basin was also affected. The tributary of Marne Creek erupted with a flash flood which brought considerable water and debris to Yankton. Several homes and businesses adjacent to the creek received

Date	Comments
	water and mud damage.
May 1952	Rapid City—Heavy flooding through the Canyon Lake area of west Rapid City. Damage was very much like that sustained in the 1972 flood. Sturgis/Deadwood—Heavy rains brought flash flooding that tore up streets and gas pipelines in Sturgis. Bridges were washed out and water erosion caused rock slides. Water damage and landslides also occurred in Deadwood.
April 8, 1952	Big Sioux River—Warm weather brought on another rapid snow melt and flooding conditions. Watertown had flooding starting at Lake Kampeska. There was also heavy flooding in the southern part of the town. Farther downstream at Estelline, the river was about one mile wide. Flooding occurred in the towns of Flandreau, Trent, and Dell Rapids. There was also heavy flooding around the Sioux Falls Air Base (Joe Foss Field). Pictures of the locality gave it the appearance of a large lake. From Watertown to Sioux Falls, about 99,000 acres were flooded and $4.5 million of damage sustained. Below the falls to the mouth of the river, an additional 30,000 acres of land were covered and about $1 million damage done to the area. James River Basin—The tributaries of the Elm and Maple rivers delivered snowmelt run-off over thousands of acres of farmland. Ice jams on the Elm and Maple rivers forced the water over land. Hundreds of farm families were isolated by the water, while other families in the area were still snowbound. The end result was an enormous amount of water standing on frozen ground, causing the Elm River to spread to one mile in width. This water washed out a number of culverts and roads and isolated farms.
Spring 1951	Big Sioux River—Heavy flooding originated in the Brookings area. An accumulation of snow throughout February and an additional six to fourteen inches during March served as the flood source. High temperatures in late March brought about rapid melting and the flood condition. The Big Sioux was ½ mile wide in Moody County, 1 ½ miles wide around Baltic and Sioux Falls, and 2 miles wide below the Rock River. The area from Brookings to below the falls of Sioux Falls had about 73,400 acres of land flooded and damage of nearly $2.25 million. The area from Sioux Falls to Sioux City, Iowa, had an estimated 29,000 acres flooded and $600,000 in damage. Vermillion River—The combination of snow melt run-off and ice dams brought extensive water to the town of Davis. The entire main street of the town had water damage. One portion of town had three inches of water, which caused a number of families to evacuate. Elsewhere, the towns of Centerville and Montrose received some water. At least three bridges were washed away, lowlands were flooded, and some stored grain destroyed.
Apr/May 1950	Grand, Moreau, and James rivers—10- to 25-year flood event. Much of the damage was the result of water lingering over the fields. Parts of Brown County and adjacent counties had flood conditions for more than a month. More than 40,000 acres of cropland were submerged and damage was greater than $900,000. Flooding also created heavy damage to road surfaces and caused the loss of some grain and livestock. Total damage was estimated at $5 million.
May 1922	Cheyenne and James river basins—25-50-year flood event: Caused by snowmelt and rain.

Date	Comments
May 1920	Rapid City—Homes were flooded, bridges were washed out, and utility systems disrupted. Hat Creek and James River—25-50-year flood event: Caused by snowmelt and rain. Deaths: 7.
Jun 12, 1907	Rapid City—Caused by more than five inches of rain throughout the Black Hills in one six-hour period. The flood destroyed five bridges, damaged roads and power lines, and washed out about ½ of Canyon Lake Dam. The entire downtown area along Rapid Creek was under water. Four people died, and the railroad system sustained heavy damage.
May 1883	Rapid City—Similar flood to 1878: bridges, buildings, and homes received heavy water damage.
Spring 1881	Big Sioux River—Winter began in mid-October 1880. The total winter was very cold and an accumulation of two to four feet of snow covered the state. When the ice broke up in March, the Big Sioux River Basin was flooded. Sioux Falls was especially hit hard. The river was recorded as rising 16 feet in 24 hours on March 20, 1881. The rapid rise brought widespread destruction throughout the Sioux Falls area. Approximately 100 buildings in north Sioux Falls were washed away. Three major bridges were also washed out in a 15-minute period. Estimated damage was $150,000 to the Sioux Falls area. Below the falls, farms along the river suffered heavy flood damage. Large amounts of grain, livestock, and personal possessions were lost to the flood. Many of the railroad bridges and wagon bridges were washed away. The only means of travel was by foot or horseback. No lives were lost. Vermillion River—The town of Vermillion was located on the banks of the Missouri and Vermillion Rivers. Almost all the homes and stores were located along or near the shoreline. The heavy accumulation of winter snow started melting, which caused the Missouri River to flood. Associated with the flood was ice blockage, which not only backed up the water into the Vermillion River but also formed an ice dam that prevented normal run-off. The tributary run-off added to the back water until the river became one to two miles wide in places. Mills, houses, and stables were washed away. When the Vermillion River finally broke through the ice blockage, the impact was devastating. A wall of water entered the town of Vermillion and covered it in depths ranging from 3 to 10 feet of water. The combined forces of the Missouri and Vermillion rivers resulted in the town literally floating away. An estimated 132 buildings were destroyed and many others were damaged by the ice and water. The end result was ¾ of the town was totally destroyed and about $142,000 in damage was sustained. This destruction was so total and severe that the town was relocated on the bluffs behind the former town to prevent another recurrence.
1878	Rapid City—Rapid Creek rose 20 feet in one hour. Streets were under water, buildings flooded, and bridges washed out.

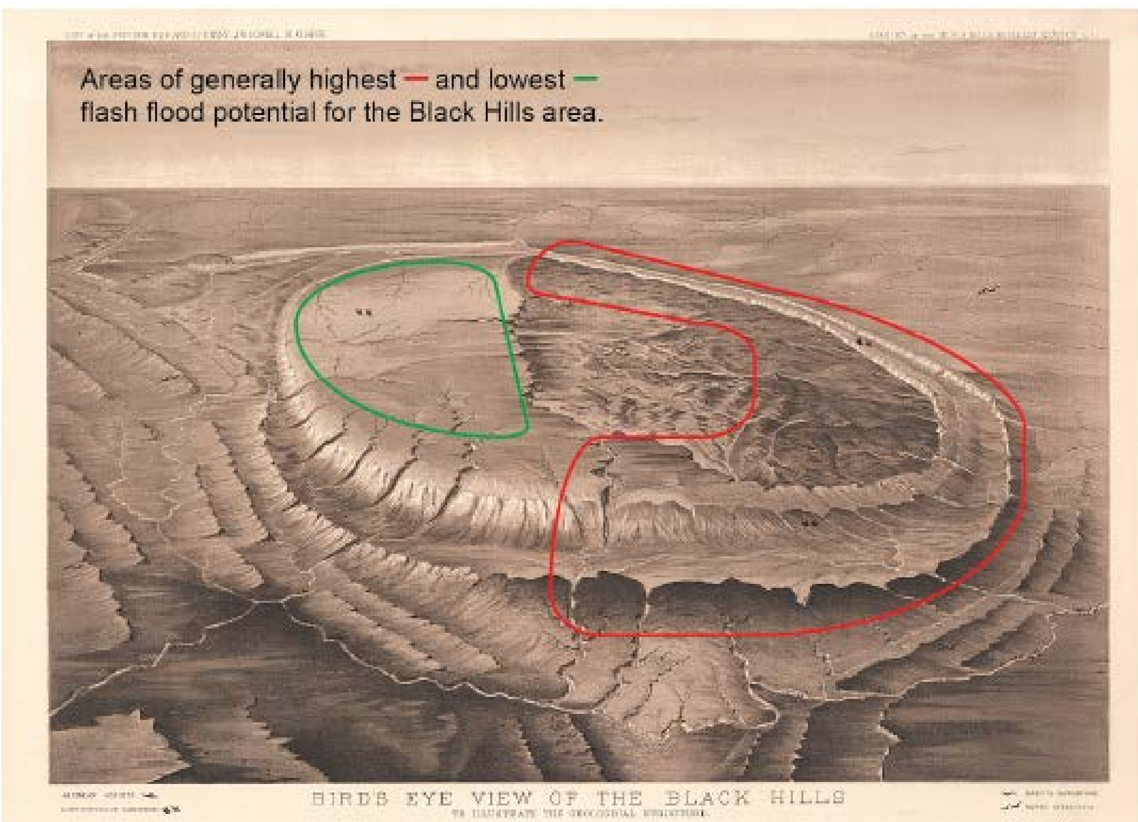
Source: If not otherwise sourced in the table, the NCDC is the information source.

3.2.3.6 Probability

FEMA flood studies provide mapping and detailed flood information for floodplains where the water body has a one percent chance of occurrence in any given year in identified special flood hazard areas. Smaller and more frequent damaging events occur in the state on an annual basis. Floods result in $15.5 million per year in average annualized losses to the state.

USGS, South Dakota Department of Transportation, and other state and federal agencies published a study in June 2012 titled "Extreme Floods in the Black Hills Area: New Insights from Recent Research." One of the most significant findings of the study is that massive floods as large or larger than the 1972 flood have occurred multiple times over the past millennium in many drainage basins of the eastern Black Hills. According to the study, geologic evidence indicates that 12 floods exceeding 66,000 cfs occurred in the past 2,000 years, with the largest one occurring 440 years ago. The study found that "the steep terrain and narrow canyons along the eastern periphery of the Black Hills are most susceptible to flash flooding. Here the thin rocky soils absorb little rainfall, and the steep slopes cause rapid runoff into the stream channels. The steep and narrow canyons further amplify ferociously fast and deep floods." Figure 3-14 depicts the areas of the Black Hills with the highest and lowest potential for flash flooding based on the USGS/SDDOT study.

Figure 3-14 Generalized Potential for Flash Flooding in the Black Hills Area (modified from Driscoll and others, 2010)



Source: Driscoll, Huft, and O'Connor, *Extreme Floods in the Black Hills Area: New Insights from Recent Research*, 2012

3.2.4 Winter Storm

3.2.4.1 Description

Winter storms are not limited to one area of the state and historically occur from late fall to the middle of spring. They vary in intensity from mild to severe. Winter storms regularly destroy property and kill livestock. They can immobilize a region, blocking roads and railways and closing airports, which can disrupt emergency and medical services, hamper the flow of supplies, and isolate homes and farms, possibly for days. Heavy snow can collapse roofs and knock down trees and power lines. Unprotected livestock may be lost. Economic impacts include cost of snow removal, damage repair, and business losses.

Figure 3-15 Jack-knifed semi-truck during blizzard November 2008

The National Weather Service describes different types of snow events as follows:

- Blizzard—Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least 3 hours.
- Blowing Snow—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- Snow Squalls—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- Snow Showers—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- Snow Flurries—Light snow falling for short durations with little or no accumulation.

Also associated with winter storms are ice, freezing rain, and sleet. Freezing rain coats objects with ice. This ice coating on sidewalks, roads, etc., creates dangerous conditions. Sleet does not generally cling to objects like freezing rain, but it does make the ground very slippery. Heavy accumulations of ice can bring down trees and topple utility poles and communication towers. Ice can disrupt communications and power for days while utility companies repair extensive damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

Figure 3-16 Electrical substation repairs after ice storm in November 2005

Winter storms can also generate flooding, usually as a result of ice jams or snowmelt, which can cause significant damage and loss of life. Ice jams form when long cold spells cause rivers and lakes to freeze and a rise in water level or a thaw breaks the ice into large chunks that become jammed at obstructions (e.g., a bridge). Water backs up at the jam, which is acting as a dam, and flooding results. The snowmelt hazard is defined as a sudden thaw of a heavy snow pack that often leads to flooding. Both snowmelt and ice jam floods are common in South Dakota.

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

In 2001, the NWS implemented an updated Wind Chill Temperature index (see Figure 3-17). This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 3-17 National Weather Service Wind Chill Chart

NWS Windchill Chart

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

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

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

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

Effective 11/01/01

Source: National Weather Service

3.2.4.2 Location

Winter storm has an even probability across the state due to its topography. The inherent nature of temperature hazards makes them a regional threat, impacting most or all of the planning area simultaneously as well as extending the effects into the surrounding jurisdictions. Prairie lands, which cover most of the state, offer little resistance to high winds and drifting snow. Even the Black Hills region, which presents some resistance to wind conditions, is not excluded from blizzard conditions. Blizzards in this region are often less severe than elsewhere in the state, but they can still produce heavy drifting snows. Early blizzards were so devastating that South Dakota had the dubious distinction of being called the Blizzard State.

According to the National Weather Service, most of South Dakota has an annual mean snowfall of 24.1 to 36 inches. Some areas in the northeast, northwest, and southwest have an annual mean snowfall of 36.1 to 48.0 inches, and a small area in the southwest has an annual mean snowfall greater than 72 inches.

More location information is in the following section on past events and Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction.

3.2.4.3 Past Events

According to the National Climatic Data Center Storm Events database, there were 1,042 winter storms (snow and ice events) in South Dakota between January 1993 and October 2012, and 82 extreme cold events from January 1994 to October 2012. Total property damage for these events is estimated at $130.5 million dollars. This suggests that South Dakota experiences 55 winter storms and $6.9 million in winter storm losses annually, as well as 4.3 extreme cold events each year. 12 deaths and 127 injuries were attributed to these events. This suggests that South Dakota can expect approximately 1 death every other year and 6 injuries each year.

South Dakota's agricultural industry is also very susceptible to losses from winter weather and extreme cold. Crop loss data was obtained from the Risk Management Agency's indemnity reports for 2010 through 2012. The Risk Management Agency identifies several causes of loss related to extreme cold and winter weather, including cold winter, freeze, and frost. The Risk Management Agency has an "other" category that includes snow, lightning, etc., but it is not possible to determine which losses in this category resulted specifically from snow. South Dakota received $4,304,101 in indemnities from winter weather-related hazards in 2012, $4,521,931 in 2011, and $1,050,838 in 2010. This averages out to $3,292,290 in winter weather-related indemnities each year.

Figure 3-18 Aerial Image of Dead Cattle as a Result of Early October 2013 Winter Storm

The USDA produced a "Cattle Death Loss" report in 2011 which detailed the number of cattle and calves lost to various causes (predator and non-predator) in each state in 2010. A total of 68,000 head of cattle and 90,000 calves died in South Dakota in 2010. 13.1% (890 head) of cattle losses and 36.8% (33,120 head) of calf losses were attributed to weather. The total value of the animals in South Dakota in 2010 was $1,133 per head for cattle and $381 per head for calves. Thus, the State's cattle industry suffered $13,627,090 in weather-related losses that year.

The USDA "Cattle Death Loss" report comes out approximately every five years, but previous reports for 2005 and 2000 organized data by region rather than state. The 1995 and 1991 reports are organized by state and can be compared to the 2011 report. The 1995 report indicates that a total of 59,600 cattle and 162,600 calves were lost in 1995. Of the 59,600 total cattle deaths, 13,000 were lost to weather. Of the 162,600 total calf deaths, 72,000 died from weather-related events. In 1991, cattle and calf losses totaled 55,000 head and 110,000 head respectively. Weather killed 8,700 cattle and 13,700 calves that year. The dollar value per head was not provided in the 1995 and 1991 reports.

The reports do not specify the exact nature of the weather related losses. However, it is reasonable to assume that many of the weather-related cattle and calf deaths resulted from winter weather. Calving seasons often occur in the fall or spring when winter storms may occur in South Dakota. Calves that are born during these times are highly susceptible to severe snow storms and extreme cold. Winter weather can also reduce the availability of forage for cattle and make it difficult (and even dangerous) for farmers and ranchers to deliver hay reserves.

See Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction for more information about how winter storms affect individual counties.

Figure 3-19 South Dakota Winter Storm Events 1993 – October 2012

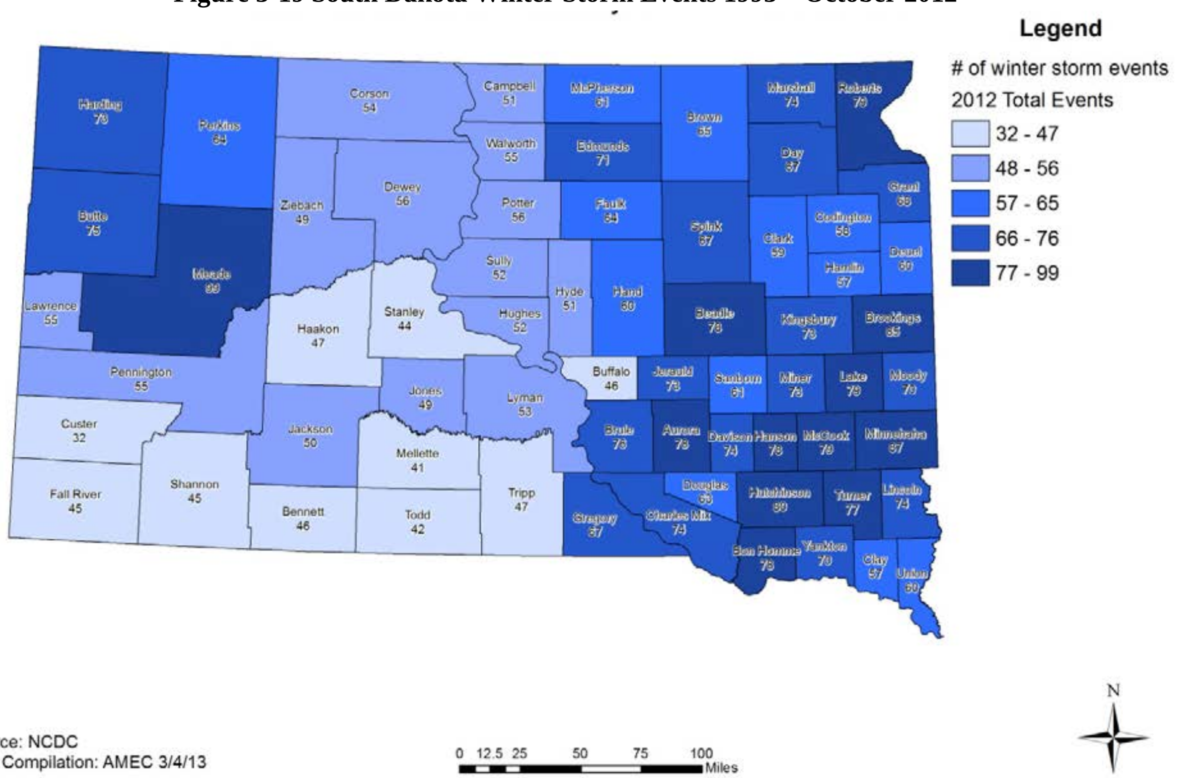


Table 3-11 South Dakota Winter Storm Events

Date	Comments
October 3-16, 2013	**Severe Winter Storm, Snowstorm, and Flooding (FEMA-4155-DR)** At the time this plan was under public review, a blizzard impacted 14 counties. According to the State government, "The blizzard dumped record amounts of snow in parts of the Black Hills, closed interstates and blocked many other roads, left thousands of homes and businesses without power, and killed thousands of cattle and other livestock on ranches across a wide area of western South Dakota."[6]
April 8-10, 2013	**Severe Winter Storm and Snowstorm (FEMA-4115-DR)** A large spring snowstorm dumped heavy snow over most of western South Dakota April 8-10, 2013. The final NWS storm report showed that Deadwood received 30 inches of snow during the storm and Rapid City received 28.2 inches for some of the highest snowfalls in the State. April 2013 ended up being the snowiest month on record for South Dakota with 39.5 inches total, beating the previous record of 38.5 inches set in April 1927. This storm resulted in a major disaster declaration for seven counties.
January 17, 2011	Northwest winds caused blowing and drifting snow over an area which extended from Brookings County into southwest Minnesota. Cold temperatures and wind chills approaching 20 degrees below zero developed during the event and continued through the night as the winds and blowing snow slowly decreased. There was a fatality from exposure in Brookings County during the event. A 65 year old woman died of exposure after she left her vehicle which had become stuck in drifts on a township road near Elkton.
January 9, 2011	Snow produced heavy accumulations of 8 to 10 inches in an area near the Missouri River in southeast South Dakota during a 24 hour period beginning in the late afternoon of January 9th. Lesser accumulations of 4 to 8 inches were reported further north and west in southeast South Dakota. An exposure fatality was reported in Sioux Falls during the snowfall. A 70 year old woman died after wandering away from her assisted living facility at night. Wind chills at the time varied from zero to 5 above.
December 23, 2010	An upper level disturbance passed over the region during the night and early morning, bringing milder air over cold air at the surface. Light freezing rain developed over western South Dakota, mixing with snow and sleet at times. The heaviest freezing rain fell across southwestern South Dakota, including the Black Hills, where as much as a quarter inch of ice accumulated. Roads became ice covered and caused many accidents during the morning. A total of $475,000 in damages (2010$) resulted from this event. NCDC did not record any injuries or fatalities.
December 10, 2010	Snowfall ranging from 2 to 8 inches was accompanied by sustained northwest winds which reached 40 mph at times, with gusts as high as 55 mph. The snowfall, strong winds, and existing snow cover resulted in widespread blizzard conditions. Travel was made impossible in much of the area. There were several accidents and vehicles going into ditches, attributed to slick roads and low visibilities. Several motorists were stranded. Businesses were forced to close, and several school and other weekend activities were canceled or postponed.

[6] South Dakota State News. http://news.sd.gov/newsitem.aspx?id=15317

Date	Comments
April 2, 2010	**Severe Winter Storm (FEMA-1914-DR)** The April 2, 2010, blizzard caused an estimated $1.6 million in damage in the three-county area. A band of heavy snow set up across Corson and Dewey counties during the early morning hours of April 2nd. Along with heavy wet snow, northwest winds gusting up to 40 mph developed. By the time the snow ended in the late morning hours, 6 to 8 inches of snow had fallen. The heavy snow, combined with the strong winds, downed many power poles across the region along with making travel treacherous. Some snowfall amounts included; 4 inches at Eagle Butte; 6 inches at Timber Lake, McLaughlin, and 14 miles north of Isabel; 7 inches at Isabel and 6 miles southeast of McIntosh; 8 inches southwest of Keldron. Heavy snow and strong winds knocked down power lines and poles, cutting off electricity to more than 1,500 rural electric customers. More than 400 poles were lost to the heavy snow leaving approximately 800 people without power. Eighty linemen worked through the Easter weekend in the snow and mud. McLaughlin and Keldron were the hardest hit. Several hundred people were still without power on April 5th. Corson, Perkins, and Ziebach Counties were also among those struck by a late-January ice storm that qualified them for an earlier Presidential Disaster Declaration. Some of the power lines damaged by the April storm had just been repaired from damage caused by the January ice storm.
January 20-26, 2010	**Severe Winter Storm (FEMA-1887-DR)** A powerful storm struck the northeast half of the state. The storm began with rain, turning to sleet, followed by heavy snow. Winds of up to 60 mph accompanied the storm. Power lines burdened by ice after several days of heavy fog began snapping and falling. FEM Electric lost over 4,300 utility poles in Edmunds, Faulk, McPherson, and Potter counties. Customers of 1,600 meters were without power for 13 days. One customer was poisoned from inhaling generator exhaust. FEM Electric's business and economic impacts were estimated at $40,000,000, while emergency repair and restoration costs were estimated at $10,000,000. High winds and blizzard conditions across the eastern and north central regions of the state stalled traffic and further complicated relief efforts. Interstate 90 was closed from Chamberlain to the Minnesota border. Interstate 29 was closed from Sioux Falls to the North Dakota border. An estimated 7,600 customers across South Dakota were without power. Some phone systems also experienced outages. At least 31 emergency shelters were open across the hard hit regions. Indian reservations were hit especially hard. The Cheyenne River Sioux Tribe had a breakdown at the water treatment plant as a result of the storm that left many residents without potable water.
December 23-27, 2009	**Severe Winter Storm (FEMA-1886-DR)** A powerful winter storm blanketed the entire state. The entire Interstate highway systems were shut down for an extended period across South Dakota. Winds gusted as high as 76 mph in western South Dakota Preliminary storm totals from the State Climatologist across the state from the Christmas blizzard indicated that the large majority of the state received over 10" of snow in the storm with 20" or greater amounts in the southeast (Marion-Vermillion-Yankton), northeast (Sisseton and Clear Lake), central (Kennebec and Murdo) and northwest (Perkins County). The northern Black Hills recorded 40-50". The statewide average was 15.4". This would place it as one of the top few storms for snowfall totals statewide.

Date	Comments
March 23-34, 2009	A powerful spring storm brought rain, snow, and very strong winds to western South Dakota. Precipitation started as rain, then changed to snow, and blizzard conditions developed. The heaviest snow fell over the northern Black Hills, where 18 to 48 inches of snow was measured. Ten to 20 inches of snow fell across far northwestern South Dakota, with drifts as high as ten feet. Most other locations received at least six inches of snow. Sustained winds of 30 to 55 mph, with gusts over 80 mph, were reported. Interstate 90 and other highways were closed for more than 24 hours. Some power outages were reported, mainly across the northern Black Hills and northwestern South Dakota. Tens of thousands of livestock perished. Damage estimates were slated in the millions.
November 5-7, 2008	An intense fall storm brought heavy snow and gusty winds to much of the Black Hills. The heaviest snow fell across the northern Black Hills as upslope-enhanced snow fell for many hours. Snowfall amounts ranged from only a few inches across the southeastern slopes of the Black Hills to near five feet from Cheyenne Crossing to Lead and Deadwood in the northern Black Hills. The next day, a strong area of low pressure moving across South Dakota and into Minnesota brought widespread rain, freezing rain, and snow to central, north central, and northeast South Dakota. Much of the freezing rain fell across central and north central South Dakota west of the Missouri River. As the freezing rain changed over to snow and the winds increased, the ice and snow buildup on the power lines and poles caused hundreds of power poles to break across Jones, Stanley, Dewey, and Corson counties. East of the Missouri River, the colder air and stronger winds moved in changing the rain over to snow. Strong winds of 30 to 45 mph with gusts near 60 mph brought widespread blizzard conditions to all of the area. Ice buildup from the freezing rain ranged from a tenth to as much as an inch for counties west of the Missouri River. Snowfall amounts across the entire area generally ranged from 2 to 8 inches with a 15 inch amount recorded in southwest Corson County. Some of the snowfall amounts included: 3 inches at Eagle Butte, Blunt, Kennebec, Mission Ridge, and Onida; 4 inches at Pollock, Gettysburg, and Bowdle; 5 inches south of Harrold, Iona, and near McIntosh; 6 inches at Mobridge; 7 inches at Murdo; 8 inches at McLaughlin, and 15 inches southwest of Keldron. All 4,600 customers of the Moreau-Grand Electric company lost power due to the storm. The last time this occurred was during the winter of 1967-68. The monetary loss to this cooperative and other electric cooperatives for Jones, Stanley, Corson, and Dewey counties was in the hundreds of thousands of dollars. There were over 100 line workers working countless hours with crews coming from as far away as Nebraska and Iowa to assist in the power recovery. Over 1,000 customers were without power for an extended period of time. Cell phone coverage was also knocked out for parts of the West River area due to downed towers.

Date	Comments
	Figure 3-20 Icy bridge during November 2008 blizzard  The blizzard resulted in numerous school, business, and road closures along with flight cancellations. Interstate-90 was shut down from Mitchell, South Dakota to the Wyoming border from Thursday the 6th until Friday evening of the 7th. Many semi trucks and cars were stranded along the Interstate with many people being rescued. Many travelers took shelter in Murdo, Chamberlain, and Pierre until the Interstate reopened Friday evening. There were also several accidents across the area with a serious accident in Walworth county on Highway 83 near the Potter county line. In the early afternoon hours of Friday the 7th, slippery roads, high winds, and low visibilities contributed to the rollover of a passenger van carrying seven students. The passenger van rolled several times causing serious injuries to three of the students. Also, a semi truck rolled over on an icy and snowy Highway 45 south of Miller in the late afternoon hours of the 6th. The driver received minor injuries. The Governor declared a state of emergency on the 7th, and President Bush declared South Dakota a disaster area.
April 25-26, 2008	A strong low pressure area brought widespread heavy snow of 6 to 20 inches to most of northeast South Dakota for much of the 25th and into the early morning hours of the 26th. The precipitation began as light freezing rain in the early morning across parts of the area before changing to all snow by mid morning. As the low pressure area intensified, snowfall rates and the north winds also increased. The heavy snow combined with the strong winds created widespread visibility problems along with large snowdrifts. Snowfall amounts included, 6 inches at Andover, Britton, Gann Valley, and 15 miles south of Miller, 8 inches at Roy Lake, 9 inches at Clark, Big Stone City, Hillside Colony, and Sisseton, 10 inches 7 miles south of Bristol, and 11 inches at Hayti. Locations with a foot or more of snowfall included, 12 inches at Wilmot, Webster, and Waubay, 13 inches at Milbank, 15 inches at Castlewood, 16 inches near Victor, and near Summit, 17 inches at Clear Lake, 19 inches at Watertown, and 20 inches at Bryant. There were a number of automobiles that went into the ditch along with many other automobiles damaged in accidents. Many stranded motorists had to abandon their vehicles in the hardest hit areas. Travel was not advised across the entire area. A school bus slid into a ditch east of

Date	Comments
	Castlewood with no injuries occurring. Interstate-29 was closed from 3 pm the 25th until 3 pm on the 26th from Brookings north to the North Dakota border. In addition, South Dakota State Highway 12 was closed from Webster to the Minnesota line from the afternoon of the 25th until the late morning of the 26th. Most counties affected by the storm opened emergency shelters when Interstate 29 was closed to house stranded motorists. Also, many schools were closed across the area. The very heavy snow set several records across the area. The 19 inches at Watertown broke its all time 24 hour snowfall record of 16 inches. Both Victor and Clear Lake had their second highest snowfall ever recorded in a 24 hour period. Watertown, along with several other locations in northeast South Dakota, received near record or record snowfall for the month of April. In fact, Watertown's 29.5 inches of snow for the month of April was almost their seasonal normal snowfall. This event was also declared a disaster by the President.
March 1, 2007	In southeast South Dakota, four to eight inches of snow was accompanied by sustained winds of over 30 mph at times with gusts over 40 mph. The combination of new snow, wind, and existing fresh snow cover resulted in a blizzard with widespread near zero visibilities. Drifting snow made travel extremely difficult to impossible. As a result, some who did attempt to travel became stuck or slid off roads. Schools and school activities were cancelled and numerous businesses closed. Source: National Climatic Data Center
April 18-20, 2006	**Severe Winter Storm (FEMA-1647-DR)** The strongest storm of the 2005-2006 winter brought heavy, wet snow to northwestern South Dakota and the Black Hills and heavy rain across southwestern and south central South Dakota. Reported snow totals included 10 to 24 inches in northwestern South Dakota, 16 to 30 inches in the Bear Lodge Mountains, 40 to 70 inches in the northern Black Hills, 74 inches in Lead, and 55 inches in Deadwood. Fifteen-foot drifts were reported on the plains of northwestern South Dakota. Source: NWS Rapid City
November 27-29, 2005	**Severe Winter Storm (FEMA-1620-DR)** This storm brought snow and ice to the state. It was one of the worst ice storms in the state's history. Snowfall accumulations in central South Dakota ranged from 2 to 20 inches. Strong northwest winds of 30 to 50 mph with gusts to 70 mph caused widespread blizzard conditions. Visibilities were reduced to zero across the area with snowdrifts of 5 to 10 feet high in some places. Freezing rain occurred before the snow in some areas coating objects with up to three inches of ice and causing power outages. Some power lines were also brought down by snow and ice accumulation and high winds. Tens of thousands of households and businesses lost power from one day to up to two to three weeks in some rural areas. One electric cooperative said it was the worst damage they had in their 65 years of existence. Bon Homme Yankton Electric Association had 455 broken poles, 82 cross arms, and numerous line breaks. 509 customers were affected. The last line was turned on 8 days after the start of the storm. Consumers experienced roughly 118.1 hours or 4.9 days without power. Emergency repair and restoration costs were estimated at $352,323 with $282,538 in federal and state disaster relief funding. Many roads, including Interstates 90 and 29 were closed due to the treacherous travel conditions. Several accidents occurred during the storm, killing two and injuring others. Many motorists were stranded. Several people had to be rescued. Air traffic was also brought to a halt across much of the area. Schools, businesses,

Date	Comments
	government offices, and many other organizations were closed. Minor damage was caused to homes and vehicles by the strong winds and by windblown debris, mainly from trees. A 79-year old man died from exposure in Douglas County. Source: National Climatic Data Center and SHMT **Figure 3-21 Broken power poles during November 2005 storm** 
April 2000	**Winter Storm (FEMA-1330-DR)** From April 19-20, a severe spring storm consisting of rain, heavy snow, and very high winds struck seven western counties of South Dakota. The storm's greatest impact was on the electrical power system. One to three feet of heavy, wet snow coupled with ice and high winds caused significant damage to three rural electric cooperatives, resulting in widespread power outages to homes and businesses. The power providers reported that over 1,500 power poles were damaged or destroyed. Eligible damage to public infrastructure was estimated at approximately $2,500,000.
April 1997	An ice storm that affected Edmunds and McPherson counties damaged 400 utility poles and caused 1,500 wire breaks. FEM Electric customers on 600 meters were without power for seven days. Business and economic impacts of this storm were estimated at $3,000,000 and emergency repair and restoration costs were estimated at $1,000,000.
January 1997	**Severe Winter Storms/Blizzards (FEMA-1156-DR)** All counties were declared disaster areas. Twice in a seven-day period in early January, cold Arctic air swept down and "froze" the state. The governor closed the interstates for public safety. More than 36,000 head of cattle perished. Roads were blocked or covered by 20-foot drifts of snow. Fifteen days after the storm ended, some roads were still blocked by snow. The Day County highway superintendent reported 20- and 40-foot vertical drifts blocking the highway. Livestock losses,

Date	Comments
	damaged buildings, and feed shortages occurred in an area called the "red zone." This is an area of 4,722 cattle operations, 1,200 sheep operations, 1,000 hog farms, and 515 dairies along the northern third of the state west to east. The storm caused more than $30 million in damage/cleanup efforts. Three people died while trapped in vehicles along the highways. The snowmelt from this record-breaking storm was a major contributor to the flood disaster a few months later.
December, 1996	Extreme cold struck portions of South Dakota. A Summit man died from exposure to the extreme cold after his vehicle became stuck in the snow. The man attempted to walk for help and was found about one mile from his car in the driveway of a home about a mile and a half west and one mile south of Summit.
November 13-26, 1996	A slow moving winter storm with severe snow and freezing rain entrenched itself over much of the state. The effects of the storm were felt primarily in the Black Hills and southeastern portions of the state. The storm was a result of a strong system of cold air, hovering close to the ground, with a system of warm air above. This combination made for rain, fog, and snow that quickly turned to damaging ice. The snow and ice formed and amassed on roadways, trees, electric transmission lines, and power poles. Some power lines were swollen by ice to five inches in diameter. The excessive weight and severe wind conditions snapped lines and flattened poles. Thousands of polebraces, crossarms, and anchors cracked under the heavy stress. Six rural electric cooperatives, affecting approximately 10,700 customers, experienced serious outages due to the loss of poles, braces, lines, crossarms, anchors, and substation failures. Customers were without power in subfreezing temperatures for several hours to several days. The force of the storm caused major delays on Interstates 90 and 29. Portions of state and county highways and roads were closed for an extended period of time due to heavy ice and snow accumulation and extremely poor visibility.
October 22-24, 1995	**Ice Storms (FEMA-1075-DR-SD)** Between October 22 and 24, 1995, a severe autumn snow and ice storm caused widespread damage in South Dakota. Effects of this storm were felt first in the Black Hills. Portions of the hills received up to 22 inches of snow. As the storm moved across South Dakota, ice and 5 to 15 inches of wet snow covered trees and electric lines and poles. Winds associated with the storm caused lines to slap together and poles to fail, producing widespread power outages to large portions of rural South Dakota. Tree damage also led to significant damage to electrical utilities. Thirteen rural electric cooperatives reported damage from this storm. The cooperatives lost nearly 9,500 poles and 170 transmission lines. Damage was estimated at $10 to $10.3 million to rural electric infrastructure only. Approximately 30,290 households were affected by the power outages. Crews from electric cooperatives in South and North Dakota, Minnesota, Iowa, and Nebraska assisted local cooperatives with line repairs. The power outages also caused several rural water system pumping stations to go off-line, causing a loss of water utilities to members of rural water systems. The National Guard provided generators to power these pumping stations to restore water service. This storm also forced major transportation delays as portions of Interstates 90 and 29 had to be closed because of the snow accumulation on the roadway and poor

Date	Comments
	visibility. One of these interstate closings led Davison and Codington counties to initiate their sheltering plans for travelers who could not find rooms at local motels. The storm also caused numerous cancellations and delays in school openings because of travel conditions or the lack of power. Interstate traffic was restored by early October 24. Twenty-eight counties were included in the disaster declaration: Aurora, Beadle, Bon Homme, Brookings, Brule, Buffalo, Charles Mix, Clark, Codington, Davison, Day, Deuel, Douglas, Grant, Gregory, Hamlin, Hanson, Hutchinson, Jerauld, Kingsbury, Lake, McCook, Marshall, Miner, Roberts, Sanborn, Spink, and Tripp Counties.
January–February 1995	**Severe Winter Storms (FEMA-1045-DR)** Damage to electric power lines in 21 counties was caused by an unusually foggy January weather. Continuous fog in many areas resulted in a heavy crust of ice forming on many of the power lines in central South Dakota. The fog-crust was reported to be three to five inches in diameter. The addition of high winds caused power poles to snap. Deep drifts of snow made it difficult for power company linemen to gain access to the damaged power lines, and in many areas, county snow removal equipment was required to provide access. According to reports, 13,435 households were without power for varying periods of time. The maximum time without power was 12 days. Early damage was estimated at more than $3.2 million. More than 1,700 power poles had to be replaced.
November–December 1983	Weeks of subzero temperatures preceded the actual blizzard and set the stage for the deadly combination of cold, blizzard conditions, and loss of electrical power. A series of winter storms struck South Dakota in late November and throughout December. The impact was felt statewide, but it was particularly heavy on the Rosebud and Pine Ridge reservations. Cheyenne River, Lower Brule, and Crow Creek reservations were also affected, but to a lesser degree. Many of the Rosebud and Pine Ridge communities had propane fueled/heated homes. At the height of the storms, reservation roads were drifted closed and became impassible. A fuel shortage occurred when the weeks of subzero temperatures drained propane tanks faster than normal. Tribal governments opened community shelters for those who could make it to the shelters. As conditions worsened, fuel contractors could not start their delivery vehicles and roads were increasingly impassible. County and tribal government snowplows were overwhelmed by the enormity of the task. One death resulted from these storms.
October 9, 1981	The entire Black Hills area was virtually paralyzed by three to six feet of heavy snow and 40 to 70 mph winds. Roads were totally blocked, trees and power lines broken, and some homes sustained heavy damage. Not only were the northern hills residents isolated, but some were also without water and power for at least three days, causing food spoilage.
March 29, 1981	A winter storm front created a tornado near Martin, which destroyed a mobile home and injured one occupant. By 3:00 a.m. on March 30, the storm was generating 50 to 80 mph winds and dumping up to 10 inches of heavy, wet snow in the northwest. Power lines and at least 1,500 poles in the northwest were snapped after being coated with one to six inches of ice. Strong winds also snapped power lines and poles in south central South Dakota. These winds overturned trucks and cars along Interstate 29. The winds also overturned a railroad tank car, spilling phosphoric acid. This accident forced the evacuation of part of Garretson.

Date	Comments
January 1981	A series of storms blocked the majority of roads in eastern South Dakota, over-turned vehicles, and stranded hundreds of motorists. The severity of these storms caused four deaths in vehicles stalled in the deep snow.
1977	February, March, and November were especially active months for winter storms. Many rural roads were blocked with snow drifts six to eight feet high. Interstate 90 was often blocked and up to 100 cars were stranded. Six people died as a result of these storms. In addition to power outages reported in various part of the state, the March storm dropped over an inch of rain in the eastern part of the state and generated walnut size hail in Grant County. In November, a winter storm toppled a 1,400 foot television tower and derailed six freight cars.
January 1975	Of the two blizzards in 1975, the one on January 11 and 12 was the worst. High winds exceeding 60 mph, subzero temperatures, and heavy snow combined to produce killer conditions. Several people died and thousands of head of livestock perished in eastern South Dakota.
March 1969	Heavy snowfall and high winds knocked out power in the Aberdeen area. Rural residents were hard hit as blocked roads prevented early power line repair. The Belle Fourche area also sustained loss of power and phone service as hundreds of poles were knocked down.
March 1966	This storm moved into eastern South Dakota and remained stationary for 12 hours. Winds of 60 to 70 mph were common. Gettysburg had gusts up to 100 mph. The driving wet snow clung to the mouths of livestock and they suffocated. Cattle and sheep loss approached 100,000 animals with a value of nearly $20 million. Many towns suffered physical damage from the storm. A total of 380 people in Pierre had to be evacuated as the result of a power failure. Many towns lost phone service, and some communities had windows shattered by high winds, allowing snow to drift into buildings. A 121-car train was completely stopped by snow drifts. This storm killed 10 people.
December 1965	An ice storm destroyed an estimated 3,500 telephone poles in the Aberdeen area. Damage was nearly $650,000. Total damage to light and power systems approached $1 million. At the time, this was the worst ice storm experienced in 40 years.
January 1952	The temperature dropped from 40°F to -8°F in a short period of time. The wet, driving snow clung to everything. Cattle were blinded and suffocated as snow covered their mouths and noses. Young country school children lost their way home and died of hypothermia. A few ranchers died when they tried to gather their livestock. Snow piled up to a point that people could walk along tops of power lines. In some isolated areas, people were snowed in for four months off and on throughout the winter. Planes were used to deliver mail, groceries, fuel, and feed for livestock. Snow track vehicles were used to transport doctors to isolated farm areas.
January 1949	A blizzard affected the entire state. Blizzard conditions existed for weeks rather than days. The general weather conditions were low temperatures (-2°F to -8°F), heavy snows (24 inches for the month), and winds from 40 to 73 mph. Towns and rural areas were completely isolated as the snow blocked up everything. Roads, railroad tracks, and buildings were buried under tons of snow. People were lost in the storm and many cattle were frozen. Airplanes were used to deliver food, fuel, and medicine to stranded people. Snow was very deep in western South Dakota. Pictures of the area showed drifts 35 feet high and several thousand feet long.
1943	A blizzard killed a large number of cattle.

Date	Comments
1927	A blizzard killed a large number of cattle.
May 1905	A blizzard hit western South Dakota counties in May. Cattle wandering around in the blizzard walked off the bluffs in the Badlands area and fell to their death. Estimated cattle loss exceeded 16,000.
January 12, 1888	A blizzard was preceded by 10 days of cold, snowy weather, 8 to 10 inches of new snow, and a low temperature of -28°F. The weather warmed on January 11 and 12; it was foggy and about 32°F. The temperature dropped on the afternoon of January 12 to -20°F in five minutes. The wind blew so strongly that it knocked people off their feet. Many children, sent home from school, did not make it home. The blizzard was so withering that people lost their sense of direction and wandered about until they died of hypothermia (exposure). Thousands of head of livestock and wild animals perished. Many buildings were covered with snow or destroyed, and all transportation stopped. Although the storm lasted less than one day, an estimated 400 people died throughout the Dakotas, 174 of which were in South Dakota.

3.2.4.4 Probability

According to the National Climatic Data Center Storm Events database, there were 1,042 winter storms (snow and ice events) in South Dakota between January 1993 and October 2012, and 82 extreme cold events from January 1994 to October 2012. Total property damage for these events is estimated at $130.5 million in 2012 dollars. This suggests that South Dakota experiences 55 winter storms and $6.9 million in winter storm losses on average annually, as well as 4.3 extreme cold events each year. 12 deaths and 127 injuries were attributed to these events. This suggests that South Dakota can expect approximately 1 death every other year and 6 injuries each year. Based on this information, the probability that at least one winter storm will occur in South Dakota in any given year is 100 percent.

3.2.5 Wildfire

3.2.5.1 Description

Wildfires are uncontrolled conflagrations that spread freely through the environment. Wildfires near populated areas pose threats, not only to natural resources, but also to human life and personal property. Natural causes, such as lightning, or human acts may ignite wildfires. Lightning remains a fixed element of the ecosystem, and human-caused fire risks continue to increase as more and more people move to and recreate in fire-prone wildland areas.

South Dakota has a history of damaging wildfires. The state’s susceptibility to wildfire was recognized nationally in 1897 when, prompted by a series of large forest fires in 1893, President Grover Cleveland established the Black Hills Forest Reserve to protect the forests from fires (as well as wasteful lumbering practices).

Prior to 2010, years of drought along with extremely low percentages of normal snowpack in the Black Hills created the potential for catastrophic wildfires in South Dakota. 2011 was a wet year, but dry conditions and thus wildfire risk returned in 2012. Compounding this situation is the impact of the mountain pine beetle on pine trees in South Dakota. The most common host is the ponderosa pine. This tree occurs on more than 1 million acres of forestland in South Dakota. When the beetle population is very low only stressed or weakened trees, such as those struck by lightning, are colonized. However, approximately every ten years the beetle population increases and the beetles begin colonizing healthy as well as stressed trees. The South Dakota Department of Agriculture (SDDA) reported in 2012 that the mountain pine beetle population had reached epidemic proportions. SDDA published a Black Hills Regional Mountain Pine Beetle Strategy (2012) which proposed mitigation strategies for reducing the population to endemic levels over the course of several years. Between mountain pine beetles and dry conditions, there is great concern for wildfires in the wildland-urban interface and also for agricultural and rural wildfires. Fires involving grass, prairie, or timber can cause mass destruction of property and vegetation.

South Dakota's semi-arid climate, highly flammable native vegetation, rugged terrain, and populated wildland-urban interface make up its wildfire hazard.

Topography—The Black Hills are an outcropping of the Rocky Mountains, lying in an ellipse 100 miles long and 50 miles wide along the state's western edge. In the Black Hills, terrain varies from broad, open valleys; rolling topography; mountainous terrain up to 7,242 feet in elevation; and steep, narrow canyons.

Fuels—Fuels are generally conducive to high rates of spread, represented by National Fire Danger Rating System fuel models "G", "L," "K," and "C." Grass predominates in the broad valley bottoms. Ponderosa Pine grows on all aspects, and extensive pure forests of Ponderosa grow in the Black Hills. Mixed grass and timber stands occur in many areas depending on aspect. Fuel loading is lightest in the southern Black Hills and heaviest in the northern Black Hills.

Weather—During the summer months, temperatures are often in the 90s and low 100s with relative humidity in the teens. The average annual precipitation is approximately 17.5 inches. Some of this precipitation comes in association with thunderstorms that bring lightning during the fire season.

Lightning fires burn more acreage than human-caused fires, in part, because 1) multiple lightning fire ignitions often occur at the same time; 2) lightning fires can occur throughout the protection area, while most human-caused fires occur in accessible areas; 3) people often detect and report human-caused fires quickly due to their proximity to inhabited areas; and 4) lightning producing thunderstorms typically occur during the hottest portion of the fire season, while many human-caused fires start during spring or fall.

Conditions—The Black Hills ecosystem is fire adapted, having evolved with fire and fire dependent plant species. The forests of the Black Hills are very different from pre-settlement times when frequent, low-intensity fires maintained a healthy forest structure. Ponderosa Pine is adapted to benefit from frequent, low-intensity fires started in summer by lightning. Historically, these fires killed smaller plants that competed with the pines for moisture and released nutrients from litter on the forest floor. These fires also prevented accumulation of fuels that feed severe fires, which can destroy the thick-bark defense of the trees.

Today, the forest contains many more trees per acre and much more undergrowth, needle litter and deadwood than it did historically. Under these circumstances, when wildfires occur under dry, warm, and windy conditions, they will frequently develop into uncontrollable crown fires that destroy the forest and any homes within it.

Mountain pine beetle attacks in Ponderosa Pine often coincide with abundant weak trees resulting from drought and overgrown conditions. These circumstances have been common throughout the Black Hills and have allowed a mountain pine beetle infestation to become epidemic. The Custer State Park area around Harney Peak, and the Norbeck Wildlife Preserve adjacent to Mount Rushmore has extremely high fuel loading due to Mountain Pine Beetle outbreaks.

Wildland-Urban Interface—Wildfires destroy hundreds of structures throughout the western United States every year. These fires can and will occur anywhere that humans and their development meet or intermix with wildland fuels. This wildland-urban interface fire problem exists in every state, including South Dakota, and worsens each year. People continue to develop residential properties in fire-prone environments, increasingly exposing themselves and their personal property to the risks of wildfire. Fire and resource management professionals know that wildland-urban interface development can draw the efforts of firefighters away from protecting the natural resources, whose stewardship they are charged with.

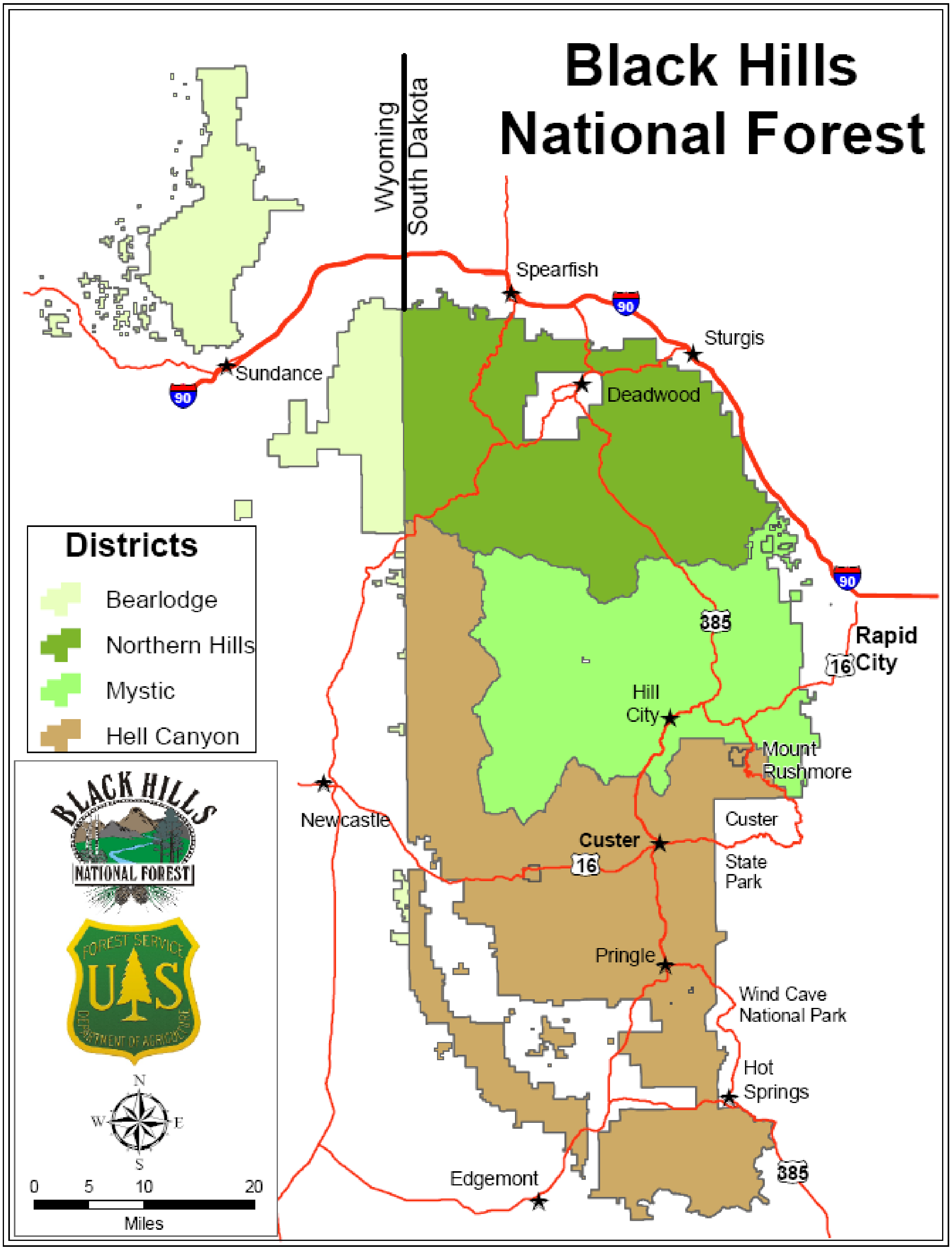
3.2.5.2 Location

Early writings by explorers, trappers, and settlers often describe South Dakota as a sea of waving grass. The descriptions would not be valid today for the eastern half of the state. The more fertile and climatically desirable prairie of the eastern portion is now used for crop production. But, the wild prairie still exists in the western part of the state. South Dakota's portion of the Great Plains now exists from the foothills of the Black Hills to the western boundary of the Missouri River. This amounts to nearly 35,000 square miles of land, which is used primarily for livestock grazing and some wheat cultivation. For most of the year, this area is at risk to wildfires because of the nature of the ground cover and the limited precipitation.

Although wildfires occur throughout the state, the grass and forestland areas west of the Missouri River represent the area most prone to large wildfires. This area remains vulnerable due to the large areas of continuous fuels and the extreme burning conditions that occur in the area. The area of the state known as the Black Hills has the highest potential for loss of lives and personal property from wildfire. After years of fire suppression, the landscape of the Black Hills has become a dense forest. High fuel loads, years of drought, and mountain pine beetle infestation have combined to make the area particularly susceptible to wildfire. Between 2000 and 2002, 10 percent of the Black Hills National Forest burned (see Past Events) (U.S. Forest Service, Spearfish, South Dakota, and the Northern Black Hills: Steps to Improve Community Preparedness for Wildfire).

The Black Hills National Forest encompasses 1,534,471 acres of land in South Dakota and Wyoming (see Figure 3-22). Over one million acres of the forest are exclusively in South Dakota (Custer, Fall River, Lawrence, Meade, and Pennington counties). Of the one million acres, about 80 percent is federally controlled. The remaining 20 percent is controlled by the state and private citizens.

Figure 3-22 Map of Black Hills National Forest with District Boundaries



Source: U.S. Forest Service, http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5228288.pdf

The land ownership pattern in the Black Hills includes a mix of private, Black Hills National Forest, State of South Dakota, Bureau of Land Management, and National Park Service lands. A “checkerboard” ownership pattern in the Black Hills National Forest produces a condition where private, residential structures are scattered throughout much of the National Forest. The U.S. Forest Service has reduced, through land exchanges, the number of individual property inholdings and the land area they cover within the Black Hills National Forest. However, the number of occupied developments on the remaining inholdings increases constantly. This rural residential growth continually and dramatically increases private property exposure within U.S. Forest Service’s fire jurisdiction.

The state primarily maintains fire protection responsibility on private and state lands, but protects a relatively large amount of Federal land as well. The State of South Dakota (WFS) is the protecting agency (under contract) for all BLM lands in SD, approximately 250,000 acres. In addition we provide mutual aid assistance to our federal wildland firefighting agencies throughout the state. Since a large portion of the state’s fire protection area is private land, single-family dwellings exist throughout the state’s protection area. However, there are existing pockets with no dwellings due to the roughness of the terrain in some areas.

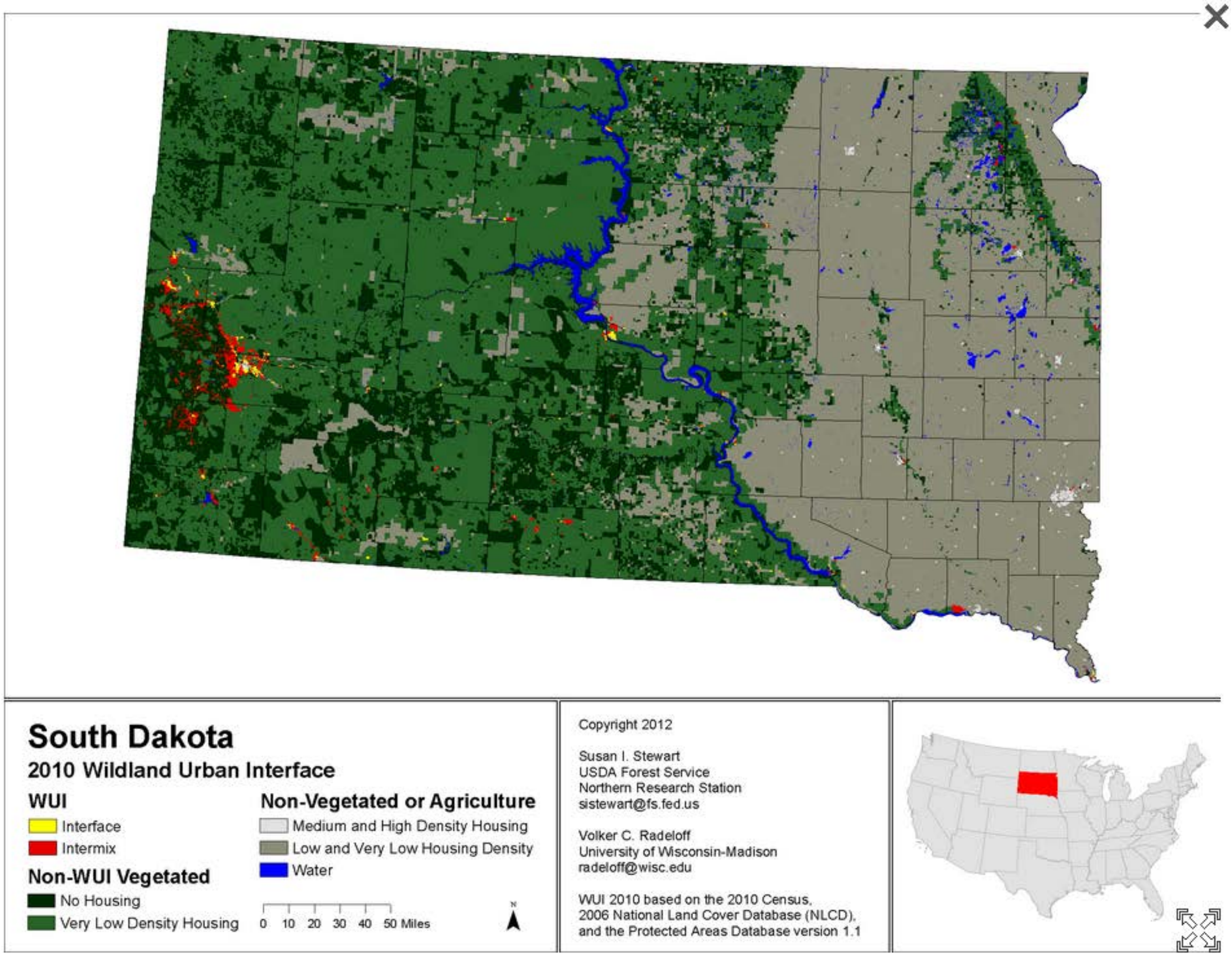
The greatest concentration of structures is located in and around the towns and cities in the Black Hills, including subdivisions within a few miles of the town and city limits. Rapid City and bedroom communities within a five-mile radius of the city represent the greatest concentration of structures located in the forested areas of the Black Hills. The population of new residents is growing, especially in Custer, Pennington, and Meade Counties, and there are far more individual property owners to deal with than in the past.

Many new residents are unfamiliar with the realities and responsibilities of living in a fire dependent ecosystem such as the Black Hills, are unaware of the natural role of fire, the concept of defensible space, and the capabilities of local government services. Many homeowners seem to value aesthetics more than safety and resist the concept of defensible space, believing that they will spoil the environment for which they came.

In addition to the Black Hills National Forest, there are fire-prone smaller forested areas on the Custer National Forest in Harding County, and BIA Trust and tribal lands on the Pine Ridge Reservation of Shannon County (unorganized), and the Rosebud reservation of Todd County (also unorganized). These three counties are in western South Dakota.

South Dakota codified law (SDCL 41-20-5) was amended in 2008 and now contains language that expands the use of the Fire Suppression Special Revenue Fund to include rangeland fires outside the Black Hills Forest Fire Protection District. The Governor has to declare an emergency for the area affected by the rangeland fire and the State Wildland Fire Suppression Division must assist with the fire suppression and extinguishment. Figure 3-23 illustrates South Dakota’s wildland-urban interface using 2010 U.S. Census data. Wildland-urban interface, as illustrated in this figure from the SILVIS Lab at the University of Wisconsin–Madison, is composed of both interface and intermix communities. In both interface and intermix communities, housing must meet or exceed a minimum density of one structure per 40 acres. Intermix communities are places where housing and vegetation intermingle. In intermix, wildland vegetation is continuous, more than 50 percent vegetation, in areas with more than 1 house per 40 acres. Interface communities are areas with housing in the vicinity of contiguous vegetation. Interface areas have more than 1 house per 40 acres, have less than 50 percent vegetation, and are within 1.5 miles of an area (made up of one or more contiguous Census blocks) over 1,325 acres that is more than 75 percent vegetated. The minimum size limit ensures that areas surrounding small urban parks are not classified as interface WUI.

Figure 3-23 South Dakota's Wildland-Urban Interface



Source: SILVIS Lab, Forest Ecology and Management, University of Wisconsin–Madison, 2012

3.2.5.3 Past Events

The South Dakota Department of Agriculture's Division of Wildland Fire Suppression database indicates that lightning represents the single largest ignition source in its jurisdiction, causing 35 percent of fires and burning 41 percent of the acreage lost between 1996 and 2000. While debris burning caused slightly more fires, these fires burned only about one third of the acreage lost to lightning-caused fires. Table 3-12 contains information about wildfires in the Black Hills between 1977 and 2000. Table 3-13 shows the large fire history for South Dakota, with emphasis on the Black Hills National Forest, between 1879 and 2010 from South Dakota Wildland Fire Suppression. Figure 3-24 indicates the communities at risk for a wildfire, updated in 2008. Most of the fire occurrence and corresponding acres burned in the Black Hills occur in Custer and Fall River Counties.

South Dakota received two Fire Management Assistance Declarations in 2012. The Myrtle Fire (FEMA-2996-FM) began on July 19th, 2012 in Custer County due to human causes. The fire burned 10,080 acres and was 100% contained by July 24th, 2012. The Wellnitz Fire (FEMA-5010-FM) began on August 29th due to lightning. The fire burned 77,159 acres across Shannon County, South Dakota and into Nebraska. Burned acreage in South Dakota alone was estimated at 28,478. The fire was 100% contained by September 7, 2012. NCDC recorded three wildfire events in South Dakota since 2010. These events are summarized in Table 3-13.

Figure 3-24 South Dakota Communities at Risk to Wildfire

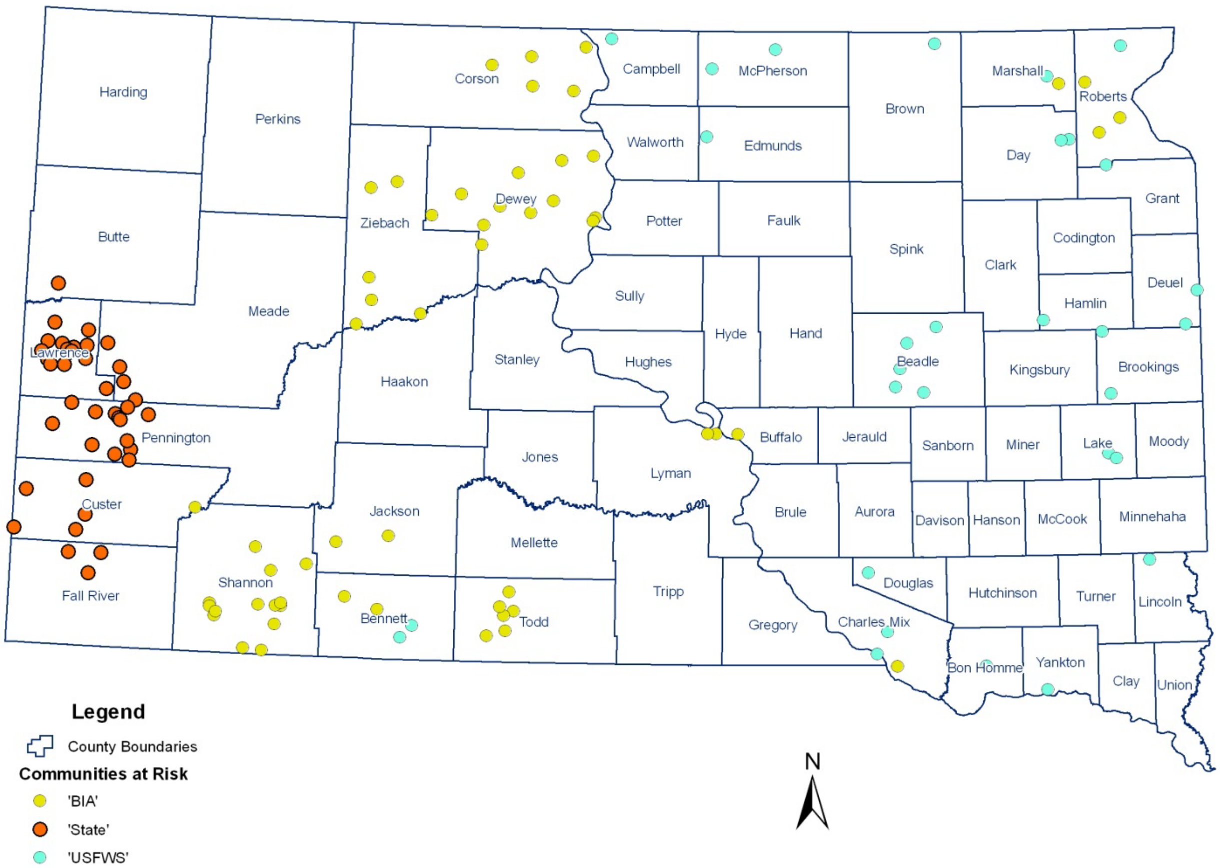


Table 3-12 Black Hills Fire Occurrence for 24 years, 1977 – 2000

Total number of fires	3,971
Total acres burned	679,293
Average number of fires per year in the Black Hills:	166
Average acres burned per year in the Black Hills	28,304
Lightning-caused	398 fires
Human-caused	2,573 fires

Source: South Dakota Department of Agriculture Division of Wildland Fire Suppression

Steve Hasenohrl, South Dakota Chief Fire Management Officer, stated that 7,986 fire occurrences were recorded between 2001 and 2010.

Additional data on wildfire occurrences was obtained from the Federal Wildland Fire Occurrence website (http://wildfire.cr.usgs.gov/firehistory/data.html). The Federal Wildland Fire Occurrence data had records for 23,537 fires between 1980 and 2011 of varying sizes between 0 and 84,782 acres. These fires burned an estimated total of 1,150,137.35 acres. The largest of these was the Jasper Fire complex in August 2000, which is profiled in Table 3-13. 88% of these fires between 0 and 84,782 acres were human-caused, 10% resulted from natural causes, and the causes of the remaining 2% were unknown. 163 fires between 1980 and 2011 burned 1,000 acres or more. Collectively these 163 fires burned a total of 890,405.1 acres. 123 (75%) of these fires occurred due to human causes, and the remaining 40 (25%) occurred due to natural causes. The location and cause distribution of the 163 events are depicted in Figure 3-25 and Figure 3-26 , respectively.

Figure 3-25 South Dakota Fire Occurrences 1,000 Acres or More: 1980-2011

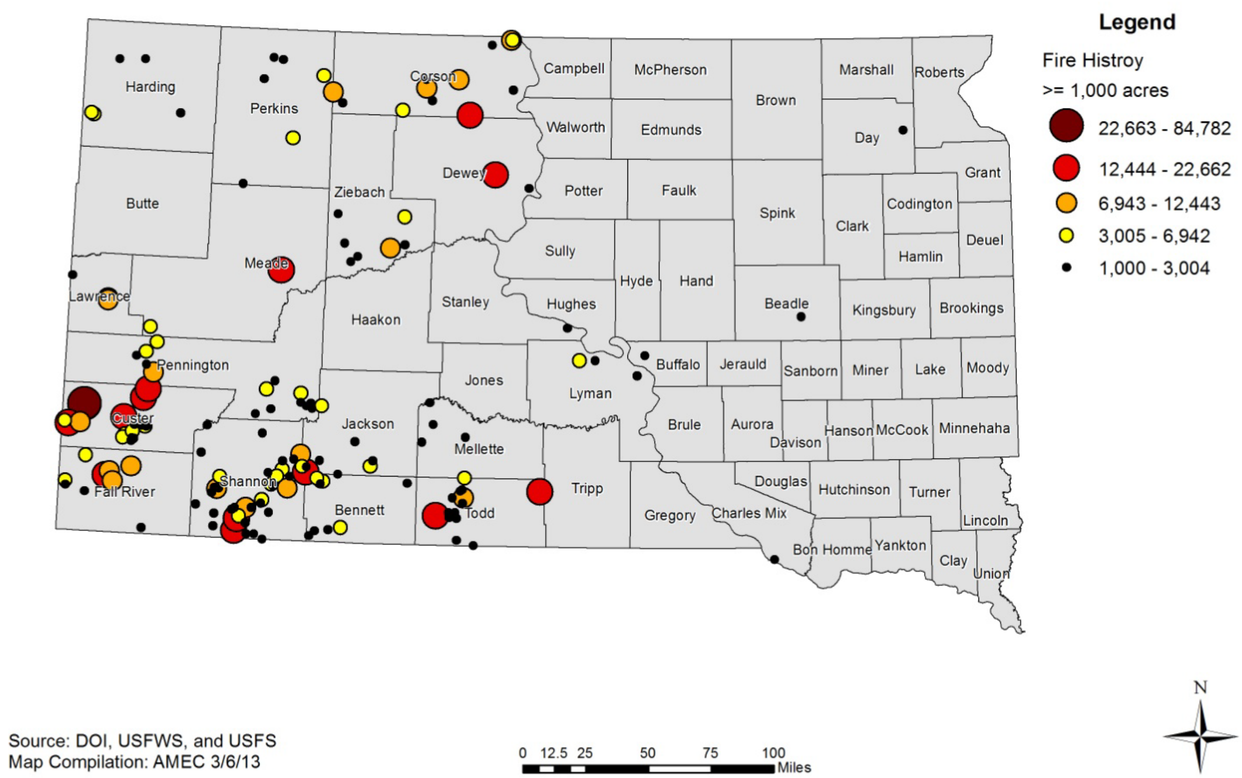


Figure 3-26 South Dakota Fire Occurrence Causes 1000 Acres or More: 1980-2011

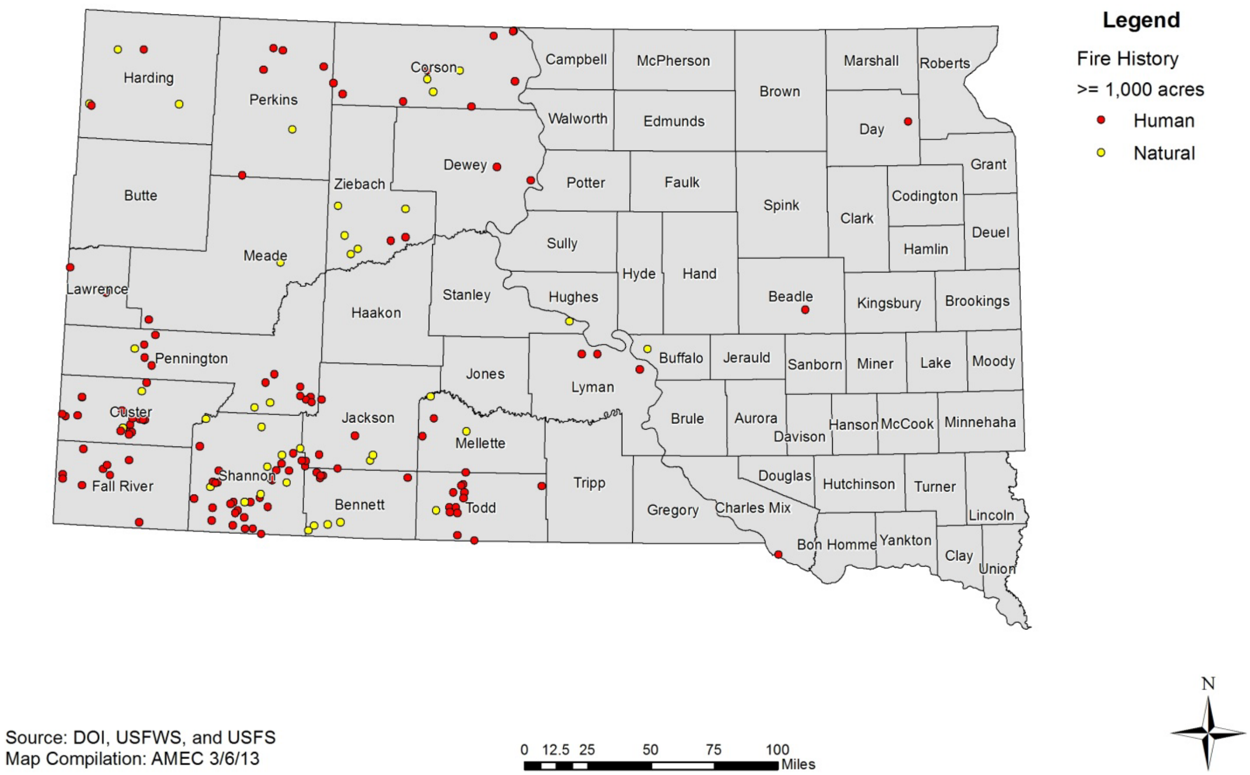


Table 3-13 South Dakota Wildfire Events

Date	Comments
August 29, 2012	**Wellnitz Fire (FEMA-5010-FM)** The Wellnitz Fire began on August 29th due to lightning. The fire burned 77,159 acres across Shannon County, South Dakota and into Nebraska. Burned acreage in South Dakota alone was estimated at 28,478. The fire was 100% contained by September 7, 2012.
August 16, 2012	A wildfire burned grassland in and near the Karl E. Mundt National Wildfire Refuge in southeastern Gregory County South Dakota on August 16th. No structures were burned. The fire burned 146 acres, including 112 acres on the refuge and 34 acres of private land.
July 19, 2012	**Myrtle Fire (FEMA-2996-FM)** South Dakota received two Fire Management Assistance Declarations in 2012. The Myrtle Fire began on July 19th, 2012 in Custer County due to human causes. The fire burned 10,080 acres and was 100% contained by July 24th, 2012.
January 9, 2012	Unseasonably warm and dry weather, along with dry and dormant vegetation, provided a setting in which several fires that were started to burn trash and vegetation went out of control in Moody County. The largest was several miles northeast of Flandreau, where the burning of a tree pile spread to grassland. This fire burned about 120 acres, reaching to the eastern border of the county and state. Another fire just northwest of Flandreau, started to burn garbage, burned 4 acres of grassland. No indications of damage amounts were received, but no structures were reported to have burned.
October 4,	Several wildfires broke out in Gregory and Charles Mix counties during the four

Date	Comments
2011	day period. Warm and dry weather, strong winds, and dry vegetation due to extended dry weather preceding this time contributed to the fires starting and spreading. The fires affected grassland and cropland, including baled hay.
2011	740 fires burned 38,684.62 acres
2010	609 fires burned 13,448.181 acres
August 27, 2010	**Flynn Creek Fire-**Human caused fire that burned 65 acres of US Forest Service Southeast of Custer, SD
2009	495 fires burned 11,372.499 acres
July 24, 2009	**Duck Creek Fire-**Railroad caused fire that burned 342.95 acres on US Forest Service Southwest of Hot Springs, SD
2008	476 fires burned 7,088.953 acres
May 18, 2008	**Freeland Well Fire-**Human caused fire that burned 168 acres on US Forest Service South of Custer, SD
2007	808 fires burned 160,851.23 acres
July 2007	**Boxelder Fire (FEMA-2716-FSA)** At the time of the state's request, the fire had burned approximately 700 acres and had resulted in the evacuation of 100 residents from the town of Nemo in Lawrence County.
July 2007	**Alabaugh Fire (FEMA-2710-FSA)** This fire near Hot Springs in Fall River County was started by lightning on July 7 and was contained on July 12. It burned 10,324 acres. The fire killed one man and destroyed 33 homes. It also forced the evacuation of about 600 residents in about 300 homes. Fire suppression costs were estimated at $2.7 million. A state official said the blaze was the most intense wildfire ever recorded in the Black Hills. Sources: InciWeb, Rapid City Journal, National Public Radio
2006	1,388 fires burned 371,226.31 acres Source: Steve Hasenohrl, South Dakota Chief Fire Management Officer
July 2006	**East Ridge Fire (FEMA-2658-FSA)** 3,204 acres burned, $1,973,107 total outlay
2005	781 fires burned 45,323.641 acres
July 2005	**Skyline #2 Fire (FEMA-2569-FSA)** 42 acres burned, total outlay: $18,975 (FEMA share: $14,231)
July 2005	**Ricco Fire (FEMA-2565-FSA)** 3,939 acres burned in Meade County, started by lightning, total outlay: $573,581 (FEMA share: $428,064)
April 2005	**Camp Five Fire (FEMA-2557-FSA)** 775 acres burned. Request for assistance withdrawn because event did not meet fire cost thresholds.
2004	437 fires burned 15,517.87 acres
2003	710 fires burned 111,999.37 acres
November 2003	**Mill Road Fire (FEMA-2513-FSA)** Total outlay: $62,852 (FEMA share: $45,685)
2002	846 fires burned 179,287.9 acres
August 2002	**Battle Creek Fire (FEMA-2458-FSA)** On August 16, 2002, the Battle Creek Fire ignited on private land near Keystone. High temperatures, low relative humidity, and strong winds created conditions that led to intense fire behavior with long-range spotting. The fire burned actively for four days and burned 12,450 acres (9,120 acres of national forest system lands,

Date	Comments
	3,330 acres of private lands) before it was fully contained on August 25. Over 600 structures and the town of Keystone were threatened, but thanks to firefighters, losses were limited to three residences near Hayward. Source: U.S. Forest Service, Battle Creek Fire Rapid Assessment (www.fs.fed.us/r2/blackhills/fire/history/battlecreek/index.shtml) Total outlay: $1.8 million
June–July 2002	**Grizzly Gulch Fire (FEMA-2434-FSA)** This fire near Deadwood and Lead burned 10,801 acres and destroyed 7 homes and 20 other structures. Source: Jerome Harvey, "Historic Wildfire in the Black Hills" (www.nfpa.org/assets/files/PDF/blackhills.pdf)
2001	611 fires burned 124,401.74 acres
July–August 2001	**Elk Mountain #2 Fire (FEMA-2369-FSA)** This fire burned mostly in Wyoming, but was complexed with the Roger's Shack fire which burned 11,896 acres in South Dakota in western Custer County. Two single family residential homes were lost. Total outlay: $293,000
August–September 2000	**Flagpole Fire Complex (FEMA-2319-FSA) and Jasper Fire (FEMA-2324-FSA)** The Flagpole fire complex started on August 11, 2000, in Fall River County in southwestern South Dakota. The wildfire was actually three different starts, the Flagpole Mountain, Green Canyon, and Chilson II fires in the southern hills area. The fires were attributed to lightning. The Flagpole Mountain fire burned in ponderosa pine; the Green Canyon fire burned in grass, scrub, and juniper. The terrain was extremely rocky and steep, making access and fire-fighting difficult. Pushed by shifting winds, the Flagpole fire immediately threatened structures, including two homes, and destroyed one outbuilding. The Flagpole and Chilson II fires burned more than 6,000 acres by the evening of August 12. The Flagpole fire threatened 30 homes on the north, south, and east sides of the fire and prompted officials to call for voluntary evacuations in the Shep's Canyon area, where there was only one access road. One residence was lost on the north side of the fire. The fires eventually burned 7,386 acres. The Jasper Fire was located in Custer County in the Southwest Black Hills. It was the largest fire to occur in the Black Hills in at least a century. The fire started at about 2:30 p.m. on August 24, 2000, and was contained on September 8, 2000. The cause of the fire was arson. The weather was very hot and dry, vegetation moisture was at record low levels, and atmospheric conditions were very unstable. The conditions caused extreme fire behavior and the fire spread rapidly, doubling in size every hour on the day it started. Almost immediately after ignition, the fire spread into the tops of the trees and blowing embers began causing spot fires ahead of the main fire. The fire created its own weather pattern as it burned. Lightning from the storm created by the fire was a big concern. The fire completely blackened some areas, leaving scorched, dead trees and ash-covered ground in its wake. Other areas experienced only a light ground burn. Large areas within the fire perimeter remained green, either lightly burned or completely undamaged. Firefighting efforts continued for a month, and firefighters declared the fire controlled on the evening of September 25, 2000. The Jasper fire burned 83,500 acres and was the largest fire in Black Hills history. It destroyed one summer cabin and three outbuildings, burned acreage at the Jewel Cave National Monument, and threatened more than 100 other structures and the communities of

Date	Comments
	Custer and Hill City. Fire losses included approximately 244 million board feet of timber, 150 miles of range fence, 65 livestock water tanks, 20 miles of range water lines, 17 wildlife water developments, 59 wooden power line structures, and 2,738 feet of above ground telephone line. Total outlay for both fires: $4.25 million
2000	1,348 fires burned 354,357.13 acres
1999	879 fires burned 161,972.42 acres
1998	208 fires burned 6,843.96 acres
1997	69 fires burned 1,353.65 acres.
March 28, 1997	**Burdock Fire**-burned 350 acres on Private
1996	69 fires burned 3,484.57 acres
February 10, 1996	**East Gate Fire-** Powerline fire that burned 996 acres on Private
1995	56 fires burned 1,588.97 acres
September 5, 1995	**Indian Canyon Fire-** Lightning caused fire on Private burned 1,504 acres
1994	201 fires burned 2,663 acres [includes Stagebarn Canyon].
August 15, 1994	**Stagebarn Canyon Fire (FEMA-2109-FSA)** Stagebarn Canyon near Indian Hills subdivision northwest of Rapid City. Fire started by lightning. 112 acres burned; cost in excess of $159,000.
1993	44 fires burned 678 acres.
1992	958 fires burned 20,367 acres.
1991	815 fires burned 43,782 acres.
September 1990	**Swedlund Fire (Cicero Peak fire) (FEMA-2076-FSA)** Burned 14,518 acres, approximately 5,000 acres in Custer State Park. Caused by logging equipment.
1990	860 fires burned 11,725 acres.
1989	911 fires burned 14,779 acres.
1988	1,171 fires burned 69,512 acres.
July 5, 1988	**Galena Fire** 16,788 acres burned in Custer State Park. Started by lightning and required the evacuation of the City of Keystone during the height of tourist season. (http://thune.senate.gov/public/index.cfm?FuseAction=PressReleases.Detail&PressRelease_id=427&Month=3&Year=2007) (WFS Agency Historical Archives)
Jul 25, 1988	**Westberry Trail Fire (FEMA-2068-FSA)** Suspected arson fire and was located in a subdivision on the western edge of Rapid City. Burned 14 homes and 3,980 acres.
June 20, 1988	**The Short Pines Fire** in Harding County started by lightning burned over 5,274 acres of School and Public state land and one 105 acre fire started by a powerline in Rapid City on Skyline Drive destroyed one single family residence.
Jul 20, 1987	**Battle Mountain Fire (FEMA-2061-FSA)** Started by lightning in the game production area, two miles from Hot Springs. Burned 2,200 acres.
1987	1,638 fires burned 52,277 acres.
1986	478 fires burned 3,572 acres.
July 12, 1985	**Flint Hill Fire (FEMA-2057-FSA)** Lightning caused fire that burned 23,000 acres west of Edgemont.
July 12, 1985	**Seven Sisters Fire (FEMA-2056-FSA)** Lightning cause fire that burned 9,300

Date	Comments
	acres south of Hot Springs.
1985	1,229 fires burned 110,669 acres.
1984	651 fires burned 28,230 acres.
1983	950 fires burned 18,613 acres.
1982	403 fires burned 6,886 acres.
1981	1,556 fires burned 24,537 acres.
1980	1,349 fires burned 42,077 acres.
1979	485 fires burned 14,214 acres.
1978	479 fires burned 48,290 acres.
1977	535 fires burned 6,952 acres.
1976	582 fires burned 9,130 acres.
July 1975	**Custer State Park (FEMA-2017-FSA)**
1975	851 fires burned 30,671 acres
July 1974	**Argle & Booms Canyon (FEMA-2016-FSA)** Lightning caused fire that burned 4,356 acres north of Hot Springs.
1974	1,022 fires burned 38,864 acres.
1973	704 fires burned 36,252 acres.
1972	452 fires burned 13,638 acres.
1971	815 fires burned 20,890 acres.
1970	477 fires burned 6196 acres.
1969	211 fires burned 3254 acres.
November 21, 1962	Burned an area that stretched from Harrold to Highmore (20 miles long) and consumed 30,000 acres of hay and cropland. No loss of life.
August 30, 1960	Two simultaneous lightning strikes south of Hot Springs started the Green Canyon fire (6,389 acres) and the Wildcat fire (10, 454 acres).
September 8, 1959	This human-caused fire nearly destroyed the town of Deadwood. The fire burned 4,500 acres (1,971 federal, 2,560 private) around the town and did more than $1 million (1959 dollars) in damage. More than 60 structures (businesses, residences, utilities, etc.) were destroyed and damage to infrastructure was severe. Nearly 4,000 people were evacuated from the town in less than 30 minutes. Source: Jerome Harvey, "Historic Wildfire in the Black Hills" (www.nfpa.org/assets/files/PDF/blackhills.pdf)
August 23, 1949	Human-caused forest fire started by Nemo. Burned out to the hogback area by Tilford. Burned 6,630 acres and required both the SDNG and Rapid City Air Base to provide over a 1000 personnel to the Black Hills NF to suppress the fire. (Source: Big Elk fire file, WFS agency historical archives)
September 5, 1947	Three human-caused fires burned into one conflagration that burned an estimated 320,000 acres in Hyde, Sully, Potter, Faulk and Hughes Counties in one day. Estimated $2,000,000 damage to improvements (1947 dollars). Considerable damage to range and farm land, (Source: WFS agency historical archives and *"75 Years of Sully County History*" published by the *Onida Watchman.*
July 10, 1939	**McVey Fire** by Hill City South Dakota. Cause is still unclear. Burned 21, 857 acres. Almost burned over the town of Hill City. One firefighter was killed by a lightning strike during mop-up. 45 miles of fireline was constructed by over 1775 men at the height of the blaze. (Source*: Sawmills of the Black Hills*, by M. Linde and WFS agency archives.
1931	Rochford Burn. Arson set forest fire. Burned approximately 20,900 acres in western

Date	Comments
	Pennington County in the high elevation limestone country of the Black Hills National Forest, 12 structures were lost. (Source: WFS Agency historical archives)
1899	The Iron Creek fire burned for most of August south of Spearfish. By the time winter snows arrived, it had burned 38,400 acres of timber on the Black Hills National Forest and numerous mining claims.
March 1879	This fire burned for at least one week in an area from Brookings County to Union County. The path was over 100 miles long and 20 miles wide.
October 1871	During the week of the Great Chicago fire, a large wildland fire occurred along the Missouri River burning from Springfield to Yankton, burning many structures and farms.

Source: NCDC, Federal Wildland Fire Occurrence Database, South Dakota Department of Agriculture Division of Wildland Fire Suppression

3.2.5.4 Probability

As shown in the differences in fires reported in Table 3-12 and Table 3-13, wildfire reporting in the State varies regionally. Given the data in Table 3-12, between 1977 and 2000 the Black Hills area averaged 167 fires per year, averaging 170 acres per fire. Table 3-13 focuses on major fires in the State. Using the data in Table 3-13 (excluding the outlier of the 1879 fire), there were 51 wildfire events in South Dakota between 1959 and 2007 (48 years). Given both sets of data, wildfires, including those of a significant size, have a 100% chance of occurrence somewhere in the state from early spring to late fall every year.

According to the Federal Wildland Fire Occurrence data, 163 significant fires (1,000 acres or more in size) occurred between 1980 and 2011. Based on this data there is a 100% chance that a large fire of 1,000 acres or more will occur in South Dakota in any given year. Smaller fires also have a 100% annual occurrence probability.

3.2.6 Drought

3.2.6.1 Description

According to the National Weather Service, "Drought is a deficiency in precipitation over an extended period, 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, from very wet to very dry. Human factors, such as water demand and water management, can exacerbate the impact that drought has on a region." Four common types of drought are defined below.

- Meteorological drought is most often described in terms of dryness and the duration of the dry period. Other types of drought typically begin with a meteorological drought.
- Hydrological drought usually occurs as a result of precipitation shortfalls that negatively impact water supply.
- Agricultural drought links impacts on agriculture to meteorological or hydrological drought with a focus on precipitation shortages, soil water deficits, reduced water levels needed for irrigation, etc.
- Socioeconomic drought refers to the situation that occurs when physical water shortages begin to affect people.

South Dakota is vulnerable to the social, economic, and environmental impacts of drought. Specifically, drought in South Dakota means limited water availability for people, agriculture, and recreation. The demand for water for multiple uses also impacts water availability. Rural water systems designed largely to supply water for people are now also being used for cattle and to fight wildfires, taxing the limits of the systems. These problems are only expected to get worse in the years to come as populations grow.

Drought in South Dakota is often accompanied by periods of extreme heat. According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. According to the National Weather Service (NWS), among natural hazards, only the cold of winter—not lightning, hurricanes, tornadoes, floods, or earthquakes—takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise and heat-related illness may develop. Elderly persons, small children, those with chronic illnesses, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails. The chart below illustrates the relationship of temperature and humidity to heat disorders.

Figure 3-27 National Weather Service Heat Index

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	118	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Source: National Weather Service

Note: Heat Index (HI) values were devised for shady, light wind conditions. Exposure to full sunshine can increase HI values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

The NWS has in place a system to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for the issuance of excessive heat alerts is when the maximum daytime high is expected to equal or exceed 105°F and a nighttime minimum high of 80°F or above is expected for two or more consecutive days.

3.2.6.2 Location

The whole state of South Dakota is susceptible to drought, but there is a difference in how. Drought in the eastern part of the state is largely an issue for row crops. Water availability in Sioux Falls, and other areas that get their water from the Big Sioux River, is also becoming an issue as population grows. In the west, the concern is the need for water for people and rangeland. Rapid City, in the Black Hills, is also experiencing water availability issues related to growth that is exacerbated by years of below average rain and snowfall. Periods of drought can vary region by region in terms of length and severity.

3.2.6.3 Past Events

South Dakota experienced some level of drought between 2002 and 2007. Some years were worse than others, and some areas were harder hit than others, and there were not any significant wet periods until recent years. The U.S. Drought Monitor summarizes current drought conditions, and also allows comparison of current drought conditions to past drought conditions. It is produced collaboratively by the U.S. Department of Agriculture, NOAA, and the National Drought Mitigation Center at the University of Nebraska–Lincoln based on multiple drought indicators. South Dakota's drought status for July 24, 2007 is shown in Figure 3-28.

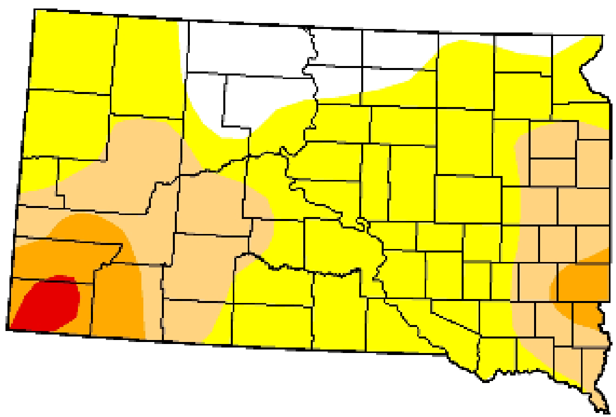
Figure 3-28 South Dakota Drought Status, July 24, 2007

U.S. Drought Monitor
South Dakota

July 24, 2007
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	11.3	88.7	33.8	9.0	1.5	0.0
Last Week (07/17/2007 map)	45.8	54.2	16.8	6.6	1.5	0.0
3 Months Ago (05/01/2007 map)	49.0	51.0	32.4	13.7	1.1	0.0
Start of Calendar Year (01/02/2007 map)	11.9	88.1	56.5	52.2	10.9	0.0
Start of Water Year (10/03/2006 map)	30.1	69.9	57.9	52.1	13.4	0.0
One Year Ago (07/25/2006 map)	0.0	100.0	100.0	81.0	54.6	18.9



Intensity:

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

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

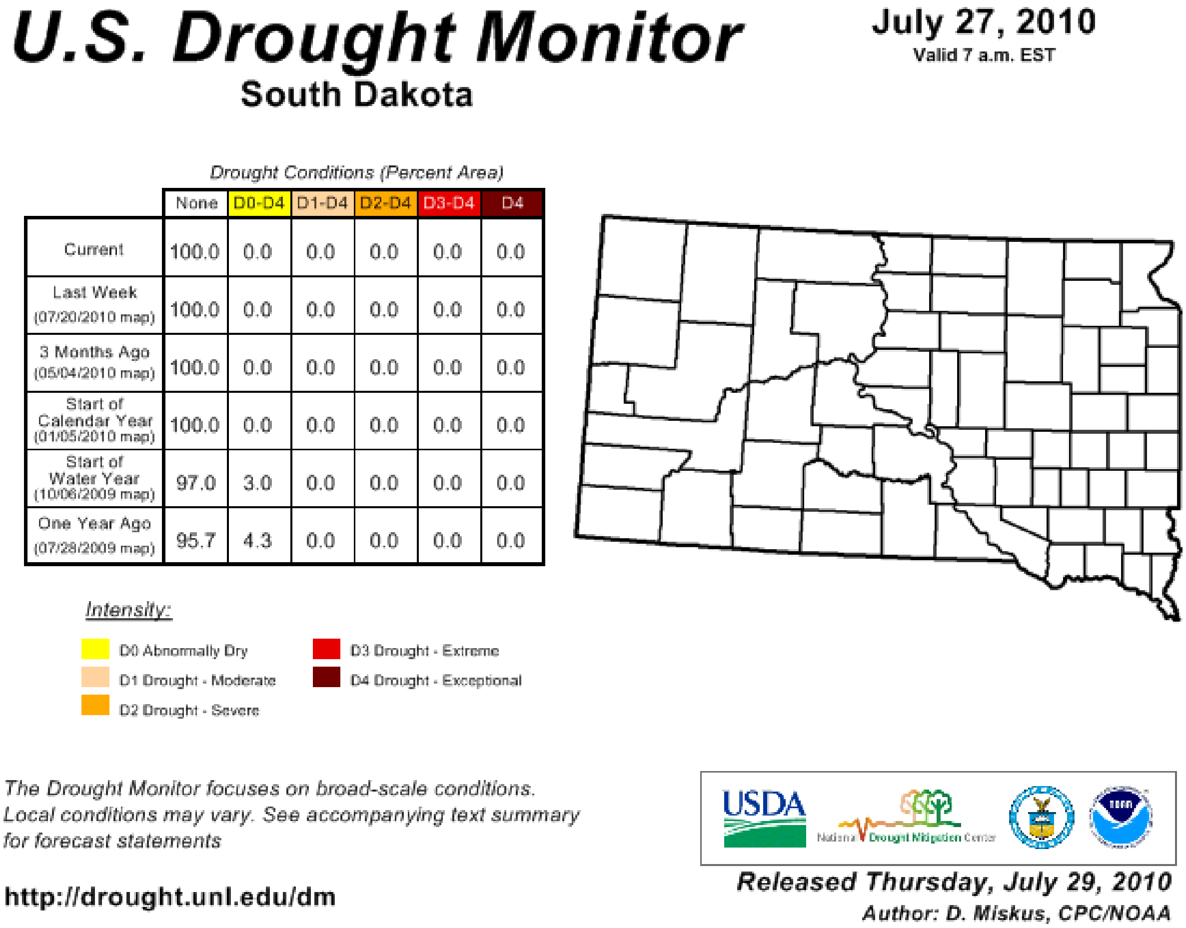
http://drought.unl.edu/dm

Released Thursday, July 26, 2007
Author: Richard Heim/Liz Love-Brotak, NOAA/NESDIS/NCDC

Source: University of Nebraska–Lincoln National Drought Mitigation Center
http://drought.unl.edu/dm/DM_state.htm?SD,HP

The Drought Monitor graphic in Figure 3-28 illustrates South Dakota's drought status as of July 24, 2007. Figure 3-29 shows the state's drought status as of July 27, 2010. Together the two graphics show how intensity and coverage varies over time, and how drought conditions improved since 2007.

Figure 3-29 South Dakota's Drought Status, July 27, 2010



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.0	0.0	0.0	0.0	0.0	0.0
Last Week (07/20/2010 map)	100.0	0.0	0.0	0.0	0.0	0.0
3 Months Ago (05/04/2010 map)	100.0	0.0	0.0	0.0	0.0	0.0
Start of Calendar Year (01/05/2010 map)	100.0	0.0	0.0	0.0	0.0	0.0
Start of Water Year (10/06/2009 map)	97.0	3.0	0.0	0.0	0.0	0.0
One Year Ago (07/28/2009 map)	95.7	4.3	0.0	0.0	0.0	0.0

Source: University of Nebraska–Lincoln National Drought Mitigation Center
http://drought.unl.edu/dm/DM_state.htm?SD,HP

U.S. Drought Monitor archives indicate that most of 2011 was also a wet year for South Dakota. However, dry conditions returned that winter. Figure 3-30 shows drought conditions in the State as of July 26, 2011. Figure 3-31 shows drought conditions as of December 13, 2011.

Figure 3-30 South Dakota's Drought Status, July 26, 2011

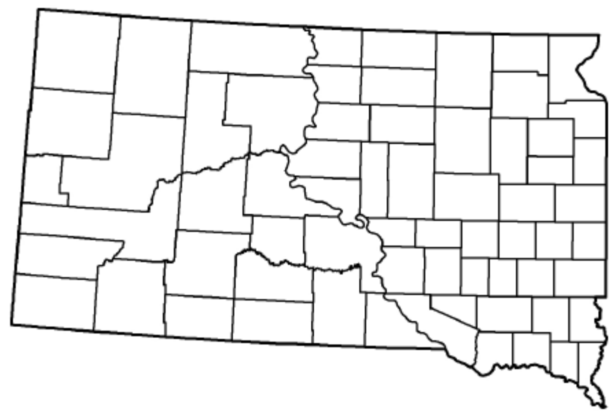
U.S. Drought Monitor

July 26, 2011
Valid 7 a.m. EST

South Dakota

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week (07/19/2011 map)	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago (04/26/2011 map)	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	99.02	0.98	0.00	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	88.56	11.44	0.00	0.00	0.00	0.00
One Year Ago (07/20/2010 map)	100.00	0.00	0.00	0.00	0.00	0.00



Intensity:

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

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

http://drought.unl.edu/dm

Released Thursday, July 28, 2011
Brad Rippey, U.S. Department of Agriculture

Source: University of Nebraska–Lincoln National Drought Mitigation Center
http://drought.unl.edu/dm/DM_state.htm?SD,HP

Figure 3-31 South Dakota's Drought Status, December 13, 2011

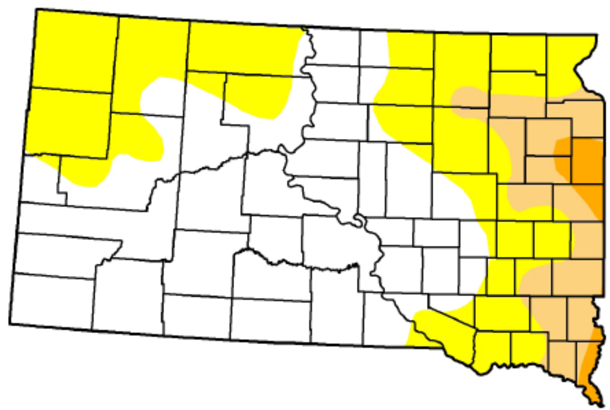
U.S. Drought Monitor

December 13, 2011
Valid 7 a.m. EST

South Dakota

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	53.48	46.52	12.06	2.11	0.00	0.00
Last Week (12/06/2011 map)	53.48	46.52	12.06	2.11	0.00	0.00
3 Months Ago (09/13/2011 map)	69.07	30.93	3.27	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	99.02	0.98	0.00	0.00	0.00	0.00
Start of Water Year (09/27/2011 map)	71.37	28.63	7.36	0.00	0.00	0.00
One Year Ago (12/07/2010 map)	99.02	0.98	0.00	0.00	0.00	0.00



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

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

http://droughtmonitor.unl.edu

Released Thursday, December 15, 2011
Matthew Rosencrans, NOAA/NWS/NCEP/Climate Prediction Center

Source: University of Nebraska–Lincoln National Drought Mitigation Center
http://drought.unl.edu/dm/DM_state.htm?SD,HP

Dry conditions returned in late 2011 and throughout 2012, and have continued through winter 2013. Figure 3-32 and Figure 3-33show drought conditions for July 24, 2012 and February 12, 2013, respectively.

Figure 3-32 South Dakota's Drought Status, July 24, 2012

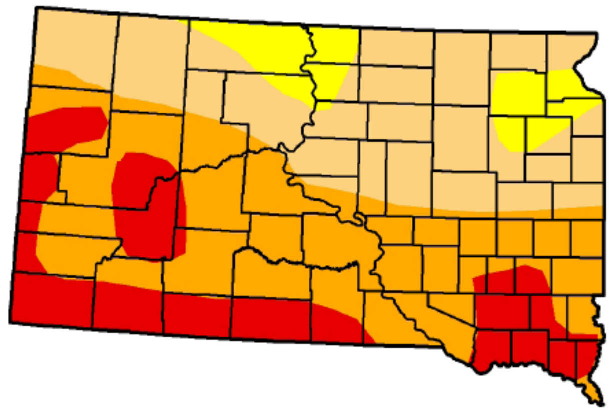
U.S. Drought Monitor

South Dakota

July 24, 2012
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	91.99	59.15	20.38	0.00
Last Week (07/17/2012 map)	0.00	100.00	90.37	44.93	0.00	0.00
3 Months Ago (04/24/2012 map)	39.81	60.19	34.10	0.00	0.00	0.00
Start of Calendar Year (12/27/2011 map)	48.14	51.86	13.86	2.11	0.00	0.00
Start of Water Year (09/27/2011 map)	71.37	28.63	7.36	0.00	0.00	0.00
One Year Ago (07/19/2011 map)	100.00	0.00	0.00	0.00	0.00	0.00



Intensity:

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

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

http://droughtmonitor.unl.edu

Released Thursday, July 26, 2012
Richard Heim, National Climatic Data Center, NOAA

Source: University of Nebraska–Lincoln National Drought Mitigation Center
http://drought.unl.edu/dm/DM_state.htm?SD,HP

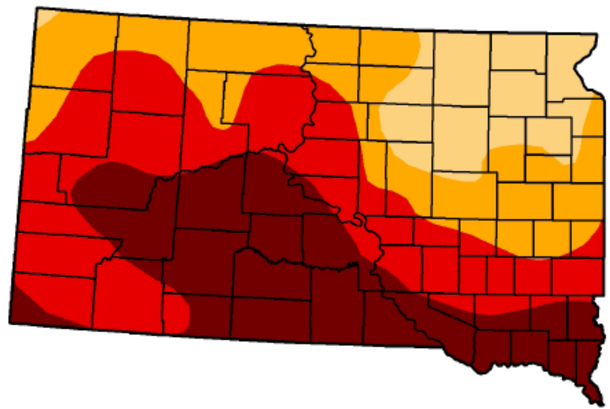
Figure 3-33 South Dakota's Drought Status, February 12, 2013

U.S. Drought Monitor **February 12, 2013**
Valid 7 a.m. EST

South Dakota

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	86.77	63.21	29.58
Last Week (02/05/2013 map)	0.00	100.00	100.00	96.93	64.29	29.57
3 Months Ago (11/13/2012 map)	0.00	100.00	100.00	93.09	54.71	32.57
Start of Calendar Year (01/01/2013 map)	0.00	100.00	100.00	96.95	63.17	30.68
Start of Water Year (09/25/2012 map)	0.00	100.00	100.00	74.69	50.53	6.72
One Year Ago (02/07/2012 map)	30.59	69.41	20.25	1.65	0.00	0.00



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

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

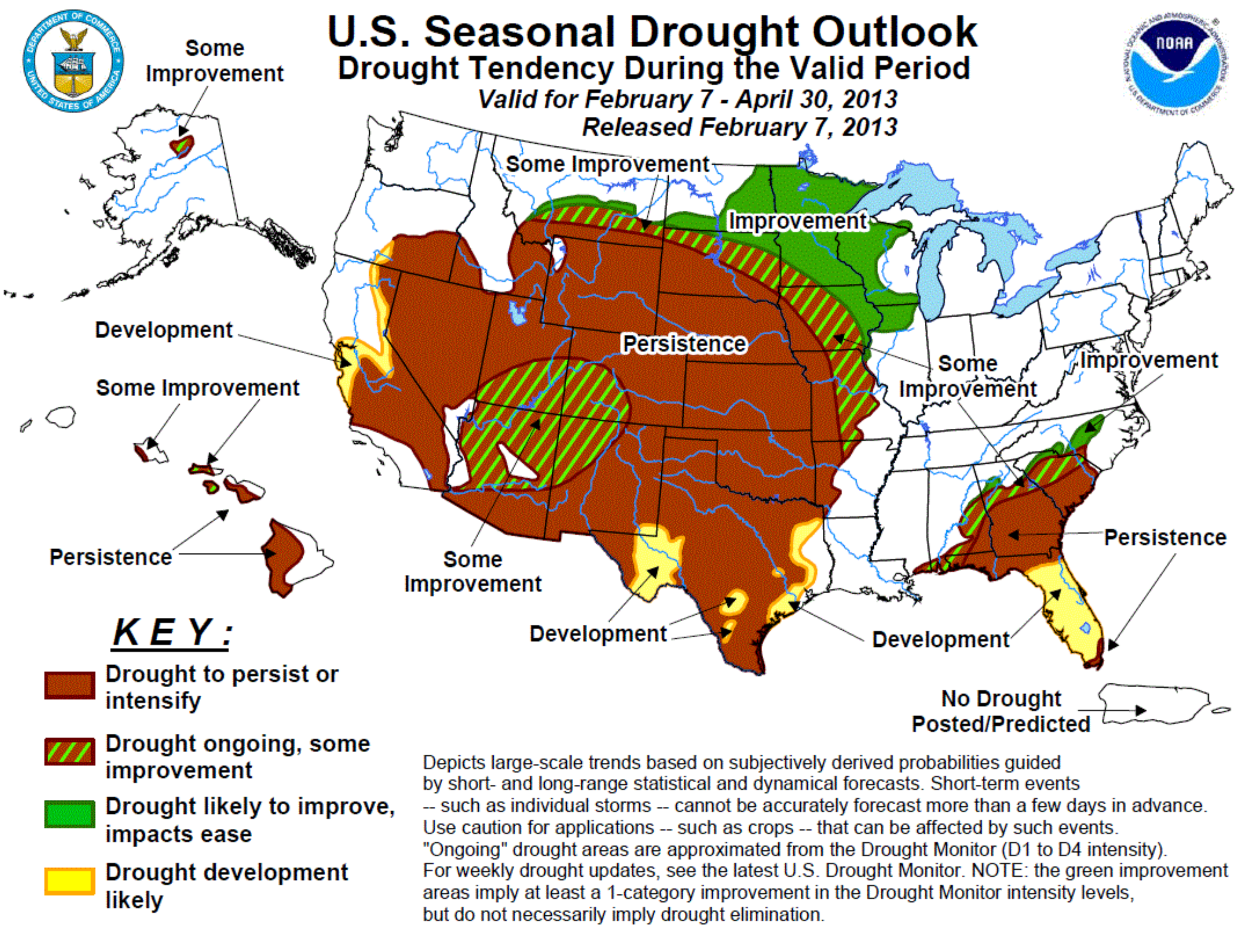
http://droughtmonitor.unl.edu

Released Thursday, February 14, 2013
Michael Brewer, National Climatic Data Center, NOAA

Source: University of Nebraska–Lincoln National Drought Mitigation Center
http://drought.unl.edu/dm/DM_state.htm?SD,HP

The National Weather Service's Climate Prediction Center expects the drought to show some improvement in the northeastern half of the State between February 7, 2013 and April 30, 2013. Drought conditions are expected to persist in the southwestern half of the State.

Figure 3-34 South Dakota's Drought Status, February 12, 2013



Source: NWS Climate Prediction Center

Historical drought information for South Dakota is difficult to find. An article in the *Proceedings of the South Dakota Academy of Science* suggests that South Dakota has seen droughts worse than the 1930's Dust Bowl. The article is based on a study of tree core data conducted to learn more about historical drought in South Dakota. The results of the study are illustrated in Table 3-14. According to the U.S. Drought Monitor, South Dakota remains in a drought as of February 2013.

Table 3-14 Duration and Magnitude Estimates of 15 Dry and 15 Wet Spells in South Dakota

	Dry Periods			Wet Periods		
Rank	Years	No. Years	% of Max	Years	No. Years	% of Max
1	1531-1551*	21	100.0	1429-1448*	20	100.0
2	1325-1344*	20	90.8	1284-1297*	14	80.3
3	1859-1873	15	82.5	1559-1574*	16	66.0
4	1397-1411*	15	73.0	1609-1617	9	53.6
5	1710-1725	16	65.8	1762-1769	8	35.7
6	1780-1791	12	51.3	1882-1892	11	31.5
7	1933-1942	10	50.0	1683-1695	12	30.0

	Dry Periods			Wet Periods		
Rank	Years	No. Years	% of Max	Years	No. Years	% of Max
8	1753-1761	9	43.5	1792-1806	15	28.1
9	1660-1668	9	44.7	1903-1910	8	27.2
10	1580-1598*	9	32.2	1962-1969	8	26.1
11	1852-1857	6	29.7	1773-1779	7	24.4
12	1956-1961	6	29.6	1832-1842	11	21.1
13	1467-1472*	6	27.0	1726-1733	8	21.0
14	1377-1388*	12	26.3	1943-1947	5	20.6
15	1637-1640	4	24.8	1641-1645	5	19.5

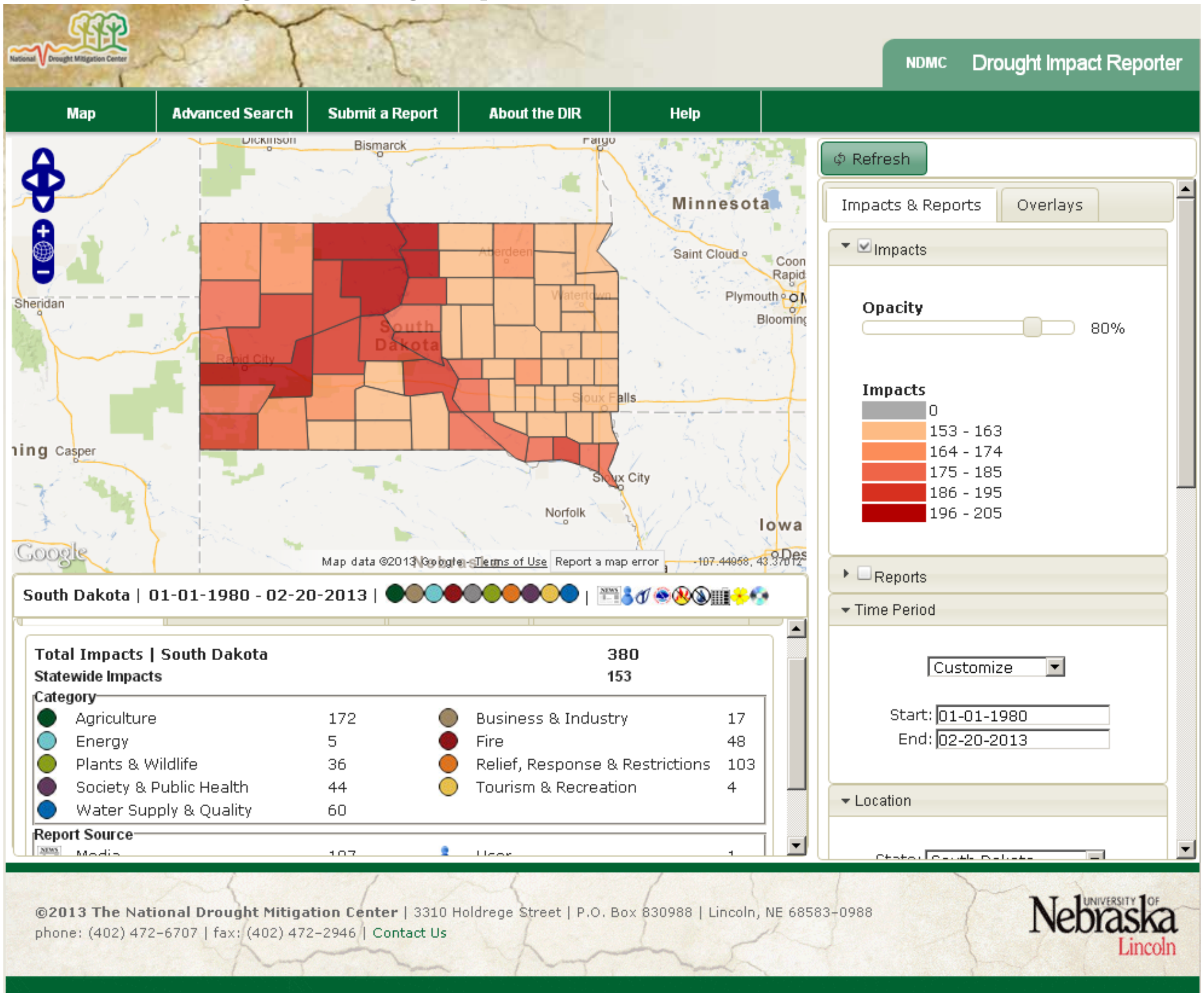
Source: Bunkers, M.J., L.R. Johnson, J.R. Miller, and C.H. Sieg. 1999. Old Black Hills Ponderosa Pines Tell a Story. *Proceedings of the South Dakota Academy of Science*, Vol. 78.
Note: *Sample size <5 trees and is likely not adequate to reliably infer precipitation patterns.

The National Drought Mitigation Center's Drought Impact Reporter contains information on 380 drought impacts from droughts that affected South Dakota between January 1, 1980 and February 2013. Figure 3-35 shows the distribution of drought impacts among South Dakota's counties. Corson, Campbell, Dewey, Walworth, and Pennington counties have experienced the most drought impacts according to the map. Most of the impacts, 172, were classified as "agriculture." Other impacts include "energy" (5), "plants and wildlife" (36), "society and public health" (44), "water supply and quality" (60), "business and industry" (17), "fire" (48), "relief, response, and restrictions" (103), and "tourism and recreation" (4). These categories are described as follows:

- **Agriculture**—Drought effects associated with agriculture, farming, aquaculture, horticulture, forestry, or ranching. Examples of drought-induced agricultural impacts include damage to crop quality; income loss for farmers due to reduced crop yields; reduced productivity of cropland; insect infestation; plant disease; increased irrigation costs; cost of new or supplemental water resource development (wells, dams, pipelines) for agriculture; reduced productivity of rangeland; forced reduction of foundation stock; closure/limitation of public lands to grazing; high cost or unavailability of water for livestock, Christmas tree farms, forestry, raising domesticated horses, bees, fish, shellfish or horticulture.
- **Business & Industry**—This category tracks drought's effects on non-agriculture and non-tourism businesses, such as lawn care, recreational vehicles or gear dealers, and plant nurseries. Typical impacts include reduction or loss of demand for goods or services, reduction in employment, variation in number of calls for service, late opening or early closure for the season, bankruptcy, permanent store closure, and other economic impacts.
- **Energy**—This category concerns drought's effects on power production, rates, and revenue. Examples include production changes for both hydropower and non-hydropower providers, changes in electricity rates, revenue shortfalls and/or windfall profits, and purchase of electricity when hydropower generation is down.
- **Fire**—Drought often contributes to forest, range, rural, or urban fires, fire danger, and burning restrictions. Specific impacts include enacting or easing burning restrictions, fireworks bans, increased fire risk, occurrence of fire (number of acres burned, number of wildland fires compared to average, people displaced, etc.), state of emergency during periods of high fire danger, closure of roads or land due to fire occurrence or risk, and expenses to state and county governments of paying firefighters overtime and paying equipment (helicopter) costs.

- **Plants & Wildlife**—Drought effects associated with unmanaged plants and wildlife, both aquatic and terrestrial, include loss of biodiversity of plants or wildlife; loss of trees from rural or urban landscapes, shelterbelts, or wooded conservation areas; reduction and degradation of fish and wildlife habitat; lack of feed and drinking water; greater mortality due to increased contact with agricultural producers, as animals seek food from farms and producers are less tolerant of the intrusion; disease; increased vulnerability to predation (from species concentrated near water); migration and concentration (loss of wildlife in some areas and too much wildlife in others); increased stress on endangered species; salinity levels affecting wildlife; wildlife encroaching into urban areas; and loss of wetlands.
- **Society & Public Health—**Drought effects associated with human, public and social health include health-related problems related to reduced water quantity and/or quality, such as increased concentration of contaminants; loss of human life (e.g. from heat stress, suicide); increased respiratory ailments; increased disease caused by wildland fire concentrations; increased human disease caused by changes in insect carrier populations; population migration (rural to urban areas, migrants into the United States); loss of aesthetic values; change in daily activities (non-recreational, like putting a bucket in the shower to catch water); elevated stress levels; meetings to discuss drought; communities creating drought plans; lawmakers altering penalties for violation of water restrictions; demand for higher water rates; cultural/historical discoveries form low water levels; prayer meetings; cancellations of fundraising events; cancellation/alteration of festivals or holiday traditions; stockpiling water; public service announcements and drought information websites; protests; and conflicts within the community due to competition for water.
- **Tourism & Recreation—**Drought effects associated with recreational activities and tourism include closure of state hiking trails and hunting areas due to fire danger; water access or navigation problems for recreation; bans on recreational activities; reduced license, permit, or ticket sales (e.g. hunting, fishing, ski lifts, etc.); losses related to curtailed activities (e.g. bird watching, hunting and fishing, boating, etc.); reduced park visitation; and cancellation or postponement of sporting events.
- **Water Supply & Quality**—Drought effects associated with water supply and water quality include dry wells, voluntary and mandatory water restrictions, changes in water rates, easing of water restrictions, increases in requests for new well permits, changes in water use due to water restrictions, greater water demand, decreases in water allocation or allotments, installation or alteration of water pumps or water intakes, changes to allowable water contaminants, water line damage or repairs due to drought stress, drinking water turbidity, change in water color or odor, declaration of drought watches or warnings, and mitigation activities.

Figure 3-35 Drought Impact Distribution in South Dakota: 1980-2013



Source: National Drought Mitigation Center Drought Impact Reporter

NCDC reported 164 drought events affecting 46 counties and/or zones in South Dakota in 2012. No damages or casualties were recorded for these events. Table 3-15 summarizes some of the most severe droughts in the State since 1889.

Table 3-15 South Dakota Droughts: 1889-2012

Date	Comments
October 2012	Drought conditions continued over all of southeast South Dakota in October with well below normal rainfall keeping soil and vegetation dry. Rainfall for the month was below normal everywhere, and less than half of normal in much of the area. Harvest of drought affected crops was completed, but there was no estimation available on how much yields were reduced. Winter wheat was planted on time, but the lack of moisture greatly hampered germination. Water restrictions were generally eased, with water use dropping off with the fall season. Drought was generally listed as continued severe to extreme for the area.
September 2012	Drought conditions continued over all of southeast South Dakota with well below normal rainfall keeping soil and vegetation dry. Rainfall for the month varied from

Date	Comments
	around half to less than a quarter of normal. Stress on crops that prevailed over the growing season became more evident with the start of harvest, although the amount of the reduced yields was still uncertain. Local governments continued to use water use restrictions in an effort to prevent serious water supply problems. Drought was generally listed as continued severe to extreme for the area.
August 2012	Drought conditions continued over all of the area with below normal rainfall keeping soil conditions dry. Stress on crops continued even though August was less hot than July, with temperatures averaging only a little above normal. Crop damage was quite evident, though the amount of reduced yields and other damage which might become evident at harvest was uncertain. While reported water supply problems were not extreme, many local governments had water use restrictions in place. 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.
July – August 2012	Drought conditions became established over much of the State with long term dry climate and soil conditions combining with much below normal rainfall during the month. Stress on crops increased and was continuous with no significant relief during the dry month. Hot weather added to the stress as it contributed to high evaporation. Crop damage in the form of reduced yields became certain, but the long remaining time to harvest and the unknown rainfall before that time made even rough damage estimates impossible. Severe general long term non-agricultural water supply problems were not observed, but the continued long term dry conditions raised fears of this for the future. Cattle sell-off's were also occurring across the region. Range and pasture conditions were poor to very poor with fire danger remaining a big issue. The severe drought continued into August.
June 2012	Long term dry climate and soil conditions combined with well below normal rainfall to make the dry conditions more acute and short term. This resulted in stress on crops developing during the month, mainly south of Interstate 90. After an abnormally dry fall and winter, short term drought fears had been temporarily forestalled by spring rains. The rains had fallen shortly after an unusually early planning brought on by very warm late winter and early spring weather. However, the return to dry weather in June compounded the effects of the long term dry conditions.
January – March 2012	The severe drought conditions from December continued across part of northeast South Dakota including the counties of Deuel, Codington, and Hamlin throughout March. The severe drought conditions would continue into February.
2007	Drought continued in some areas of South Dakota. The July 24, 2007, Drought Monitor for South Dakota (Figure 3-29) showed that drought encompassed most of the state. Most of Fall River County was experiencing severe drought conditions that also reached north into southern Custer County.
2006	Fifty-six counties designated primary natural disaster areas by the USDA. The other 10 were contiguous to primary natural disaster areas and thus also eligible for assistance. For many areas, this was their seventh consecutive year of drought. The National Weather Service cooperative observer 8 miles north-northwest of Usta in Perkins County recorded a maximum temperature of 120 degrees on July 15th, which tied the previous all-time record high in South Dakota, first set on July 5th, 1936 in Gann Valley. A woman died of heat exhaustion while hiking in the Badlands National Park on July 16th.
2005	Fifteen counties designated primary natural disaster areas by the USDA.

Date	Comments
	Twenty nine were contiguous to primary natural disaster areas and thus also eligible for assistance. In 2005, the Missouri River basin had experienced five consecutive years of below normal runoff. System storage was at a record low due to the combined impact of the drought and water allocation decisions made during the drought. Impacts included reduced hydropower production, loss of fish production, unusable boat ramps, and irrigation water supply problems. Source: South Dakota Engineer Society
2004	Thirty-four counties designated primary natural disaster areas by the USDA. Eighteen were contiguous to primary natural disaster areas and thus also eligible for assistance.
2003	Forty-three counties designated primary natural disaster areas by the USDA. Twenty were contiguous to primary natural disaster areas (in South Dakota or neighboring states) and thus also eligible for assistance.
2002	Many areas in South Dakota were devastated by drought in 2002. After a dry winter and spring, below normal rainfall for June brought severe drought conditions to the area. Much of the rainfall for June was below 50 percent of normal with much of the area receiving 20 to 40 percent of the normal rainfall. Some locations were at 10 to 15 percent of normal rainfall. Central and north central South Dakota were the hardest hit with the drought conditions. As a result of the severe dryness, a lot of grazing land and stock ponds dried up, and ranchers had to buy additional feed for their animals, transport them to healthier pastureland for grazing, or sell their herds prematurely. Crops suffered with much having to be cut up for hay or replanted. Water levels on lakes and rivers were also way down. Burn bans and voluntary or mandatory water restrictions were implemented across much of the area. All counties were declared drought disasters.
May/July 1992	Twenty-eight counties declared by governor as drought disaster areas: Aurora, Bon Homme, Buffalo, Butte, Campbell, Charles Mix, Corson, Dewey, Douglas, Edmunds, Haakon, Hand, Harding, Hughes, Hyde, Jackson, Jerauld, Jones, Lawrence, Lyman, Meade, Perkins, Stanley, Sully, Todd, Tripp, Walworth, and Ziebach.
1988	Statewide. Regional impact varied.
1985–1987	Western half of state during 1985; continued in Black Hills during 1986 and 1987. Rated as a 10- to 25-year event.
1980–1982	Statewide. Rated as a 10- to 25-year event. Most severe in 1981.
1973–1977	Statewide, except Black Hills. Rated as a 10- to 25-year event. Most severe in 1976. Includes drought emergency declaration (FEMA-3015-EM) in 1976.
1954–1962	Statewide. Rated as a 25-year event. Regional variations. Most severe in 1956 and 1959, except in the Black Hills where it was most severe in 1961.
1929–1942	Statewide. Rated as greater than a 25-year event. Dust Bowl years. Regional impact varied a little. Most severe in 1931, 1933, 1934, and 1936. Included in this period was a "plague" of grasshoppers.
1910–1914	Western half of state. Regional impact varied. Most severe in 1911.
1889–1905	Statewide. Regional impact varied. Most severe between 1894 and 1896 and 1898 and 1901.

Source: NCDC

Data on indemnity payouts for crop loss due to drought and high heat between 2010 and 2012 was obtained from the Risk Management Agency. In 2012, the State received $838,876,036 for crop loss due to drought and $47,640,782 due to heat, for a total of $886,516,818. This contrasts sharply with the indemnity payments in 2011 and 2010, both of which were wet years. In 2011, the State received $9,879,016 for crop losses from heat and $4,766,416 for drought for a total of $14,555,432. In 2010, the State received $4,985,132 for crop losses from drought and $2,110,751 for heat, for a total of $7,095,883. Clearly, severe drought years can have a devastating financial impact on South Dakota's agricultural industry.

3.2.6.4 Probability

Based on the tree ring research, which spans a period of roughly 400 years, multi-year droughts as significant as the 1930's drought or worse occur on average every 57 years. Based on historical records (10 in the past 118 years, counting the 2003-2007 dry spell and other multi- year events as one event) notable droughts have occurred somewhere in the state on average about every 12 years, which is equivalent of an 8% chance any given year. The State returned to drought conditions in 2012 after several wet years, but it is difficult to predict if this will become a multi-year drought. Inadequate data on past impacts exists to calculate average annual losses, but it is assumed to be in the millions of dollars.

3.2.7 Tornado

3.2.7.1 Description

The National Oceanic and Atmospheric Administration (NOAA) National Weather Service defines a tornado as a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one-mile wide and 50 miles long. In an average year, about 1,000 tornadoes are reported across the United States, resulting in approximately 80 deaths and more than 1,500 injuries.

Though climate data is available to explain a predisposition to tornadoes, there is no accurate way of predicting when or where a tornado may occur. Tornado systems have been linked to the development of temperature and wind flow patterns in the atmosphere, which can cause moisture, instability, lift, and wind shear (NOAA). Expert predictions of these conditions begins first by modeling in the long term and relying on critical analysis of satellite data, weather stations, balloon packages, airplanes, wind profilers, and radar-derived winds to pinpoint storm activity for the short term (NOAA).

Tornadoes typically occur in South Dakota in May, June, and July, but they can occur in any month. The greatest period of tornado activity (about 82 percent of occurrence) is from 11 a.m. to midnight. Within this time frame, most tornadoes occur between 4 pm and 6 pm.

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 3-16 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity. Table 3-17 shows the wind speeds associated with the Enhanced Fujita Scale ratings. The Enhanced Fujita Scale's damage indicators and degrees of damage can be found online at www.spc.noaa.gov/efscale/ef-scale.html.

Table 3-16 Original Fujita Scale

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
F0	< 73	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/f-scale.html

Table 3-17 Enhanced Fujita Scale

Enhanced Fujita (EF) Scale	Enhanced Fujita Scale Wind Estimate (mph)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

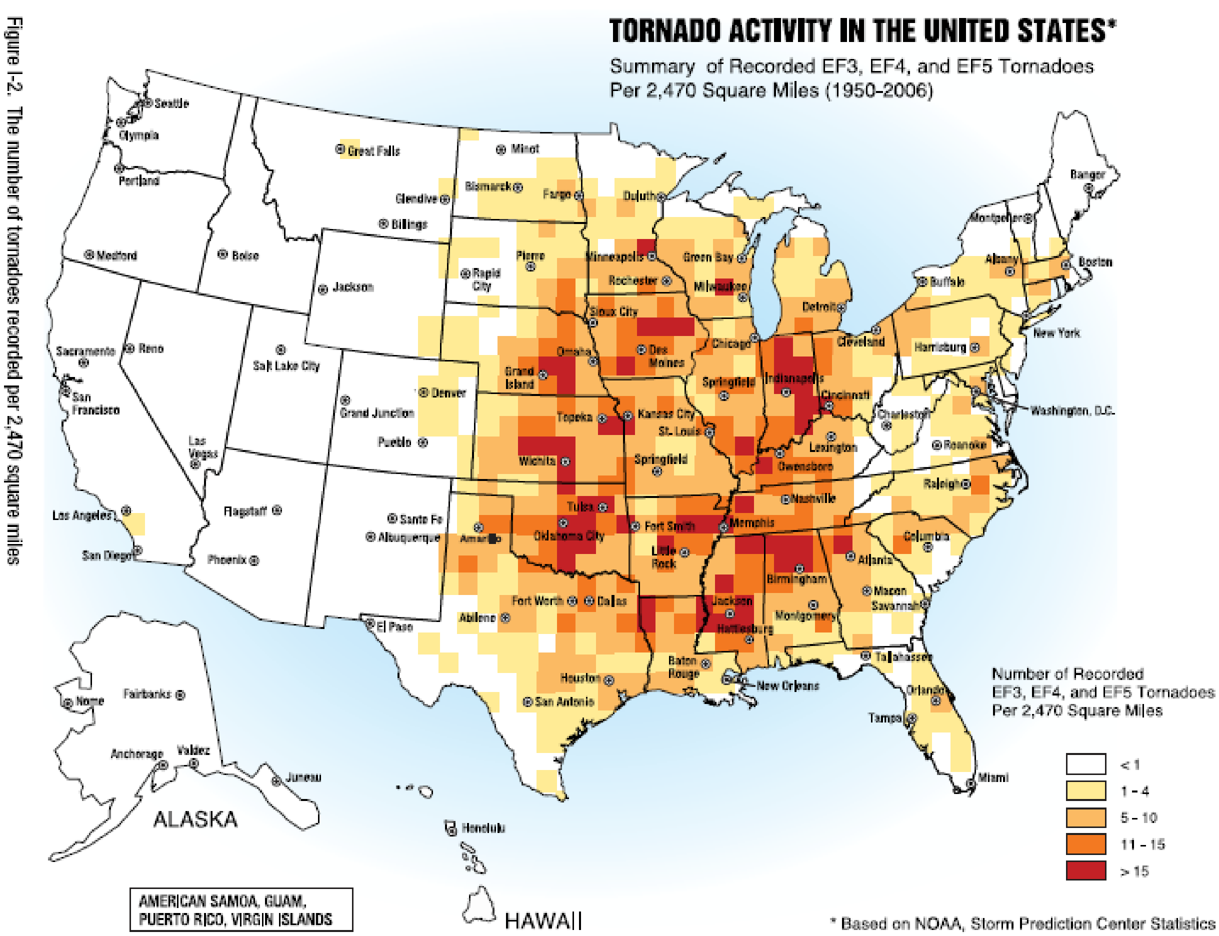
Source: National Oceanic and Atmospheric Administration Storm Prediction Center, www.spc.noaa.gov/faq/tornado/ef-scale.html

3.2.7.2 Location

Tornado disasters are often associated with Tornado Alley (the area from the Gulf to the Northern Great Plains that has high tornado incidence). South Dakota sits in the northern region of Tornado Alley and is susceptible to the specific conditions to which the formation of tornadoes has been attributed: warm Gulf air coming in contact with cool Canadian air fronts and dry air systems from the Rocky Mountains. The intersection of these three systems produces thunderstorm conditions that can spawn tornadoes. According to NOAA, tornadoes can occur at any location and from a wide variety of conditions. Western South Dakota, though not in the Tornado Alley, is still vulnerable to tornadoes of different strengths.

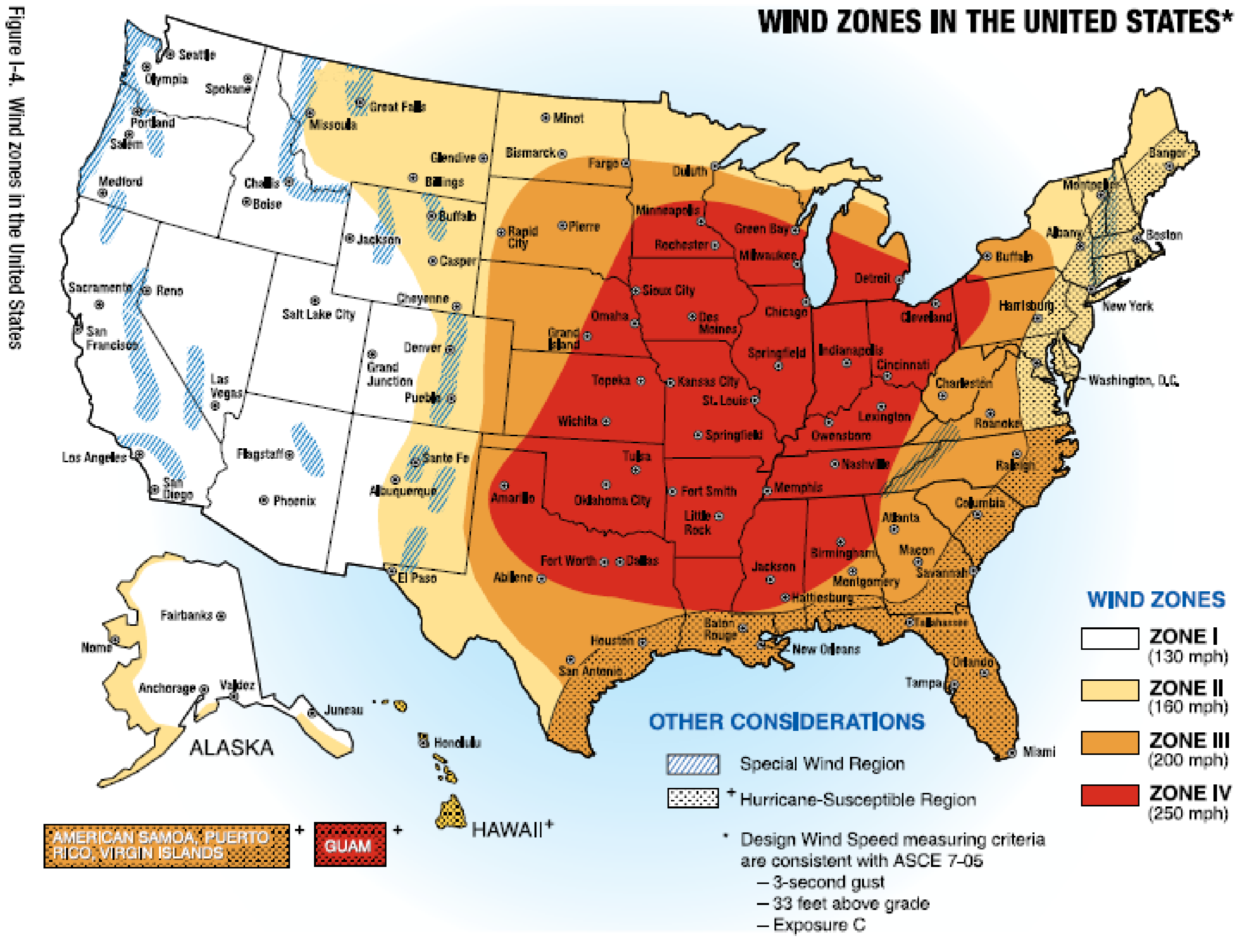
Figure 3-36 illustrates the number of F3, F4, and F5 tornadoes recorded in the United States per 2,470 square miles between 1950 and 2006. Figure 3-37 illustrates the wind zones in the United States. By noting the South Dakota data from these two maps and matching them up in Table 3-18, it appears that approximately 90 percent of South Dakota has a high tornado risk and 10 percent has a moderate tornado risk. A very small area in the northwest corner of the state has a low tornado risk.

Figure 3-36 Tornado Activity in the United States



Source: Taking Shelter from the Storm (FEMA 2008)

Figure 3-37 Wind Zones in the United States



Source: Taking Shelter from the Storm (FEMA 2008)

Table 3-18 Wind Zones

Number of Tornadoes Per 2,470 square miles (See Figure 3-36)	Wind Zone (See Figure 3-37)			
	I	II	III	IV
<1	Low Risk	Low Risk	Low Risk	Moderate Risk
1-4	Low Risk	Moderate Risk	High Risk	High Risk
5-10	Low Risk	Moderate Risk	High Risk	High Risk
11-15	High Risk	High Risk	High Risk	High Risk
>15	High Risk	High Risk	High Risk	High Risk

Source: Taking Shelter from the Storm (FEMA 2008)

3.2.7.3 Past Events

According to the National Climatic Data Center (NCDC) Storm Events database, there were 618 tornadoes in South Dakota between 1950 and October 2012 rated as an F1 or higher. Tornadoes reported in the database are in segments. One tornado can have multiple segments as the NCDC counts a new segment when county boundaries are crossed. So, the number of past occurrences is really a reflection of the number of past tornado segments. Total property damage for these events is estimated at $680 million in 2012 dollars. There were 17 deaths and 443 injuries in this time period. This number increases to 18 deaths and 452 injuries if all tornado events, including those smaller than an F1, are recorded. This suggests that South Dakota experiences 10 tornadoes of F1 intensity or greater, $10,967,741 in damages, and seven injuries each year. See Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction for more information about how tornadoes affect individual counties. Figure 3-38 shows the number of tornadoes by county between 1950 and 2012. Figure 3-39 shows tornado paths of individual tornadoes where data was available.

Figure 3-38 South Dakota Tornadoes by County, 1950-2012

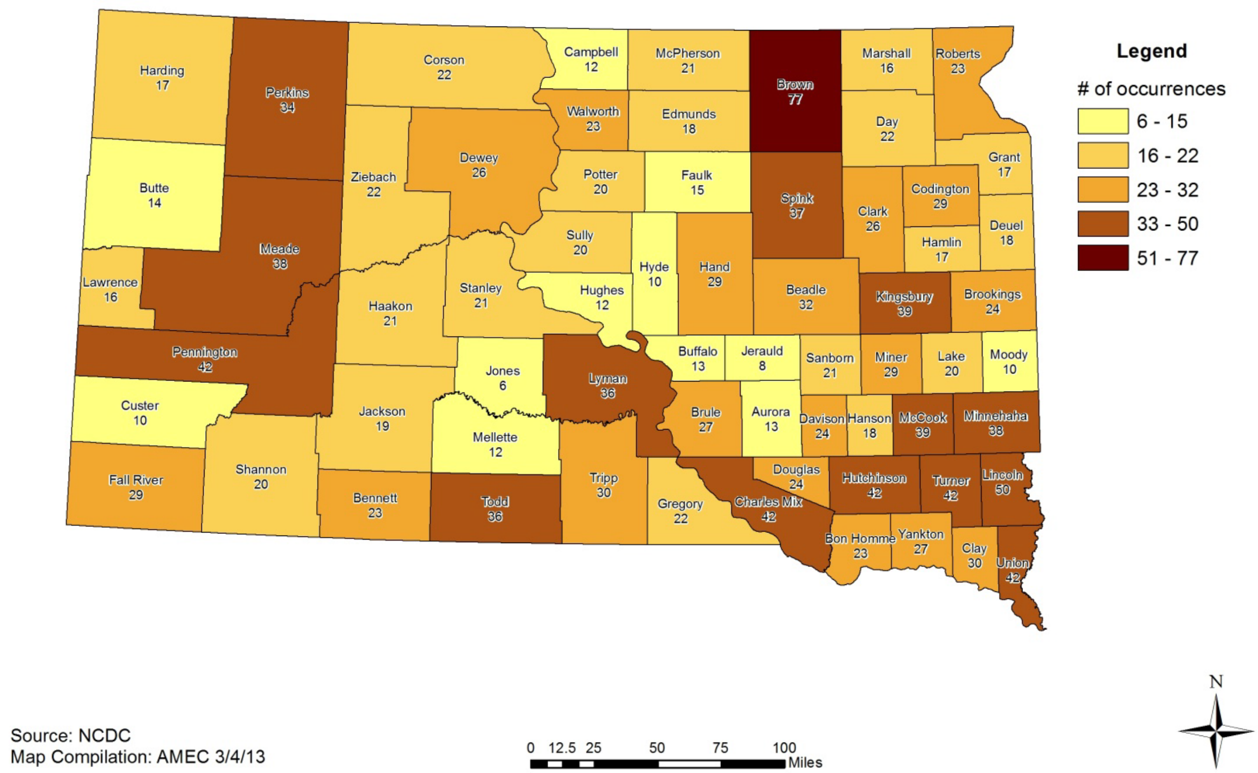


Figure 3-39 Tornado Paths in South Dakota 1953-2012

Table 3-19 South Dakota Tornadoes

Date	Comments
June 19-29, 2013	**FEMA-4137-DR** A major disaster declaration was declared in South Dakota due to severe storms, tornado, and flooding in Bennett, Corson, Lawrence, Lincoln, and Union counties and the Pine Ridge Indian Reservation within Bennett County.
May 24-31, 2013	**FEMA-4125-DR** A major disaster declaration was declared in South Dakota due to severe storms, tornado, and flooding in Spink, Beadle, Hughes, Kingsbury, Hamlin, Codington, Grant, and Deuel counties.
June 22, 2012	A severe thunderstorm tracked eastward from Wyoming across southern Fall River County. The storm produced enormous hail near Edgemont and a tornado between Edgemont and Ardmore. The tornado damaged buildings on a ranch north of Ardmore and blew down power poles and trees. A large wooden barn was completely destroyed; its walls and roof were blown more than 100 yards away. Two large sheds lost roofs and walls, and smaller sheds were blown apart. A modular house sustained minor damage. Damage was estimated at $500,000.
June 12, 2011	A cluster of severe thunderstorms moved east from northeastern Wyoming and southeastern Montana across Harding and Butte counties. The storms produced hail, wind gusts near 80 mph, and a small tornado west of Redig. The tornado destroyed part of a barn, rolled large steel calf shelters, blew down steel stockade walls, and lifted a calf shelter over a nine foot fence.
May 9, 2011	A severe thunderstorm produced a tornado northeast of Wall and wind gusts to 60 mph over far eastern Meade County. A large electric transmission tower was crumpled, seven wooden power poles were snapped, and trees were snapped.
June 16, 2010	**FEMA-1929-DR** An intense low pressure system developed across the northern Plains states and impacted the region on June 17. At least 61 tornadoes were reported that afternoon and evening across North Dakota, South Dakota, and Minnesota. A supercell around Dupree and Faith spawned 16 or more tornadoes, with 4 and possibly 5 on the ground at the same time.
May 22, 2010	Severe weather shifted north as a low pressure system tracked across the northern Plains states on May 22. Isolated tornadoes were reported across portions of central South Dakota that afternoon. The most intense supercell produced a long-lived wedge tornado in and around Bowdle, South Dakota where numerous houses and farm buildings were destroyed and cars were thrown into the air. It was rated as an EF4, but fortunately remained in rural areas and no injuries were reported. Tornadoes in Edmunds and McPherson counties damaged 60 utility poles. FEM Electric customers on 40 meters were without power for 48 hours. Emergency repair and restoration costs for FEM Electric were estimated at $210,000.
July 9, 2009	Severe storms developed over Fall River County and moved eastward across southwestern and south central South Dakota. The storms produced large hail and strong wind gusts. Two tornadoes were observed in Todd County and two tornadoes touched down in southern Tripp County. A small tornado touched down on a farm west of the intersection of 286th Street and 313th Avenue. The tornado blew a garage off its foundation, tipped over a combine, and snapped large cottonwood trees.
May 12, 2009	An F1 tornado travelled for eight miles with a width of 200 yards. The tornado touched down west of Dupree and tracked eastward before dissipating northeast of

Date	Comments
	Dupree. It dented several grain bins, blew over a small mobile home and semi trailer truck, tore sheet metal off sheds, and toppled a large communications tower.
June 5, 2008	An F1 tornado 100 yards wide damaged a path ten miles long. The tornado severely damaged a home, destroyed outbuildings, and damaged storage bins at a farm near Ravinia. The tornado also caused tree damage along its path. An F2 tornado caused damage to silos, farm buildings, power lines, and numerous trees southeast of Baltic.
May 29, 2008	An F-1 Tornado two miles long and 100 yards wide destroyed a barn, damaged or destroyed several outbuildings, scattered lumber across a field, and damaged trees and power lines. Damages were estimated at $100, 000.
May 5, 2007	**Severe Storms, Tornadoes, and Flooding (FEMA-1702-DR)** Twenty-five tornadoes were recorded in southeast South Dakota. It was the most significant tornado outbreak in southeast South Dakota since June 24, 2003. The strongest tornado, an EF-3, occurred in Aurora County. On the ground for five miles, it did its most significant damage to a pheasant hunting lodge/preserve, where numerous buildings and trees were severely damaged and numerous adult and chick pheasants were lost. Winds were estimated at around 140 mph. In Bon Homme County, an EF-2 tornado was on the ground for six miles, severely damaging many homes, barns, out-buildings, and trees. An EF-2 tornado traveled through both McCook and Hanson Counties and was observed to be very large before it dissipated. Most of the damage was to trees and a junk yard. In western Hanson County, an EF-1 tornado damaged trees and took a roof off a building. In Yankton County, a tornado began at the Lewis and Clark Recreation Area and resulted in considerable tree damage and damage to homes. It was on the ground for approximately four miles. For a while, it was joined by a second tornado. These tornadoes were determined to be EF-1s based on the damage homes. High winds related to these storms damaged power distribution lines and poles in Bon Homme and Yankton counties. Seven poles were damaged in Bon Homme County for a total of $13,014 in damages. Twenty-five poles were damaged in Yankton County for $34,809 in damages. 20 outages affected 214 customers, leaving them without power for roughly 9 hours. Source: NWS Sioux Falls and SHMT
September 16, 2006	Seven tornadoes touched down over southeast South Dakota. The strongest, an F2, was in McCook County and damaged several buildings and killed several cattle. An F1 tornado in Minnehaha County damaged some buildings and downed power lines. There was no damage reported from the other storms (F0s). Source: NWS Sioux Falls
August 26, 2006	Severe weather in east central South Dakota produced at least three tornadoes. In Beadle County, two tornadoes did considerable damage to farmsteads, power lines, and crops. One was a 24.5 mile long-track F2/F3 tornado with winds up to 200 mph that measured between 400 and 500 yards at its widest. Another tornado touched down in Kingsbury County, but did little to no damage. Source: NWS Sioux Falls
May 2, 2006	An F1 tornado touched down in Kingsbury County. While the tornado was generally F0, there were a couple of periods where it approached F1 intensity. It hit a hog

Date	Comments
	operation, destroying a barn and two other outbuildings, downing several trees, and killing numerous hogs. Source: NWS Sioux Falls
June 24, 2003	Sixty seven tornadoes touched down in South Dakota on this day. This rare occurrence tied the U.S. record at the time for the most tornadoes within a state in a 24-hour time period. However, the 67 tornado touchdowns recorded that day occurred in a period of less than eight hours. The strongest of the 67 tornadoes was an F4, which destroyed the town of Manchester and injured five people. Winds were estimated to be between 207 and 260 mph. The tornado warning issued by the National Weather Service in Sioux Falls provided the residents of Manchester with 28 minutes of advance warning. The National Weather Service offices in Aberdeen and Sioux Falls issued more than 350 warnings, statements, and storm reports on the evening of June 24. The 67 tornado touchdowns recorded that day represented a significant portion of the 85 total tornado touchdowns recorded for all of 2003. Despite the historic events of this day and the destruction of the town of Manchester, no presidential disaster declarations were issued.
June 23, 2002	Four separate tornado tracks and two satellite tornadoes were confirmed across McPherson and Brown counties. The first was an F0, the second an F1, the third an F3, and the fourth an F4. This was the first F4 tornado recorded in Brown County. Source: NWS Aberdeen
July 27, 2001	In Lincoln County, an F1 tornado downed numerous trees and damaged storage sheds and buildings along Main Street in Lennox, including the VFW (Veterans of Foreign Wars). Source: NWS Sioux Falls
July 11, 2000	An F2 tornado hit Lake County and damaged the Lake County Speedway. Source: NWS Sioux Falls
June 4, 1999	**Severe Storms, Flooding, and Tornadoes (FEMA-1280-DR)** A deadly tornadic storm moved across southwest South Dakota during the late afternoon and evening of June 4. Multiple tornadoes (F1 and F2) were observed from several supercells that moved toward the northeast from west of Chadron, Nebraska, to near Kyle, South Dakota, between 5:30 and 8:00 p.m. The most severe damage occurred where the paths of these storms passed near the community of Oglala in Shannon County, South Dakota. Oglala was heavily impacted by the tornadoes as were other smaller communities on the Pine Ridge Indian Reservation. The Red Cross estimated that 123 homes sustained major damage and an additional 139 sustained minimal damage. FEMA deemed 49 homes beyond repair and demolished them. In one area, all of the telephone poles were snapped and tossed, mobile homes were thrown over 100 yards with debris strewn over a quarter of a mile, and a newly framed house was leveled with wood projectiles in the ground 100 yards downwind. The total Public Assistance damage for the disaster was $1,029,000. One person was killed and over 40 were injured; 22 required medical attention at area hospitals. The fatality was the first from a tornado in western South Dakota since 1939 and only the third ever recorded in western South Dakota. Very large hail was also reported in the area. Grapefruit-sized hail was observed two miles west of Oglala with golf ball and baseball-sized stones reported in Oglala itself.
May–June 1998	**Flooding, Severe Storms, and Tornadoes (FEMA-1218-DR)** By late afternoon of May 30, 1998, the atmosphere over the north central United States had become favorable to a significant outbreak of severe weather. At

Date	Comments
	approximately 8:40 p.m., following a series of thunderstorm warnings and numerous funnel sightings in the area, a violent tornado struck the town of Spencer, South Dakota, approximately 45 miles west northwest of Sioux Falls in extreme western McCook County. Deemed the deadliest tornado in recorded South Dakota history, the F4 tornado killed 6 people, injured more than one-third of the town's 320 residents, and destroyed most of the town's 190 buildings, including all public and numerous private facilities. Only 12 structures were left standing in the entire town of Spencer. An assisted living center was destroyed, and since it had no basement, there was no protection from the tornado. Most of the fatalities were residents of the center. In addition to the town of Spencer, some farms in Hanson and McCook Counties were heavily damaged. Total damage was estimated at $18 million. During the storm, electrical service was out. Survivors reported that the warning siren system lost power prior to the touchdown of the tornado.
June 14, 1993	Pierre—Three homes damaged. No deaths. Arlington—Minor damage.
March 29, 1981	A winter storm front created a tornado near Martin, which destroyed a mobile home and injured one occupant.
May 12, 1984	Clark and Codington counties—18 to 20 farmsteads and homes were directly affected and ten homes severely damaged.
June 19, 1979	Watertown—Damage to trees, roofs, and power lines. Bon Homme, Turner, Yankton, Hanson, Sanborn counties—Tornado damage. Letcher—Tornado caused minor injuries with numerous reports of tree and building damage. Springfield—Tree damage.
June 1978	Aberdeen—On June 15 and 16, Aberdeen and Marshall County experienced tornadoes, hail, and some flooding. Five trailers were damaged by tornadoes. Marshall County had crop and building damage from hail and tornado winds.
Summer 1977	Arlington—Minor damage.
July 23, 1973	Ft. Pierre/Pierre—The tornado began in Ft. Pierre where it did minor damage; one grain elevator and a few mobile homes were affected. It jumped the Missouri River and then "skipped" through Pierre. Houses and businesses were damaged and a few homes were completely destroyed. Many mobile homes were either scattered about or piled upon one another. No deaths. Ten people were injured. Damage amounted to over half a million dollars.
June 18, 1967	Rapid City—One motel suffered heavy structural damage along with several other buildings in the city. No deaths. Three people were injured. Over $2 million in damage was done.
May 21, 1962	Gregory County—Several homes were destroyed as was farm equipment, automobiles, and livestock. Many miles of power poles and lines were also knocked down. Damage exceeded $500,000. Mitchell—Damage was estimated at about $2 million to Mitchell and the surrounding countryside.
July 31, 1949	Beresford and Elk Point—A series of tornadoes struck the countryside between Beresford and Elk Point in the southeast corner of the state. Property damage exceeded $1 million.
June 29, 1947	Howard and Carthage—Occurred in the rural area of Howard and Carthage. Damage was light. A barn and airplane hangar were damaged. One death resulted.
June 12, 1947	Turner/Yankton counties—The rural area of Turner/Yankton counties was struck by a tornado that did hundreds of thousands of dollars in damage. Barns, houses, and sheds

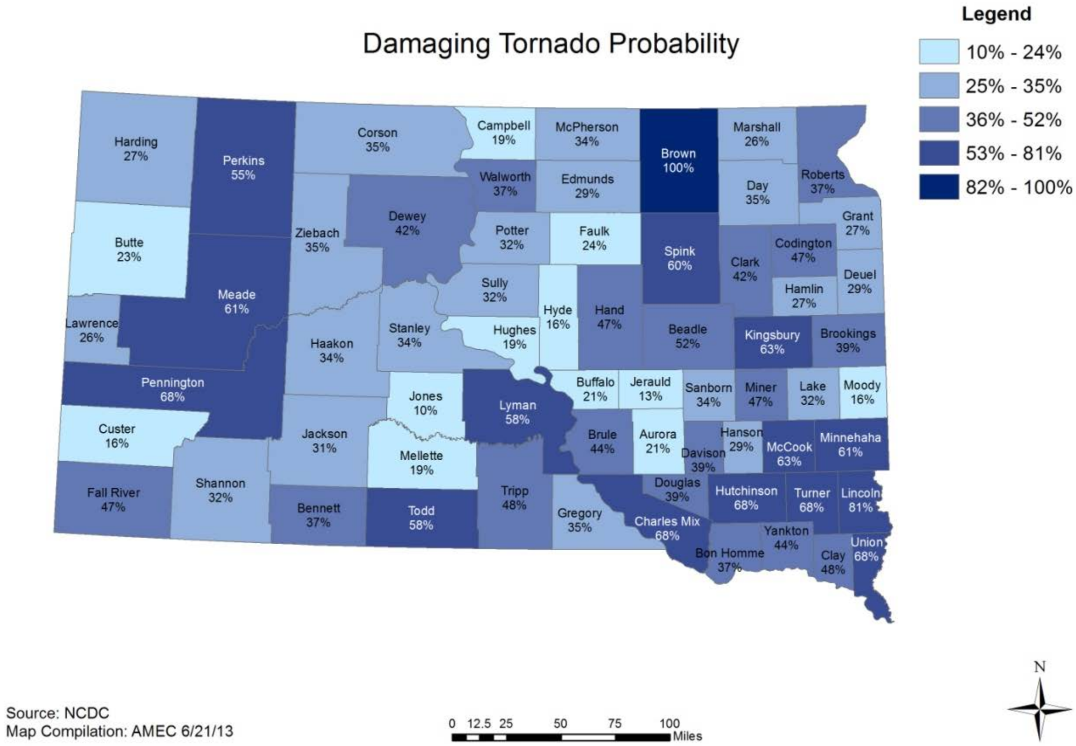
Date	Comments
	were destroyed, and crop damage was listed as heavy. There were no recorded deaths or injuries.
July 9, 1932	South of Sioux Falls (Minnehaha County)—One person died, 11 were people injured, and damage was estimated at $150,000. A number of horses and cattle were killed or injured, buildings were knocked down, and telephone and power lines were destroyed. This tornado was from a storm that also dropped baseball-sized hail throughout the area.

Source: NCDC, unless otherwise noted.

3.2.7.4 Probability

According to the National Climatic Data Center, there were 1,639 tornadoes, of which 618 were F1 or higher, in South Dakota between 1950 and 2012 (62 years). Based on this information, the probability that at least one tornado will occur in South Dakota is 100%. Annualized losses are estimated at nearly $11 million. Figure 3-40 depicts the probability of a damaging tornado occurring in each county based on the historical data.

Figure 3-40 Damaging Tornado Probability by County



3.2.8 Windstorm

3.2.8.1 Description

Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, that represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase. One type of straight-line wind is the downburst, which can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Thunderstorms over the Northern Plains typically happen between late April and early September, but, given the right conditions, they can develop as early as March. They are usually produced by supercell thunderstorms or a line of thunderstorms that typically develop on hot and humid days.

3.2.8.2 Location

The entire state is susceptible to high wind events. Figure 3-37 in the tornado section above illustrates the wind zones in the United States. Most of South Dakota is in Zone III, which is vulnerable to winds up to 200 mph. The westernmost part of the state is in Zone II, which is susceptible to winds up to 160 mph.

3.2.8.3 Past Events

According to the National Climatic Data Center Storm Events database, there were 7,077 windstorm events (6,401 thunderstorm wind, 670 high wind, and 6 strong wind events) in South Dakota between 1955 and October 2012. There were nine deaths and 132 injuries in this time period. Total property and crop damage for events between 1993 (when damage figures began being kept) and 2012 is estimated at $148,541,000 in 2012 dollars. This suggests that South Dakota could experience 124 wind events, $2,605,982 in wind losses, and approximately two injuries each year. See Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction for more information about how wind affects individual counties.

Figure 3-41 shows the number of wind events by county between 1955 and 2012.

Figure 3-41 South Dakota Wind Events by County, 1955 – 2012

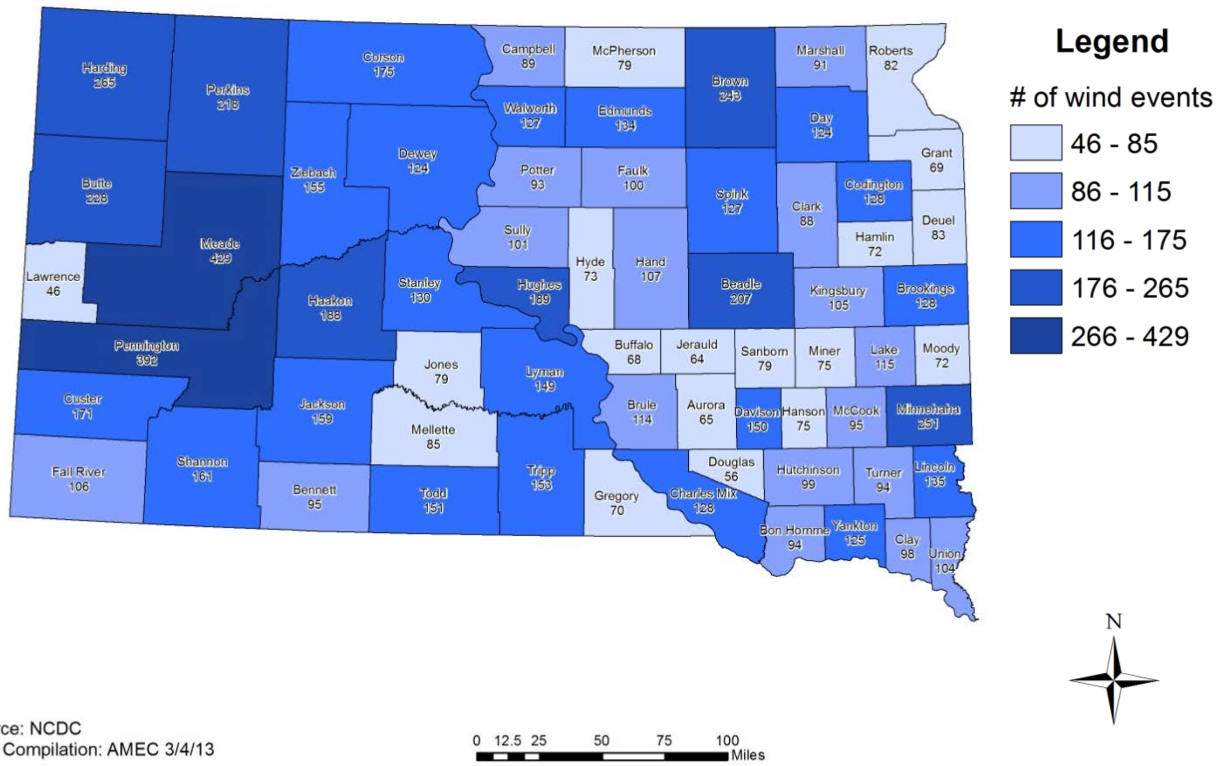


Table 3-20 South Dakota Wind Events

Date	Comments
April 15, 2012	Very strong northerly winds affected southeast South Dakota during the evening of April 15th. Winds gusted to over 60 mph in parts of the area. A large outbuilding was destroyed near the western edge of Hitchcock, and a power pole standing in water was snapped off 4.5 miles east of Hitchcock.
April 2, 2012	A strong cold front passed through the region during the night. Strong north to northwest winds developed behind the front for several hours. The strongest winds occurred in the Rapid City area, where wind gusts to 65 mph were recorded. A semi trailer was blown over on Interstate 90 six miles east of New Underwood.
April 30, 2011	A tight pressure gradient over the region resulted in strong northwesterly winds across western and central South Dakota. Sustained winds of 35 to 55 mph with gusts near 80 mph caused minor damage around Newell and Sturgis. The strongest winds were over the northwestern South Dakota plains. A large metal sign at a campground east of Sturgis was blown over. A pickup truck and travel trailer were flipped over south of Bear Butte.
June 10, 2010	Damaging winds, not directly from thunderstorms, affected the Madison to Brookings South Dakota area during the morning of June 10th. High winds severely damaged a barn. The winds also caused tree damage, with a playhouse damaged by tree debris. Vehicles were damaged by flying tree debris.

Date	Comments
May 24, 2010	An intense low pressure system and cold front produced strong winds across southwestern South Dakota. Ahead of the low, strong south the southwest winds developed across south central South Dakota during the early afternoon. Behind the front, winds switched to the west across southwestern South Dakota in late afternoon. Sustained winds of 30 to 45 mph, with gusts to 70 mph, were recorded over much of the area. Some trees were downed by the wind. Minor damage occurred around the Hot Springs area.
August 7, 2009	A super cell thunderstorm developed across the northern Black Hills and moved eastward across the Sturgis area, southern Meade County, northeastern Pennington County, Haakon County, and northeastern Jackson County. The storm produced baseball sized near Sturgis, then strong winds of 61 knots and hail larger than baseball sized developed as the storm moved across the plains. The storm hit Sturgis during the annual motorcycle rally and caused extensive damage to motorcycles, vehicles, and property. Minor injuries from the hail were also reported.
July 13, 2009	High winds developed behind an existing area of thunderstorms causing damage along with some injuries. Wind gusts to 50 to 70 mph were estimated or measured across parts of north central and northeast South Dakota. As a result, A mobile home was rolled twenty feet and destroyed by gradient winds associated with a wake low pressure area. The mobile home was not tied down and caught fire as it rolled into a propane tank. The three people inside the mobile home at the time all escaped with minor injuries.
October 26, 2008	Strong northwest winds reached sustained speeds of 40 mph or more with gusts to around 60 mph over all of southeast South Dakota during the morning and afternoon of October 26th.High winds sustained at 40 to 45 mph and gusting to over 60 mph caused damage to trees, shingles, and road signs. The tree damage included one very large weeping willow tree blown down in De Smet.
July 31, 2008	In the early morning hours of July 31st, a line of storms originating in North Dakota began to expand and surge southeast into northeast South Dakota. As the storms moved southeast, they began to tap into warmer, more humid air and rapidly evolve into a line of severe thunderstorms. Widespread damage occurred in a wide swath extending from Long Lake in McPherson County all the way into eastern Grant County and southern Big Stone County in Minnesota. The most extensive damage was generally found along and near US Highway 12 from Aberdeen to Milbank. Several observing stations in the path of this system measured wind speeds ranging from 70 mph to over 115 mph. Estimated wind speeds from damage surveys indicated even stronger winds with peak speeds of 120 mph. Over fifty communities in northeast South Dakota and the surrounding rural areas received minor to major tree and structural damage as straight line winds from 70 to 120 mph raced across the area. Webster and Waubay received the

Date	Comments
	most extensive damage from the storms. Thousands of trees were snapped or uprooted, hundreds of grain bins were damaged or destroyed, hundreds of homes, businesses, and outbuildings were damaged or destroyed along with many power poles and miles of power lines downed. Many mobile homes, campers, and boats were damaged or destroyed along with many road and business signs. Countless homes, vehicles, and campers were also damaged by fallen trees. Thousands of acres of crops were also damaged or completely destroyed by the winds and hail. The greatest crop damage occurred in the Roslyn, Grenville, Eden, and Pickeral Lake areas in Marshall and Day counties. Many acres of corn were blown down and not able to come back. The large hail combined with the strong winds also broke out countless windows in homes and vehicles along with damaging the siding on homes. Thousands of people were left without power for up to several days. Large hay bales were moved up to 700 yards by the high winds. A semi was overturned on Highway 12 near Webster, injuring the driver. Near Milbank on Highway 12, two other semis were blown off the road resulting in injuries to both drivers. A State Forestry Specialist said it was one of the worst tree damage events he has ever seen in the Webster area. A fifty-eight year old man died two miles north of Waubay during the cleanup after the storms when he was pinned between a backhoe and a tree.
June 26, 2008	On the evening of 26 June 2008, a compact upper level low pressure system tracking through the Northern Plains interacted with a very moist and unstable airmass over western and central South Dakota resulting in a widespread severe weather outbreak. Three confirmed tornadoes occurred briefly in western Dewey County. Little or no damage was reported and all three tornadoes were rated EF-0. In addition to the tornadoes, multiple reports of large hail were received over Corson and Dewey Counties, including some to the size of baseballs near the communities of McLaughlin and Isabel. The large hail broke out many home and vehicle windows and damaged many roofs in Dewey, Corson, and Sully Counties. Significant wind damage occurred over sections of Sully County. There were multiple reports of wind gusts in excess of 70 mph, with the most concentrated swath of damaging winds extending from near Sutton Bay, eastward to the city of Onida, then southeast to the community of Harrold. The storm survey began near Sutton Bay on Lake Oahe, where a wind gust of 92 mph was recorded. The most significant property damage was found further east near the community of Agar where multiple grain bins were either damaged or destroyed. Nine miles west of Agar, a barn was destroyed and a large pine tree was snapped in half. Winds in this area were estimated to range from 80 to 100 mph. Near the intersection of Highways 1804 and 175th Street, several

Date	Comments
	Western Area Power Administration (WAPA) electrical transmission towers were completely collapsed. This is consistent with wind speeds ranging from 130-140 mph. In the city of Onida a bank roof was damaged and the city was without power until the next day. Four miles north of Onida, a feed wagon was tossed nearly 40 feet. In Harrold, several railroad cars were tipped over. Also of great significance during the event was the peak wind speed of 124 mph recorded at the Onida airport. This wind speed is the strongest wind gust ever measured in the Aberdeen County Warning Area (CWA) and the 4th strongest wind speed ever reported in South Dakota
January 27, 2008	Strong southwesterly winds developed across the Black Hills during the afternoon and persisted through much of the night. Wind gusts of 60 to 70 mph were common across the higher terrain of the Black Hills and the northern and eastern foothills. The strongest winds were noted in the Spearfish and Hermosa areas, where a few gusts exceeded 90 mph. The strong winds caused a semi-trailer to jack knife on interstate 90 in Spearfish. Downed tree branches, signs, and damage to roofs were also reported around Spearfish.
July 9, 2007	Severe storms produced wind gusts to 80 mph across south central South Dakota. Roofs were torn off two houses and a trailer house was rolled three times. No injuries were reported. Damage estimates were reported at $75,000.
November 19, 2006	Strong southwest winds developed during the evening across parts of the northern Foothills. Winds gusted near 80 mph just west of Spearfish, while gusts over 50 mph were recorded in the Sturgis area. Several power poles and lines were downed in the Spearfish area, with minor damage around Sturgis.
August 18, 2006	Damaging winds associated with a line of thunderstorms moved through Lincoln County and were estimated between 50 and 80 mph. A downburst caused significant damage, especially to crops, which were shredded by wind-blown hail. Source: NWS Sioux Falls
May 23, 2006	Eighty mph straight-line winds damaged a Union County farm. Two outbuildings were destroyed and a third building lost its roof. A fourth building was also damaged, and debris was strewn along a ¼ mile stretch. Tree damage was also documented in the area. Source: NWS Sioux Falls
April 17, 2006	Severe thunderstorms. The earliest reports of large hail and strong winds on record for northwestern South Dakota. Source: NWS Rapid City
June 7-8, 2005	This was one of the most damaging severe thunderstorm events of the past several years for central and northeast South Dakota. In the late afternoon of June 7, a line of thunderstorms developed across western South Dakota and moved east across the state and into west central Minnesota. Widespread damage was reported. Hundreds of grain bins and countless buildings were damaged or destroyed and numerous trees, power lines, and poles were downed. Winds of 60 to over 100 mph were reported. It illustrated the fact that extreme straight-line winds can do as

Date	Comments
	much damage as tornadoes. NWS Aberdeen
March 10, 2005	Sustained winds of 40 to 45 mph with gusts above 60 mph persisted from mid morning until late afternoon. The winds caused widespread tree damage with branches and smaller tree debris broken off. Several power lines were knocked down by the wind or by windblown debris. This resulted in several power outages, especially between the Missouri and James Rivers. Damages to buildings were mostly to shingles and gutters. However, a metal storage building was blown over at Mitchell. Also at Mitchell, construction barriers were blown over, and windows were broken in two vehicles by blowing rocks. An aluminum recycling cage was blown away at Woonsocket. A window was blown out at a school in Freeman. In Sioux Falls, there was damage to the airport tower.
July 3-4, 2003	A line of severe thunderstorms developed in Montana and moved into and across North Dakota, South Dakota, and Minnesota. It brought large hail and winds over 80 mph at times to Brown, Marshall, and Roberts counties, which resulted in widespread property and crop damage. Approximately 30 percent of Marshall County’s 227,000 acres of crops were damaged or destroyed. Trees, branches, and power lines and poles were downed; roofs and siding were damaged from hail and fallen trees; farm outbuildings were damaged or destroyed; and many windows were broken out of homes and vehicles. A crop spraying plane at the Sisseton airport was thrown 450 feet and a 55,000 bushel grain bin in Claire City was blown off of its foundation and flattened. On the opposite side of the state, a supercell thunderstorm developed over Lawrence County and moved into Meade County. It moved through Rapid City with 60 to 70 mph winds and moved quickly east-southeast across southwestern and south central South Dakota producing 60 to 80 mph winds. The strong winds downed many trees and power lines from Rapid City to the Winner area. Source: NCDC, NWS Aberdeen
June 9, 2001	A severe windstorm struck portions of western South Dakota with gusts estimated to 80 mph. The greatest damage occurred in Philip and Wanblee. The damage was consistent with strong straight-line winds. Source: NWS Rapid City
August 1, 2000	A powerful thunderstorm moved into western South Dakota from northeast Wyoming. Winds in the Spearfish area, estimated at 90-110+ mph, were particularly devastating, causing a considerable amount of damage and several injuries. Strong downburst winds were responsible for most of the observed damage. As the storm approached Sturgis, it evolved into a bow echo with winds estimated at 65-80 mph that toppled and blew away merchandise tents that had been set up for the Sturgis Rally. Strong winds in excess of 70 mph were also noted in the Black Hawk, Piedmont, Rapid City, and Ellsworth AFB areas. Source: NWS Rapid City
June 3-4, 2000	Two severe thunderstorms brought strong straight-line winds to Clay and Union counties. The first storm had wind gusts of 70-75 mph. The second storm had 60-65 mph wind gusts. Trees were damaged and a picnic shelter was destroyed.

Date	Comments
	Source: NWS Sioux Falls
August 6, 1999	Downburst wind event in Meade County. Winds were estimated up to 70 mph at 8:05 p.m. as the front passed through the area. Numerous trees were damaged and a few were blown down. The worst of the storm hit Ellsworth Air Force Base at 8:18 p.m. where they gusted to 89 mph. Between that time and 8:30 p.m., the wind speed did not drop below 50 mph at the base. Sensors measured gusts of 129 mph and 165 mph. Damage was minimal due the rural location. Source: NWS Rapid City
June 20, 1997	These severe thunderstorms brought strong straight-line winds, estimated at 80-90 mph, which caused widespread tree, crop, power line, and building damage and destruction in Davison County and injured eight people. The damage path was at least 15 miles wide by 50 miles long. Many people believed the damage was caused by a tornado, but the damage assessment proved otherwise. Source: NWS Sioux Falls

Source: NCDC, if not otherwise sourced

3.2.8.4 Probability

According to the National Climatic Data Center, there were 7,077 wind events (excluding events from October through March 31 and those associated with snow, see event description above) in South Dakota between 1955 and October 2012 (57 years). Based on this information, the probability that at least one wind event will occur in South Dakota in any given year is 100 percent. Annualized losses are estimated at $2,605,982, with two injuries per year on average.

3.2.9 Hazardous Materials

3.2.9.1 Description

A hazardous materials incident can occur during production, storage, transportation, use, or disposal of material. South Dakota's Codified Law Chapter 33-15 Emergency Management defines "hazardous material" as "any material, including but not limited to, explosives, flammable liquids, flammable compressed gas, flammable solids, oxidizing materials, poisons, corrosive materials, and radiological materials, the loss of control or mishandling of which could cause personal injury or death to humans or damage to property or the environment." These substances are most often released as a result of transportation accidents or chemical accidents in plants and can be caused and complicated by a different type of hazard event (e.g., flood, earthquake). They affect humans through inhalation, ingestion, and direct contact with skin. South Dakota is concerned about transportation, fixed facility, and pipeline hazardous materials incidents.

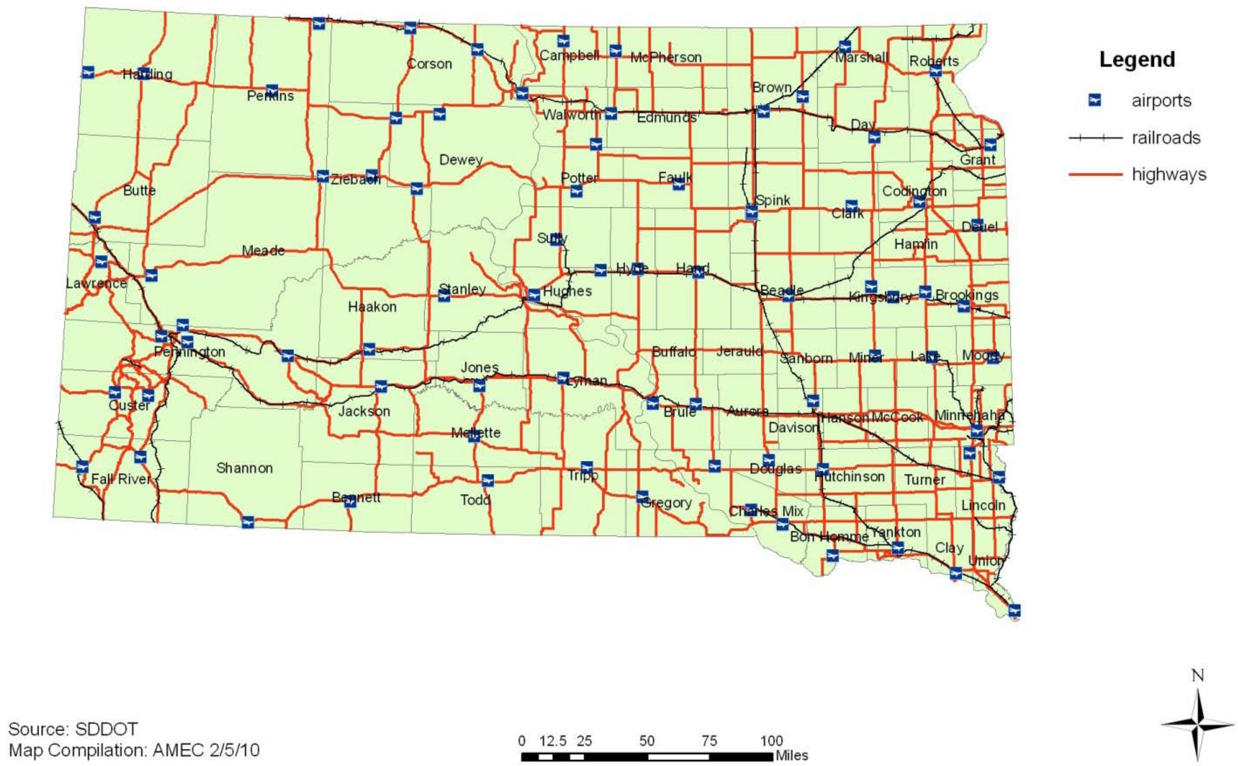
3.2.9.2 Location

Hazardous materials incidents can happen throughout the state. Localities where hazardous materials are fabricated, processed, and stored as well as those where hazardous waste is treated, stored, and disposed of are most at risk for hazardous materials incidents. Additionally, localities along transportation corridors that carry these materials to their final destinations are also at risk. More than half of the transportation incidents between 1971 and 2012 occurred in Minnehaha and Pennington counties, where the state's largest cities, Sioux Falls and Rapid City, are located (see the discussion on past events in the following section).

3.2.9.2.1 Transportation

Figure 3-42 illustrates South Dakota's transportation infrastructure.

Figure 3-42 South Dakota Transportation Infrastructure



Pipelines

According to the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), South Dakota's pipeline system is as follows:

- Hazardous liquid line mileage: 803
- Gas transmission line mileage: 1,661
- Gas gathering line mileage: 0
- Gas distribution mileage: 4,570*
- Total pipeline mileage: 7,034

All mileages are for 2011 and are approximate as some data sources may not have contained a complete record of state pipeline mileage.
*Gas distribution service lines (the connection between the distribution line and the end user) are not included in the gas distribution mileage. The total number of such services is 193,628.

Table 3-21 shows the breakdown of gas transmission line and hazardous liquid line mileage by county. Note that some counties are not listed on the table. Figure 3-43 shows the location of these lines, the majority of which are located in the eastern half of the State.

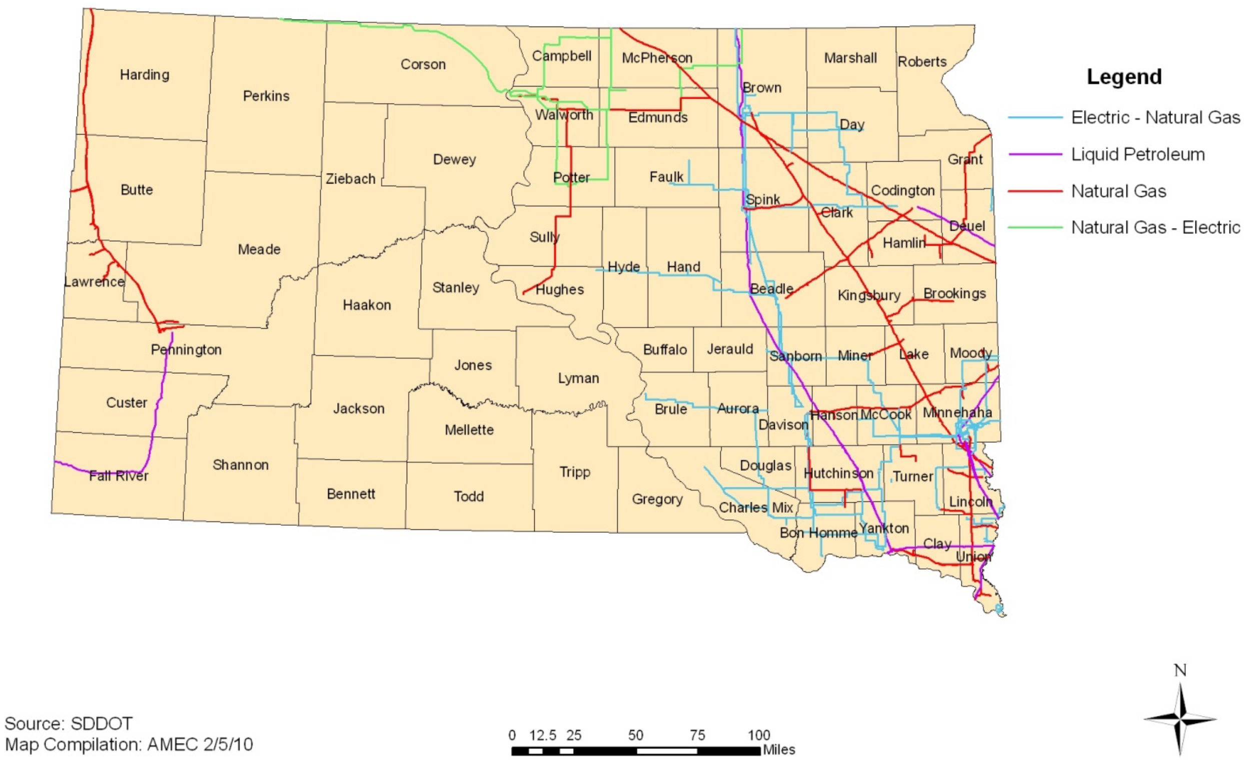
Table 3-21 Gas Transmission Line and Hazardous Liquid Line Mileage by County (ranked by percent of total)

County	Gas Miles	Liquid Miles	Percent of Total
Lincoln	85	106	7.70%
Minnehaha	126	37	6.60%
Brown	83	53	5.50%
Clark	87	39	5.10%
Spink	71	46	4.70%
Butte	99	0	4.00%
Hutchinson	43	52	3.80%
Union	74	19	3.70%
Harding	84	0	3.40%
Kingsbury	67	16	3.30%
Yankton	22	60	3.30%
Deuel	53	24	3.10%
Beadle	19	51	2.80%
Meade	60	0	2.40%
Edmunds	56	0	2.30%
Hanson	20	37	2.30%
Clay	36	17	2.10%
Day	20	33	2.10%
McCook	40	12	2.10%
Walworth	54	0	2.10%
Fall River	0	50	2.00%
Hamlin	50	0	2.00%
Sully	50	0	2.00%
Lawrence	46	0	1.90%
Codington	28	12	1.60%
Lake	39	0	1.60%
McPherson	40	0	1.60%
Pennington	22	18	1.60%
Miner	8	26	1.30%
Grant	30	0	1.20%
Custer	0	29	1.10%
Sanborn	0	29	1.10%
Davison	16	8	1.00%
Marshall	0	26	1.00%
Moody	22	3	1.00%
Potter	26	0	1.00%
Turner	24	0	0.90%
Hughes	19	0	0.70%

County	Gas Miles	Liquid Miles	Percent of Total
Brookings	15	0	0.60%
Roberts	11	0	0.40%
Totals	**1,660**	**803**	**100%**

Source: Pipeline and Hazardous Materials Safety Administration, http://primis.phmsa.dot.gov/comm/reports/safety/SD_detail1.html

Figure 3-43 South Dakota Hazardous Materials Transmission Lines



3.2.9.2.2 Fixed Facility

HAZUS-MH defines hazardous material facilities as those that contain substances that can pose significant hazards because of their toxicity, radioactivity, flammability, explosiveness, or reactivity. Facilities that meet this definition are mapped in Figure 3-44. Figure 3-45 shows the number of Tier II facilities in each county. Tier II refers to facilities that are covered by the Emergency Planning and Community Right-to-Know Act (EPCRA). These facilities are required to submit an Emergency and Hazardous Chemical Inventory Form to their LEPC, the State Emergency Response Commission, and local fire departments each year. South Dakota requires that these facilities use the Tier II reporting form.

Figure 3-44 South Dakota Hazardous Material Site Locations

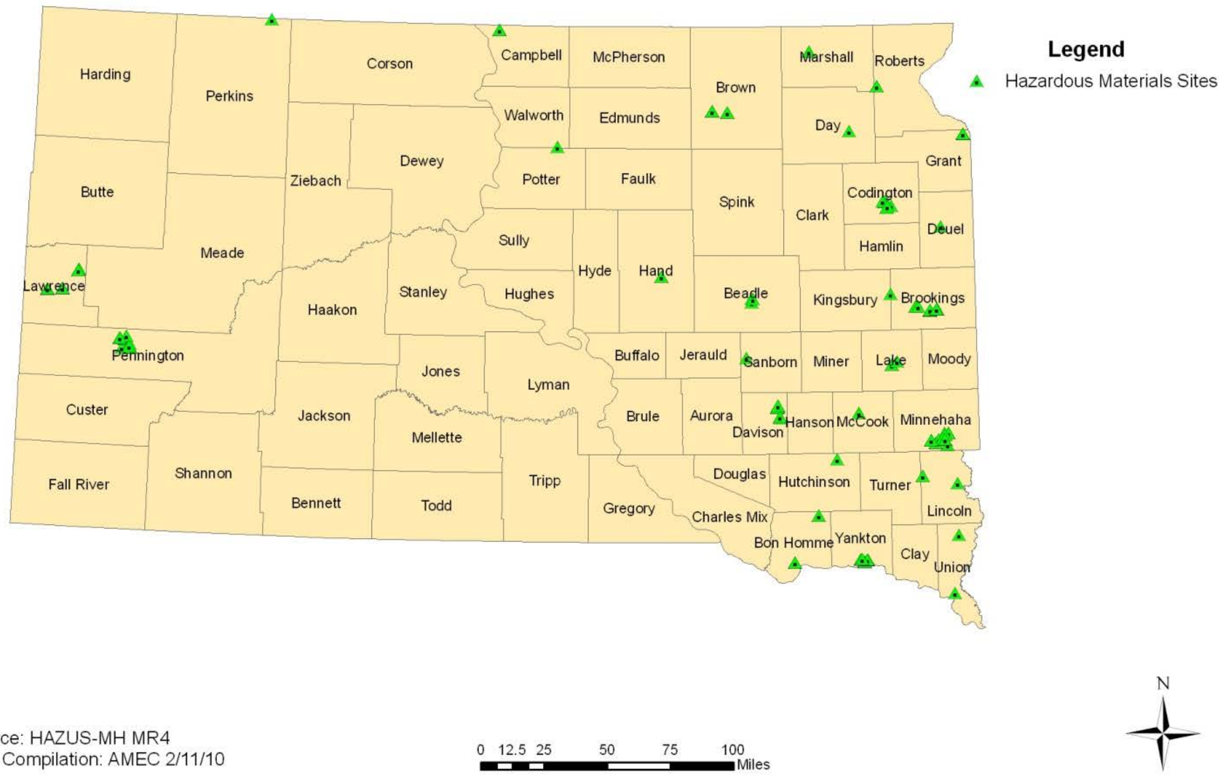
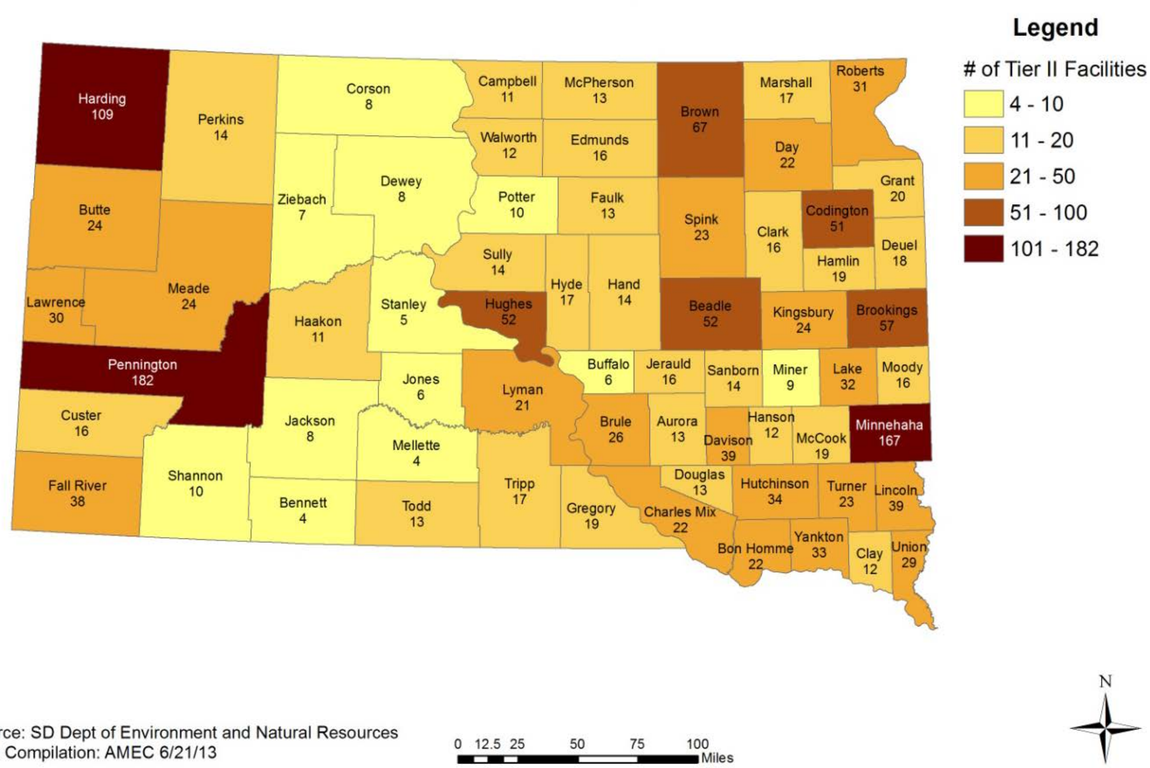


Figure 3-45 South Dakota Tier II Facility Counts



3.2.9.3 Past Events

3.2.9.3.1 Transportation

The Hazardous Materials Incident Report Subsystem (HMIRS) of the PHMSA Hazardous Materials Information System was established in 1971 to fulfill the requirements of the federal hazardous materials transportation law. Unintentional releases of hazardous materials or the discharge of any quantity of hazardous waste must be reported. The federal law defines hazardous material as “a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous … The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see 49 CFR 172.101).”

According to the U.S. Department of Transportation’s (DOT) Hazardous Materials Information System, South Dakota experienced 760 transportation incidents involving hazardous materials between 1971 and 2012 (see Table 3-22). The total cost of damage associated with these incidents was approximately $6,537,056. This suggests that South Dakota experiences 18 transportation incidents involving hazardous materials and $159,440 in related damage each year. Among these incidents there were 3 deaths and 16 injuries. In total, 357 people were evacuated. 16 of the incidents were rail related, 28 were air, and the remaining 716 were highway.

Table 3-22 Transportation Hazardous Materials Incidents, 1971-2012

County	# of Events	Fatalities	Total Injuries	Damages ($)	Evacuations
Minnehaha	387	0	5	468,559	213
Pennington	111	1	1	88,836	0
Brown	34	0	2	286,470	0
Codington	30	0	0	7,402	0
Brookings	17	0	0	207,419	1
Davison	16	0	0	57,948	5
Lawrence	15	0	0	3,366	0
Beadle	13	0	3	10,742	40
Hughes	13	0	0	1,150	0
Meade	12	0	0	84,915	0
Fall River	10	0	0	0	0
Grant	10	0	0	377,456	75
Butte	9	0	1	100	0
Tripp	9	0	0	0	0
Clay	7	0	0	135,500	0
Haakon	7	0	0	575	0
Hand	7	0	0	165,665	0
Custer	6	0	1	0	0
Lake	5	0	0	44,887	0
Shannon	5	0	0	12,347	0
Yankton	5	0	0	2,500	2

County	# of Events	Fatalities	Total Injuries	Damages ($)	Evacuations
Hutchinson	4	0	0	0	0
Perkins	4	0	0	0	0
Union	4	0	0	134,786	0
Brule	3	0	2	0	0
Potter	3	0	0	133031	0
Walworth	3	0	0	1,200	0
Aurora	2	2	1	4,000,000	0
Corson	2	0	0	1,230	0
Day	2	0	0	0	0
Jackson	2	0	0	83,000	0
Kingsbury	2	0	0	0	0
Lincoln	2	0	0	55,837	21
McCook	2	0	0	0	0
Spink	2	0	0	0	0
Ziebach	2	0	0	0	0
Bon Homme	1	0	0	3,828	0
Buffalo	1	0	0	100	0
Clark	1	0	0	0	0
Edmunds	1	0	0	0	0
Hyde	1	0	0	600	0
Marshall	1	0	0	5,000	0
McPherson	1	0	0	0	0
Moody	1	0	0	89,387	0
Stanley	1	0	0	64,840	0
Sully	1	0	0	8,380	0
Todd	1	0	0	0	0
Turner	1	0	0	0	0
Total	**760***	**3**	**16**	**6,537,056**	**357**

Source: DOT's Office of Hazardous Materials Safety Incident Reports Database, https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/search.aspx

*Although this column totals up to 761, one event occurred in both Meade and Pennington counties and thus is only counted once.

Reports from PHMSA provide detail and significant incident history for the pipeline systems in the State of South Dakota between 1983 and 2012. Table 3-23 lists these incidents. Significant incidents are those incidents reported by pipeline operators with any of the following conditions met: 1) fatality or injury requiring in-patient hospitalization; 2) $50,000 or more in total costs, measured in 1984 dollars; 3) highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more; 4) liquid releases resulting in an unintentional fire or explosion.

Table 3-23 Details of South Dakota Pipeline Incidents, 1983 – 2012

County	Date	Fatalities	Injuries	Damage ($)	Gross Barrels Lost	Barrels Recovered	Type of Incident
Beadle	2/20/2012	0	0	266,340	500	450	Hazardous Liquid
Lawrence	2/10/2012	0	0	108,650	n/a	n/a	Natural Gas Distribution
Clark	5/21/2010	0	0	207,508	0	0	Hazardous Liquid
Hughes	04/02/2009	0	0	150,000	0	0	Natural Gas Transmission
Hughes	02/20/2008	0	0	152,979	0	0	Natural Gas Distribution
Lincoln	03/29/2007	0	0	499,705	0	0	Natural Gas Distribution
Davison	03/08/2007	0	0	505,216	0	0	Natural Gas Transmission
Minnehaha	10/14/2006	0	0	25,100	n/a	n/a	Natural Gas Distribution
Minnehaha	6/16/2006	0	0	14,400	n/a	n/a	Natural Gas Transmission
Sanborn	12/28/2004	0	0	192,102	193	154	Hazardous Liquid
Pennington	10/11/2004	0	0	107,577	n/a	n/a	Natural Gas Distribution
Clark	4/28/2003	0	0	75,027	n/a	n/a	Natural Gas Distribution
Beadle	2/26/2001	0	0	62,642	n/a	n/a	Natural Gas Distribution
Lincoln	10/4/2000	0	0	0	n/a	n/a	Natural Gas Distribution
Custer	8/10/1998	0	0	37,083	123	0	Hazardous Liquid
McCook	5/30/1998	0	0	92,707	n/a	n/a	Natural Gas Distribution
Union	4/4/1998	0	0	49,444	195	0	Hazardous Liquid
Lawrence	3/19/1997	0	0	0	n/a	n/a	Natural Gas Transmission
Pennington	9/12/1994	0	0	68,027	147	30	Hazardous Liquid
Walworth	10/22/1993	0	1	69,735	n/a	n/a	Natural Gas Distribution

County	Date	Fatalities	Injuries	Damage ($)	Gross Barrels Lost	Barrels Recovered	Type of Incident
Pennington	4/9/1993	0	0	7,601	300	250	Hazardous Liquid
Pennington	3/2/1993	0	0	174,338	n/a	n/a	Natural Gas Distribution
Minnehaha	1/13/1992	0	0	0	7,200	1,849	Hazardous Liquid
Brown	5/14/1991	0	1	0	n/a	n/a	Natural Gas Distribution
Union	4/8/1991	0	0	184,911	2,881	0	Hazardous Liquid
Codington	2/18/1990	0	0	10,802	332	101	Hazardous Liquid
Minnehaha	12/25/1989	0	0	40,650	1	1	Hazardous Liquid
Minnehaha	12/24/1989	0	0	40,650	6	6	Hazardous Liquid
Yankton	7/5/1989	0	0	0	n/a	n/a	Natural Gas Distribution
McCook	3/21/1989	0	1	0	n/a	n/a	Natural Gas Transmission
Pennington	1/9/1989	0	0	0	0	0	Hazardous Liquid
Pennington	1/9/1988	0	0	0	n/a	n/a	Natural Gas Distribution
Lincoln	12/10/1987	0	0	0	100	0	Hazardous Liquid
Pennington	4/9/1987	0	1	13,321	n/a	n/a	Natural Gas Distribution
Minnehaha	4/8/1987	0	0	444,050	25	0	Hazardous Liquid
Minnehaha	3/11/1987	0	0	888,099	200	5	Hazardous Liquid
Minnehaha	2/16/1987	0	0	7,104,796	715	19	Hazardous Liquid
Brown	9/25/1986	2	0	551,471	n/a	n/a	Natural Gas Distribution
Pennington	12/20/1985	0	0	93,633	n/a	n/a	Natural Gas Distribution
Kingsbury	6/17/1985	0	0	0	n/a	n/a	Natural Gas Transmission
Decatur	5/7/1984	0	0	6,796	n/a	n/a	Natural Gas Distribution

County	Date	Fatalities	Injuries	Damage ($)	Gross Barrels Lost	Barrels Recovered	Type of Incident
Beadle	2/13/1983	0	0	n/a	n/a	n/a	Natural Gas Transmission

Source: DOT's PHMSA Significant Incident Listings and Incident Report Files, http://primis.phmsa.dot.gov/comm/reports/safety/IncDetSt_st_SD_flt_sig.html?nocache=9577
Notes:
The costs in the years prior to 2012 are in 2012 dollars.
For years 2002 and later, property damage is estimated as the sum of all public and private costs reported in the 30-day incident report. For years prior to 2002, accident report forms did not include a breakdown of public and private costs, so property damage for these years is the reported total property damage field in the report.

3.2.9.3.2 Fixed Facility

The U.S. Environmental Protection Agency maintains a database on toxic chemical releases and other waste management activities, which are reported annually by certain covered industry groups as well as federal facilities: the Toxics Release Inventory. In 2011, the most recent data available, 5.9 million pounds of hazardous materials were disposed of or released in South Dakota. Table 3-24 ranks chemical releases by county for 2011. Table 3-25 and Table 3-26 show the top 10 releasing facilities and the top 10 chemicals released in 2011.

Table 3-24 Chemical Releases* by County, 2011 (all figures are in pounds)

County	Total On-site Disposal or Other Releases	Total Off-site Disposal or Other Releases	Total On- and Off-site Disposal or Other Releases
Minnehaha	3,322,928	66,531	3,389,459
Grant	563,721	128,251	691,972
Lawrence	776,145	382	776,527
Brookings	436,607	1,313	437,919
Pennington	113,263	26,138	139,401
Yankton	18,154	706	18,859
Lincoln	43,289	983	44,272
Codington	87,524	7,259	94,783
Roberts	70,781	0	70,781
Brown	41,151	167	41,318
Davison	6,960	662	7,622
Edmunds	66,945	0	66,945
Turner	55,778	6	55,784
Bon Homme	5,797	00	5,797
Spink	8,870	0	8,870
Lake	22,391	908	23,300
Day	11,279	0	11,279
Deuel	96	704	799
Beadle	20,399	120	20,520
Hutchinson	4	0	4
Hamlin	192	0	192
Campbell	0	3	3
Total	**5,672,274**	**234,133**	**5,906,406**

Source: U.S. Environmental Protection Agency, Toxics Release Inventory Explorer, www.epa.gov/triexplorer/
*Includes releases to land, air, and water

Table 3-25 Top 10 South Dakota Facilities with Greatest Total Releases,* 2011 (all figures are in pounds)

Facility	County or Parish or County Equivalent	Total On-site Disposal or Other Releases	Total Off-site Disposal or Other Releases	Total On- and Off-site Disposal or Other Releases
John Morrell & Co.	Minnehaha	3,205,448.87	66,468.19	3,271,917.06
Wharf Resources	Lawrence	764,179.70	164.83	764,344.53
Otter Tail Corp (DBA Otter Tail Power Co)	Grant	504,512.28	127,250.95	631,763.22
South Dakota Soybean Processors LLC	Brookings	357,095.00	0	357,095.00
Glacial Lakes Energy LLC	Codington	76,208.00	0	76,208.00
Starmark Cabinetry	Minnehaha	72,031.06	0	72,031.06
Woodland Cabinetry	Roberts	69,232.45	0	69,232.45
Aberdeen Energy LLC	Edmunds	66,945.00	0	66,945.00
Valley Queen Cheese Factory Inc.	Grant	49,735.00	1,000.00	50,735.00
Midwest Manufacturing Inc (DBA Dakota Panel)	Pennington	46,800.00	0	46,800.00

Source: U.S. Environmental Protection Agency, Toxic Resources Inventory, www.epa.gov/tri/
*Includes releases to land, air, and water

Table 3-26 Top 10 Chemicals Reported Released* in South Dakota, 2011 (all figures are in pounds)

Chemical	Total On-site Disposal or Other Releases	Total Off-site Disposal or Other Releases	Total On- and Off-site Disposal or Other Releases
Nitrate Compounds	3,337,602.75	10,805.00	3,348,407.75
Lead Compounds	570,312.99	2,858.23	573,171.22
Barium Compounds	373,383.50	137,952.35	511,335.85
N-Hexane	412,564.71	2	412,566.71
Ammonia	102,586.00	56,802.00	159,388.00
Xylene (Mixed Isomers)	136,678.36	0	136,678.36
Acetaldehyde	106,277.54	1	106,278.54
Formic Acid	82,409.00	0	82,409.00
Toluene	72,191.12	0	72,191.12
Formaldehyde	70,967.00	1	70,968.00

Source: U.S. Environmental Protection Agency, Toxic Resources Inventory, www.epa.gov/tri/; *Includes releases to land, air, and water

3.2.9.4 *Probability*

3.2.9.4.1 Transportation

According to the U.S. Department of Transportation's Hazardous Materials Information System, there were 760 transportation incidents involving hazardous materials in South Dakota between 1971 and 2012 (41 years). Based on this information, the probability that at least one transportation incident involving hazardous materials will occur in South Dakota annually is 100%.

3.2.9.4.2 Pipeline

According to the U.S. Department of Transportation's Office of Pipeline Safety, there were 42 pipeline incidents in South Dakota between 1983 and 2012 (29 years). Based on this information, the probability that at least one pipeline incident will occur in South Dakota annually is 100%.

3.2.9.4.3 Fixed Facility

According to the U.S. Environmental Protection Agency's Toxic Resource Inventory, 5.9 million pounds of hazardous materials were disposed of or released in South Dakota in 2011. Based on this information, there is a 100 percent probability that a fixed facility will dispose of or release a hazardous material in South Dakota each year.

3.2.10 Geologic Hazards

A multitude of geologic hazards affect the State of South Dakota. For purposes of this plan, the geologic hazards profiled consists of landslides, mudflows, expansive soils, subsidence, and earthquakes

3.2.10.1 *Description*

3.2.10.1.1 What Is a Landslide?

Landslides are a serious geologic hazard common to almost every state in the United States. It is estimated that nationally they cause up to $2 billion in damage and 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include saturation by water, steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides.

The Columbia Electronic Encyclopedia, 6th ed. Copyright @ 2003, Columbia University Press defines landslides as rapid slipping of a mass of earth or rock from a higher elevation to a lower level under the influence of gravity and water lubrication. More specifically, rockslides are the rapid downhill movement of large masses of rock with little or no hydraulic flow, similar to an avalanche. Water-saturated soil or clay on a slope may slide downhill over a period of several hours. Earthflows of this type are usually not serious threats to life because of their slow movement, yet they can cause blockage of roads and do extensive damage to property.

Earthquakes also may cause landslides by shaking unconsolidated or weathered material from slopes. Rockslides triggered by an earthquake in Montana in 1959 caused an entire mountainside to slide into the Madison River Gorge, killing 27 people in its path, damming the gorge, and forming a new lake. Humans have triggered a number of tragic landslides that have caused great damage and loss of life. In the Los Angeles area of California, extensive real estate development carried out on hillsides has resulted in widespread mudflows after winter rains have saturated the over-steepened embankments of soil. In some areas, slow-moving earthflows have been initiated by the lubrication of certain types of underlying clays by septic tank effluent. Submarine slides, or a sliding mix of seawater and mud, are called turbidity currents. Undersea landslides can travel several hundred miles across very gradual slopes, riding on a thin film of water that reduces friction.

3.2.10.1.2 What Is a Mudflow?

Mudflows (or debris flows) are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." A slurry can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. A slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. In hilly or mountainous areas for years after a wildfire, heavy rainfall creates mudflow and landslide risks to people, structures, and infrastructure located below such areas.

Damages from mudflows are covered under the National Flood Insurance Program; landslides are not.

3.2.10.1.3 What is Expansive Soil?

Expansive soils are referred to by many names. "Expandable soils," "expansive clays," "shrink-swell soils," and 'heavable soils" are some of the many names used for these materials. Expansive soils contain minerals such as smectite clays that are capable of absorbing water. When expansive soils are present, they will generally not cause a problem if their water content remains constant. The situation where greatest damage occurs is when there are significant or repeated moisture content changes. When they absorb water they increase in volume. The more water they absorb the more their volume increases. Expansions of ten percent or more are not uncommon. This change in volume can exert enough force on a building or other structure to cause damage. The force of expansion is capable of exerting pressures of 15,000 pounds per square foot or greater on foundations, slabs, and other confining structures. Cracked foundations, floors and basement walls are typical types of damage done by swelling soils. Damage to the upper floors of the building can occur when motion in the structure is significant. Expansive soils will also shrink when they dry out. This shrinkage can remove support from buildings or other structures and result in damaging subsidence. Fissures in the soil can also develop. These fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling that places repetitive stress on structures.

Expansive soils are present throughout the world and are found in each American state. Every year they cause billions of dollars in damage. The American Society of Civil Engineers estimates that 1/4 of all homes in the United States have some damage caused by expansive soils. In a typical year in the United States they cause a greater financial loss to property owners than earthquakes, floods, hurricanes and tornadoes combined. Even though expansive soils cause enormous amounts of damage most people have never heard of them. This is because their damage is done slowly and cannot be attributed to a specific event. The damage done by expansive soils is then attributed to poor construction practices or a misconception that all buildings experience this type of damage as they age.

3.2.10.1.4 What is Subsidence?

Land subsidence is the sinking of the land over manmade or natural underground voids. Subsidence occurs naturally and also through man-driven or technologically exacerbated circumstances. Natural causes of subsidence occur when water in the ground dissolves minerals and other materials in the earth, creating pockets or voids. When the void can no longer support the weight of the earth above it, it collapses, causing a sinkhole depression in the landscape. Often, natural subsidence is associated with limestone erosion, but may also occur with other water-soluble minerals. Man-driven or technology-exacerbated subsidence conditions are associated with the lowering of water tables, extraction of natural gas, or subsurface mining activities. As the underground voids caused by these activities settle or collapse, subsidence occurs on the surface.

3.2.10.2 Location

3.2.10.2.1 Landslides

Areas that are generally prone to landslide hazards include existing old landslides, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges, set back from the tops of slopes.

In certain areas of South Dakota landslides do occur. Over the years, many landslides have been dealt with by the State of South Dakota and in particular the South Dakota Department of Transportation (SDDOT). SDDOT has spent a lot of time stabilizing landslides throughout the state. Two of the larger slides were the US 12 Missouri River Crossing at Mobridge and the US 212 Missouri River crossing at Forest City. At Mobridge, stone columns were used for the first time in the United States to stabilize a clay-shale landslide. Forest City also used stone columns and also incorporated the use of massive concrete shear pins installed by slurry wall process to stabilize the approach berm. This was the first time in the United States that this technique was used to mitigate a landslide of this magnitude. A civil engineer, who was head of the SDDOT Geotechnical Activity Section from 1969 to 2001, achieved national recognition for his innovative work with these two landslides. A slide area also exists near Cheyenne Crossing along U.S. Highway 14A in Lawrence County. Road crews were engaged in landslide repair efforts at the site in 2012 and continuing into 2013. A potential landslide area existed near Yates Pond in Lawrence County along U.S. Highway 14A, but SDDOT mitigated this area in 2010.

3.2.10.2.2 Subsidence

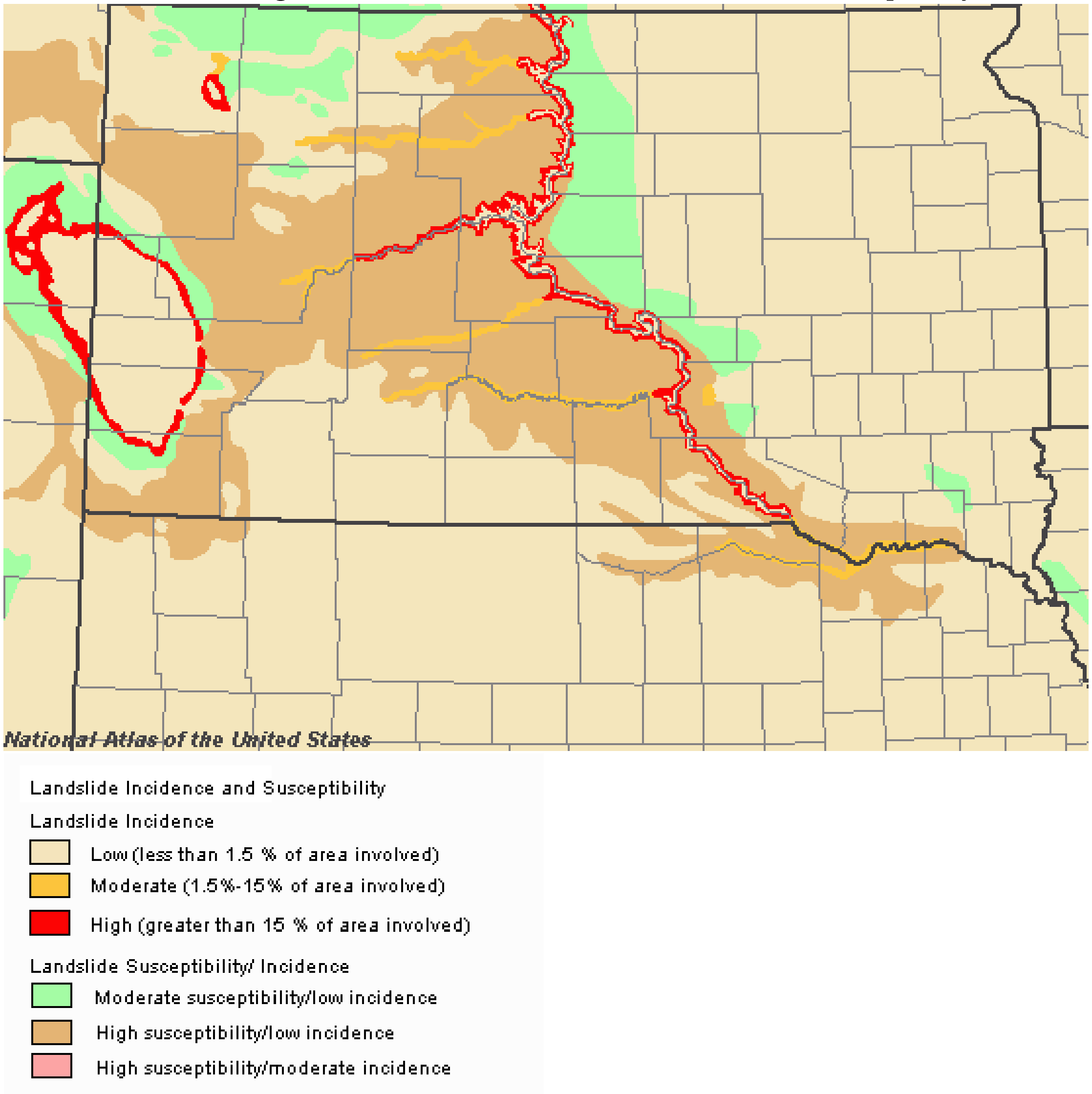
There are certain areas in South Dakota at risk to subsidence (see Figure 3-46). The Niobrara Formation (Upper Cretaceous) and its equivalents are the most widespread carbonate rocks in western Kansas, eastern Nebraska, and southeastern South Dakota. The Niobrara is generally covered by more than 50 ft (15 m) of younger sediments. Small fissures, less than 1,000 ft (300 m) long and up to 100 ft (30 m) deep, are present, but they are not common and are generally irregularly spaced with 1,000 ft (300 m) or more of solid rock between fissures.

In western South Dakota and adjacent parts of Wyoming and Montana, Paleozoic and Cretaceous carbonate rocks, arched steeply upwards, encircle the structural dome that forms the Black Hills. Caves and open fissures are common in the Paleozoic carbonate rocks. A few caves contain many miles of passages but most of the cave passages and fissures in the Black Hills area only extend up to 3,000 ft (900 m) in length and are generally less than 150 ft (45 m) in depth. Closely spaced solution joints also are prevalent.

3.2.10.2.3 Expansive Soils

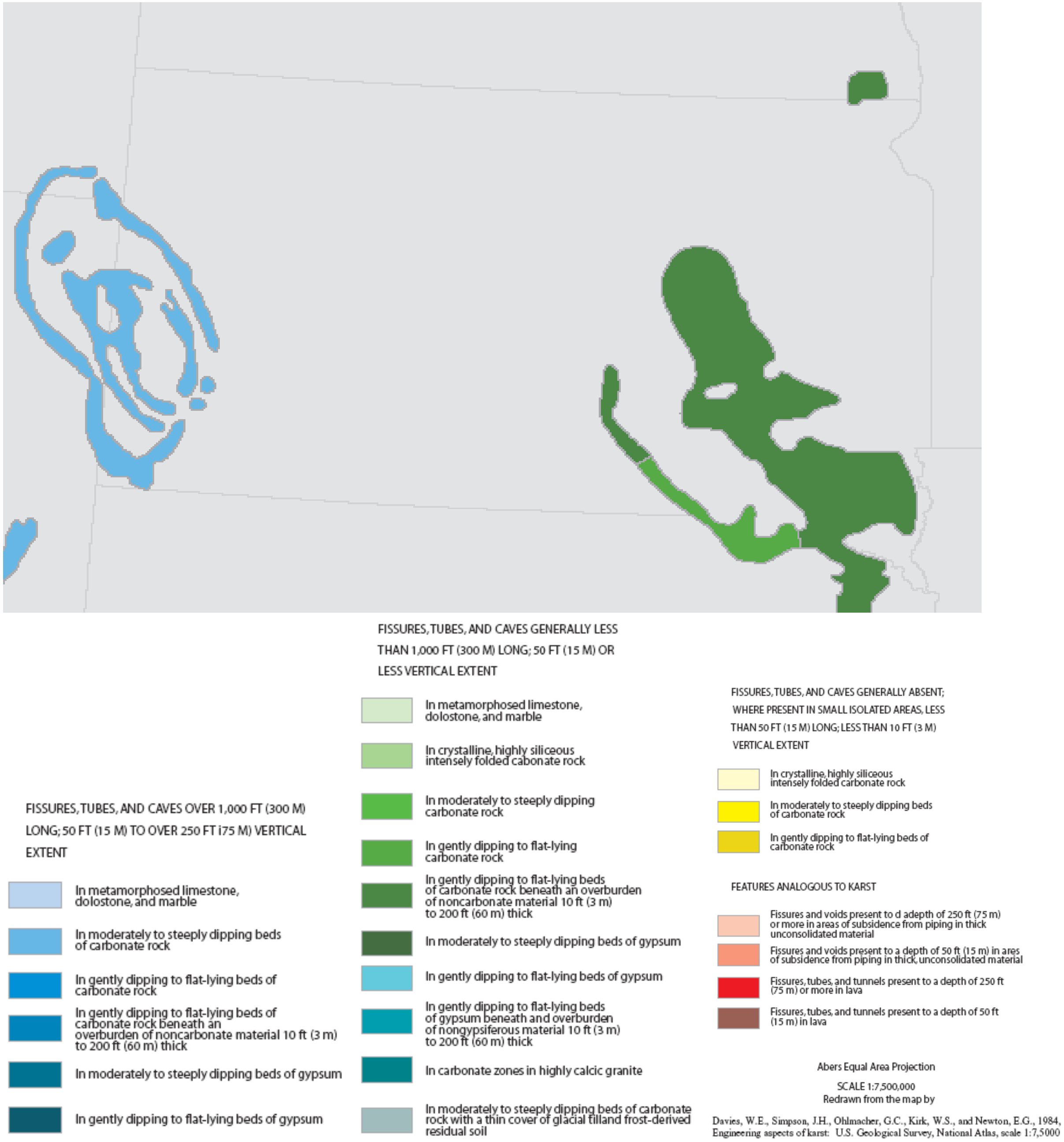
There are certain areas of South Dakota at risk to expansive soils. The map in Figure 3-48 below shows the geographic distribution of soils which are known to have expandable clay minerals which can cause damage to foundations and structures. It also includes soils that have a clay mineral composition which can potentially cause damage. The map is meant to show general trends in the geographic distribution of expansive soils. It is not meant to be used as a property evaluation tool. It is useful for learning areas where expansive soils underlie a significant portion of the land and where expansive soils might be a localized problem. According to this map, the majority of the State has the potential for expansive soils.

Figure 3-46 South Dakota Landslide Incidence and Susceptibility



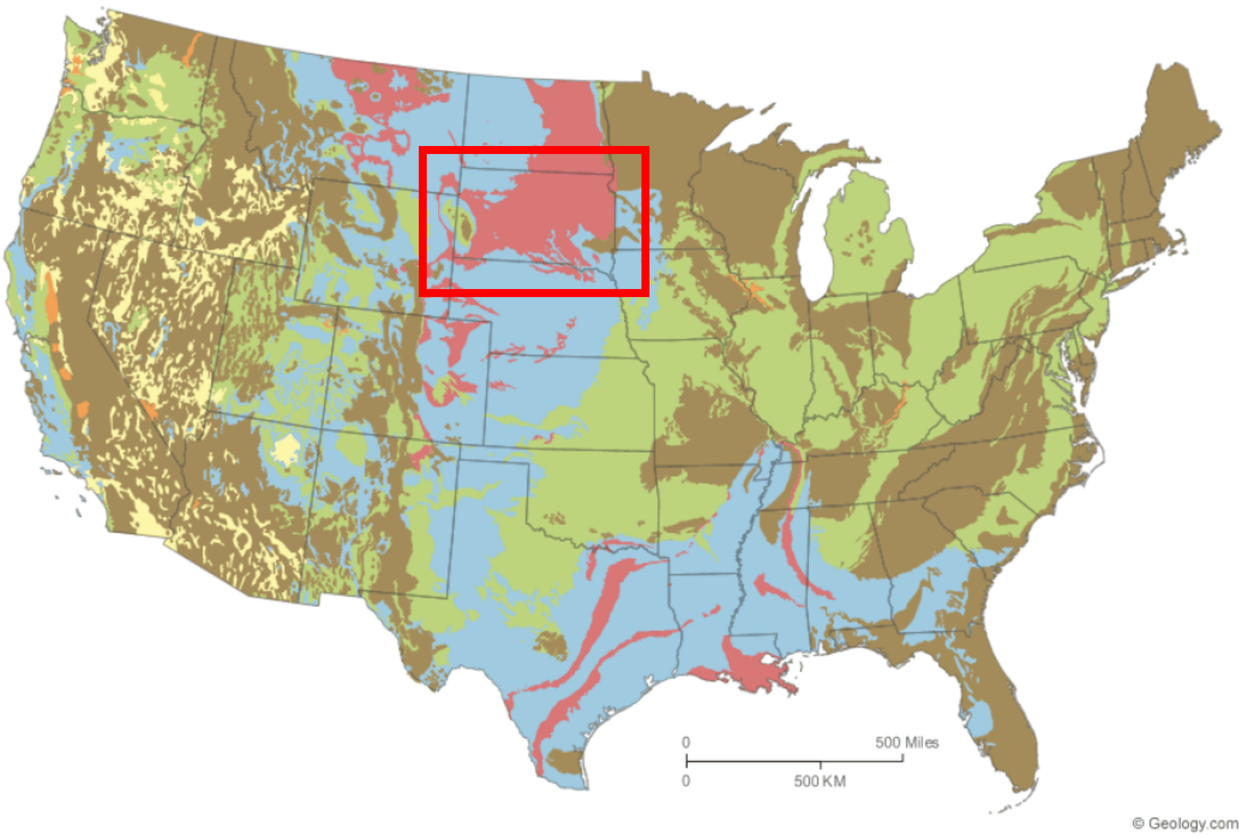
Source: U.S. Geological Survey, map generated by www.nationalatlas.gov

Figure 3-47 State of South Dakota Subsidence Risk



Source: The National Karst Map http://www.nckri.org/map/maps/engineering_aspects/davies_map_PDF.pdf

Figure 3-48 South Dakota Expansive Soils



- Over 50 percent of these areas are underlain by soils with abundant clays of high swelling potential.
- Less than 50 percent of these areas are underlain by soils with clays of high swelling potential.
- Over 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.
- Less than 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.
- These areas are underlain by soils with little to no clays with swelling potential.
- Data insufficient to indicate the clay content or the swelling potential of soils.

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

3.2.10.3 Past Events

Table 3-27 provides information regarding past landslides, mudflows, subsidence, and expansive soils.

Table 3-27 South Dakota Landslides and Mudflows

Date	Comments
2012-2013	Road crews worked to repair a slide area near Cheyenne Crossing along U.S. Highway 14A in Lawrence County. Repair efforts included excavating landslide debris and constructing a new back slope.
2006	A landslide near Wasta in Pennington County took the water system out for a week.
August 8, 2004	A heavy rain at the rate of about one inch per hour fell over the area burned by the Grizzly Gulch fire in Lawrence County just six weeks before. The result was that the steep hillsides lost most of their topsoil, which flowed down into Deadwood. Hardest hit was the area of the Northern Hills General Hospital where a retaining wall was damaged, Whistler's Gulch Campground and Mile High Mobile Home Park, and properties along Sherman Street in Deadwood. Cleanup would have been well over one million dollars, but the use of a state prison work crew and volunteers reduced the out of pocket expense to property owners.
2001	A mudflow caused by heavy rain occurred after the Black Hills Grizzly Gulch Fire in 2001. The mudflow caused damage to many homes in the burn area or below.
June 1976	**Flash Flooding, Mudslides (FEMA-511-DR)** In a 24-hour period on June 13-14, 3 to 10 inches of rain fell in the northern Black Hills. And additional two to three inches of rain plus heavy snow was recorded over this area on the June 15 and 16. The run-off from this precipitation did considerable damage in the counties of Lawrence, Meade, Butte, and Harding. There was also a problem with mudslides and landslides.
May 1952	Sturgis/Deadwood—Heavy rains brought flash flooding that tore up streets and gas pipelines in Sturgis. Bridges were washed out and water erosion caused rock slides. Water damage and landslides also occurred in Deadwood.

Limited information was available regarding past impacts from swelling soils. Modern building practices often take this hazard into account and incorporate mitigation. The Department of Transportation does normal maintenance and accounts for this hazard in their construction practices. Research yielded little information regarding past impacts from subsidence.

3.2.10.4 Probability

Although historical landslide/mudflow/subsidence/expansive soil occurrence data is limited it can be assumed that landslides will occur occasionally in the future, typically during wet climate cycles or following heavy rains, but in limited areas of the state.

3.2.10.5 Earthquake Description

Earthquakes east of the Rocky Mountains are less frequent than in the western United States and are typically felt over a much broader region. Most of North America east of the Rocky Mountains has infrequent earthquakes. Most of the enormous region from the Rockies to the Atlantic can go years without an earthquake large enough to be felt, and several U.S. states have never reported a damaging earthquake. The earthquakes that do occur are typically small and occur at irregular intervals.

East of the Rockies it is difficult to determine the specific fault that is responsible for an earthquake since this vast region is far from plate boundaries, which are in the Atlantic Ocean, the Caribbean Sea, and in California and offshore from Washington and Oregon. Known faults do exist in this “stable continental region,” but numerous smaller or deeply buried faults remain undetected, even most of the known faults are poorly located at depths typically associated with earthquakes. Thus, few earthquakes east of the Rockies can be linked to named faults. Also, it is difficult to determine if a fault is still active and capable of generating an earthquake. Consequently, in most areas east of the Rockies, the best guide to earthquake hazards is the earthquakes themselves.

South Dakota is somewhat more seismically active than other areas in the Northern Great Plains, although the earthquake magnitudes have been relatively minor to date. At least two mechanisms may be important in generation of the earthquakes. These include initiation of movement along preexisting fractures due to crustal plate movements or movements due to glacial rebound. Ground motion accelerations can be calculated based upon historical seismic records, but the poor quality of the database does not allow great confidence to be placed in those calculations. These calculations show highs in ground motion acceleration that correspond reasonably closely with areas of greater earthquake frequency.

3.2.10.6 Location

A zone of higher earthquake frequency extends from the northeastern corner of the state and a generally higher frequency of earthquakes is recorded along the eastern flank of the Black Hills and in the southwestern corner of the state. The earthquakes occurring in South Dakota appear to be concentrated along the Great Lakes Tectonic Zone and possibly along the boundaries of the structural provinces in the Precambrian, crystalline basement.

The Black Hills, being a structural dome, is full of faults and joints dating to the uplift some 50 million years ago. Very little strain now accumulates along them, so only small, rare earthquakes have occurred in the region during historic times. Work by several geologists during the last decade or so have shown that much of the region has widely spaced joints and faults breaking the Earth’s crust into blocks, each a township size in area. Fortunately, there is very little strain to release as earthquakes in South Dakota. In the south central part of the state, the South Dakota Geologic Survey have mapped some of these blocks and have identified individual block-bounding faults that have moved 40 feet or more vertically and a few hundreds of feet horizontally in very small increments during the last 50 million years.

3.2.10.7 Past Events

According to the USGS, no major earthquakes have been reported in South Dakota since 1967. However, earthquakes have historically caused relatively minor damage in South Dakota. Documented damages include cattle stampedes, shaking buildings, falling or rattling dishes and pictures, stuck doors and windows, cracked window glass, foundations heaving or cracking, wall and ceiling plaster cracks, furniture moving, etc.

The following is excerpted directly from an abridged version of Carl A. von Hake's "South Dakota History" in Earthquake Information Bulletin, Volume 9, Number 1, January-February 1977:

> The first earthquake reported in the region occurred on October 9, 1872, 17 years before South Dakota was admitted to the Union. This shock was apparently centered near Sioux City, Iowa. Severe effects were noted at Sioux City, at Yankton and White Swan, South Dakota, and elsewhere in the Dakota Territory. Two strong tremors 45 minutes apart caused some damage in eastern Nebraska on November 15, 1877. The large felt area (over 350,000 square kilometers) included all or most of South Dakota.
>
> On December 29, 1879, a mild earthquake produced rumbling noises at Yankton (V). Two shocks, estimated at intensity IV-V, occurred in the Black Hills region on October 11, 1895. The first was reported strongest at Rochford; the latter was strongest at Keystone and Hill City.
>
> The earthquake of June 2, 1911, was reported from Huron (V) and other places in South Dakota, Iowa, and Nebraska, an area covering approximately 100,000 square kilometers. It was apparently centered in the James River valley. A shock on October 23, 1915, near Kadoka, was accompanied by loud noises. Some cracks in the ground were reported (V). The Black Hills region experienced another earthquake on November 16, 1928. At Custer and Rochford there was a deep rumbling sound (V).
>
> Buildings were jarred, dishes rattled, and loose object swayed (V) at Sioux Falls from an October 11, 1938, tremor. Police stations received more than 50 calls from alarmed residents. The total felt area affected was about 7,500 square kilometers in South Dakota and one town in Minnesota. A strong, localized shock on July 23, 1946, caused several cracks in water mains (VI) at Wessington. The earthquake, which occurred about 12:45 a.m., also awakened sleepers at Huron. The small felt area extended from Pierre to De Smet and from Wessington to Redfield. A similar disturbance occurred on December 31, 1961, causing slight damage at Pierre. Reports of cracked plaster and a cracked cement floor were received. Also, buildings shook and loose objects rattled. Newspaper and police switchboards were swamped with calls from alarmed residents (VI). Fisherman along the Missouri River reported that many fish leaped into the air at the time the earthquake occurred. The felt area extended from Midland on the west to Huron on the east.
>
> An earthquake with an abrupt onset and a short duration (3-5 seconds) was felt by all at Wind Cave National Park. The March 24, 1964, tremor caused small rocks to fall in the cave. Buildings creaked, and a slight trembling motion was noticed at Hot Springs (V). Three days later (March 27), another shock was reported from the same area. The epicenter was apparently located near Van Tassell, Wyoming, although no instrumental records were available for this event owing to the proximity in time of its occurrence to the occurrence of the great Alaska earthquake. There was no connection between the shocks, although many persons within the felt area thought effects from the Alaskan earthquake had been observed. Maximum intensity (V) was noted at Van Tassell; felt

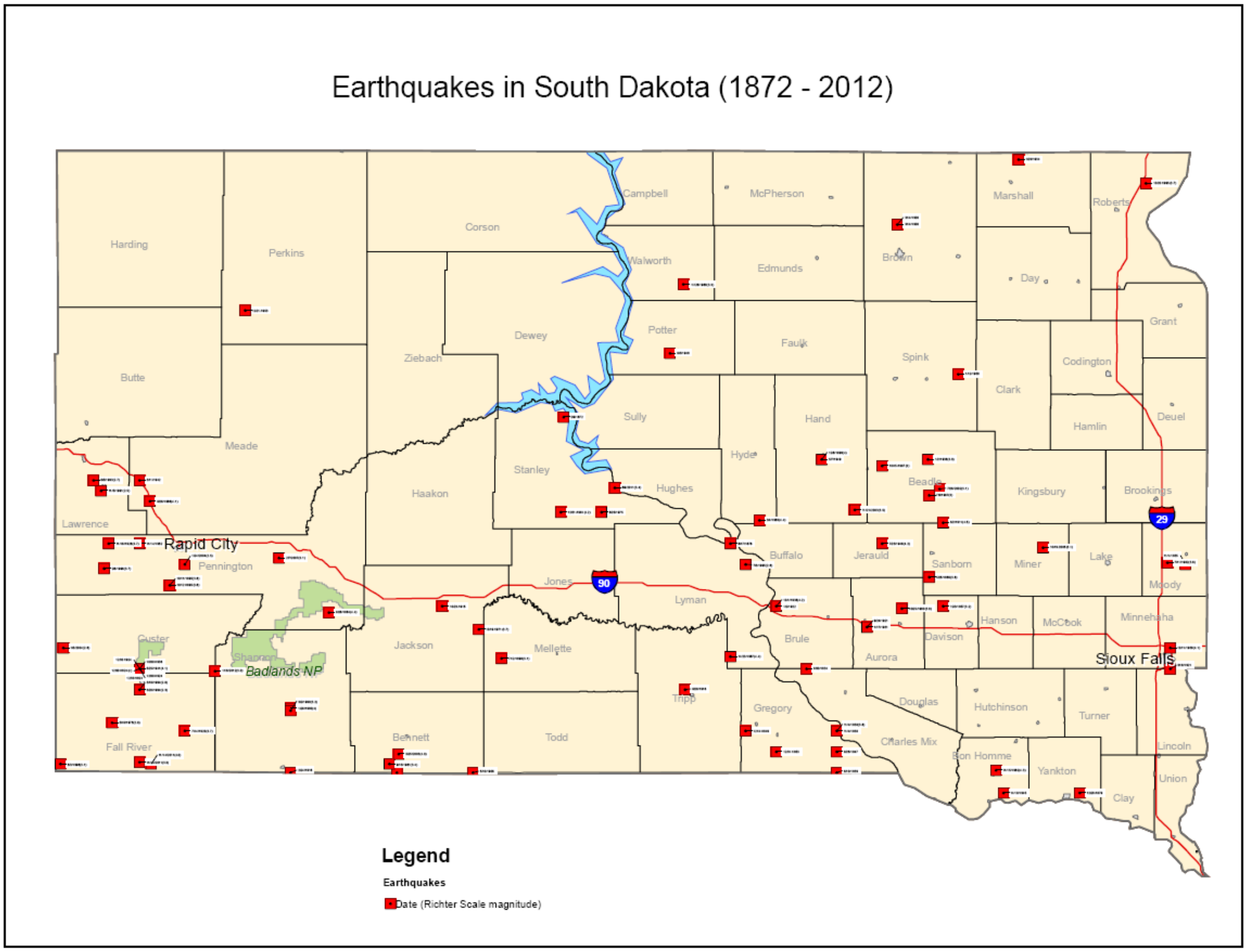
reports were received from Harrison and Hyannis, Nebraska, and Edgemont, Hot Springs, Keystone, Pine Ridge, and Provo, South Dakota.

The strongest tremor in this series (measured at magnitude 5.1) occurred at 3:08 a.m. CST, March 28, 1964. The instrumental epicenter was near Merriman, Nebraska, where broken goods were reported in stores; also, dishes were broken in homes, and stucco under windows cracked. Sixteen kilometers south, 75 cracks were noted in the highway, and some steep banks tumbled along the river (VII). Plaster fell at Rushville, and part of a chimney toppled at Alliance, Nebraska. Slight damage also occurred in southwestern South Dakota - a retaining wall was damaged at Deadwood, there were a few slight cracks in ceiling plaster at Interior, a glass container broke in a market at Martin, and wall and ceiling plaster cracked at Pine Ridge. Several farms near Martin also reported broken glass. The total felt area, including several places in Wyoming, covered approximately 230,000 square kilometers. One town in Montana (Alzada) reported this tremor.

An earthquake on June 26, 1966, near Rapid City, caused slight damage over a small area. A patio and concrete steps were cracked at Rapid City; well water was muddied and could not be used for several hours at Keystone (VI). The magnitude 4.1 shock produced intensity V effects at Deadwood and Silver City. It was also felt at Black Hawk, Hill City, Lead, Piedmont, Pine Ridge, and Shannon.

A magnitude 4.4 shock on November 23, 1967, was felt over a small area of southern South Dakota and northern Nebraska. Press reports indicated that houses shook and dishes fell from shelves in the Winner - Rosebud - White River areas (V). Many residents were frightened at Gregory, where furniture was shifted and some windows were cracked. Livestock stampeded through fences on some farms. Felt reports were also received from Carter, Chamberlain, Colome, Martin, Mission, and Stephan, South Dakota, and Ainsworth and Dunning Nebraska. One isolated report stated the shock was felt by a few people at Douglas, Wyoming.

Figure 3-49 Earthquakes in South Dakota 1872-2012



Source: South Dakota Geological Survey

Table 3-28 South Dakota Earthquakes

Date	Comments
January 16, 2012	Magnitude 3.0 near Custer/Fall River/Shannon County borders
November 15, 2011	Magnitude 3.3 in Fall River County
November 14, 2011	Magnitude 4.0 in Fall River County
August 9, 2011	Magnitude 3.4 near Hughes/Stanley County border
September 25, 2009	Magnitude 3.8 at 10:11 am. 30 miles northwest of Belle Fourche
February 7, 2007	Maximum Intensity III—Magnitude 3.1, 4:35 a.m. 7 miles west southwest of Wasta, 17 miles west northwest of Wall.
October 19, 2005	Magnitude 3.1
January 24, 2004	Magnitude 2.5
January 5, 2004	Magnitude 2.8
November 21, 2003	Magnitude 3.5
May 25, 2003	Intensity IV at Kyle and Gordon, III at Pine Ridge and Chadron—Magnitude 4.0, 1:32 a.m. 35 miles east of Pine Ridge, 115 miles southwest of Pierre.
July 26, 2002	Magnitude 3.1
July 12, 1998	Magnitude 3.1

Date	Comments
May 3, 1996	Magnitude 3.1
February 6, 1996	Intensity V—9:10 a.m. 24 miles south southwest of Yankton (Magnitude 3.6). Felt by many people. The quake caused Gavins Point Dam personnel to conduct dam safety checks. Intensity V—9:08 a.m. Northwest of Mt. Rushmore (3.7 Richter). Felt by many people who noticed typical earthquake ground movement. Both of these quakes were centered about 5 km below the surface. Neither quake can be definitely associated with any mapped fault, but both are near known or postulated faults.
July 3, 1995	Intensity III—Southwest of Ft. Thompson (2.8 Richter)
March 18, 1994	Intensity III—Hot Springs (2.8 Richter)
September 5, 1993	Intensity III—Deadwood (2.7 Richter)
October 25, 1990	Intensity V—Aurora County north of Plankinton and west southwest of Storla.
March 2, 1990	Intensity IV—Shannon County north of Manderson.
January 28, 1990	Intensity V—Shannon County north of Manderson.
November 26, 1989	Intensity III—Walworth County near Lowery.
October 15, 1987	Intensity III—Beadle County northeast of Wessington.
July 9, 1987	Intensity III—Beadle County near Virgil.
May 25, 1986	Intensity IV—Sanborn County slightly northeast of Storla.
March 4, 1983	Intensity VI—On Hyde–Buffalo County border south of Mac's Corner.
November 15, 1982	Intensity V—Bon Homme County near Avon.
July 11, 1982	Intensity V—Moody County near Egan.
September 13, 1981	Intensity V—Bennett County southeast of Batesland on the Nebraska border.
May 16, 1975	Intensity IV—Fall River County near Edgemont.
October 19, 1971	Intensity IV—3:15 p.m. Jackson County half way between Kadoka and Norris. Glass rattled.
November 23, 1967	Intensity V—Lyman County east of Hamill near Tripp-Lyman County border. Magnitude 4.4, felt in Winner, Rosebud, White River areas. Many residents were frightened in Gregory, where furniture shifted and windows cracked. Livestock stampeded through fences on some farms.
Jun 26, 1966	Intensity VI—5:59 a.m. Meade County between Bethlehem and Tilford. Magnitude 4.1, slight damage at Rapid City. At Keystone, well water was muddied for several hours. At Rapid City, concrete steps cracked away from a house and a patio cracked. At Deadwood, there was a fallen tree due to the shock. At Keystone, one observer reported he could see the ground moving. Pictures on walls bounced, buildings creaked, and dishes rattled. There was a gradual on-set with a bumping swaying motion. In Rapid City, buildings creaked and loose objects rattled. There was a rapid on-set with a bumping motion, and moderately loud earth sounds were also heard.
August 26, 1964	Intensity IV—Pennington County south of Wall in Badlands National Park.
March 28, 1964	Intensity VII—Epicenter in western Nebraska. Magnitude 5.1. Duration: 10 seconds. Depth: 65.98 miles. (This quake was not actually in South Dakota but caused damage anyway. It is listed here to represent the danger from earthquakes that originate outside the state's borders.)

Date	Comments
March 27, 1964	Unknown strength due to proximity of the Great Alaska Quake—9:00 p.m. Near Van Taussell, Wyoming. Felt throughout Black Hills with an apparent intensity of IV. (This quake was not actually in South Dakota but caused damage anyway. It is listed here to represent the danger from earthquakes that originate outside the state's borders.)
March 24, 1964	Intensity V—12:12 a.m. Custer County north northeast of Hot Springs near Fall River-Custer County border. Felt by all at Wind Cave National Park. Small rocks fell in cave, buildings creaked, and loose objects rattled. Moderately loud, rumbling noise heard. Abrupt on-set, trembling motion. Duration: 3–5 seconds.
December 31, 1961	Intensity VI—10:35 a.m. Stanley County near Wendte. Felt by many in Pierre. Slight damage. Plaster cracked, cement floors cracked, refrigerator doors shaken open, clothes dryer moved several inches. Fishermen along the Missouri River reported that the moment the quake struck, hundreds of fish jumped into the air. Buildings shook and loose objects rattled. Intensity V—Murdo—felt by many. Plaster on walls cracked, venetian blinds swayed, dishes rattled, faint earth sounds heard, trembling motion with abrupt onset. Intensity IV—Presho and Winner. Intensity I-III—Draper, Hayes, Huron, Midland, Onida, Philip, and White River.
January 12, 1959	Intensity IV—7:15 a.m. Spink County near Doland. Felt by many; rumbling sound followed by what sounded like a boiler explosion. Dishes and windows rattled.
December 3, 1957	Intensity IV—1:30 a.m. Davison County near Loomis. Awakened several people in Mount Vernon, where buildings creaked and loose objects rattled. At Mitchell, houses shook and windows and doors rattled. Livestock was "alarmed and all bunched up."
December 31, 1953	Intensity IV—Gregory County south of Burke.
December 21, 1953	Intensity IV—Perkins County near Zeona
November 14, 1952	Intensity IV—Pennington County near Silver City
December 14, 1949	Intensity III—Gregory County near Dallas.
Jun 3, 1949	Intensity IV—Potter County near Gettysburg.
March7, 1949	Intensity III—Hand County near Miller.
August 25, 1947	Intensity IV—Gregory County near Bonesteel.
July 23, 1946	Intensity VI—Jerauld County near Wessington Springs. In Wessington water mains cracked at two points.
November 10, 1945	Intensity IV—3:00 a.m. Bon Homme County east of Kingsbury and southeast of Tyndall. Rattled dishes.
May 16, 1943	Intensity IV—12:40 p.m. Custer County north northeast of Hot Springs near Fall River-Custer County border. Felt by many "like heavy trucks rumbling down the street." Dishes rattled.
March 11, 1942	Intensity III—11:55 a.m. Meade County near Sturgis. Light shock felt in Deadwood, Fort Meade, Lead, Piedmont, Sturgis, Terraville, Trojan, Whitewood, and Black Hawk.

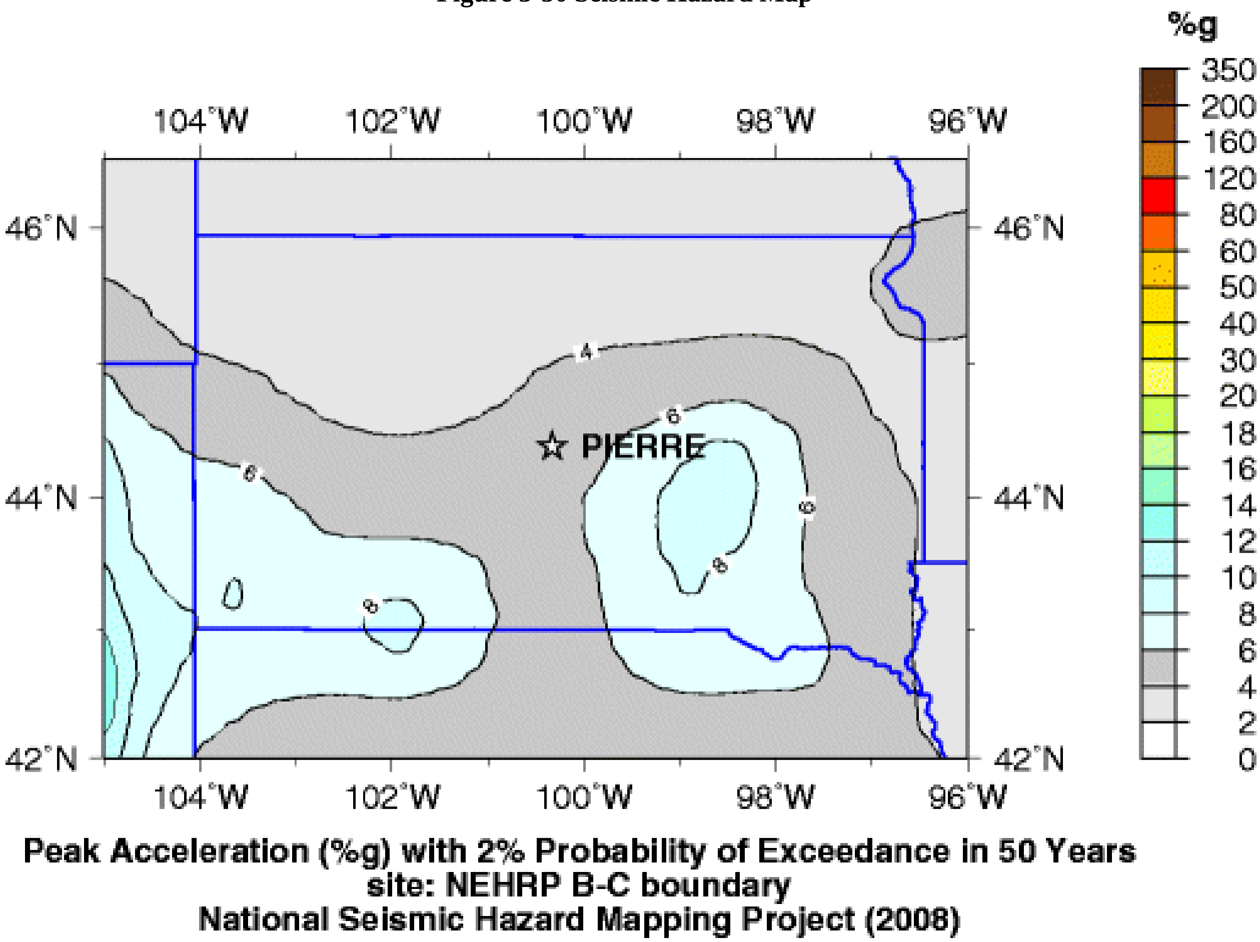
Date	Comments
May 25, 1941	Intensity V—12:25 a.m. Custer County north northeast of Hot Springs near Fall River-Custer County border. In Hot Springs, one wall reported cracked. Pictures and light fixtures swayed in Hot Springs, Rapid City, and Martin. Not felt in Longvalley, Belvidere, Oelrichs, or Cottonwood.
Jun 10, 1939	Intensity IV—12:30 p.m. Gregory County on Nebraska border south of Fairfax. There was one shock of about 15 seconds duration. It was of a gradual bumping nature, direction northwest to southeast, with a rumbling sound.
November 4, 1938	Intensity IV—10:10 and 10:15 p.m. Gregory County near Whetstone Bay. Felt in Academy, Lake Andes, Burke, Colome, Dallas, Gregory, and Platte.
October 11, 1938	Intensity V—3:37 a.m. Minnehaha County between Renner and Sioux Falls. In Sioux Falls, buildings jarred, beds shook, dishes rattled, and pictures and other loose objects swayed. A rumbling subterranean noise came as a climax of the earthquake. The recording pens on water and electric meters at the municipal water works were jarred. Sioux Falls police received more than 50 calls from citizens. Intensity IV—Humboldt, Madison, Parker, Spencer, and Yankton. Intensity III and under—Canton, Centerville, Egan, Hudson, Lennox, Salem, Sherman, and Vermillion. Not felt in Beresford, Brookings, Howard, Mitchell, or Olivet.
October 1, 1938	Intensity V—4:15 p.m. Brule County near Chamberlain.
January 2, 1938	Intensity IV—11:05 a.m. Beadle County near Broadland.
October 30, 1936	Intensity IV—Custer County north northeast of Hot Springs near Fall River. Not felt elsewhere.
November 1, 1935	Intensity III—Moody County between Egan and the Minnesota border on Highway 34.
August 30, 1934	Intensity IV—On the Brule and Charles Mix County border between Bijou Hills and Academy: Abrupt trembling motion accompanied by a rumbling sound, felt by many, small objects moved. Also felt in Pukwana.
January 29, 1934	Intensity IV—6:30 a.m. Marshall County north northwest of Kidder near Newark. Awakened several, dishes rattled, rumbling sound.
January 17, 1931	Intensity IV—Aurora County east of Platte Lake and south of White Lake. Felt by many. Trembling motion with loud sounds.
October 6, 1929	Strong Shock—6:30 a.m. City of Yankton. Deep rumbling resembling distant thunder set windows rattling. Some dishes thrown from shelves. Felt around Yankton and at Gayville and Volin about 15 miles to the east.
November 16, 1928	Intensity V—Pennington County near Mystic City. Felt at Custer and Rochford.
December 30, 1924	Intensity IV— 10:10, 10:15, 10:20, and 10:30 p.m.—Custer County north northeast of Hot Springs near Fall River-Custer County border.
January 2, 1922	Intensity VI—Brule County near Chamberlain.
September 24, 1921	Intensity IV—Aurora County east of Platte Lake and south of White Lake.
March 16, 1921	Intensity III—Minnehaha County near Sioux Falls at Lincoln County border.
July 14, 1920	Intensity III—Fall River County near Oelrichs.
June 29, 1916	Intensity III—Tripp County near Winner.
February 24, 1916	Intensity III—Shannon County near Pine Ridge.
October 23, 1915	Intensity V—Jackson County near Kadoka. Loud noises and some cracks in the ground.

Date	Comments
Jun 2, 1911	Intensity V—Beadle County near James River crossing into Sanborn County. Felt in the James River Valley.
May 10, 1906	Intensity VI—Bennett County near southeast corner and on the Nebraska border. Felt from Rushville to Valentine, Nebraska.
March 14, 1900	Intensity III—5:00a.m. Brown County near northeast corner of Richmond Lake. Intensity III—3:00a.m. Brown County near northeast corner of Richmond Lake.
December 6, 1899	Intensity IV—Hand County near Miller.
October 12, 1895	Intensity V—Pennington County near Hayward.
October 11, 1895	Intensity IV–V—Pennington County near Hayward. Felt at Rochford, Keystone, and Hill City.
December 29, 1879	Intensity V—Yankton County near Yankton.
August 17, 1876	Intensity IV—Lyman County near Lower Brule.
October 9, 1872	Intensity V—At Sioux City, Iowa. Severe effects at Yankton and White Swan. Felt in all or most of South Dakota.
February 9, 1872	Intensity III—Stanley County near Mission Ridge.

3.2.10.8 Probability

South Dakota seems to be relatively geologically stable based upon the sparse data available. However, there is potential for larger earthquakes than the magnitude 4.4 earthquake that struck the Black Hills in 1964. The U.S. Geological Survey estimates this risk as only a 10 percent chance of exceeding a 5.1 magnitude in any one 50-year period. The map in Figure 3-50 shows ground motions that have a 2 percent chance of being equaled or exceeded in a 50-year period.

Figure 3-50 Seismic Hazard Map



Source: U.S. Geological Survey, National Earthquake Information Center

3.3 ASSESSING VULNERABILITY AND ESTIMATING POTENTIAL LOSSES BY JURISDICTION

44 CFR Part 201 Requirement:
[The State risk assessment shall include an] overview and analysis of the State's vulnerability to the hazards described in paragraph (c)(2), based on estimates provided in local risk assessments. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards and most vulnerable to damage and loss associated with hazard events….   *Plan must be reviewed and revised to reflect changes in development….*

44 CFR Part 201 Requirement:
[The State risk assessment shall include an] overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in local risk assessments….

The following section assesses the vulnerability of South Dakota by county to the hazards previously identified and profiled. For purposes of this plan, county boundaries are the smallest jurisdictions considered and include information pertinent to all smaller jurisdictions located within the county. Other geographical, political and jurisdictional boundaries such as cities, towns, municipalities, and townships are better evaluated in local hazard mitigation plans, which allow for the collection and analysis of more detailed information at the local jurisdictional level.

Vulnerability is defined as the extent to which people and property are exposed to harm or damages created by a hazard. The quantification of vulnerability is based on best available data on the hazard and exposed populations and buildings. The method of determining vulnerability varies by hazard and data availability, and these methods are discussed in detail in each hazard profile. Where the data permits, loss estimations to people and property are provided. It was noted at stakeholder meetings during the 2007 plan update that the state may want to consider impacts to South Dakota's agricultural economy as a vulnerability factor in future plan updates. As such, the hazard profile "Agricultural Diseases and Pestilence" was added during the 2011 update. Additional data on crop and livestock loss due to natural hazards was added to the 2014 plan update.

The 2007 update to this plan synthesized and analyzed data that was previously included in several attachments and annexes. In 2011, the plan expanded on those data resources and attempted to fill previous data gaps. In 2014, additional data was obtained to fill in data gaps identified in the 2011 plan. This new data utilized the methods established in 2011 and 2007 and allowed for a comparative perspective on vulnerability to the hazards which impact the state. The results of this analysis are presented in this section. In addition, and in response to the FEMA evaluation of 2007, the growth and development trends were developed further in this update. The social vulnerability section, which was added in 2007, was also re-evaluated in the 2011 update and again in the 2014 update. Counties and other local jurisdictions can follow this same process to assist in developing or updating their local mitigation plans in a manner that consistently reflects vulnerability evaluations.

New vulnerability assessment methodologies were conducted during the 2007 update to refine vulnerability and loss estimates for flood, tornadoes, severe wind, winter storm, wildfire, and earthquake. These assessments were updated in 2011 and again in 2014. A significant change to the 2011 plan was the incorporation of a statewide flood loss estimation based on FEMA's HAZUS-MH computer model. Additional information was added in 2011 to improve the drought vulnerability section. A limited vulnerability analysis was added for hazardous materials. Vulnerability and loss assessments were not conducted for geologic hazards due to their ranking as limited for planning significance. New vulnerability assessment methodologies and data were introduced in 2014. Data on crop loss and livestock death was added to the profiles and vulnerability assessments for agricultural pests and disease, drought, and winter storm. Vulnerability assessments for tornado, wind, and winter storm were enhanced with more detailed analysis on events with higher magnitudes (e.g. tornadoes of F1 or greater), damages, and casualties. Damage estimates were inflated to 2012 dollars. Vulnerability for the Rural Electric Cooperatives was further analyzed with new data on hazards and completed or planned mitigation projects. The 2014 update also includes new data on Individual Assistance and Public Assistance claims for major disasters that have occurred in South Dakota. With each successive update the vulnerability and loss estimates improve, though some information gaps remain.

The State Hazard Mitigation Team reviewed current and approved local hazard mitigation plans covering 66 counties and 2 tribal governments to understand vulnerabilities and potential losses at the local level. While some plans used a standard format for estimating potential losses, most of the plans contained limited vulnerability information and utilized different methodologies for determining vulnerability. It is difficult to conduct a complete statewide comparison. The most common methodologies used in the local plans are listed below:

- Calculating average annualized losses (property and crops) based off of SHELDUS, NCDC, NWS, etc.
- Exposure analysis calculating the total amount of land and/or improvement values within the hazard area
- HAZUS MH
- Narratives of losses that summarize potential property, utility, and infrastructure vulnerabilities but do not provide monetary loss amounts

Potential losses due to flooding is the most comprehensive loss estimations in the local plans. Appendix 4B contains the results of the local plan review for estimated potential losses.

3.3.1 Growth and Development

As part of the plan update process, the state looked at changes in growth and development at the county level and examined these changes in the context of the state's hazard-prone areas and how the changes in growth and development affect loss estimates and vulnerability. Population and development growth increases the vulnerability of a given area and appropriate mitigation measures should be undertaken to minimize this increase.

3.3.1.1 General Land Use in South Dakota

Land use and development trends exert a significant impact on the vulnerability assessments for South Dakota relative to specific hazards. In some cases, a dominant land use may increase the vulnerability to a specific hazard, such as agricultural diseases or wildfire. Land use trends may also indicate areas where vulnerability and risk may be more sustained than in other areas of the state, and also help identify areas where vulnerability and risk levels vary. This is particularly important to examine in a statewide hazard mitigation plan, to ensure the document reflects accurate variability of these elements.

One characteristic of local land use in South Dakota that must be considered in both state and local hazard mitigation planning is how the land use patterns are changing at the community level. Identifying both the type and rate of change from existing land uses to future land uses, whether they are planned or unplanned, can help to identify the local jurisdictions most subject to development pressures and consequently help to focus the mitigation planning to minimize the vulnerability to future disasters of the newly constructed neighborhoods, facilities, and infrastructure. Data from local plans can be used to identify the jurisdictions where planned land uses are significantly different from existing land uses.

Land cover in South Dakota is predominantly cropland and rangeland. The significant forested areas in the state are concentrated in the Black Hills region, located in the south west corner of the state. Large bands of cultivated cropland and pastureland or haymaking areas run from north to south across eastern South Dakota. Areas in the western half of the state are marked with cropland and pastureland and pockets of barren land, but are primarily characterized by grasslands. Highly concentrated areas of development, including residential and commercial/industrial/transportation classifications of land, are limited geographically and centralized around the major population centers of Rapid City, Pierre, and Sioux Falls. Other areas of concentrated urbanization include Aberdeen, Watertown, and Huron, which correspond to the population and demographic information outlined in the next section.

3.3.1.2 County Land Use in South Dakota

Notable and important growth and development trends were identified in the review of county hazard mitigation plans. Considerations of county growth and development trends is important in that increased growth exposes more citizens and buildings to hazards such as tornadoes, winter storms, wildfires, and floods. As such, Table 3-29 summarizes the trends identified in the local county hazard mitigation plans.

Table 3-29 Growth and Development Trends Extracted from Local Plans

County	Growth and Development Trend
Aurora	The rural landscape has been experiencing a population decline and the population is expected to continue decreasing. Residential growth is not expected to be significant in the county, but any new development needs to be controlled through planning and development guidelines. Some residential development is occurring in Plankinton just east of the school, an area that is located in a designated floodplain.
Beadle	Household size, number of households, and population is decreasing with the City of Huron. Little business within the City has changed within the last five years. However, Huron continues to expand south. On the west side, the Planning Commission rezoned an area along the new truck route to be zoned for commercial and residential uses. The rest of the County and local jurisdictions are not experiencing growth.
Bennett	The County has lost population between 2000 and 2010. Since the 2004 plan was adopted, the county has not witnessed any major housing

County	Growth and Development Trend
	development projects and the number of occupied housing units has decreased. There are plans to explore ways to incentivize and encourage the construction of residential safe rooms for new housing developments.
Bon Homme	The County has been experiencing a population decline for the last few decades and the population is expected to continue decreasing. The county's Comprehensive Plan indicates that little development is expected anywhere in the county.
Brookings	There was a 12 percent population increase 1990 and 2000. Mitigation activities are needed at the business level to ensure the safety and welfare of workers and limit damage to industrial infrastructure. Transportation systems in Brookings County have expanded and evolved.
Brown	The only communities in Brown County that are experiencing growth and/or development are Aberdeen, Groton, and some areas around Richmond Lake.
Brule	Comprehensive plans indicate that little development is expected anywhere in the county. There are no plans for the construction of any major new infrastructure or critical facilities anywhere in the county in the near future. Minor development may occur, mostly in Chamberlain, but nothing to significantly increase vulnerability to hazards.
Buffalo	Some growth may occur between now and 2020. If growth does occur it is most likely to happen in Fort Thompson. There are no plans for the construction of any major new infrastructure or critical facilities in the near future.
Butte	Butte County is growing. US Census projections indicate continuing growth, primarily in and around the edges of Belle Fourche and the southwestern portions of the County. The City of Belle Fourche has designated an individual to manage floodplain development and code enforcement. As new development continues in the County, code enforcement and better construction materials and techniques should reduce damage to property from some natural events.
Charles Mix	There is no significant development occurring in the county nor is any activity foreseen. There has been some development occurring in the hilly terrain west of Wagner where there is a possibility for an increase in damage from fires because this area is thick with vegetation, making firefighting difficult.
Codington	The only communities in the county that are experiencing any growth and/or development are Watertown and Florence. Jurisdictions maintain comprehensive land use plans for growth and development.
Custer	The Black Hills and Custer County are experiencing an influx of people. The county's agricultural and ranching traditions are slowly being displaced by suburban land development. Hermosa is planning for major growth in its residential population. It is estimated that the area surrounding Hermosa could triple in size in the next 3-5 years. Numerous developments have been built surrounding Custer State Park, Wind and Jewel Cave National parks, and throughout the Black Hills National Forest.

County	Growth and Development Trend
Davison	Slow but steady growth is expected to continue in the county, centered in the Mitchell area. Most of this growth is expected to be residential development on the outskirts of Mitchell in the Lake Mitchell area, on the east side of town, and just south along SD Highway 37. Some residential development is occurring south of Mitchell near the flood zone of Enemy Creek and in the vicinity of Firesteel Creek.
Day	Steadily losing population since 1930. No future buildings, infrastructure, or critical facilities proposed that would be located in identified hazard areas. Mitigation options will be considered in future land use decisions.
Douglas	Little development is expected anywhere in the county.
Edmunds	The only community experiencing any growth and/or development is Ipswich.
Gregory	Some development is occurring south of Whetstone Bay and near the intersection of highways 44 and 1806. Land near Whetstone Bay is being rezoned for rural residential development. Each of these areas will consist of approximately a dozen homes when all the lots are developed.
Haakon	Declining number of farms, rural population steadily decreased and now leveling off, and some rural subdivision development. No future development is identified in a hazard area.
Hamlin	Slow and steady growth due to its proximity to larger communities such as Watertown and Codington County. No future buildings, infrastructure, or critical facilities are planned within hazard areas and mitigation options will be considered in future land use decisions. Small businesses and industries that are agricultural related are also increasing employment in the area. Agriculture is the basis of the economy.
Hand	The declining population offers limited potential for growth in the county and communities. As a result, there are no planned or potential buildings for Hand County.
Hanson	It is reasonable to expect growth and development to continue in Hanson County due to its proximity to Mitchell. However, this growth is not expected to be significant.
Harding	The county as a whole experienced a 28% decline in population from 1990 to 2009. Occupied housing units have also declined.
Hughes	Pierre and Fort Pierre are growing at a steady pace with more restaurants, hotels, and small businesses opening every year. In comparison, Blunt and Harrold are struggling with their economic and population growth.
Hutchinson	No development in this county is expected to increase severity of identified hazards.
Hyde	Growth will most likely be limited to the expansion of existing agricultural storage facilities. No new growth in hazard prone areas for business or recreation is anticipated.

County	Growth and Development Trend
Jackson	There has been a decline in the number of farms, the rural population is steadily leveling off, and there has been some rural subdivision development. No major future development is identified in a hazard area.
Jerauld	There is possibility of increased development along the Wessington hills, an area of the county that is somewhat more vulnerable to the threat of wildfires than flatter, less wooded parts of the county.
Jones	Declining number of farms, rural population steadily decreased and now leveling off, and some rural subdivision development. No future development is identified in a hazard area. Future development will focus on the traveling public.
Lake	While the rural areas have steadily been declining, the City of Madison has steadily increased both its population and overall proportion of the county's population. Future population growth is expected in the City of Madison and the developments of Lake Madison and Lake Herman. More than half of residential development occurred in the Lake Park I and II Districts around Lake Madison, Lake Herman, Brant Lake, Round Lake, and Long Lake. Over ninety percent of the Town District development happened in the Village of Chester.
Lawrence	The County is experiencing growth in both residential and industrial areas. Development in rural areas may increase the risk of wildland urban interface fire. Rural development includes smaller tracts of land that are being broken up into subdivisions for individual development.
Lincoln	Lincoln County has nearly doubled in population size from 2000 to 2010. All indicators are the population will continue to grow and expand in the coming years. Much growth has occurred in Tea and Harrisburg. Future development is expected to occur in southern Sioux Falls, Tea, and Harrisburg. Since the county is growing, each jurisdiction assesses the capacity of its utilities to handle excess rain and localized flooding. In addition, the identification of emergency snow routes is reassessed based on development trends and the location of new businesses and homes in the community.
Lyman	Although residential growth is not expected to be significant in the county, new developments need to be controlled through planning and development guidelines.
McCook	The County is predominantly farm and rangeland. McCook County has 367,612 acres in farmland which is a 5% increase from 2002 and the number of farms increased to 545 compared to 539 in 2002 for a 1% increase. Between 2000 and 2010, the County as a whole lost population by 3.7%.44% of the total population lives in rural McCook County, predominately on farms.
Meade	Growth and development along I-90, Sturgis, and also in the southwest corner of the County near Piedmont and Summerset. The Black Hills Motorcycle Rally increases population and chances for hazards for a short period during the Rally in August of each year.

County	Growth and Development Trend
Mellette	Hunting lodges in the county are one of the fastest growing businesses. This boom has caused land prices to rise sharply over the past few years. No future development is expected to increase the severity of wildfire. The amount and location of prairie dog towns limits new development not only because of the sheer amount of them but also because of restrictions to removing their habitat. Periodic flooding affects numerous areas of the County; however, the majority of the land is unincorporated and has very little residential development.
Minnehaha	Minnehaha County has experienced significant population growth over the last 20 years. All indicators are that the population will continue to grow and expand over the next twenty years. Much growth has occurred in Baltic, Brandon, Crooks, Dell Rapids, Hartford, and Sioux Falls. Over the next decade, future growth is anticipated on the fringes of these cities and along the I-29, I-229, and I-90 corridors. Since the county is growing, each jurisdiction assesses the capacity of its utilities to handle excess rain and localized flooding. In addition, the identification of emergency snow routes is reassessed based on development trends and the location of new businesses and homes in the community.
Moody	Moody County has and continues to lose population. Local officials have indicated that there are no future buildings, infrastructure, or critical facilities that have been proposed to be built in identified hazard areas.
Pennington	Many areas in the county are not suitable or available for development. The majority of the county land is owned or controlled by the federal government. Many areas are not conducive to development due to physical limitations such as flood hazard, poor soil conditions, steep terrain, or lack of water. Most development is found along major US or state highways. A commercial land use corridor extends from Rapid City south towards Keystone and Hill City. Box Elder and Hill City have experienced a growth in population.
Potter	Steadily losing population since 1930. Agriculture is the basis of the economy. No future buildings, infrastructure, or critical facilities proposed to be located in identified hazard areas. Mitigation options will be considered in future land use decisions.
Roberts	Steadily losing population since 1930. Agriculture is the basis of the economy. No future buildings, infrastructure, or critical facilities proposed to be located in identified hazard areas. Mitigation options will be considered in future land use decisions.
Sanborn	There are no plans for construction of any major new infrastructure or critical facilities anywhere in the county in the near future. Some new residential development will occur but not at a significant rate.
Shannon	The county Hazard Mitigation Plan indicates that there is minimal population growth.
Spink	Decreasing population and limited potential for growth. There are no planned or potential buildings.

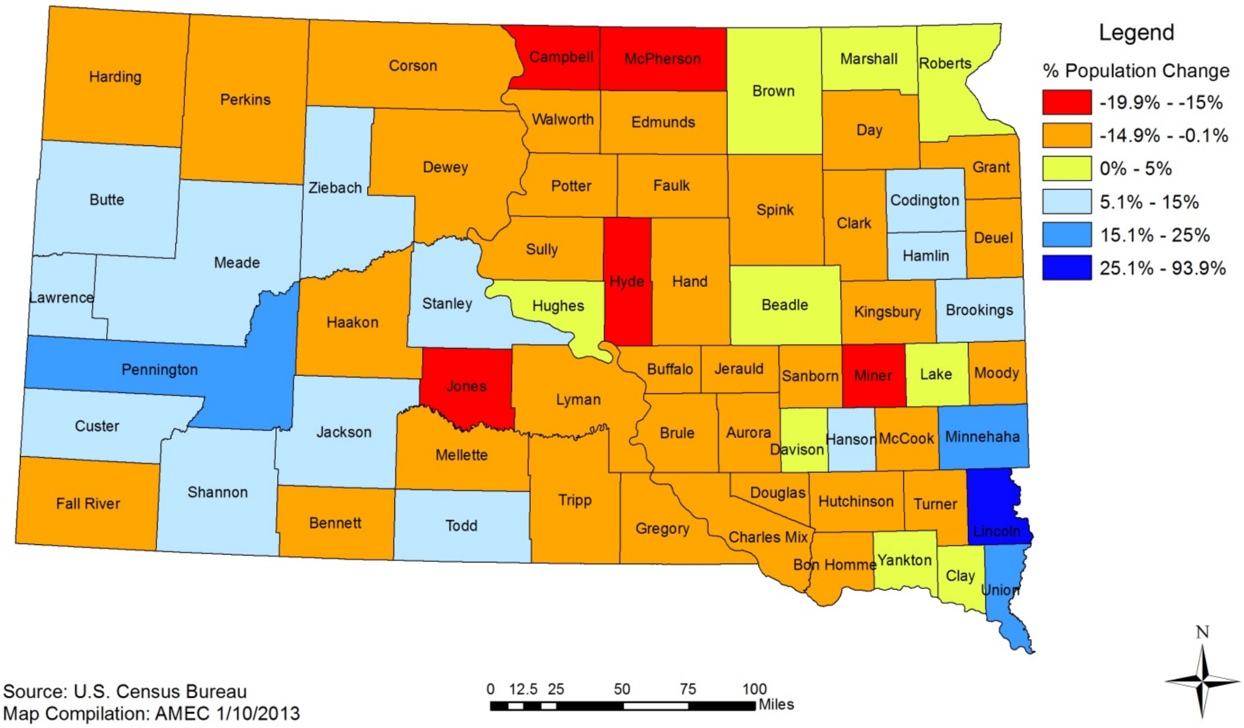
County	Growth and Development Trend
Stanley	Pierre and Fort Pierre are growing at a steady pace with more restaurants, hotels, and small businesses opening every year. In comparison, Blunt and Harrold are struggling with their economic and population growth.
Sully	Declining number of farms, rural population steadily decreased and now leveling off, and some rural subdivision development. Not future development planned in hazard areas.
Todd	There is a new housing project called Sunshine Apartments which will provide affordable housing. Aside from this development, there are very few development trends for the county since the majority of the area is agricultural in nature.
Tripp	Tripp County has been experiencing a population decline for the last few decades and the population is expected to continue decreasing. No new development is expected in the county.
Turner	As of 2010, there were 8,347 people living in Turner County, which is a 5.6% decrease from the 2000 Census.
Union	Steady decline in population since 1930, large increase in population since 1990.
Yankton	Most of the county's population is concentrated around the City of Yankton. Growth is expected to continue. Most of this increase is expected to occur in and around Yankton, including the residential areas west of the city. Continued development west of Yankton will put additional numbers of people at risk to failure of the Gavins Point Dam and to wildfire. The development that is occurring is reducing the amount of permeable surface, increasing surface water runoff in some areas of the city.
Rosebud Sioux Tribe	Rural housing may increase vulnerability to winter storms and tornadoes. Increasing number of methamphetamine labs.

The discussion that follows focuses on population growth and housing unit trends and density by county, based on the most recent U.S. Census Bureau data.

3.3.1.3 Population

U.S. Census Bureau American Community Survey (ACS) estimates South Dakota’s 2011 population at 824,082. This reflects an increase of 9.2% between 2000 and 2011. South Dakota ranked 46th among the 50 states in population in 2010, 25th in rate of growth from 2000 to 2010, 16th in land area, and 46th in population density in 2011. Figure 3-51 illustrates the estimated population changes (by percent) for the counties in the state.

Figure 3-51 Estimated Percent Change in Population by County, 2000-2011



Decennial Census findings from the last few decades illustrate South Dakota's growth (see Table 3-30).

Table 3-30 South Dakota Decennial Census 1970-2010

Year	Population	% Change
1970	665,507	-2.2
1980	690,768	+3.8
1990	696,004	+.8
2000	754,844	+8.5
2010	814,180	+7.9

Source: U.S. Census Bureau

Between 2000 and 2011, 26 South Dakota counties gained population. With an estimated population gain of 85.8%, Lincoln County was the 4th fastest growing county in the United States (of counties with 10,000 or more in population) between 2000 and 2011 at 93.9% change in population. No counties in South Dakota were ranked among the top 100 largest (by population) in the U.S. The three largest counties in the state (Minnehaha, Pennington, and Lincoln) were in the Top 10 Counties that experienced the largest population growth by number and by percent gained. Table 3-31, Table 3-32, and Table 3-33 show the Top 10 South Dakota counties ranked by estimated population and those with the greatest estimated population gains.

Table 3-31 10 Largest Counties Ranked by Population (Estimated), 2011

County	2011 Population
Minnehaha	171,752
Pennington	102,815
Lincoln	46,793
Brown	36,822
Brookings	32,226
Codington	27,442
Meade	25,546
Lawrence	24,312
Yankton	22,612
Davison	19,651

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Table 3-32 Top 10 Counties with Greatest Estimated Population Gains (Numerical), 2000-2011

County	Population Gain 2000-2011
Minnehaha	23,471
Lincoln	22,662
Pennington	14,250
Brookings	4,006
Lawrence	2,510
Union	2,067
Codington	1,545
Shannon	1,462
Brown	1,362
Meade	1,293

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Table 3-33 Top 10 Counties with Greatest Estimated Population Gains (Percent), 2000-2011

County	Population Gain (%) 2000-2011
Lincoln	93.9%
Union	16.4%
Pennington	16.1%
Minnehaha	15.8%
Custer	14.6%
Brookings	14.2%
Ziebach	13.2%
Butte	12.8%
Shannon	11.7%
Lawrence	11.5%

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Between 2000 and 2011, 40 South Dakota counties lost population (see Table 3-35 and Table 3-36). Of the counties with the most rapid losses, five of them (Campbell, Jones, Miner, Hyde, and Haakon) also rank among South Dakota's 10 least populous counties (see Table 3-34). Four counties reported rapid population loss in 2007. In the 2011 plan update, only two counties reported rapid population loss. This seemed to indicate that the State's population was stabilizing. Data from the 2011 American Community Survey Estimates suggests that several counties are experiencing rapid population decline again.

Table 3-34 Ten Smallest Counties Ranked by Population (Estimated), 2011

County	2011 Population
Jones	1,003
Harding	1,269
Sully	1,375
Hyde	1,394
Campbell	1,427
Haakon	1,907
Buffalo	1,988
Mellette	2,067
Jerauld	2,085
Miner	2,359

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Table 3-35 Top 10 Counties with Greatest Estimated Population Losses (Numerical), 2000-2011

County	Population Loss 2000-2011
Spink	-984
Hutchinson	-818
Tripp	-815
Kingsbury	-636
Grant	-597
Gregory	-576
Dewey	-551
Day	-526
Miner	-525
Turner	-517

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Table 3-36 Top 10 Counties with Greatest Estimated Population Losses (Percent), 2000-2011

County	Population Loss (%) 2000-2011
Campbell	-19.9%
Miner	-18.2%
Hyde	-16.6%
Jones	-15.9%
McPherson	-15.6%
Douglas	-14.1%
Spink	-13.2%
Haakon	-13.2%
Tripp	-12.7%

County	Population Loss (%) 2000-2011
Clark	-12.4%

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Interim population projections issued by the U.S. Census Bureau in 2009 suggests that South Dakota's population will continue to grow but percentages will drop through 2020 (see Table 3-37). After 2020, population growth is projected to level off and begin to decline slightly after 2025. Population projections are only available at the state level. The U.S. Census Bureau has not updated this information and currently has no plans to produce a new set of state population projections.

Table 3-37 Interim South Dakota Population Projections, 2010-2030

Year	Projected Population	% Change
2010	786,399	+1.9
2015	796,954	+1.3
2020	801,939	+.6
2025	801,845	0
2030	800,462	-.2

Source: U.S. Census Bureau 2009

Appendix 3A Population and Growth contains population and growth information for all South Dakota counties.

3.3.1.4 Housing Units

Another indicator of growth is the number of housing units in a county. The Census defines a housing unit as a house, an apartment, a mobile home or trailer, a group of rooms, or a single room that is occupied, or, if vacant, is intended for occupancy as separate living quarters. According to the U.S. Census Bureau, the number of estimated housing units in South Dakota increased 12.4 percent (40,230 units) between 2000 and 2011. With 363,438 units, South Dakota ranked 46th among the 50 states in number of housing units. Table 3-38 lists the ten counties with the most housing units, which corresponds to the ten most populous counties shown in Table 3-31. Minnehaha, Lincoln, and Pennington topped the list for numerical gains (Table 3-39) and, tracking with its rate of population growth, Lincoln topped the list of percent gained (104.4 percent). Table 3-39 and Table 3-40 list the counties that have grown the most in terms of housing units by number and percent respectively.

Table 3-38 Top 10 Counties Ranked by Number of Housing Units (Estimated), 2011

County	2011 Housing Units
Minnehaha	72,772
Pennington	45,421
Lincoln	18,665
Brown	16,956
Brookings	13,472
Lawrence	12,956
Codington	12,484
Meade	11,022

County	2011 Housing Units
Yankton	9,690
Davison	8,884

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Table 3-39 Top 10 Counties with Greatest Estimated Housing Unit Gains (Numerical), 2000 – 2011

County	Housing Unit Gains 2000-2011
Minnehaha	12,535
Lincoln	9,534
Pennington	8,172
Lawrence	2,529
Brookings	1,896
Codington	1,160
Brown	1,095
Custer	1,062
Union	1,017
Meade	873

Source: U.S. Census Bureau American Community Survey 2011 Estimates

Table 3-40 Top 10 Counties with Greatest Estimated Housing Unit Gains (Percent), 2000–2011

County	Housing Unit Gains (%) 2000-2011
Lincoln	104.4%
Custer	29.3%
Lawrence	24.3%
Pennington	21.9%
Minnehaha	20.8%
Union	19.0%
Brookings	16.4%
Shannon	16.2%
Butte	15.1%
Todd	14.3%

Source: U.S. Census Bureau American Community Survey 2011 Estimates

3.3.1.5 Density

South Dakota has a surface land area of 75,811 square miles (2010 Census) and a population of 823,593 (American Community Survey 2011 Estimate). Based on these estimates, South Dakota ranked 46th in both population and housing density among the 50 states. The same 10 counties ranked at the top in terms of both population density and housing density, as shown in Table 3-41. Eight of these counties (excluding Clay and Union) also ranked among South Dakota's Top 10 Most Populous Counties in Table 3-31.

Table 3-41 Top 10 Counties Ranked by Population Density, 2011

County	2011 Estimated Population Density*	Population Density Change (%) 2000-2011	2011 Estimated Housing Density	Housing Density Change (%) 2000-2011
Minnehaha	212.8	15.6%	90.2	20.8%
Lincoln	81.1	91.0%	32.3	104.4%
Davison	45.1	4.9%	20.4	9.8%
Yankton	43.4	4.7%	18.6	9.6%
Brookings	40.7	14.2%	17.0	16.4%
Codington	39.9	5.8%	18.1	10.2%
Pennington	37.0	15.8%	16.4	21.9%
Clay	34.1	4.0%	13.7	3.6%
Union	31.8	16.3%	13.8	19.0%
Lawrence	30.4	11.7%	16.2	24.3%

Source: U.S. Census Bureau 2000 Census and American Community Survey 2011 Estimate
*Note: Density is reported as people/housing units per square mile and is based on the square mileage of each county's land area.

The percent change in population density tracks with the percent change in population growth. The fastest growing counties are also experiencing a more rapid increase in population density than the other counties. This information is located in Table 3-42. Determining areas of significant population density growth helps establish areas that may be more vulnerable to hazards due to the increased number of people living in a potentially impacted area.

Table 3-42 Counties with Greatest Estimated Population Density Gains (Percent), 2000 – 2011

County	Population Density* Gains (%) 2000-2011
Lincoln	91.0%
McCook	88.1%
Union	16.3%
Pennington	15.8%
Minnehaha	15.6%
Ziebach	15.3%
Custer	14.5%
Brookings	14.2%
Butte	12.5%
Lawrence	11.7%

Source: U.S. Census Bureau 2000 Census and American Community Survey 2011 Estimate
*Note: Density is reported as people per square mile and is based on the square mileage of each county's land area.

3.3.1.6 Summary of Impact of Growth and Development Trends on Vulnerability and Loss Estimates

In general, counties with growing populations and number of housing units have an increased vulnerability to hazards not defined by specific geographic areas. These hazards may include winter storms, tornadoes, wind, drought, wildfire, and earthquake. The counties experiencing the most development pressures all participate in the National Flood Insurance Program. Rapid City, in

Pennington County, is in the Community Rating System at Class 8. This suggests that flood risk should not be increasing, assuming that county floodplain ordinances are being effectively implemented and wise use of floodplains encouraged. However, new data in Table 3-48 suggests that repetitive loss is increasing in the State. This may be mostly attributed to second homes. Union County is one of the fastest growing counties and also has potential for high flood losses as described in the flood vulnerability section. Growth and development trends and their impact on vulnerability were noted during stakeholder meetings held in conjunction with the 2007 update to the plan. In Charles Mix County, lodges are being built with potential risk to wildfire. New development in forested areas in Minnehaha County east of Sioux Falls are demanding city services for fire protection. New housing being built near Mitchell Lake and in North Lincoln County could also be at risk to wildfire. Values of homes in forested areas in the Black Hills are rising, thus the exposure analysis conducted for this plan is likely to underestimate the property values exposed to wildfire risk. New homes being built in Meade and other Counties increase the exposure to damage from tornadoes.

3.3.2 Social Vulnerability

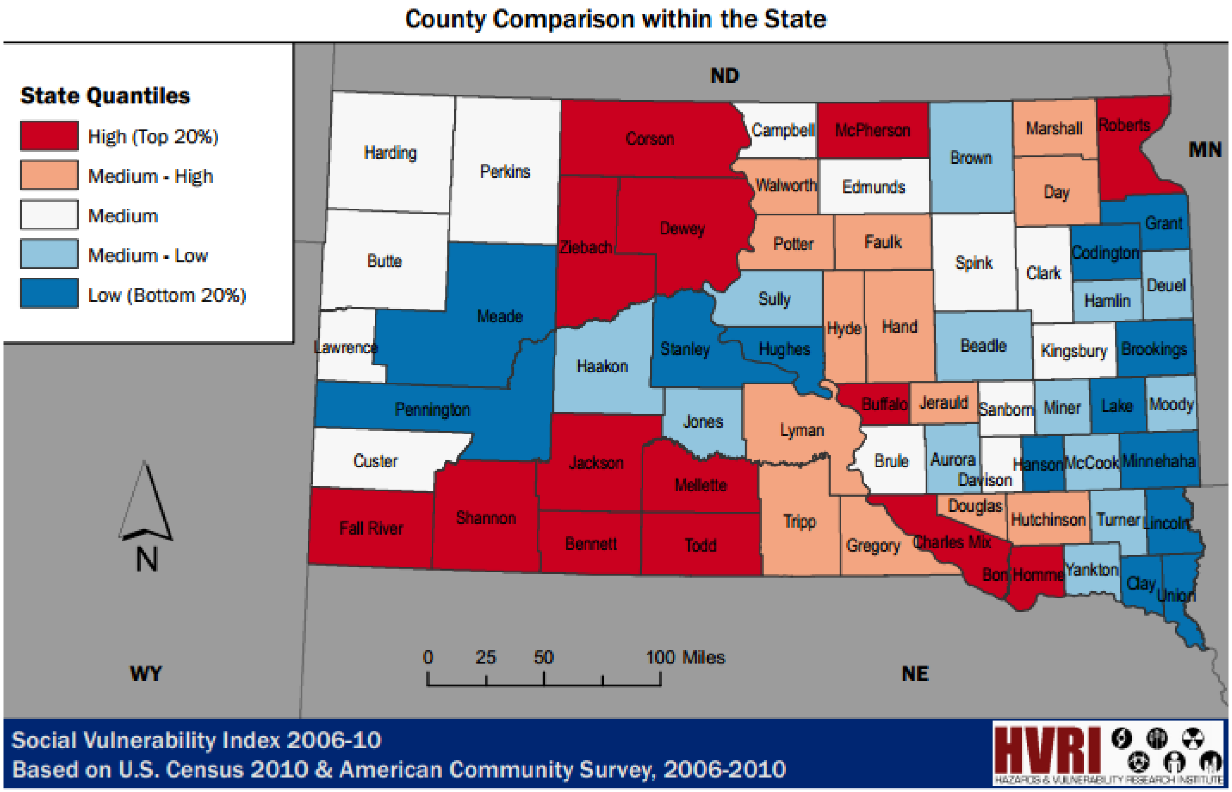
A Social Vulnerability Index (SoVI) compiled by the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina measures the social vulnerability of U.S. counties to environmental hazards. The comparison of SoVI values between counties within the state allows for a more detailed depiction of variances in risk and vulnerability. The Index is based on national data sources, primarily the 2010 census, and synthesizes 30 socioeconomic variables that research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. Seven components differentiate counties according to their relative level of social vulnerability. The components include race and class, wealth, elderly residents, Hispanic ethnicity, special needs individuals, Native American ethnicity, and service industry employment.

The index can be used by the state to help determine where social vulnerability and exposure to hazards overlaps and how and where mitigation resources might best be used. See Figure 3-52 for a map that illustrates South Dakota's geographic variation in social vulnerability. According to the index, the following, listed in order, are South Dakota's most socially vulnerable counties (i.e., they rank in the top 20 percent in the state):

- Buffalo
- Todd
- Shannon*
- Jackson
- Mellette
- McPherson
- Bennett
- Ziebach*
- Corson
- Fall River
- Dewey
- Charles Mix
- Bon Homme
- Roberts

*Note: An asterisk (*) denotes counties that are among the 10 fastest growing counties in the state. The counties of Potter, Faulk, Lyman, Gregory, Jerauld, Walworth, Douglas, Day, Hyde, Hand, Hutchinson, Tripp, Marshall, Perkins, Spink, and Edmunds also rank in the top 20 percent in the nation in terms of social vulnerability.

Figure 3-52 Social Vulnerability to Environmental Hazards, County Comparison within the State, 2006-2010



3.3.3 Federal Disaster Declaration History and Analysis

Another indicator of vulnerability by jurisdiction is looking at the pattern of past disaster declarations by county across the State. FEMA Region VIII made available summary counts of the number of Individual Assistance (IA) and Public Assistance (PA) claims. These summaries are presented on the maps in Figure 3-53 and Figure 3-54 for the time period of July 1993 to May 2009 for the IA claims and 2008 to 2012 for the PA claims. 2011 IA claims numbers were not available at the time the 2014 plan update was written. A limitation of the data used to generate the PA claims map is that several events were listed as occurring “statewide,” and thus not all claims were able to be linked to a County. A total of 1,091 statewide claims are not represented in the figures or tables in this report due to the inability to tie those events to individual counties. It is worth noting that Custer and Walworth counties have never had any PA claims. As of the writing of the 2011 plan, Campbell, Corson, Hyde, and Union did not have any PA claims but do as of 2013. In Perkins County, multiple power line issues lead to high amounts of PA claims.

Table 3-43 summarizes the IA claims information for the FEMA-1984-DR, the most recent major disaster declaration in South Dakota. Table 3-44 summarizes PA claims data for major disaster declarations in South Dakota since 2008. IA and PA claim data for FEMA-4115-DR, FEMA-4125-DR, FEMA-4137-DR, and FEMA-4155-DR will be included in the next plan update.

Based on this data the majority of PA funding is for public utilities damage and emergency protective measures. Detailed data on PA claims was obtained for disaster declarations 1844, 1886, 1887, 1914, 1915, 1929, 1938, and 1947. 494 public utilities claims were made for all eight of these disaster declarations combined. This included 403 claims involving downed power lines, broken power poles, or disrupted electrical distribution/transmission lines; 62 claims involving water, wastewater, or sewage; 13 claims involving communication lines or towers; and 16 claims categorized as "other." This indicates that the State is actively investing hazard mitigation funding into electric utilities, which appears to be a worthwhile investment given patterns of past damages and claims. See the discussion on Rural Electric Cooperatives later in this section for more on the use of PA Section 406 funding and Hazard Mitigation Grant Program funding used to assist with mitigation and retrofitting of power infrastructure.

Table 3-43 IA Claims Summary for FEMA-1984-DR

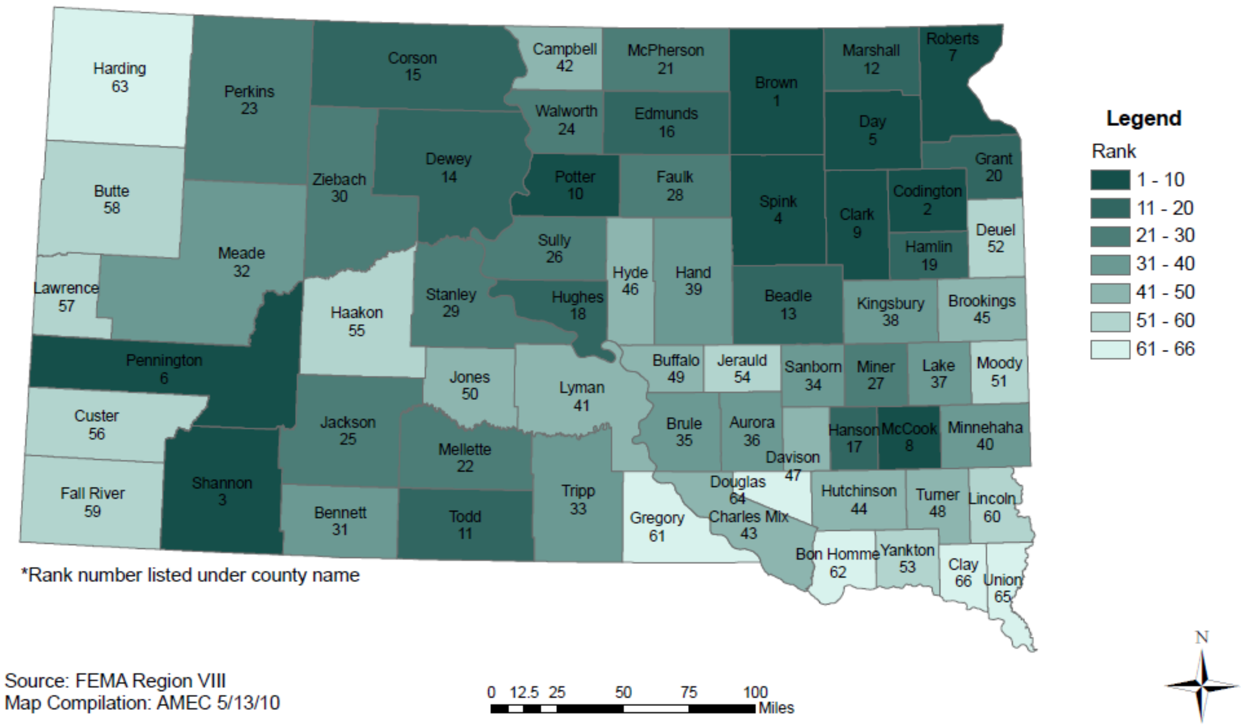
County	Sum of Eligibility Amount
Charles Mix	$14,772
Hughes	$913,770
Stanley	$1,379,925
Union	$2,236,771
Yankton	$164,717
TOTAL	**$4,709,955**

Table 3-44 PA Claims Summary for FEMA Disaster Declarations 1759, 1774, 1811, 1844, 1886, 1887, 1914, 1915, 1929, 1938, and 1947*

Categories	Total Requested (100% PWs)	Federal Share Requested (75% of total)	Non-Federal Share (25% of total)
Debris Removal	$5,831,419	$4,373,565	$1,457,855
Protective Measures	$60,198,373	$45,148,781	$15,049,592
Roads and Bridges	$54,548,619	$40,911,472	$13,637,148
Water Control Facilities	$3,730,907	$2,798,181	$932,727
Public Buildings	$866,765	$650,074	$216,691
Public Utilities	$85,250,253	$63,937,690	$21,312,563
Recreational or Other	$686,781	$515,086	$171,695
Total PWs	**$211,113,118**	**$158,334,847**	**$52,778,271**
Grantee Admin Cost*	$0	$0	$0
Subgrantee Admin Cost*	$0	$0	$0
State Management*	$421,482	$414,414	$7,068
Total Administrative Cost*	$421,482	$414,414	$7,068
Grand Total	**$211,534,600**	**$158,749,261**	**$52,785,339**

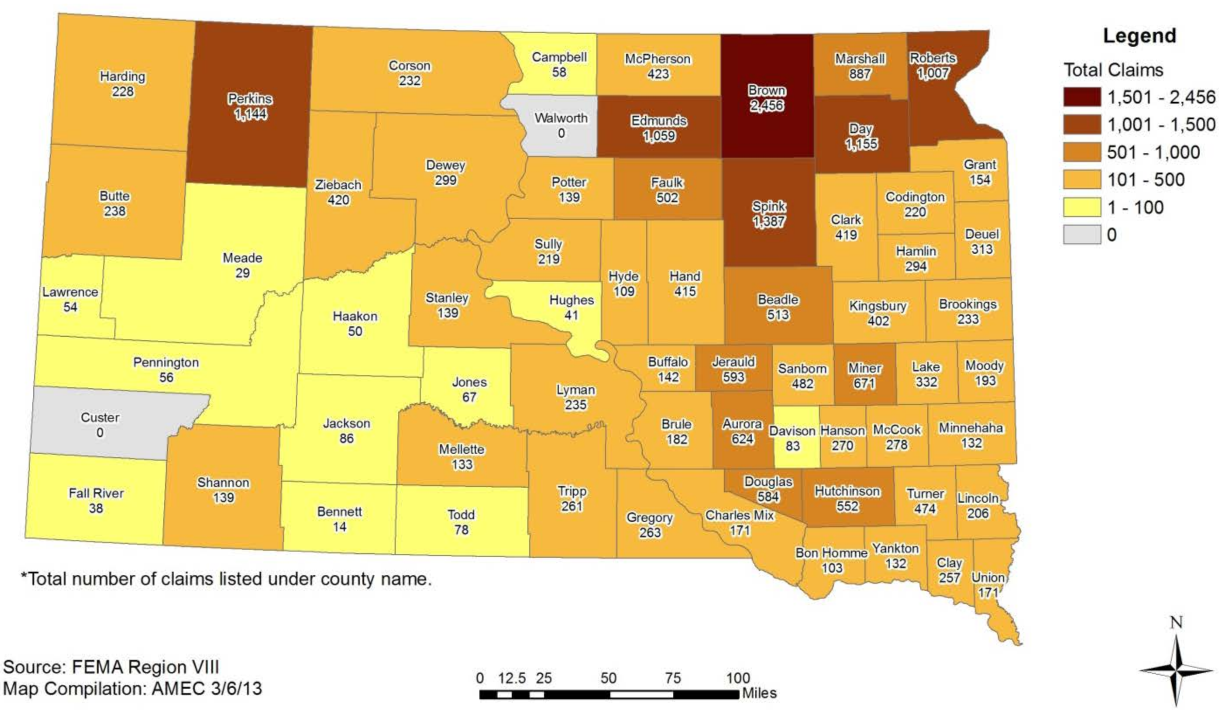
*Not broken down into 75% federal share, 25% non-federal share
*FEMA-1984-DR was not included as it was IA only

Figure 3-53 FEMA Individual Assistance Claims 1993-2009



Source: FEMA Region VIII

Figure 3-54 FEMA Public Assistance Claims 2008-2012



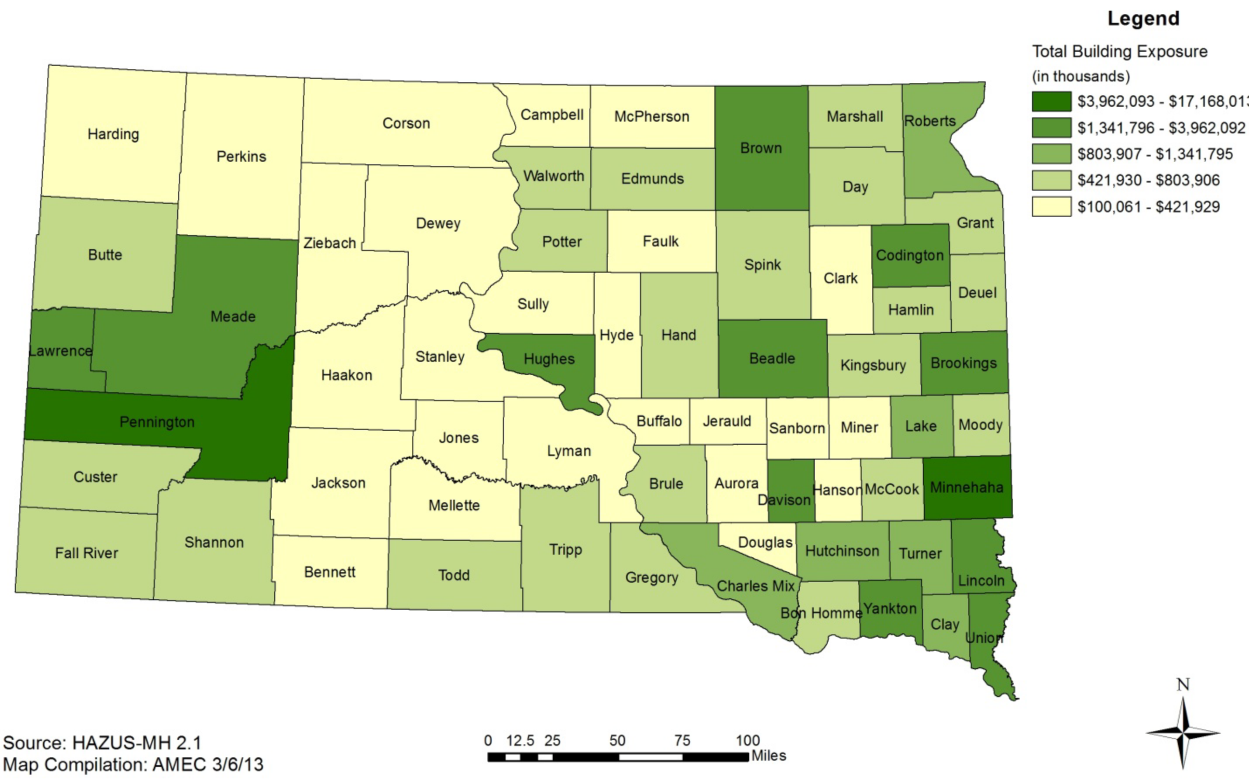
Source FEMA Region VIII

3.3.4 Building Exposure

Exposure is a term borrowed from the insurance industry as a measure of property "exposed" to a particular hazard. HAZUS-MH Version 2.0 building inventory data provided the basis for measuring the number and value of buildings vulnerable to hazards. There are an estimated 406,141 buildings in South Dakota with a total building replacement value (excluding contents) of $79,488,700,000. Approximately 92 percent of the buildings (and 70 percent of the building value) are associated with residential housing. Figure 3-55 shows a thematic map at how building exposure varies by county across the state.

In terms of a catastrophic event, the entire building inventory could be at risk to a hazard. An event that would destroy or damage the entire inventory in a given county is unlikely, but it is possible that a tornado impacting the heart of a rural community could result in considerable building losses.

Figure 3-55 Building Exposure



3.3.5 Floods

Nearly every county in South Dakota is vulnerable to floods. South Dakota's January 2004 Map Modernization Plan divides the state into five regions based on population and flooding hazards. The priority regions and the jurisdictions associated with those regions are:

- **Priority 1: Big Sioux Region**—Brookings, Clark, Clay, Codington, Day, Deuel, Grant, Hamlin, Hutchinson, Kingsbury, Lake, Lincoln, Marshall, McCook, Miner, Minnehaha, Moody, Roberts, Turner, Union, and Yankton.

- **Priority 2: James Region**—Aurora, Beadle, Bon Homme, Brown, Brule, Buffalo, Campbell, Charles Mix, Davison, Douglas, Edmunds, Faulk, Hand, Hanson, Hughes, Hyde, Jerauld, McPherson, Potter, Sanborn, Spink, Sully, and Walworth*.
- **Priority 3: Grand/Moreau Region**—Butte, Corson, Dewey, Harding, Meade, Perkins, and Ziebach.
- **Priority 4: Cheyenne Region**—Custer, Fall River, Haakon, Lawrence, Pennington, Shannon, and Stanley.
- **Priority 5: White/Bad Region**—Bennett, Gregory, Jackson, Jones, Lyman, Mellette, Todd, and Tripp.

The following section describes progress the State has made developing vulnerability and loss estimates for the highlighted counties. Future updates to this plan will include additional vulnerability analyses as more DFIRMs become available and as more resources for HAZUS-MH studies are obtained.

3.3.5.1 Methodology

Planning level flood loss estimates were made available for every county in South Dakota with the 2011 update to the South Dakota Hazard Mitigation Plan. These estimates were still relevant for the 2014 update. FEMA used HAZUS-MH MR2 to model the 100-year floodplain and perform associated building and population risk assessments. HAZUS-MH is FEMA's GIS-based natural hazard loss estimation software. The HAZUS-MH flood model results included analysis for each of the 66 counties modeling streams draining a 10 square mile minimum drainage area, using 30 meter (1 arc second) Digital Elevation Models (DEM). Hydrology and hydraulic processes utilize the DEMs, along with flows from USGS regressions and gauge data, to determine reach discharges and to model the floodplain. Losses are then calculated using HAZUS-MH national baseline inventories (buildings and population) at the census block level.

HAZUS-MH produces a flood polygon and flood-depth grid that represents the 100-year floodplain. The 100-year floodplain represents a flood that has a 1% chance of being equaled or exceeded in any single year. While not as accurate as official flood maps, these floodplain boundaries are available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program. HAZUS-MH generated damage estimates are directly related to depth of flooding and are based on FEMA's depth-damage functions. For example, a two-foot flood generally results in about 20 percent damage to the structure (which translates to 20 percent of the structure's replacement value). The HAZUS-MH flood analysis results provide number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory. Building damage can cause additional losses to a community as a whole by restricting the building's ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses.

Data Limitations: Potential losses derived from HAZUS-MH used default national databases and may contain inaccuracies; loss estimates should be used for planning level applications only. There could also be errors and inadequacies associated with the hydrologic and hydraulic modeling of the HAZUS-MH model. In rural South Dakota, census blocks are large and often sparsely populated or developed; this may create inaccurate loss estimates. HAZUS-MH assumes population and building inventory to be evenly distributed over a census block; flooding may occur in a small section of the census block where there are not actually any buildings or people, but the model assumes that there is damage to that block.

In addition, excessive flood depths may occur due to problems with a DEM or with modeling lake flooding. Errors in the extent and depth of the floodplain may also be present from the use of 30 meter digital elevation models. HAZUS-MH Level II analyses based on local building inventory, higher resolution terrain models, and DFIRMs could be used in the future to refine and improve the accuracy of the results. Another limitation is that HAZUS does not model lake shore flooding and may not represent the closed basin flooding scenarios common in South Dakota, as in Brown County. HAZUS level 1 modeling does not account for levee protection.

HAZUS-MH building data is based on average housing costs and 2000 census counts. There may be errors within the HAZUS-MH data itself. The size and shape of the census block affects the accuracy of this model. The larger and more irregular the census block, typically found in rural areas, the less accurate this method becomes. There could be spatial inaccuracies with DFIRM data, or the data may not include all the possible flood hazards within a particular county. This model may include structures within the 100-year floodplain (A Zone) that may be elevated above the level of the base flood elevation, according to local floodplain development requirements. This model may not reflect actual real world conditions, but it does serve as a basis to quantify the possible risk from floods, using the best available data.

HAZUS-MH produces a flood polygon and flood-depth grid that represents the base flood. While not as accurate as official flood maps, such as digital flood insurance rate maps, these floodplain boundaries are available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program. A statewide digital flood hazard layer was created by appending floodplain boundaries created in each county run and is displayed in Figure 3-57. Figure 3-58 and Figure 3-59 show sample HAZUS-MH flood hazard outputs. Figure 3-56 shows the current extent of effective DFIRMs in the State.

Figure 3-56 South Dakota Digital Flood Insurance Rate Map Coverage 2012

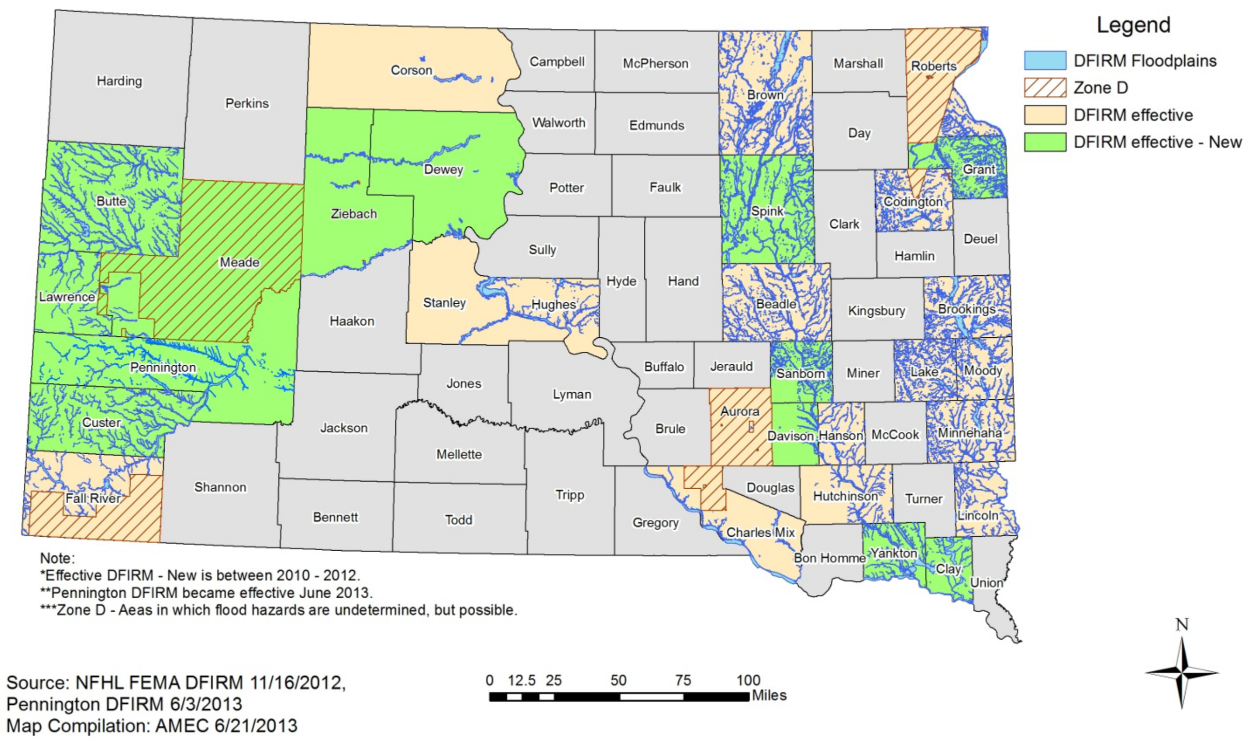


Figure 3-57 South Dakotas 100-year Flood Zones based on HAZUS

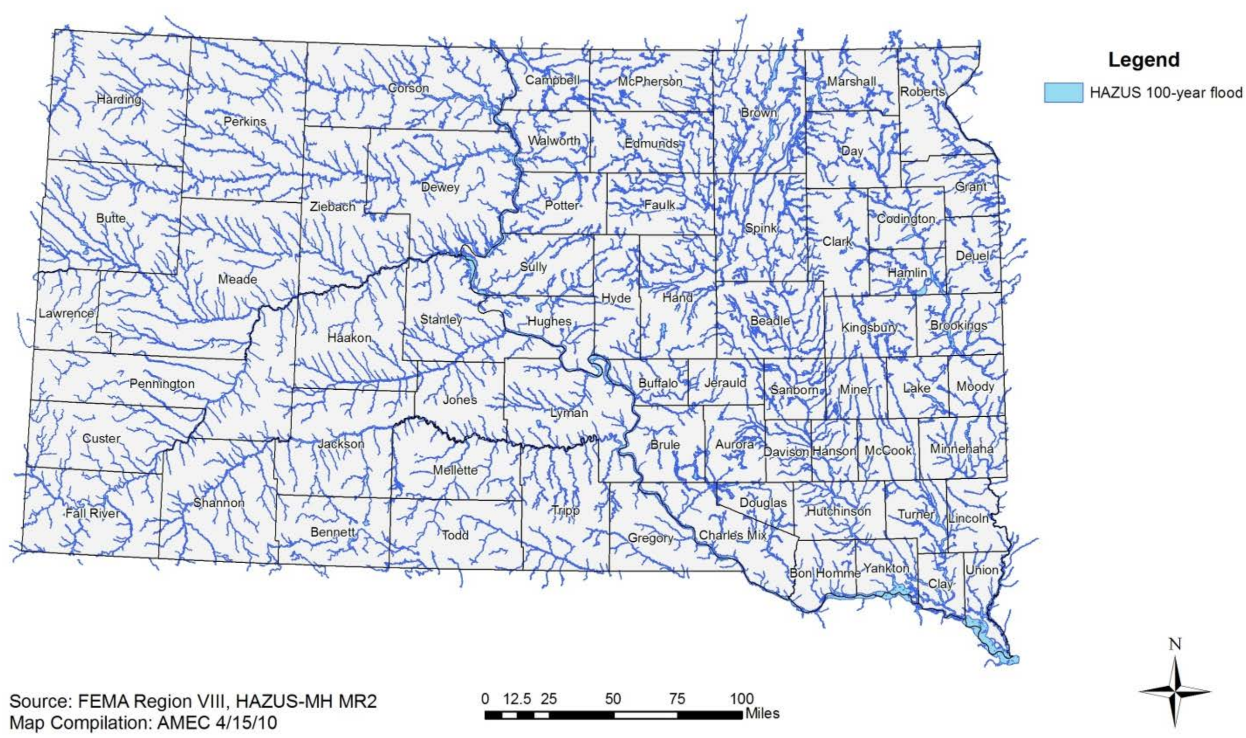


Figure 3-58 Example of a Floodplain Depth Grid Output by HAZUS-MH Minnehaha County

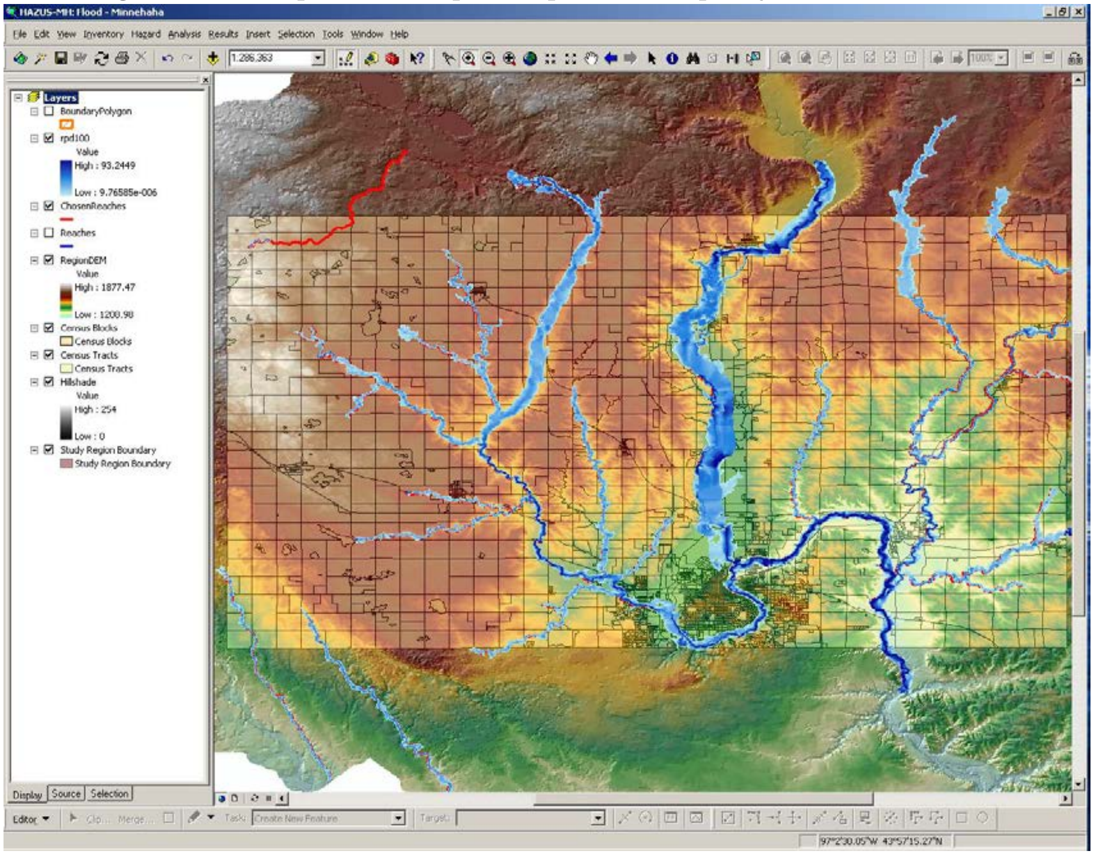
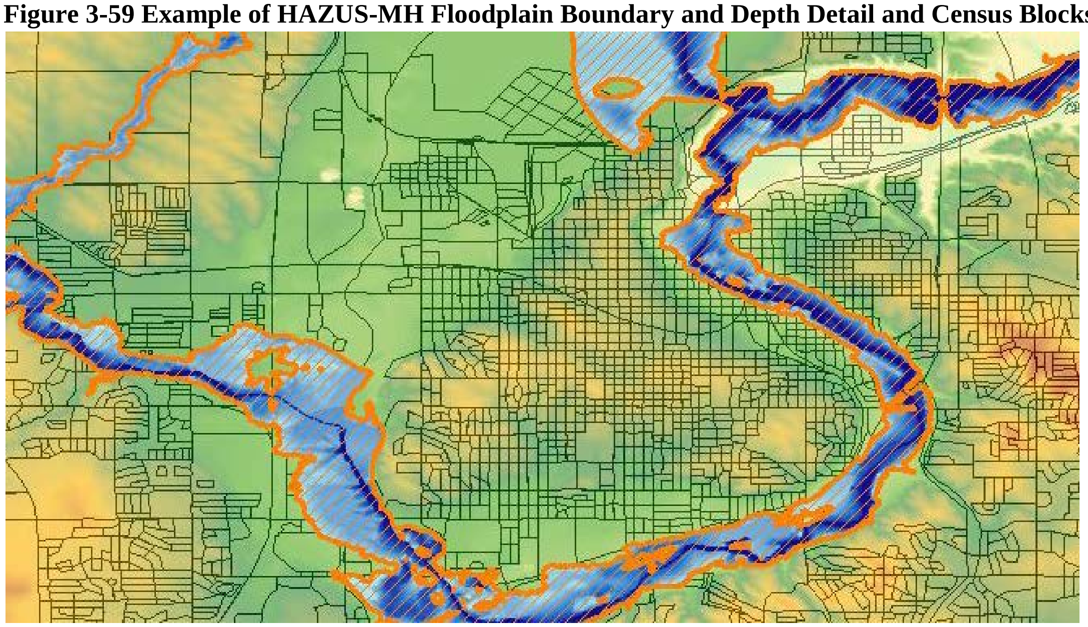


Figure 3-59 Example of HAZUS-MH Floodplain Boundary and Depth Detail and Census Blocks – Sioux Falls



HAZUS-MH can analyze additional impacts, including what type of infrastructure could be affected and how severely. Project files for the studied counties are available for use by local governments and the state if more details on the impacts discussed here, or information about other impacts, such as vehicle losses, agricultural losses, utility system losses, essential facility impacts, and transportation impacts, are desired.

3.3.5.2 Vulnerable Jurisdictions and Potential Losses

The intent of this analysis was to enable the state to estimate where flood losses could occur and quantify the degree of severity using a consistent methodology. The computer modeling helps quantify risk along known flood hazard corridors such as along the James, Big Sioux, and Vermillion rivers. In addition, flood losses are estimated for certain lesser streams and rivers where the flood hazard may not have been previously studied.

HAZUS-MH impact analyses were run for direct economic losses for buildings and societal impacts (displaced people and shelter needs) to display the relative ranking of counties based on these risk indicators (these losses and impacts are illustrated in the tables that follow). The primary indicators used to assess flood losses were:

- Direct building losses combined with income losses,
- Loss ratio of the direct building losses compared to overall building inventory,
- Loss ratio of building contents compared to overall building inventory, and
- Population displaced by the flood and shelter needs.

The results, shown in Table 3-45, Figure 3-60, Figure 3-61, Figure 3-62, and Figure 3-63, display the potential base flood losses to all counties. More detailed results are in Appendix 3B. The results show potential losses as highest in Minnehaha, Union, Yankton, Pennington, Codington, Lawrence and Brown counties. Floods in these counties have the potential to displace at least a thousand persons in each county. Statewide there is the potential for $1.7 Billion in flood losses from the 1% annual chance flood.

Based on the loss ratio, which is the percent of the total building inventory value that could be damaged from flooding in any given year, Union, Yankton, Fall River and Campbell Counties are most at risk and may have difficulty recovering from a flood event. Note that Union County does contain levees (see the flood hazard profile section), which is likely being ignored by HAZUS. The results presented for Union County may be more representative of a levee failure scenario.

Table 3-45 HAZUS-MH Base Flood (1 Percent Chance) Loss Estimation Results: Impacts by County, Ranked by Highest Building Losses

County Name	Building Damage Count	Building Damage Loss ($K)	Building Damage Loss Ratio*	Contents Damage Loss ($K)	Contents Loss Ratio	Total Direct Econ Bldg Loss **($K)	Short Term Shelter Needs	Displaced Population
Minnehaha	719	162,527	1.6%	252,358	3.6%	432,484	6,159	7,482
Union	867	119,836	11.6%	203,473	25.4%	349,991	3,451	4,428
Yankton	713	81,492	5.6%	105,103	9.7%	193,250	2,614	3,328
Pennington***	88	15,085	0.32%	33,970	0.4%	113,162	888	1,301
Codington	221	28,917	1.7%	48,403	3.9%	81,843	2,301	3,027

County Name	Building Damage Count	Building Damage Loss ($K)	Building Damage Loss Ratio*	Contents Damage Loss ($K)	Contents Loss Ratio	Total Direct Econ Bldg Loss **($K)	Short Term Shelter Needs	Displaced Population
Lawrence	72	20,631	1.5%	28,237	3.0%	50,103	504	979
Brown	71	16,502	0.7%	22,083	1.4%	40,502	854	1,785
Stanley	131	14,974	9.2%	11,356	10.9%	26,644	340	666
Fall River	92	14,007	3.2%	20,735	7.5%	36,379	250	525
Butte	24	9,890	2.3%	10,891	4.0%	21,428	271	892
Lake	72	8,740	1.1%	11,306	2.1%	20,840	664	1,128
Shannon	34	8,180	2.5%	11,173	5.1%	20,430	492	1,214
Lincoln	26	7,275	0.5%	6,826	0.7%	14,514	210	524
Spink	15	6,474	1.3%	7,554	2.4%	14,644	217	572
Davison	24	6,417	0.6%	6,297	0.8%	13,185	216	530
Hutchinson	29	5,799	1.2%	9,436	2.6%	16,001	646	957
Turner	12	5,659	0.9%	7,748	1.9%	14,191	39	391
Hamlin	18	5,398	1.4%	9,963	4.0%	16,441	31	387
Custer	6	5,092	1.1%	10,476	3.7%	16,746	44	257
Meade	8	4,808	0.4%	6,458	0.8%	11,765	106	469
Brookings	7	4,563	0.3%	9,953	0.8%	15,476	383	943
Grant	22	4,422	0.9%	4,652	1.4%	9,592	97	415
Charles Mix	4	4,020	0.7%	5,337	1.4%	9,842	46	232
Aurora	17	3,914	2.0%	5,561	4.5%	10,125	101	481
Haakon	13	3,761	2.6%	5,756	5.3%	10,151	78	303
Beadle	6	3,673	0.3%	6,000	0.8%	10,393	64	387
Tripp	31	3,470	0.9%	3,446	1.3%	7,248	86	265
Campbell	37	3,393	3.2%	5,017	7.1%	8,813	124	383
Lyman	13	3,267	1.5%	3,329	2.3%	6,876	38	145
McCook	18	3,257	0.9%	2,680	1.1%	6,096	65	252
Hughes	7	3,195	0.3%	5,319	0.7%	8,871	297	611
Clay	18	2,952	0.4%	2,268	0.5%	5,327	88	248
Roberts	8	2,903	0.5%	3,991	1.0%	7,273	36	320
Edmunds	30	2,718	1.0%	2,526	1.4%	5,461	156	293
Todd	9	2,227	0.8%	3,458	1.9%	5,723	105	314
Corson	16	2,089	1.5%	1,711	1.9%	3,894	285	446
Hand	9	2,083	0.7%	1,931	1.0%	4,161	39	197
Moody	2	2,072	0.5%	1,949	0.8%	4,220	9	216
Bon Homme	7	1,815	0.4%	1,870	48.9%	3,828	37	117
Day	5	1,649	0.3%	1,386	0.5%	3,187	10	157
Dewey	3	1,532	0.8%	981	0.9%	2,557	31	166
Miner	9	1,527	0.8%	1,685	1.4%	3,363	66	159

County Name	Building Damage Count	Building Damage Loss ($K)	Building Damage Loss Ratio*	Contents Damage Loss ($K)	Contents Loss Ratio	Total Direct Econ Bldg Loss **($K)	Short Term Shelter Needs	Displaced Population
Mellette	14	1,501	1.9%	817	1.6%	2,331	109	223
Brule	1	1,423	0.4%	1,813	0.7%	3,498	19	151
Ziebach	8	1,403	2.1%	749	1.9%	2,158	75	191
Deuel	2	1,386	0.5%	2,256	1.2%	3,922	34	154
Hanson	0	1,368	0.8%	1,029	0.9%	2,473	3	94
Kingsbury	0	1,366	0.3%	2,080	0.8%	3,672	48	281
Perkins	0	1,293	0.6%	982	0.7%	2,339	-	76
Faulk	4	1,275	0.8%	1,592	1.4%	3,056	94	179
Clark	2	1,208	0.5%	1,880	1.1%	3,328	45	159
Bennett	0	1,165	1.0%	1,808	2.3%	3,145	2	71
Sanborn	0	1,121	0.7%	1,121	1.0%	2,400	3	142
Marshall	0	1,062	0.3%	1,052	0.5%	2,223	7	143
Douglas	5	984	0.5%	1,163	0.9%	2,342	14	152
Walworth	0	780	0.2%	786	0.3%	1,632	-	63
Jackson	0	702	0.6%	723	1.0%	1,445	3	69
Buffalo	1	645	1.1%	631	1.5%	1,347	30	79
McPherson	0	628	0.3%	815	0.6%	1,545	4	95
Jerauld	0	591	0.3%	833	0.7%	1,534	8	77
Potter	0	537	0.2%	781	0.4%	1,416	1	44
Harding	0	504	0.6%	516	1.0%	1,045	2	43
Sully	0	502	0.4%	456	0.6%	1,016	1	42
Gregory	0	474	0.2%	254	0.1%	731	-	44
Hyde	0	292	0.3%	370	0.5%	709	-	39
Jones	1	288	0.4%	243	0.5%	551	-	17
	3,571	634,703	1.3%	929,402	3%	1,706,878	22,876	40,598

Source: FEMA Region VIII HAZUS-MH MR2 Notes:
*Loss ratio is the percent of the total building inventory value that could be damaged from flooding in any given year.
**Total Direct Economic loss includes relocation loss, capital-related loss, wages loss, rental income loss and building loss.
***Added from South Dakota Emergency Management HAZUS run to account for problem reach in FEMA analysis

Figure 3-60 HAZUS-MH Base Flood (1 Percent Chance) Building and Income Loss Estimation by County

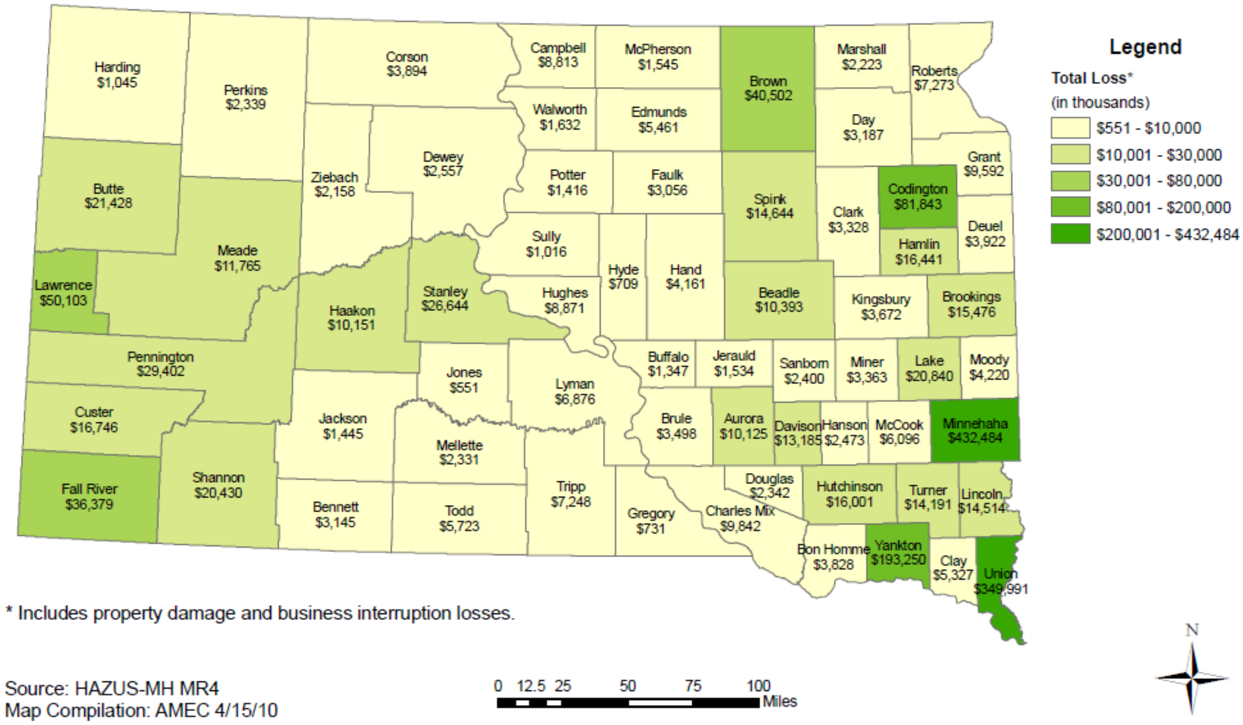


Figure 3-61 HAZUS-MH Base Flood (1 Percent Chance) Building Loss Ratio

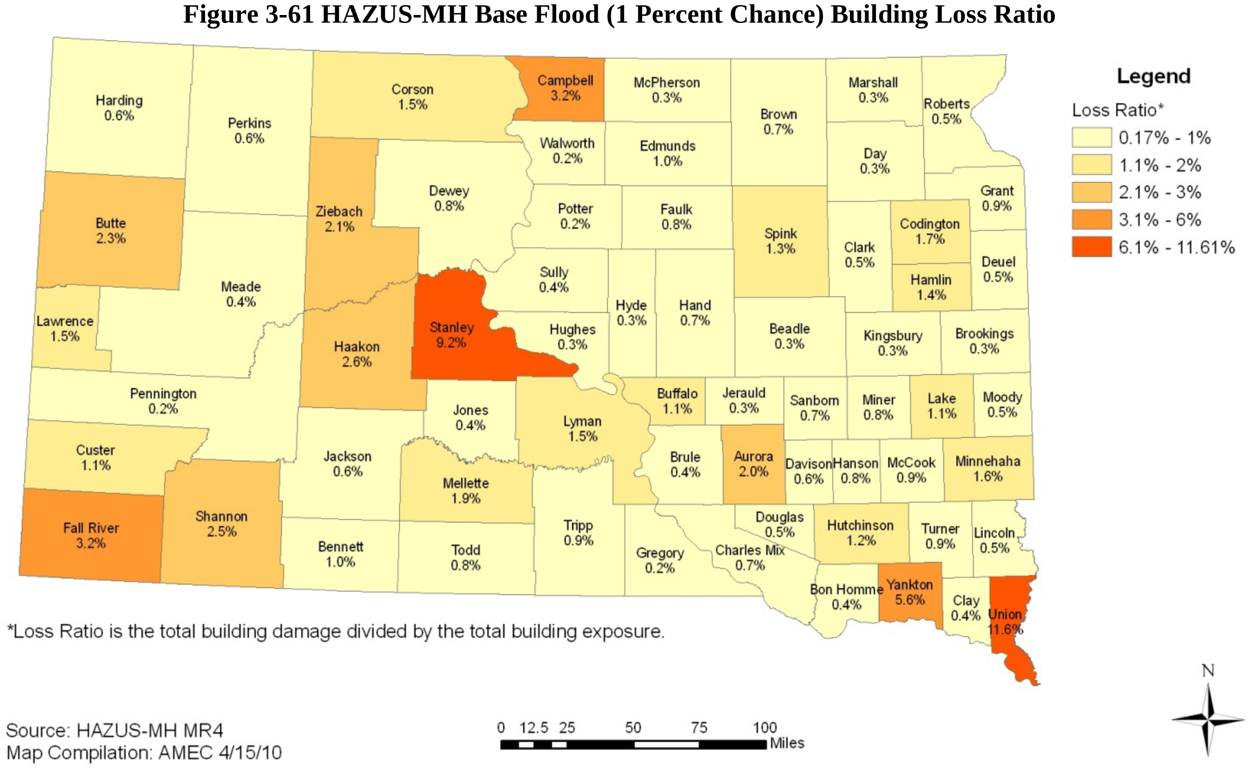


Figure 3-62 HAZUS-MH Base Flood (1 Percent Chance) Content Loss Ratio

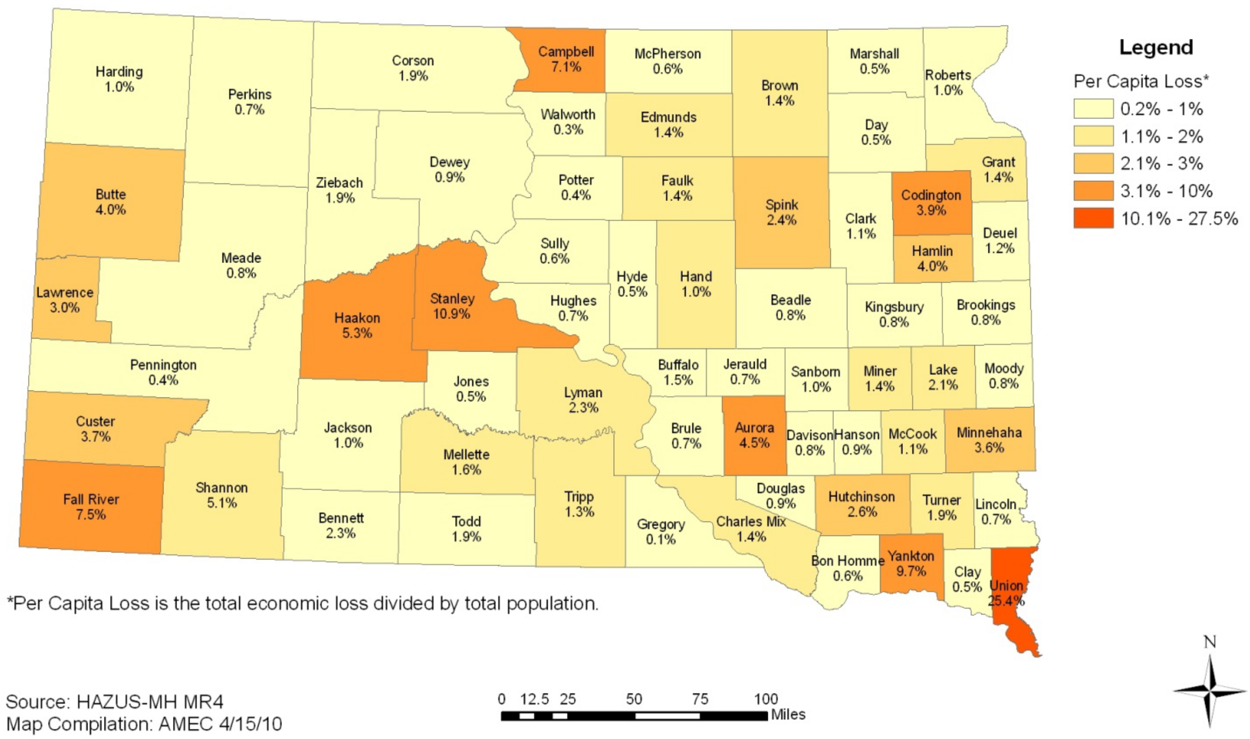
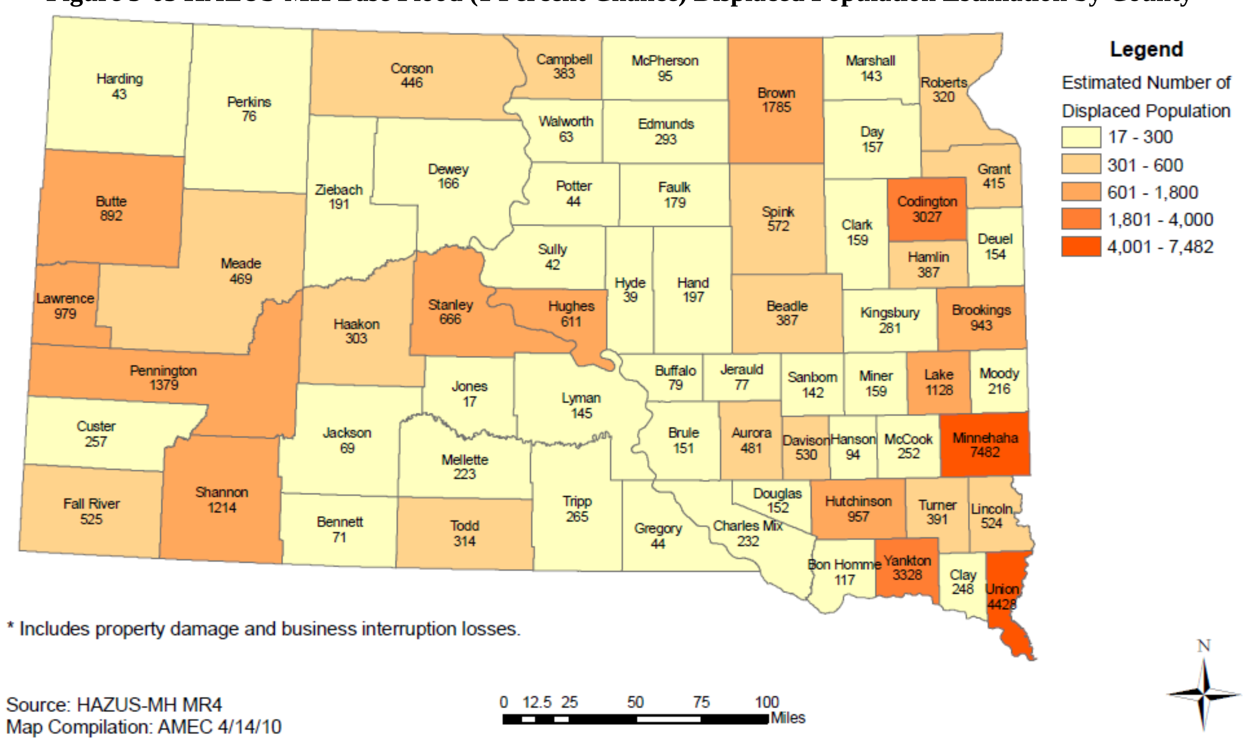


Figure 3-63 HAZUS-MH Base Flood (1 Percent Chance) Displaced Population Estimation by County



A separate methodology was used in 2007 and updated in 2013 to analyze those counties with existing DFIRMs. Using GIS, the DFIRM special flood hazard area boundaries were overlaid on HAZUS-MH building inventory, which is linked to census block geography. A proportional division was performed to account for blocks that were split by flood boundaries, and to better model values in the floodplain. For example, a census block that was split in two by a floodplain (50 percent in, 50 percent out) had its building count and valuation attributes multiplied by .50. From this method, information on the number of buildings and building replacement value at risk could be estimated by county and by flood zone.

The DFIRM loss estimation results are presented separately in Table 3-46. The DFIRM floodplains should be more accurate, but in some cases not as extensive, as the HAZUS-MH generated floodplains. Some DFIRMs are community-based only and do not cover the entire county.

Table 3-46 Digital Flood Insurance Rate Maps Base Flood (1 Percent Chance) Loss Estimations

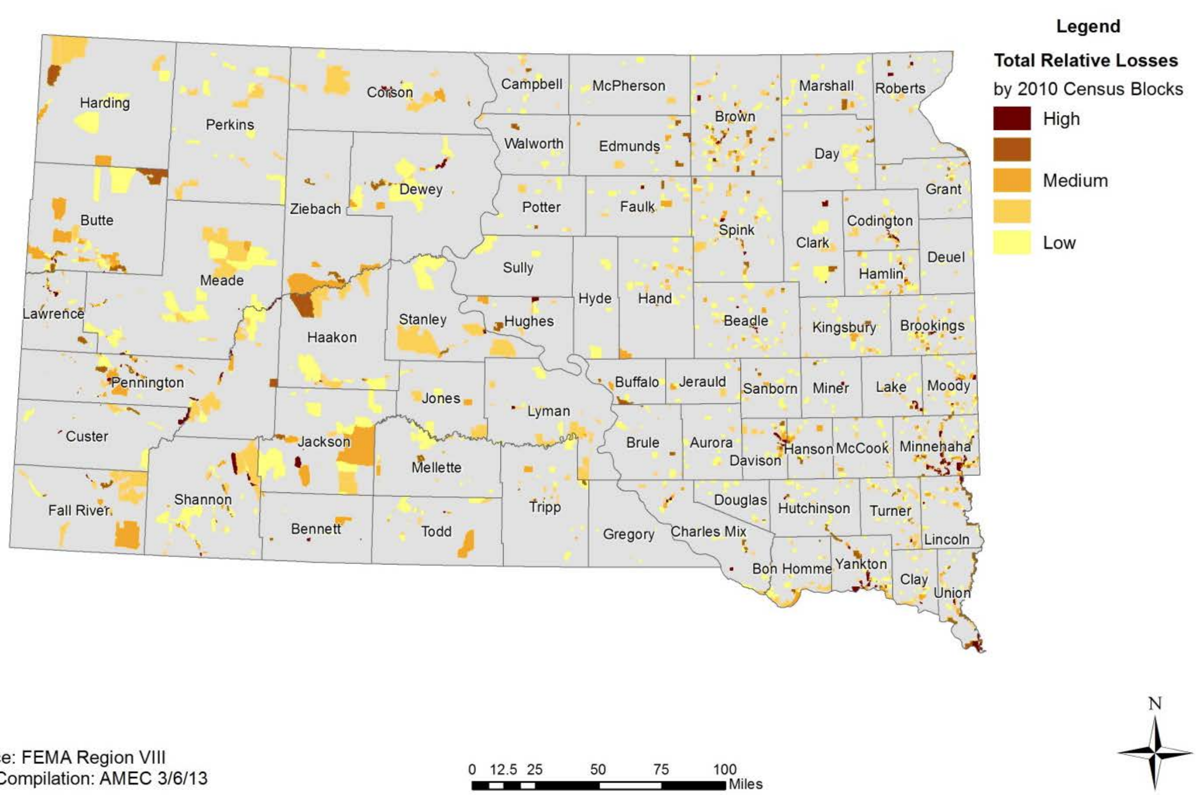
County	Percent of County in Floodplain	Building Count	Total Exposure	Estimated Flood Loss
Minnehaha	12.86%	4,508	$1,700,878,282	$425,219,570
Pennington	2.26%	2,627	$554,516,791	$138,629,198
Codington	3.70%	1,961	$387,336,901	$96,834,225
Brown	13.56%	1,534	$278,794,681	$69,698,670
Brookings	8.99%	1,088	$202,465,157	$50,616,289
Yankton	11.93%	824	$192,415,451	$48,103,863
Lawrence	1.22%	903	$162,485,138	$40,621,284
Meade	1.63%	709	$148,200,897	$37,050,224
Lake	3.88%	747	$121,188,376	$30,297,094
Hughes	2.67%	354	$95,424,076	$23,856,019
Lincoln	5.23%	444	$88,456,803	$22,114,201
Custer	1.71%	449	$88,280,833	$22,070,208
Stanley	1.82%	558	$73,146,476	$18,286,619
Roberts	10.08%	464	$69,161,018	$17,290,255
Moody	8.70%	445	$59,291,843	$14,822,961
Spink	7.22%	414	$55,893,903	$13,973,476
Butte	1.44%	408	$55,729,397	$13,932,349
Fall River	2.02%	238	$55,237,998	$13,809,500
Beadle	6.56%	394	$51,825,695	$12,956,424
Davison	11.42%	297	$50,427,520	$12,606,880
Grant	2.05%	313	$49,909,217	$12,477,304
Hutchinson	8.46%	198	$29,063,726	$7,265,932
Sanborn	3.28%	168	$23,740,640	$5,935,160
Charles Mix	12.22%	164	$21,228,852	$5,307,213
Clay	21.00%	137	$18,929,360	$4,732,340
Aurora	11.17%	66	$9,353,611	$2,338,403
Hanson	7.93%	91	$8,802,869	$2,200,717
Corson	3.67%	70	$7,451,377	$1,862,844
Ziebach	4.33%	71	$5,565,882	$1,391,471

County	Percent of County in Floodplain	Building Count	Total Exposure	Estimated Flood Loss
Dewey	4.50%	49	$4,629,792	$1,157,448

Source: Building value is from HAZUS-MH. Estimated flood loss is 25 percent of total value.

In 2009-2010 FEMA conducted a Hazus Flood Average Annualized Loss (AAL) study which was performed for the entire continental United States using the MR4 release of Hazus-MH. The analysis was performed at the county level using Level 1 methodology with national datasets. FEMA subsequently revised the study as the initial AAL costs appeared to over-estimate the average annual loss potential in most areas. The revised results were obtained from FEMA Region VIII during the 2014 update to this plan and compared with the previous 1% annual chance Hazus analysis included from the 2011 update. AAL total losses for the state are estimated to be $45,996,000 based on this study. FEMA staff indicated that this loss estimate could be high. Based on updated NCDC data (see the flood hazard profile) alone AAL is $15.5 M, and about $1M based on NFIP claims data. The 1% annual chance total losses associated with the AAL study are $817,993,000. Based on the previous HAZUS Level 1 studies done in the 2011 plan (including buildings, contents and economic loss) the 1% annual chance $1.7 billion in flood losses for the state. It was determined that the existing level 1 HAZUS for the 1% annual chance flood (100-year) was still valid. Based on FEMA staff recommendations the AAL loss data is being used for relative risk comparisons only, and is illustrated on a loss by census block basis in the following figure.

Figure 3-64 Hazus MH Flood Average Annualized Loss



3.3.5.3 Flood Insurance Claims Analysis

In addition to the HAZUS-MH flood runs and local plans, the state analyzed National Flood Insurance Program (NFIP) flood-loss data to determine areas of South Dakota with the greatest flood risk. South Dakota flood-loss information was obtained from FEMA's "NFIP Policy and Claims Report" for South Dakota, which documents losses from 1978. This section was updated based on information obtained from FEMA dated November 20, 2012.

There are several limitations to analyzing flood risk entirely on this data, including:

- Only losses to participating NFIP communities are represented,
- Communities joined the NFIP at various times since 1978,
- The number of flood insurance policies in effect may not include all structures at risk to flooding, and
- Some of the historical loss areas have been mitigated with property buyouts.

Despite these limitations, the data depict a pattern of historical flood losses in the state. The greatest losses have been in Codington, Union, and Hamlin counties. Table 3-47 shows the details of the 10 South Dakota counties with the greatest historical dollar losses. Union County was not within the top ten list in the 2011 plan update, but is now number two behind Codington County. Codington remains the leader in terms of overall dollars paid. Codington's polices, however, decreased from 835 in 2010 to 704.

Table 3-47 Top 10 Counties for Flood Insurance Dollars Paid (Historical), 1978 - 2012

County	Dollars Paid ($ Historical)	Flood Claims	Current Policies	Coverage ($)
Codington	$5,749,018	425	706	$117,682,000
Union	$4,335,281	394	518	$158,992,300
Hamlin	$4,187,791	345	103	$22,031,700
Day	$3,951,436	252	47	$7,360,800
Brown	$3,284,315	482	429	$80,478,000
Minnehaha	$2,518,709	235	1,424	$360,821,600
Stanley	$2,444,199	110	148	$36,934,000
Lincoln	$1,961,278	118	1,371	$364,899,000
Lake	$1,419,607	152	216	$34,953,800
Spink	$921,480	69	47	$7,626,100

Source: FEMA, "NFIP Insurance Report," February 13, 2013

Information about flood insurance losses and policies for all South Dakota counties is in Appendix 3C. Based on this data the average annual insured losses are about $1 million.

3.3.5.4 Repetitive Loss Analysis

A high priority in South Dakota and nationwide is the reduction of losses to repetitive loss structures. These structures strain the National Flood Insurance Fund. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. At least two of the claims must be more than 10-days apart."

Table 3-48 illustrates the number and location (county) of South Dakota's 181 repetitive loss properties. The table ranks counties by repetitive loss dollars paid. Codington, Day, and Hamlin counties are the top three. The numbers from the 2010 and 2007 plans have been preserved to show changes in the past 6 years. Note the increase in repetitive loss claims for several counties, likely due to the 2011 floods and to second homes. The State does not buyout second homes. Multiple buyouts in Day County are in process. Several new counties were added to this list, including Spink, Roberts, Brookings, Turner, Marshall, Pennington, Meade, Yankton, Butte, Hanson, Clay, and McCook. This indicates that repetitive loss property counts are increasing across the State.

Table 3-48 NFIP Policies and Repetitive Loss Summary by County (Ranked by Total Repetitive Loss Dollars Paid)

County*	Total Current Policies 2010	Total Current Policies 2012	Total Flood Claims since 1978	2012 Total Flood Claims since 1978	Total Dollars Paid ($ Historical) 2010	2012 Total Dollars Paid ($ Historical)	2007 # of RL Properties**	2010 # of RL Properties	2012 # of RL Properties	2007 # of RL Claims	2010 # of RL Claims	2012 # of RL Claims	2010 RL Dollars Paid ($ Historical)	2012 RL Dollars Paid ($ Historical)
Codington	835	706	359	425	5,225,806	5,749,018	33	33	39	74	72	95	1,427,850	1,872,695
Hamlin	159	103	150	345	1,050,799	4,187,791	4	4	41	9	9	90	185,508	1,599,878
Day	71	47	166	252	1,883,101	3,951,436	8	9	21	16	18	43	359,057	1,186,524
Spink		47		69		921,480			8			19		446,931
Minnehaha	1,352	1,424	120	235	836,205	2,518,709	10	10	17	21	21	41	94,423	266,517
Brown	588	429	452	482	2,826,266	3,284,315	7	10	14	14	21	29	162,871	206,324
Charles Mix	9	10	3	4	239,659	265,077	0	1	1	0	2	3	156,344	181,763
Moody	32	34	41	58	224,909	455,782	3	3	7	7	8	19	81,815	180,728
Clark	13	13	8	11	162,850	184,850	1	2	2	2	4	5	78,954	117,455
Beadle	19	19	12	21	281,396	327,076	0	1	2	0	3	6	43,389	116,289
Roberts		70		58		584,782			4			8		99,611
Brookings		202		80		803,195			3			7		96,691
Lake	196	216	105	152	941,529	1,419,607	3	3	3	6	6	6	81,511	81,511
Hughes	67	94	39	80	206,061	666,910	2	2	4	4	4	8	36,385	75,263
Grant	44	41	22	24	198,277	206,990	2	2	2	4	5	5	44,453	30,943
Turner		18		12		77,189			1			2		28,259
Marshall		9		11		144,192			2			6		23,766
Pennington		492		97		209,427			2			4		17,331
Davison	36	47	8	13	43,213	85,072	1	1	1	2	2	2	17,207	17,207
Meade		150		14		25,523			1			2		15,788
Yankton		121		48		353,891			2			4		17,331
Butte		66		12		11,834			1			2		6,593
Hanson		7		3		30,480			1			2		5,771
Clay		24		12		45,954			1			2		4,881
McCook		29		11		41,756			1			2		4,431

Source: South Dakota Emergency Management, FEMA's "NFIP Insurance Report," February 13, 2013
*County includes policy and loss information for both incorporated and unincorporated areas
**Includes insured and uninsured properties

3.3.5.5 Severe Repetitive Loss Analysis

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss, severe repetitive loss, and defined it as "a single family property (consisting of one-to-four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property." Fortunately for South Dakota, there is only one property that meets this definition: a property in Beadle County with three losses. Total payments for this property total $72,899.50.

3.3.5.5.1 Future vulnerability

Pennington and Codington counties identified population growth and construction of new homes in their local plans. Lincoln experienced the greatest population gain from 2000 – 2011 of all the counties in South Dakota. Campbell experienced the greatest population loss from 2000 – 2011. These growth and development trends must be taken into consideration when reviewing the vulnerability results. Minnehaha, Union, Pennington, and Yankton counties continue to increase their vulnerability as population and development increases.

3.3.6 Winter Storms

3.3.6.1 Methodology

All counties in South Dakota are vulnerable to winter storms. To assess the relative vulnerability of each of South Dakota's counties to winter storms, the state assigned ratings to three factors that were examined at the county level: prior events, building exposure, and population density. The state then summed the ratings to obtain overall vulnerability scores for each county so that they could be compared and greatest relative vulnerability determined.

This methodology assumes that the more developed areas, represented by greater building values and higher population densities, will generally have greater costs for snow removal and functional downtime as a result of loss of utility services. The more developed areas may have the capacity to absorb those costs more than the rural areas, so in terms of loss ratio (ratio of the losses to the total inventory in the county) the rural areas are potentially more vulnerable. This is difficult to measure without good historical damage data, and is a limitation of this vulnerability assessment.

3.3.6.2 Vulnerability Factors

Prior Events—This rating is based on the number of past winter storms experienced by each county between January 1993 and October 2012 according to data from the National Climatic Data Center's Storm Events database (a compilation of storm data from the National Weather Service). The database does not have information for winter storms prior to 1993. Although the University of South Carolina Hazards and Vulnerability Research Institute's Spatial Hazard Events and Losses Database for the United States (SHELDUS) has events from 1963-2011, it only includes those events for which damage was reported, thus it is not as comprehensive as the National Climatic Data Center. The winter storm profile in Section 3.2.2 describes events that happened before 1993, but that data is not appropriate for this vulnerability assessment. This information was verified during the 2014 update, and the NCDC database remains the most comprehensive dataset for assessing vulnerability.

In the previous plan, no records were identified for Lawrence County. During the update process in 2009 and again in 2013, this information was verified: the NCDC database reflects no documented ice and snow events for Lawrence County. However, there are 13 recorded events listed as impacting the northern Black Hills region which, presumably, includes this county. In addition, there are 11 events not counted above that impacted the three counties surrounding Lawrence, so it would be reasonable to assume Lawrence was also impacted. As such, 55 events are recorded for this county.

To develop the prior event rating, the total range of past occurrences (32 to 99) was divided into 10 roughly equal ranges as shown in Table 3-49. The ranges were numbered 1 through 10 in ascending order.

Table 3-49 Winter Storm Prior Event Ratings

# of Past Occurrences	Rating
32-38	1
39-45	2
46-52	3
53-59	4
60-66	5
67-73	6
74-80	7
81-87	8
88-93	9
94-99	10

Building Exposure—To best compare the vulnerability of one county to another, it is necessary to consider assets vulnerable to loss. This rating is based on total building exposure from HAZUS V2.0 (residential, commercial, industrial, agricultural, religion, government, and education). The total range of building exposure ($100,061,000 to $17,168,013,000) was divided into 10 roughly equal ranges as shown in Table 3-50. The ranges were numbered 1 through 10 in ascending order.

Table 3-50 Building Exposure Ratings

Building Exposure ($000)	Rating
100,061 – 1,806,856	1
1,806,857 – 3,513,651	2
3,513,652 – 5,220,446	3
5,220,447 – 6,927,242	4
6,927,243 – 8,634,037	5
8,634,038 – 10,340,832	6
10,340,833 – 12,047,627	7

Building Exposure ($000)	Rating
12,047,628 – 13,754,422	8
13,754,423 – 15,461,217	9
15,461,218 - 17,168,013	10

Population Density—Population density is determined by dividing a county's population by its land area. This section is based on the 2011 U.S. Census Bureau population estimates and the land area reported in the 2010 Census. The range of population densities (0.5 to 212.8) was divided into 10 roughly equal ranges as shown in Table 3-51. The ranges were numbered 1 through 10 in ascending order.

Table 3-51 Population Density Ratings

Population Density	Rating
0.5 - 21.6	1
21.7 - 42.8	2
42.9 - 64	3
64.1 - 85.2	4
85.3 - 106.4	5
106.5 - 127.6	6
127.7 - 148.8	7
148.9 - 170.1	8
170.2 - 191.4	9
191.5 - 212.8	10

A fourth factor, past winter storm damage, may be considered for the next plan update based on the availability of information. Currently, county-level damage information is not available for winter storms. The damage values captured in the National Climatic Data Center's Storm Event database are for an entire event and cannot be approximated for each individual county.

After the rating for each of the factors described above was determined for each county, the three factor ratings were added together to produce a county-level vulnerability rating. The highest possible total vulnerability rating is 30. The range of vulnerability (3 to 28) was divided into three equal ranges as shown in Table 3-52. The ranges were assigned a corresponding level of winter storm vulnerability: moderate, high, and very high.

Table 3-52 Winter Storm Vulnerability

Winter Storm Vulnerability Range	Winter Storm Vulnerability
3-11	Moderate
12-20	High
21-28	Very High

3.3.6.3 Results

Summary of Prior Event Ratings—The lowest number of recorded winter storms over this 19-year period was 32 in Custer County; the highest was 99 in Meade County. All counties in South Dakota experienced at least 32 winter storms. Meade was the only county that received a rating of 10 and Custer was the only county that received a rating of 1. 46 counties (70%) received ratings between 4 and 7. The 18 counties that received a prior event rating greater than 6 are shown in Table 3-53.

Table 3-53 Counties with Winter Storm Prior Event Ratings Greater Than 6

County	# of Prior Events	Prior Event Rating
Charles Mix	74	7
Davison	74	7
Lincoln	74	7
Marshall	74	7
Butte	75	7
Brule	76	7
Turner	77	7
Aurora	78	7
Beadle	78	7
Bon Homme	78	7
Hanson	78	7
Lake	79	7
McCook	79	7
Hutchinson	80	7
Roberts	79	7
Minnehaha	87	8
Brookings	85	8
Meade	99	10

Table 3-56 in the Total Winter Storm Vulnerability section shows prior event ratings for all South Dakota counties. A spreadsheet that includes the corresponding values can be found in Appendix 3D South Dakota Winter Storm Vulnerability.

Table 3-54 Counties with Winter Storm Building Exposure Ratings Greater Than 1

County	Building Exposure ($000)	Building Exposure Rating
Union	$1,827,003	2
Hughes	$1,902,172	2
Beadle	$1,916,945	2
Davison	$1,924,360	2
Meade	$2,055,433	2
Lawrence	$2,359,878	2
Lincoln	$2,523,166	2
Yankton	$2,540,290	2
Codington	$2,906,193	2
Brookings	$2,935,763	2
Brown	$3,962,092	3

County	Building Exposure ($000)	Building Exposure Rating
Pennington	$9,445,117	6
Minnehaha	$17,168,013	10

Table 3-56 in the Total Winter Storm Vulnerability section shows building exposure ratings for all South Dakota counties. A spreadsheet that includes the corresponding values can be found in Appendix 3D South Dakota Winter Storm Vulnerability.

Summary of Population Density Ratings—The lowest population density was 0.5 people per square mile in Harding County; the highest was 212.8 people per square mile in Minnehaha County. Minnehaha, the most populous county in the state, was the only county to receive a 10 rating and the only county to receive a rating greater than 4. With a population density of 81.1 people per square mile, Lincoln County is the second densest county and received the only 4 rating. More than 83 percent of the counties received a rating of 1. The counties that received a rating greater than 1 are listed in Table 3-55.

Table 3-55 Counties with Population Density Ratings Greater Than 1

County	Population Density	Population Density Rating
Hughes	23.3	2
Lawrence	30.4	2
Union	31.8	2
Clay	34.1	2
Pennington	37.0	2
Codington	39.9	2
Brookings	40.7	2
Yankton	43.4	3
Davison	45.1	3
Lincoln	81.1	4
Minnehaha	212.8	10

Table 3-56 in the Total Winter Storm Vulnerability section shows population density ratings for all South Dakota counties. A spreadsheet that includes the corresponding values can be found in Appendix 3D South Dakota Winter Storm Vulnerability.

3.3.6.4 Total Winter Storm Vulnerability and Estimate of Potential Loss

According to this methodology, while every county in South Dakota is vulnerable to winter storms, only Minnehaha was rated as having a very high vulnerability. Pennington, Brookings, Davison, Meade, and Lincoln all rated at high vulnerability. The remaining counties (91%) have a moderate vulnerability. Since the 2009 plan update, Butte, Hutchinson, Brown, Beadle, and Yankton all decreased in vulnerability rating from high to moderate. Figure 3-65 illustrates the vulnerability of South Dakota counties to winter storms, and Table 3-56 lists all the South Dakota counties ranked by total winter storm vulnerability along with their three vulnerability factor ratings.

To estimate potential losses to winter storms, historic loss data was analyzed. The National Climatic Data Center data did not lend itself to county by county loss summaries, only a statewide summary. According to the National Climatic Data Center Storm Events database, there were 1,042 winter storms (snow and ice events) in South Dakota between January 1993 and October 2012, and 82 extreme cold events from January 1994 to October 2012. Total property damage for these events is estimated at $130.5 million dollars. This suggests that South Dakota experiences 55 winter storms and $6.9 million in winter storm losses annually, as well as 4.3 extreme cold events each year. 12 deaths and 127 injuries were attributed to these events. This suggests that South Dakota can expect approximately 1 death every other year and 6 injuries each year. Of these storms, 11 resulted in major disaster declarations. Based on the frequency of events, South Dakota averages one major disaster-level winter storm every year and a half.

If areas with the highest number of winter storm events are plotted on a map, it becomes immediately clear that some areas of the state have a higher occurrence rate than others. If counties with at least 50 events are plotted, the concentration of winter storms occurs primarily in the southeast corner of the state and in the Black Hills region, with a smaller occurrence in the far northeast corner. When these counties are narrowed to those with at least 60 events, the groupings of events is even clearer. This distribution corresponds to the areas of highest elevation (the Black Hills region) and the areas with the greatest moisture content (the southeast corner of the state, where terrain is peppered with lakes and streams.

Figure 3-65 Vulnerability of South Dakota Counties to Winter Storms

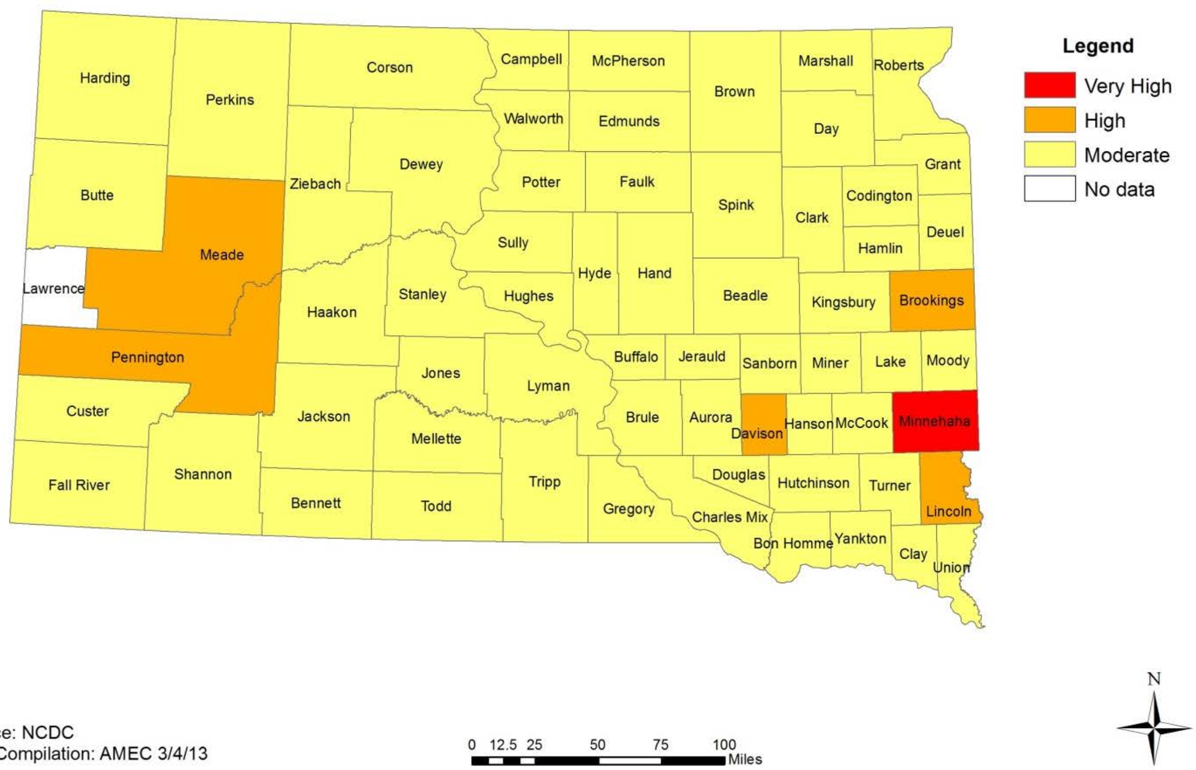


Table 3-56 Vulnerability of South Dakota Counties to Winter Storms (ranked by vulnerability)

County	Prior Event Rating	Building Exposure Valuation Rating	Pop. Density Rating	Total Vuln.	Winter Storm Vulnerability
Minnehaha	8	10	10	28	Very High
Lincoln	7	2	4	13	High
Meade	10	2	1	13	High
Brookings	8	2	2	12	High
Davison	7	2	3	12	High
Pennington	4	6	2	12	High
Yankton	6	2	3	11	Moderate
Beadle	7	2	1	10	Moderate
Aurora	7	1	1	9	Moderate
Bon Homme	7	1	1	9	Moderate
Brown	5	3	1	9	Moderate
Brule	7	1	1	9	Moderate
Butte	7	1	1	9	Moderate
Charles Mix	7	1	1	9	Moderate
Hanson	7	1	1	9	Moderate
Hutchinson	7	1	1	9	Moderate
Lake	7	1	1	9	Moderate
Marshall	7	1	1	9	Moderate
McCook	7	1	1	9	Moderate
Roberts	7	1	1	9	Moderate
Turner	7	1	1	9	Moderate
Union	5	2	2	9	Moderate
Codington	4	2	2	8	Moderate
Day	6	1	1	8	Moderate
Edmunds	6	1	1	8	Moderate
Grant	6	1	1	8	Moderate
Gregory	6	1	1	8	Moderate
Harding	6	1	1	8	Moderate
Jerauld	6	1	1	8	Moderate
Kingsbury	6	1	1	8	Moderate
Lawrence*	4	2	2	8	Moderate
Miner	6	1	1	8	Moderate
Moody	6	1	1	8	Moderate
Spink	6	1	1	8	Moderate
Clay	4	1	2	7	Moderate
Deuel	5	1	1	7	Moderate
Douglas	5	1	1	7	Moderate

County	Prior Event Rating	Building Exposure Valuation Rating	Pop. Density Rating	Total Vuln.	Winter Storm Vulnerability
Faulk	5	1	1	7	Moderate
Hand	5	1	1	7	Moderate
Hughes	3	2	2	7	Moderate
McPherson	5	1	1	7	Moderate
Perkins	5	1	1	7	Moderate
Sanborn	5	1	1	7	Moderate
Clark	4	1	1	6	Moderate
Corson	4	1	1	6	Moderate
Dewey	4	1	1	6	Moderate
Hamlin	4	1	1	6	Moderate
Lyman	4	1	1	6	Moderate
Potter	4	1	1	6	Moderate
Walworth	4	1	1	6	Moderate
Bennett	3	1	1	5	Moderate
Buffalo	3	1	1	5	Moderate
Campbell	3	1	1	5	Moderate
Haakon	3	1	1	5	Moderate
Hyde	3	1	1	5	Moderate
Jackson	3	1	1	5	Moderate
Jones	3	1	1	5	Moderate
Sully	3	1	1	5	Moderate
Tripp	3	1	1	5	Moderate
Ziebach	3	1	1	5	Moderate
Fall River	2	1	1	4	Moderate
Mellette	2	1	1	4	Moderate
Shannon	2	1	1	4	Moderate
Stanley	2	1	1	4	Moderate
Todd	2	1	1	4	Moderate
Custer	1	1	1	3	Moderate

South Dakota's agricultural industry is also very susceptible to losses from winter weather and extreme cold. Crop loss data was obtained from the Risk Management Agency's indemnity reports for 2010 through 2012. The Risk Management Agency identifies several causes of loss related to extreme cold and winter weather, including cold winter, freeze, and frost. The Risk Management Agency has an "other" category that includes snow, lightning, etc., but it is not possible to determine which losses in this category resulted specifically from snow. South Dakota received $4,304,101 in indemnities from winter weather-related hazards in 2012, $4,521,931 in 2011, and $1,050,838 in 2010. This averages out to $3,292,290 in winter weather-related indemnities each year.

The USDA produced a “Cattle Death Loss” report in 2011 which detailed the number of cattle and calves lost to various causes (predator and non-predator) in each state in 2010. A total of 68,000 head of cattle and 90,000 calves died in South Dakota in 2010. 13.1% (890 head) of cattle losses and 36.8% (33,120 head) of calf losses were attributed to weather. The total value of the animals in South Dakota in 2010 was $1,133 per head for cattle and $381 per head for calves. Thus, the State’s cattle industry suffered $13,627,090 in weather-related losses that year. 85,000 cattle and calves in 1995 and 165,000 cattle and calves in 1991 died from weather-related causes. The total dollar value per head in 1995 and 1991 is not known.

3.3.6.4.1 Future vulnerability

Lincoln County experienced the greatest population gain from 2000 – 2011 of all the counties in South Dakota. Of the other counties with high or very high vulnerability to winter storms, Meade, Brookings, Davison, Pennington, and Minnehaha all experienced population growth between 2000 and 2011. As these counties continue to grow, their vulnerability to winter storms will increase as the exposure of population and property continues to grow. The agricultural industry will also continue to be vulnerable to winter storms. Counties that are particularly dependent economically on crops or livestock will have high vulnerability.

3.3.7 Wildfire

3.3.7.1 Methodology

During the 2007 update to this plan a more detailed (in comparison to the 2004 plan) exposure analysis was performed on the southwestern counties of Butte, Custer, Fall River, Lawrence, Meade, Pennington and Shannon. These counties are known to contain forested lands, so the vulnerability assessment was focused on these counties. This analysis was expanded to other parts of the State in 2013.

The vulnerability analysis involved the use of GIS to quantify the population and buildings at risk within wildfire risk zones. The best available data for wildfire risk was the wildland- urban interface/intermix data from the SILVIS Lab at the University of Wisconsin–Madison mentioned previously in the wildfire hazard profile. The SILVIS data is classified into 13 categories, based on 2010 Census housing unit density and percent of vegetation in the area. In both interface and intermix communities, housing must meet or exceed a minimum density of one structure per 40 acres. Intermix communities are areas where housing and vegetation intermingle and vegetation exceeds 50 percent. Interface communities are areas with housing in the vicinity of contiguous vegetation, have less than 50 percent vegetation, and are within 1.5 miles of an area that exceeds 1,325 acres and are more than 75 percent vegetated. For the purposes of this plan these areas were further classified into High, Moderate, and Low risk threat zones as follows:

High Risk Threat Zone (areas of various housing unit density within areas of high vegetation)

- High Density Intermix
- Medium Density Intermix
- High Density Interface

Moderate Risk Threat Zone (areas of lower housing unit density within areas of high vegetation)

- Medium Density Interface
- Low Density Intermix

Low Risk Threat Zone (either no vegetation, or no housing density)

- Low Density Interface
- High Density No Vegetation
- Medium Density No Vegetation
- Wildland Intermix
- Uninhabited Vegetation
- Uninhabited No Vegetation
- Low Density No Vegetation
- Wildland No Vegetation

The SILVIS Census Blocks that met the High or Moderate Risk Threat Zone definitions above were selected within GIS and are represented on Figure 3-23. The total population and number of housing units within each zone was summarized by county, based on 2010 Census Block data included in the SILVIS data set. The results are shown in Table 3-57. The analysis shows 212,659 person and 98,378 housing units exposed in the high and moderate threat zones. Pennington County has the highest building and population exposure by far compared to the other counties, followed by Lawrence, Meade, Hughes, Custer and Butte. To estimate losses an exposure analysis was used based on applying an average home value for each county (based on 2010 Census median home value) multiplied by the number of housing units at risk. For the purposes of estimating potential loss, the total replacement value is used as well as an estimate of contents (based on HAZUS occupancy class content estimate standards), as catastrophic fires tend to result in total loss of the structure. The total property exposed based on this methodology is $6 Billion in structures and $18 Billion including structure and contents. It is very unlikely that a wildfire would result in loss of all the structures potentially at risk within a given county, but the results provide an indication of where the highest losses from a fire in the Interface or Intermix areas could occur.

Table 3-57 WUI Exposure

County	Total Population	Total Housing Units	2010 Census Median Home Value ($)	2010 Medium Home Value*Housing Units ($)	Contents Replacement Value ($)	Total Replacement Value ($)
Aurora	-	-	-	-	-	-
Beadle	138	82	83,400	6,838,800	3,419,400	10,258,200
Bennett	1,669	597	60,200	35,929,818	17,964,909	53,894,727
Bon Homme	851	506	67,700	34,256,200	17,128,100	51,384,300
Brookings	494	282	138,300	39,000,600	19,500,300	58,500,900
Brown	125	71	115,700	8,214,700	4,107,350	12,322,050
Brule	2,262	1,091	87,300	95,221,556	47,610,778	142,832,335
Buffalo	1,071	299	67,500	20,182,500	10,091,250	30,273,750
Butte	7,335	3,333	114,300	380,927,373	190,463,687	571,391,060

County	Total Population	Total Housing Units	2010 Census Median Home Value ($)	2010 Medium Home Value*Housing Units ($)	Contents Replacement Value ($)	Total Replacement Value ($)
Campbell	748	554	40,600	22,492,400	11,246,200	33,738,600
Charles Mix	376	199	67,700	13,472,300	6,736,150	20,208,450
Clark	197	104	64,500	6,708,000	3,354,000	10,062,000
Clay	100	54	116,900	6,312,600	3,156,300	9,468,900
Codington	828	361	131,000	47,291,000	23,645,500	70,936,500
Corson	2,054	741	45,900	34,011,900	17,005,950	51,017,850
Custer	6,340	3,578	160,700	574,984,600	287,492,300	862,476,900
Davison	661	277	108,800	30,137,600	15,068,800	45,206,400
Day	742	894	64,800	57,919,128	28,959,564	86,878,692
Deuel	444	193	87,200	16,812,339	8,406,170	25,218,509
Dewey	3,284	1,187	56,900	67,540,300	33,770,150	101,310,450
Douglas	10	4	58,300	233,200	116,600	349,800
Edmunds	618	324	70,300	22,777,200	11,388,600	34,165,800
Fall River	5,264	3,174	86,800	275,503,200	137,751,600	413,254,800
Faulk	788	485	51,300	24,880,500	12,440,250	37,320,750
Grant	233	121	99,800	12,123,280	6,061,640	18,184,920
Gregory	2,278	1,407	56,100	78,921,613	39,460,807	118,382,420
Haakon	1,013	558	74,800	41,738,400	20,869,200	62,607,600
Hamlin	173	76	83,700	6,361,200	3,180,600	9,541,800
Hand	98	72	74,900	5,392,800	2,696,400	8,089,200
Hanson	77	24	87,300	2,095,200	1,047,600	3,142,800
Harding	385	261	67,000	17,487,000	8,743,500	26,230,500
Hughes	14,059	6,485	133,200	863,839,923	431,919,962	1,295,759,885
Hutchinson	22	14	68,700	961,800	480,900	1,442,700
Hyde	776	385	66,600	25,641,000	12,820,500	38,461,500
Jackson	1,791	660	54,600	36,036,000	18,018,000	54,054,000
Jerauld	71	43	62,200	2,674,600	1,337,300	4,011,900
Jones	629	373	75,000	27,975,000	13,987,500	41,962,500
Kingsbury	82	59	70,300	4,147,700	2,073,850	6,221,550
Lake	203	80	108,800	8,704,000	4,352,000	13,056,000
Lawrence	20,958	11,355	155,100	1,761,160,500	880,580,250	2,641,740,750
Lincoln	101	53	169,700	8,994,100	4,497,050	13,491,150
Lyman	2,280	1,034	64,900	67,106,600	33,553,300	100,659,900
Marshall	205	472	81,700	38,562,400	19,281,200	57,843,600
McCook	50	19	91,900	1,746,100	873,050	2,619,150
McPherson	824	653	45,100	29,450,300	14,725,150	44,175,450
Meade	20,512	9,013	145,800	1,314,095,400	657,047,700	1,971,143,100

County	Total Population	Total Housing Units	2010 Census Median Home Value ($)	2010 Medium Home Value*Housing Units ($)	Contents Replacement Value ($)	Total Replacement Value ($)
Mellette	1,200	465	49,800	23,157,000	11,578,500	34,735,500
Miner	-	-	-	-	-	-
Minnehaha	899	329	144,900	47,672,100	23,836,050	71,508,150
Moody	66	26	102,800	2,672,800	1,336,400	4,009,200
Pennington	78,815	34,905	149,700	5,225,253,054	2,612,626,527	7,837,879,581
Perkins	19	11	50,800	558,800	279,400	838,200
Potter	502	516	55,600	28,681,869	14,340,935	43,022,804
Roberts	964	415	73,200	30,378,000	15,189,000	45,567,000
Sanborn	104	52	62,700	3,260,400	1,630,200	4,890,600
Shannon	8,334	2,054	18,600	38,204,400	19,102,200	57,306,600
Spink	119	53	62,700	3,323,100	1,661,550	4,984,650
Stanley	2,161	995	113,700	113,131,500	56,565,750	169,697,250
Sully	153	88	72,200	6,353,600	3,176,800	9,530,400
Todd	5,898	1,862	53,800	100,175,600	50,087,800	150,263,400
Tripp	1,313	707	69,400	49,093,265	24,546,633	73,639,898
Turner	47	18	85,600	1,540,800	770,400	2,311,200
Union	2,392	1,059	132,200	140,049,081	70,024,541	210,073,622
Walworth	4,528	2,525	62,500	157,791,465	78,895,732	236,687,197
Yankton	752	388	115,500	44,814,000	22,407,000	67,221,000
Ziebach	1,176	304	62,200	18,903,145	9,451,573	28,354,718
Totals	**212,659**	**98,378**	**5,337,800**	**12,205,037,912**	**6,105,938,356**	**18,317,815,068**

Between 1974 and 2012, South Dakota received 21 fire management assistance declarations from FEMA, which provided financial support for fire suppression. Fire suppression costs for these 38 years totaled $11,647,391 (see the fire management assistance declarations in Table 3-4). This averages $306,510 annually *per year* and does not include losses to structures, forests, utilities, etc. Note that the amount of financial support was not known for every event.

Forest fires are of longer duration due to the heavy fuels and resistance to control efforts. Fires in forested areas have the potential to do significant damage to homes and property. These fires generally cost more to suppress than prairie fires. Prairie fires tend to stress local response resources and can quickly damage livestock grazing areas. Damage to agricultural resources is very dependent on when the fire occurs, with the early season March and April fires easier to recover from. Research yielded little information on agricultural losses due to wildfire. RMA indemnities data for 2010, 2011, and 2012 only showed fire-related losses in 2011. Total fire-related indemnities for that year were $126,230. While historic loss data was limited on agricultural losses from fires this information may be collected in future updates from sources that might include the Farm Services Agency, Risk Management Agency, State Department of Agriculture, or South Dakota State University.

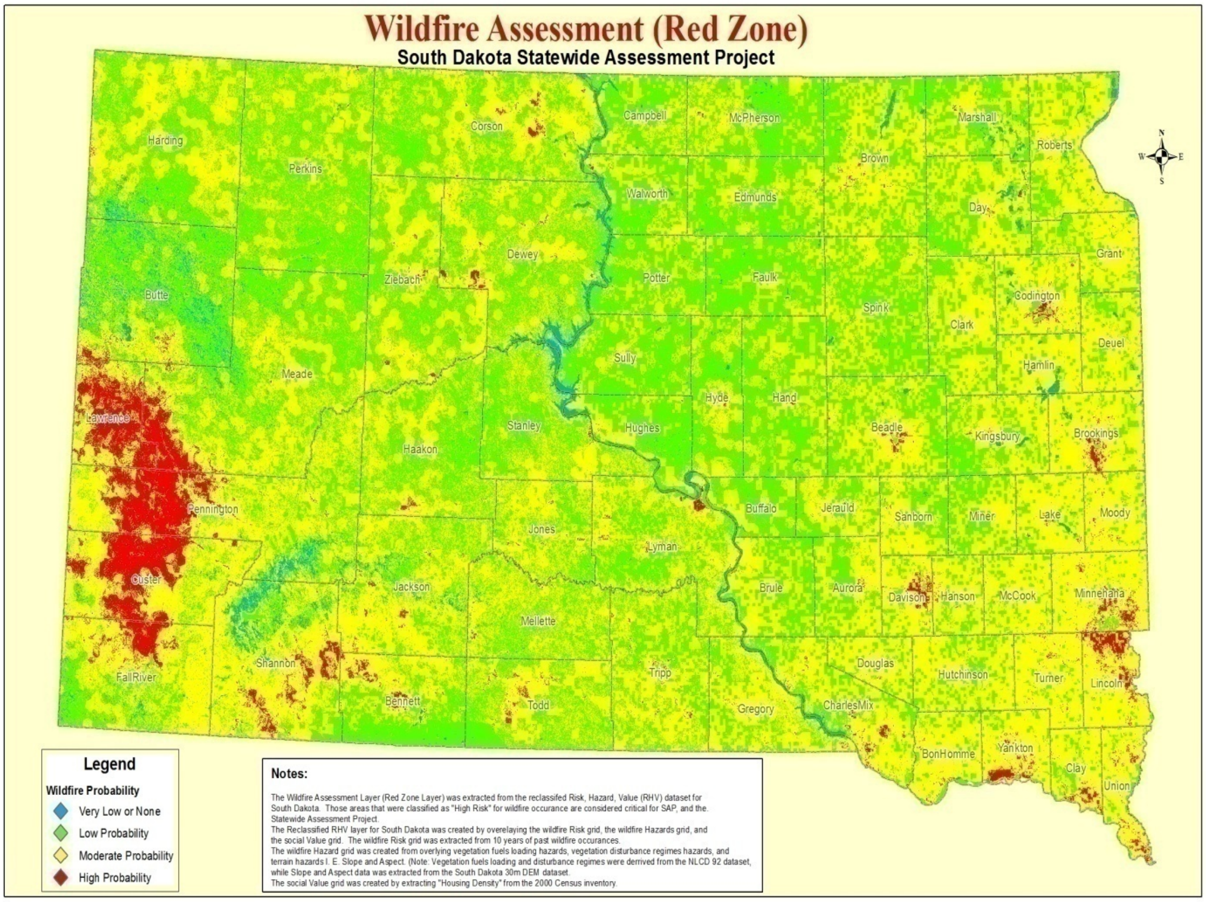
Additional vulnerability data was obtained from individual county Community Wildfire Protection Plans (CWPPs) where possible. A digital copy of Fall River County's CWPP was reviewed for the 2014 plan update. The Fall River County CWPP identified 3,918 structures in the County with an assessed value of roughly $388 million as of 2008. 523 structures with an assessed value of $6.8 million were located in the Black Hills Forest Fire Protection District. Lawrence, Meade, Pennington, and Perkins counties also provided digital CWPPs but did not provide estimates of assessed property values at risk to wildfire. Other jurisdictions that have completed CWPPs in the State include Butte, Custer, and Stanley counties and Rapid City. South Dakota's numerous recreational, historical, archaeological, and paleontological sites are also vulnerable to wildfire events.

3.3.7.1.1 Future vulnerability

Wildland fire vulnerability is particularly high in the Black Hills region and in some southeastern counties. Lincoln, Union, Minnehaha, Pennington, Custer, Butte, and Shannon were all within the top 10 counties for population percent change between 2000 and 2011. These growth and development trends must be taken into consideration when reviewing the vulnerability results below. As population increases in these counties the vulnerability to wildland and prairie fires also increases.

Figure 3-66 portrays a summary of statewide wildfire vulnerability. Vulnerability is assessed is terms of probability of occurrence. Probability is determined through the consideration of the number of wildfire occurrences in the past 10 years, the environment (vegetation fuels, vegetation disturbance, and terrain), and housing density.

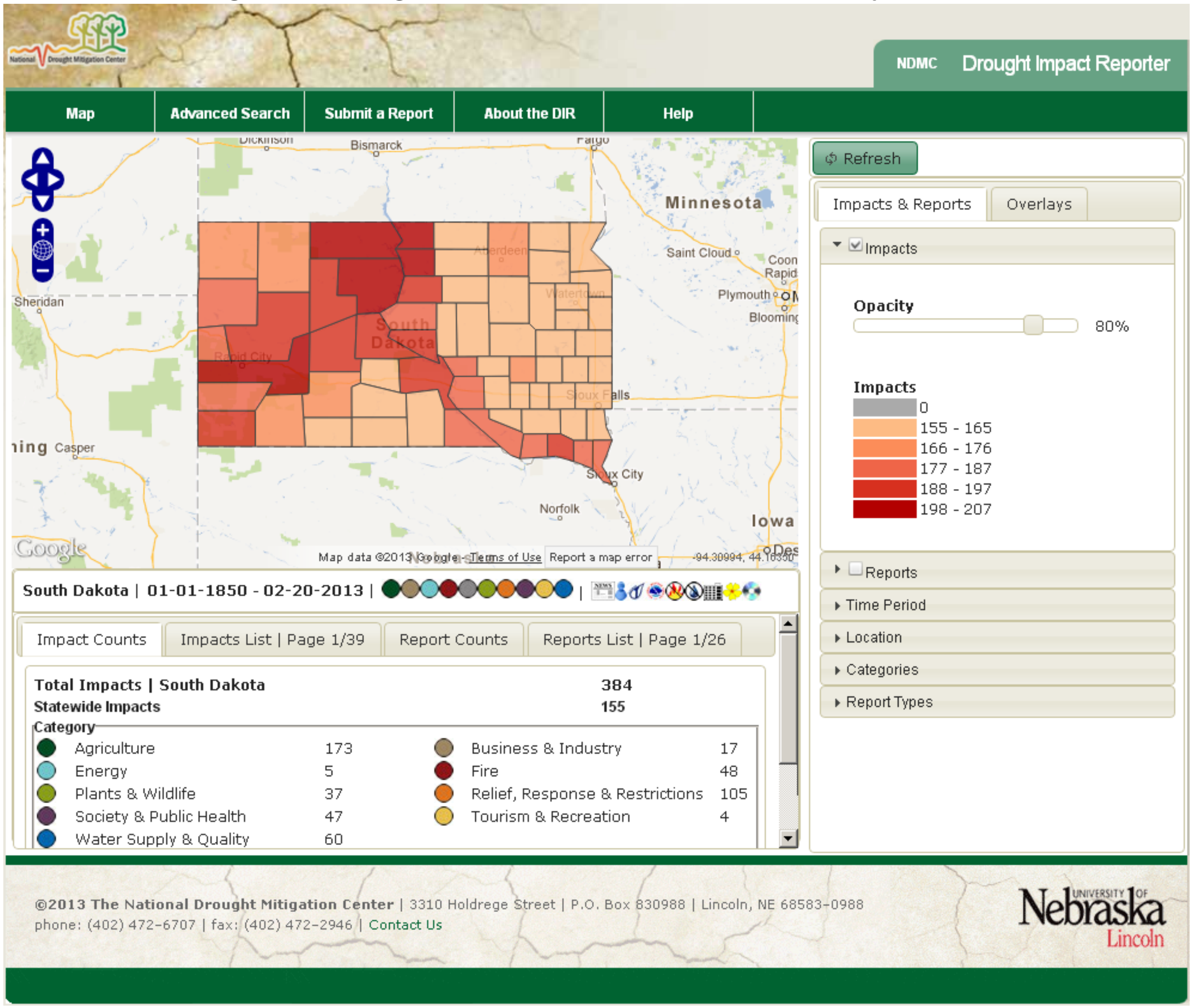
Figure 3-66 Wildfire Assessment from the 2010 State of South Dakota Statewide Assessment Project



3.3.8 Drought

As discussed in the profile, the entire State of South Dakota is vulnerable to drought, but in different ways. A summary of impacts from the Drought Impact Reporter for the period of 1850-February 2013 indicates that all counties are vulnerable. Those counties shown has having 198 or more reported impacts are also susceptible to social impacts related to recreational areas such as the “Great Lakes” Missouri River corridor and Black Hills Regions. In addition to agriculture impacts these areas could suffer from lowered lakes levels impacting boating and fishing activities and associated revenue.

Figure 3-67 Drought Monitor for South Dakota as of February 20, 2013



Source: National Drought Mitigation Center

Table 3-58 Drought Monitor Reported Impacts by County: 1850 - 2013

County	Agriculture	Business & Industry	Energy	Fire	Plants & Wildlife	Relief, Response & Restrictions	Society & Public Health	Tourism & Recreation	Water Supply & Quality
Aurora	97	12	5	10	11	47	**17**	**2**	**12**
Beadle	99	12	5	9	10	47	**17**	**2**	**13**
Bennett	96	12	5	9	10	48	**17**	**2**	**11**
Bon Homme	98	12	5	10	12	48	**20**	**3**	**26**
Brookings	99	12	5	10	11	49	**17**	**2**	**12**
Brown	98	12	5	9	11	49	**17**	**2**	**13**
Brule	97	12	5	10	11	48	**20**	**2**	**26**

County	Agriculture	Business & Industry	Energy	Fire	Plants & Wildlife	Relief, Response & Restrictions	Society & Public Health	Tourism & Recreation	Water Supply & Quality
Buffalo	97	12	5	9	11	48	**20**	**2**	**26**
Butte	110	12	5	12	14	54	**22**	**2**	**14**
Campbell	112	12	5	11	11	49	**26**	**2**	**29**
Charles Mix	97	12	5	10	14	50	**20**	**4**	**27**
Clark	97	12	5	9	10	45	**17**	**2**	**11**
Clay	98	12	5	9	12	47	**21**	**3**	**26**
Codington	96	12	5	9	11	44	**17**	**2**	**11**
Corson	103	12	5	15	12	51	**24**	**2**	**28**
Custer	103	12	5	17	16	53	**19**	**2**	**15**
Davison	97	12	5	9	10	47	**19**	**2**	**12**
Day	96	12	5	9	10	43	**17**	**2**	**11**
Deuel	98	12	5	9	10	45	**17**	**2**	**11**
Dewey	102	12	5	14	12	52	**24**	**2**	**30**
Douglas	97	12	5	10	11	46	**17**	**2**	**12**
Edmunds	98	12	5	9	10	47	**17**	**2**	**11**
Fall River	107	12	5	18	13	53	**21**	**2**	**21**
Faulk	99	12	5	10	10	47	**17**	**2**	**11**
Grant	96	12	5	9	10	45	**17**	**2**	**11**
Gregory	97	12	5	9	11	51	**20**	**2**	**26**
Haakon	103	12	5	12	11	54	**22**	**2**	**28**
Hamlin	98	12	5	9	10	46	**17**	**2**	**11**
Hand	98	12	5	9	10	47	**17**	**2**	**11**
Hanson	97	12	5	9	10	45	**17**	**2**	**12**
Harding	99	12	5	12	13	53	**18**	**2**	**11**
Hughes	101	12	5	11	11	51	**23**	**2**	**28**
Hutchinson	97	12	5	9	11	47	**17**	**3**	**12**
Hyde	97	12	5	9	10	47	**17**	**2**	**11**
Jackson	98	12	5	12	10	52	**17**	**2**	**12**
Jerauld	97	12	5	9	10	47	**17**	**2**	**11**
Jones	99	12	5	9	10	50	**17**	**2**	**11**
Kingsbury	97	12	5	9	10	46	**17**	**2**	**11**
Lake	97	12	5	10	11	44	**17**	**2**	**13**
Lawrence	101	12	5	19	13	52	**19**	**2**	**12**
Lincoln	97	12	5	10	11	43	**17**	**2**	**12**
Lyman	101	12	5	10	11	51	**20**	**2**	**26**
Marshall	96	12	5	9	10	43	**17**	**2**	**11**
McCook	97	12	5	9	10	45	**17**	**2**	**11**

County	Agriculture	Business & Industry	Energy	Fire	Plants & Wildlife	Relief, Response & Restrictions	Society & Public Health	Tourism & Recreation	Water Supply & Quality
McPherson	100	12	5	10	10	48	**17**	**2**	**11**
Meade	105	12	5	16	14	56	**19**	**2**	**14**
Mellette	97	12	5	9	10	49	**17**	**2**	**11**
Miner	91	12	5	9	10	47	**18**	**2**	**11**
Minnehaha	99	12	5	10	11	46	**17**	**2**	**12**
Moody	98	12	5	10	11	45	**17**	**2**	**12**
Pennington	108	12	5	20	16	58	**22**	**2**	**22**
Perkins	100	12	5	13	12	54	**18**	**2**	**11**
Potter	101	12	5	11	11	48	**23**	**2**	**28**
Roberts	96	12	5	9	10	44	**17**	**2**	**11**
Sanborn	101	12	5	9	10	48	**17**	**2**	**12**
Shannon	97	12	5	10	10	51	**17**	**2**	**12**
Spink	96	12	5	9	10	46	**17**	**2**	**13**
Stanley	102	12	5	13	11	53	**23**	**2**	**29**
Sully	99	12	5	9	11	48	**23**	**2**	**28**
Todd	96	12	5	9	10	48	**17**	**2**	**11**
Tripp	97	12	5	9	11	48	**17**	**3**	**11**
Turner	97	12	5	9	10	45	**17**	**2**	**11**
Union	98	12	5	10	13	44	**20**	**3**	**27**
Walworth	105	12	5	12	13	50	**25**	**2**	**28**
Yankton	98	17	5	12	13	55	**21**	**3**	**31**
Ziebach	99	12	5	11	12	53	**23**	**2**	**28**
Totals	**6,534**	**797**	**330**	**699**	**735**	**3,200**	**1,242**	**140**	**1,094**

Source: National Drought Mitigation Center

Drought takes a particularly heavy toll on agriculture due to crop losses from lack of moisture. Farmers often protect themselves from the affects of drought by insuring all or a portion of their crop against drought losses. This is done through multi-peril crop insurance, which is underwritten by The Risk Management Agency. The Risk Management Agency, part of the USDA, maintains a database of crop insurance claims. Table 3-59 shows the crop losses due to drought in one of the most recent and severe periods of statewide drought, which occurred in 2002. Drought-related crop losses that year totaled $294,625,661. Data for 2002 is compared to that of 2012, the latest significantly dry year in South Dakota. In 2012 drought-related crop losses totaled $838,876,036, nearly three times as much as the losses in 2002. The drought in 2012 was particularly worse for some counties, notably Hutchinson, Bon Homme, Charles Mix, Lincoln, and McCook.

Table 3-59 South Dakota Crop Loss Due to Drought: 2002 and 2012

County	2002 Indemnities ($)	2012 Indemnities ($)
Aurora	9,981,468	20,312,297
Beadle	16,888,079	15,920,978
Bennett	3,031,438	2,547,781
Bon Homme	6,868,510	53,074,783
Brookings	387,848	4,652,860
Brown	3,492,269	3,867,983
Brule	10,078,871	11,189,445
Buffalo	3,093,701	5,442,786
Butte	570,113	568,080
Campbell	3,352,881	1,639,784
Charles Mix	14,953,511	52,741,118
Clark	4,452,317	6,613,557
Clay	1,250,351	37,583,767
Codington	1,394,286	6,544,813
Corson	4,422,324	3,837,987
Custer	309,970	617,713
Davison	7,885,578	25,309,304
Day	979,621	2,046,009
Deuel	371,275	3,268,970
Dewey	2,612,684	1,718,676
Douglas	5,463,319	32,805,118
Edmunds	5,121,562	3,333,600
Fall River	319,562	1,659,373
Faulk	3,245,911	3,244,005
Grant	218,744	3,096,120
Gregory	4,700,874	13,427,341
Haakon	4,439,525	5,317,145
Hamlin	347,794	5,296,778
Hand	12,896,771	7,447,056
Hanson	3,298,202	26,245,752
Harding	3,402,141	1,841,929
Hughes	9,941,061	5,915,209
Hutchinson	9,758,512	94,572,548
Hyde	8,411,019	4,555,116
Jackson	2,546,546	1,749,899
Jerauld	5,164,721	3,543,515
Jones	2,182,334	2,660,595
Kingsbury	4,896,508	4,912,931
Lake	1,167,346	3,646,413
Lawrence	19,545	83,794
Lincoln	139,801	55,931,547
Lyman	9,304,102	9,970,739

County	2002 Indemnities ($)	2012 Indemnities ($)
McCook	624,002	45,295,473
McPherson	4,624,314	4,338,115
Marshall	476,464	1,021,099
Meade	4,288,087	4,512,961
Mellette	1,187,891	1,459,244
Miner	3,799,930	6,899,052
Minnehaha	576,527	29,759,062
Moody	311,254	2,742,224
Pennington	3,261,621	3,339,429
Perkins	8,077,696	3,292,653
Potter	13,821,626	3,994,871
Roberts	80,479	880,552
Sanborn	3,651,509	5,650,254
Shannon	1,188,991	1,157,968
Spink	10,169,572	8,827,121
Stanley	4,749,540	1,951,946
Sully	18,609,676	8,206,428
Todd	978,776	1,580,025
Tripp	7,241,518	15,736,702
Turner	1,379,258	56,652,120
Union	131,241	28,868,718
Walworth	5,895,543	781,254
Yankton	3,498,560	49,536,920
Ziebach	2,638,591	1,636,631
Total	**294,625,661**	**838,876,036**

Source: Risk Management Agency Cause of Loss Historical Data Files

3.3.9 Tornadoes

3.3.9.1 Methodology

All 66 counties in the state of South Dakota are vulnerable to tornado hazards. To refine and assess the relative vulnerability of each of South Dakota's counties to tornadoes, the state assigned ratings to four factors that were examined at the county level: prior events, building exposure, population density, and past tornado damage. The state then summed the ratings to obtain overall vulnerability scores for each county so that they could be compared and greatest vulnerability determined. The factors are described below.

3.3.9.2 Vulnerability Factors

Prior Events—This rating is based on the number of past tornadoes experienced by each county between January 1950 and October 2012 according to data from the National Climatic Data Center's Storm Events database (a compilation of storm data from the National Weather Service). Tornadoes reported in the database are in segments. So, the number of past occurrences is really a reflection of the number of past tornado segments. To develop the prior event rating, the total range of past occurrences was divided into 10 roughly equal ranges as shown in Table 3-60. The ranges were numbered 1 through 10 in ascending order.

Table 3-60 Tornadoes Prior Event Ratings

# of Past Occurrences	Rating
0-6	1
7-14	2
15-22	3
23-30	4
31-38	5
39-46	6
47-54	7
55-62	8
63-70	9
71-77	10

In addition to the total events tabulation, a prior event rating was established for each county based on the number of F1 or greater tornadoes in the county, the number of tornadoes that caused death or injury, or the number of tornadoes with recorded financial damage. This was used to help determine if there are areas of particular vulnerability to more severe tornado events. The increased the overall number of tornadoes analyzed, as well as total damages. Total damages were inflated to $2012 dollars instead of year-of-event dollars. The information was drawn from the NCDC database and may not account for new methodologies in assessing a tornado's rating. This information was also divided into ten roughly equal ranges and is displayed in the table below.

Table 3-61 Tornadoes of at least F1 Rating Prior Event Ratings*

# of Past Occurrences	Rating
0-2	1
3-5	2
6-8	3
9-11	4
12-14	5
15-17	6
18-20	7
21-23	8
24-26	9
27-29	10

*Also includes events that caused death or injury, or resulted in recorded financial damage

Building Exposure—To best compare the vulnerability of one county to another, it is necessary to consider assets vulnerable to loss. This rating is based on total building exposure from HAZUS V2.0 (residential, commercial, industrial, agricultural, religion, government, and education). The total range of building exposure ($100,061,000 to $17,168,013,000) was divided into 10 roughly equal ranges as shown in Table 3-62. The ranges were numbered 1 through 10 in ascending order.

Table 3-62 Building Exposure Ratings

Building Exposure ($000)	Rating
100,061 – 1,806,856	1
1,806,857 – 3,513,651	2
3,513,652 – 5,220,446	3
5,220,447 – 6,927,242	4
6,927,243 – 8,634,037	5
8,634,038 – 10,340,832	6
10,340,833 – 12,047,627	7
12,047,628 – 13,754,422	8
13,754,423 – 15,461,217	9
15,461,218 - 17,168,013	10

Population Density—Population density is determined by dividing a county's population by its land area. This section is based on the 2011 U.S. Census Bureau population estimates and the land area reported in the 2010 Census. The range of population densities (0.5 to 212.8) was divided into 10 roughly equal ranges as shown in Table 3-63. The ranges were numbered 1 through 10 in ascending order.

Table 3-63 Population Density Ratings

Population Density	Rating
0.5 - 21.6	1
21.7 - 42.8	2
42.9 - 64	3
64.1 - 85.2	4
85.3 - 106.4	5
106.5 - 127.6	6
127.7 - 148.8	7
148.9 - 170.1	8
170.2 - 191.4	9
191.5 - 212.8	10

Past Tornado Damage— This rating is based on the property damage for the tornadoes that occurred in South Dakota between 1950 and 2012 as reported in the National Climatic Data Center's Storm Events database. This damage was presented in actual values for the year the events occurred. To more accurately compare the damage values, they were converted to 2012 dollars using Consumer Price Index conversion factors published by Oregon State University (this is similar to the methodology used in FEMA's inflation calculator in its Benefits Cost Analysis Toolkit). The inflated values suggest that the state had $694,733,985 (2012 dollars) in tornado damage between 1950 and 2012, which averages out to approximately $11,205,387 per year. The total range of past tornado damage was divided into 10 roughly equal ranges as shown in Table 3-64. The ranges were numbered 1 through 10 in ascending order.

Table 3-64 Past Tornado Damage Ratings

Damages ($)	Rating
118,852 – 15,858,404	1
15,858,405 – 31,597,956	2
31,597,957 – 47,337,509	3
47,337,510 – 63,077,061	4
63,077,062 – 78,816,614	5
78,816,615 – 94,556,166	6
94,556,167 – 110,295,719	7
11,0295,715 – 126,035,271	8
126,035,272 – 141,774,824	9
141,774,825 - 157,514,376	10

After rating each of the counties on the factors described above, the four factor ratings were added together to produce a county-level vulnerability rating. The highest possible total vulnerability rating was 40. The total range of vulnerability was divided into three equal ranges as shown in Table 3-65. The ranges were assigned a corresponding level of tornado vulnerability: moderate, high, and very high. The vulnerability scale begins at moderate as every county has some degree of vulnerability.

Table 3-65 Tornado Vulnerability

Tornado Vulnerability Range	Tornado Vulnerability
1-13	Moderate
14-27	High
28-40	Very High

3.3.9.3 Results

Summary of Prior Event Ratings—The lowest number of recorded tornadoes over this 62 year period was 6 in Jones County, which is the same as identified in the 2011 plan. The highest number of tornadoes was 77 in Brown County, the only county to receive a ranking of 10. Lincoln County experienced the second highest number of tornadoes with 50 events. When only F1 or greater tornadoes or those that caused damage or casualties were considered, Brown County still held the highest number (29), and was again the only county to receive a ranking of 10. The difference in the range of F1 or greater tornado events, including those that caused damage or casualties, was significantly lower. When evaluating all prior events, only Jones County received a rating of 1, while 32 counties (48%) received ratings of 2 or 3. The counties that received a prior event rating greater than 4 are shown in Table 3-66. When only events of F1 magnitude or greater, or those that caused damages or casualties, were evaluated, Hyde and Jerauld Counties received ratings of 1, while Jones County increased in rating to a rating of 2. Brown County received a rating of 10, Charles Mix rated a 9, and Lincoln, Turner, McCook, and Minnehaha all rated at 8. 39 counties (59%) received a rating between 3 and 5. The list of all counties receiving a rating greater than 6 is listed in Table 3-67.

Table 3-66 Counties with Tornadoes Prior Event Ratings Greater Than 4

County	# of Prior Events	Prior Event Rating
Beadle	32	5
Perkins	34	5
Lyman	36	5
Todd	36	5
Spink	37	5
Meade	38	5
Minnehaha	38	5
Kingsbury	39	6
McCook	39	6
Charles Mix	42	6
Hutchinson	42	6
Turner	42	6
Union	42	6
Pennington	42	6
Lincoln	50	7
Brown	77	10

Table 3-67 Counties with at least F1 Tornadoes Prior Event Ratings Greater Than 6

County	# of Prior Events	Prior Event Rating
Meade	20	7
Hutchinson	20	7
Minnehaha	21	8
Lincoln	21	8
Turner	22	8
McCook	23	8
Charles Mix	25	9
Brown	29	10

Table 3-69 in the Total Tornado Vulnerability section shows population density ratings for all South Dakota counties. A spreadsheet that includes the corresponding values can be found in Appendix 3E South Dakota Tornado Vulnerability. Building exposure ratings and population density ratings can be found in Table 3-62 and Table 3-63 respectively.

Summary of Past Tornado Damage Ratings— During the 62-year period, Lincoln County incurred the most tornado damage: $157,514,376. Jerauld County incurred the least: $118,852. Lincoln County was the only one to receive a rating of 10. Those counties that received a rating higher than two are listed in Table 3-68.

Figure 3-68 shows the distribution of tornado damage across the state between 1950 and 2012.

Table 3-68 Counties with Past Tornado Damage Ratings Greater Than 2

County	Damages Amount	Damages Rating
Buffalo	$40,991,510	3
McCook	$44,441,499	3
Turner	$51,471,078	4
Lincoln	$157,514,376	10

Figure 3-68 Tornado Damage 1950-2012

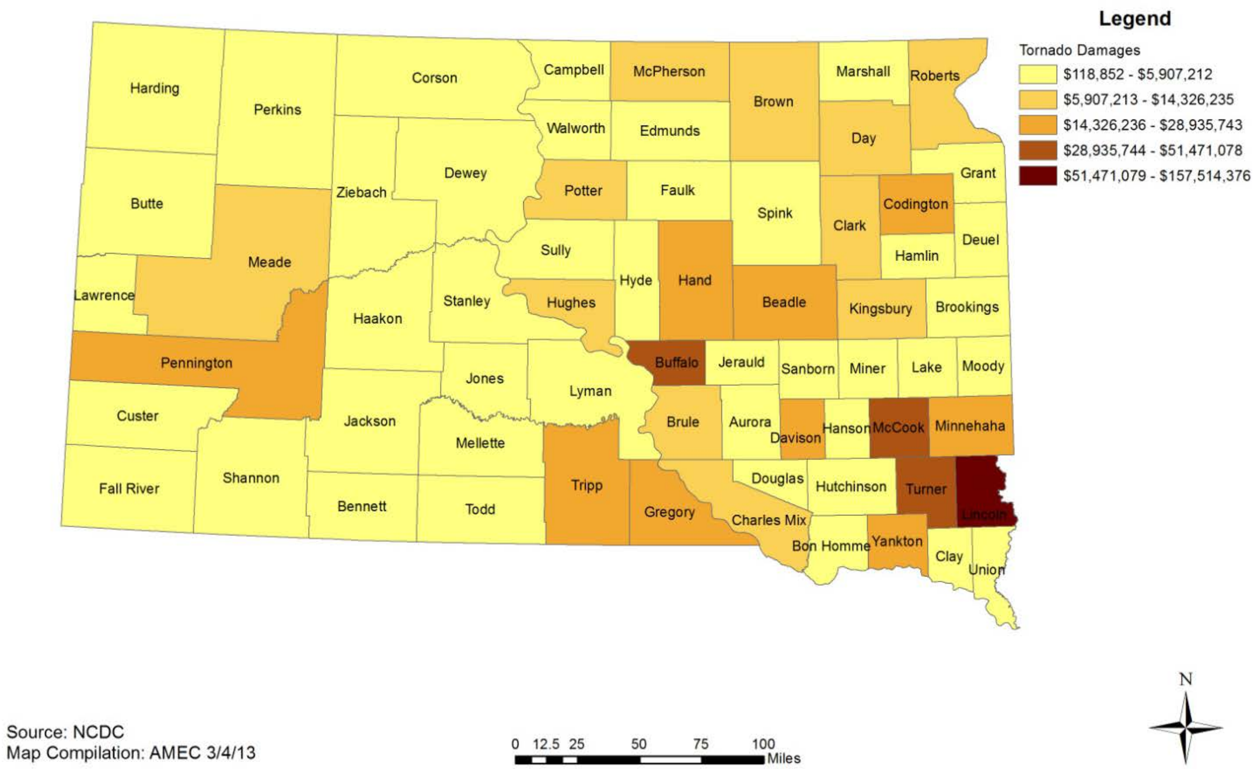


Table 3-69 in the Total Tornado Vulnerability section shows past tornado damage ratings for all South Dakota counties. A spreadsheet that includes the corresponding values can be found in Appendix 3E South Dakota Tornado Vulnerability.

3.3.9.4 Total Tornado Vulnerability and Estimate of Potential Loss

According to this methodology, while every South Dakota county is vulnerable to tornadoes, only Minnehaha County has a very high vulnerability for tornadoes with a Fujita rank of F1 or greater, or that caused damage or casualties. No county has a very high rating for total tornado events, although Minnehaha still has the top high rating with a total vulnerability score of 27. Brown, Pennington, Turner, and Lincoln have a high vulnerability rating for tornadoes with a Fujita rank of F1 or greater, or that caused damage or casualties. Brown, Pennington, Minnehaha, and Turner have high vulnerability ratings for total tornado events. The remaining 61 counties (92%) have moderate vulnerability for tornadoes with a Fujita rank of F1 or greater, or that caused damage or casualties. 62 counties (94%) have moderate vulnerability for total tornado events. Figure 3-69 illustrates the vulnerability of South Dakota counties to tornadoes, and Table 3-69 shows all the South Dakota counties ranked by total tornado vulnerability along with their four vulnerability factor ratings.

To provide additional insight into potential losses caused by tornadoes, historic loss data were also analyzed on a statewide scale. According to the National Climatic Data Center Storm Events database, there were 1,639 tornadoes in South Dakota between January 1950 and October 2012. Of those, 61 were rated as an F3 event, 6 as an F4, and 1 as an F5. Total property damage for these events is estimated at \$694.7 million in 2012 dollars. This suggests that South Dakota experiences 26 tornadoes and \$11,205,386 in losses each year. There were 18 deaths and 452 injuries in this time period, which averages out to approximately seven injuries each year. Of these storms, five resulted in major disaster declarations, with a total relief cost estimated at \$158,555,869 in 2012 dollars. This averages out to \$31.711 million (also in 2012 dollars) per major disaster. Based on the frequency of events, South Dakota averages one major disaster-level tornado every 328 events or approximately every 12.4 years.

The total historic losses and annualized losses by county are presented in Table 3-70. A loss ratio is calculated, which is the average annual loss divided by the total building exposure, as an indication of the significance of past tornado impacts to the overall building inventory in the county.

Based on Figure 3-69, tornadoes do not seem to concentrate in one particular area of the State. If the counties with at least 15 F1 or greater events are plotted on the map, the concentration remains in the southeast corner. The only outliers are Pennington, Meade, and Brown. As such, it is expected that the counties of Minnehaha, Lincoln, Turner, McCook, Yankton, Charles Mix, and Davison have higher vulnerabilities to tornados and associated losses than the other counties in the state, although Pennington, Beadle, and Brown Counties should all also be considered at high risk.

3.3.9.4.1 Future vulnerability

Lincoln County experienced the greatest population gain from 2000 – 2011 of all the counties in South Dakota. Of the other counties with high or very high vulnerability to tornadoes, Minnehaha, Brown, and Pennington County experienced population growth between 2000 and 2011. Turner County’s population declined during that timeframe. As these counties continue to grow, their vulnerability to winter storms will increase as the exposure of population and property continues to grow. However, future growth in any county may alter the increased future vulnerability to tornado events, as density increases (which increases the potential for catastrophic damages) or as more population becomes exposed. This should be carefully monitored in the southeast corner of the state.

Figure 3-69 Tornado Vulnerability

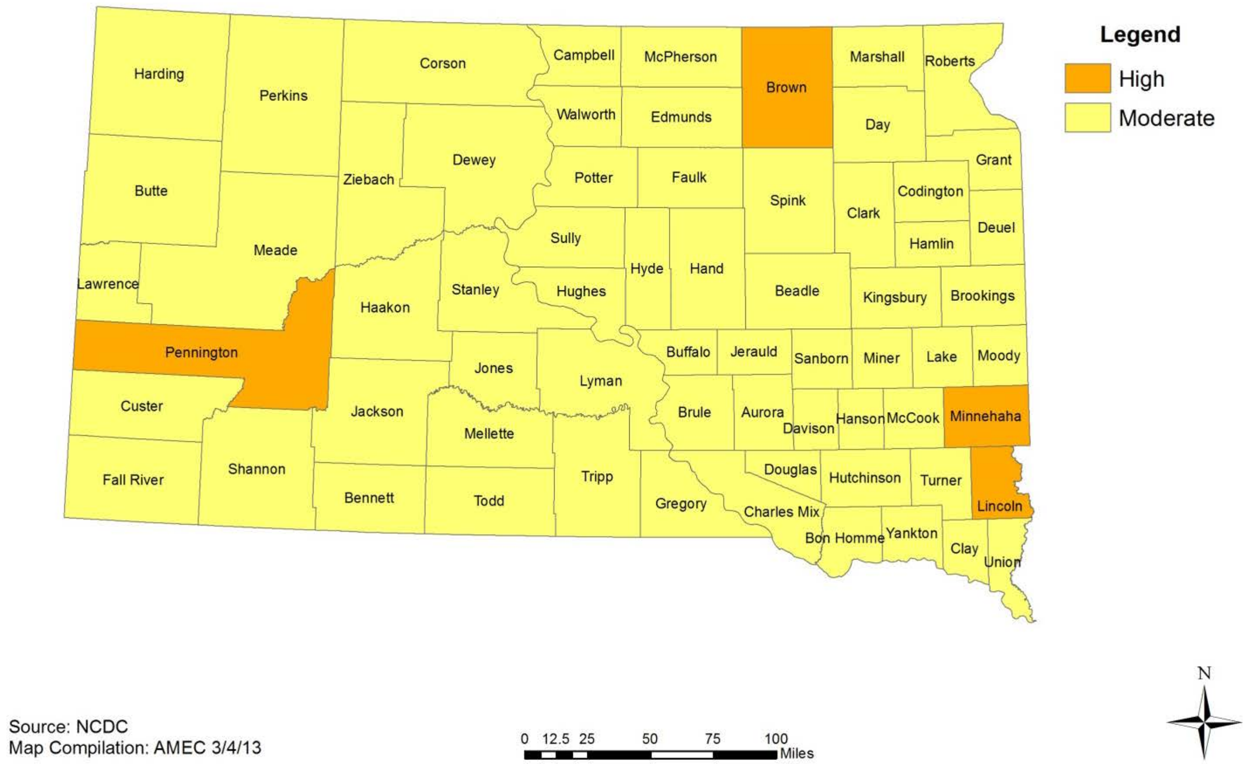


Table 3-69 Vulnerability of South Dakota Counties to Tornadoes

County	2012 Prior Event Rating	2012 Prior Event Rating ≥F1	Building Exposure Valuation Rating	Pop. Density Rating	Tornado Vulnerability	Tornado Vulnerability ≥F1
Minnehaha	5	8	10	10	High	Very High
Brown	10	10	3	1	High	High
Lincoln	7	8	2	4	High	High
Pennington	6	6	6	2	High	High
Turner	6	8	1	1	Moderate	High
Aurora	2	2	1	1	Moderate	Moderate
Beadle	5	6	2	1	Moderate	Moderate
Bennett	4	4	1	1	Moderate	Moderate
Bon Homme	4	6	1	1	Moderate	Moderate
Brookings	4	4	2	2	Moderate	Moderate
Brule	4	5	1	1	Moderate	Moderate
Buffalo	2	2	1	1	Moderate	Moderate
Butte	2	4	1	1	Moderate	Moderate
Campbell	2	3	1	1	Moderate	Moderate
Charles Mix	6	9	1	1	Moderate	Moderate
Clark	4	6	1	1	Moderate	Moderate
Clay	4	5	1	2	Moderate	Moderate
Codington	4	4	2	2	Moderate	Moderate

County	2012 Prior Event Rating	2012 Prior Event Rating ≥F1	Building Exposure Valuation Rating	Pop. Density Rating	Tornado Vulnerability	Tornado Vulnerability ≥F1
Corson	3	2	1	1	Moderate	Moderate
Custer	2	4	1	1	Moderate	Moderate
Davison	4	5	2	3	Moderate	Moderate
Day	3	3	1	1	Moderate	Moderate
Deuel	3	3	1	1	Moderate	Moderate
Dewey	4	3	1	1	Moderate	Moderate
Douglas	4	3	1	1	Moderate	Moderate
Edmunds	3	3	1	1	Moderate	Moderate
Fall River	4	6	1	1	Moderate	Moderate
Faulk	3	3	1	1	Moderate	Moderate
Grant	3	3	1	1	Moderate	Moderate
Gregory	3	4	1	1	Moderate	Moderate
Haakon	3	5	1	1	Moderate	Moderate
Hamlin	3	3	1	1	Moderate	Moderate
Hand	4	5	1	1	Moderate	Moderate
Hanson	3	4	1	1	Moderate	Moderate
Harding	3	3	1	1	Moderate	Moderate
Hughes	2	3	2	2	Moderate	Moderate
Hutchinson	6	7	1	1	Moderate	Moderate
Hyde	2	1	1	1	Moderate	Moderate
Jackson	3	4	1	1	Moderate	Moderate
Jerauld	2	1	1	1	Moderate	Moderate
Jones	1	2	1	1	Moderate	Moderate
Kingsbury	6	6	1	1	Moderate	Moderate
Lake	3	5	1	1	Moderate	Moderate
Lawrence	3	4	2	2	Moderate	Moderate
Lyman	5	6	1	1	Moderate	Moderate
Marshall	3	4	1	1	Moderate	Moderate
McCook	6	8	1	1	Moderate	Moderate
McPherson	3	4	1	1	Moderate	Moderate
Meade	5	7	2	1	Moderate	Moderate
Mellette	2	2	1	1	Moderate	Moderate
Miner	4	6	1	1	Moderate	Moderate
Moody	2	3	1	1	Moderate	Moderate
Perkins	5	6	1	1	Moderate	Moderate
Potter	3	5	1	1	Moderate	Moderate
Roberts	4	6	1	1	Moderate	Moderate
Sanborn	3	4	1	1	Moderate	Moderate
Shannon	3	4	1	1	Moderate	Moderate
Spink	5	5	1	1	Moderate	Moderate
Stanley	3	4	1	1	Moderate	Moderate
Sully	3	3	1	1	Moderate	Moderate
Todd	5	4	1	1	Moderate	Moderate

County	2012 Prior Event Rating	2012 Prior Event Rating ≥F1	Building Exposure Valuation Rating	Pop. Density Rating	Tornado Vulnerability	Tornado Vulnerability ≥F1
Tripp	4	6	1	1	Moderate	Moderate
Union	6	5	2	2	Moderate	Moderate
Walworth	4	5	1	1	Moderate	Moderate
Yankton	4	6	2	3	Moderate	Moderate
Ziebach	3	3	1	1	Moderate	Moderate

Table 3-70 Annualized Losses from Tornadoes

County	Total Events	Total Damage (inflated to 2012 $)	Annualized Losses	Total Building Exposure	Loss Ratio
Buffalo	13	$40,991,510	$661,153	$100,061,000	0.00661
McCook	39	$44,441,499	$716,798	$612,248,000	0.00117
Lincoln	50	$157,514,376	$2,540,554	$2,523,166,000	0.00101
Turner	42	$51,471,078	$830,179	$1,007,884,000	0.00082
Gregory	22	$22,208,895	$358,208	$456,957,000	0.00078
McPherson	21	$13,099,466	$211,282	$314,202,000	0.00067
Hand	29	$19,966,516	$322,041	$493,566,000	0.00065
Tripp	30	$18,830,914	$303,724	$658,946,000	0.00046
Clark	26	$11,402,416	$183,910	$421,929,000	0.00044
Brule	27	$12,031,035	$194,049	$596,509,000	0.00033
Potter	20	$8,462,831	$136,497	$456,830,000	0.00030
Kingsbury	39	$12,048,831	$194,336	$656,453,000	0.00030
Campbell	12	$3,142,331	$50,683	$174,844,000	0.00029
Miner	29	$5,017,096	$80,921	$297,868,000	0.00027
Bennett	23	$3,231,730	$52,125	$195,828,000	0.00027
Ziebach	22	$1,671,568	$26,961	$104,699,000	0.00026
Beadle	32	$21,846,842	$352,368	$1,916,945,000	0.00018
Yankton	27	$28,935,743	$466,706	$2,540,290,000	0.00018
Davison	24	$20,572,249	$331,810	$1,924,360,000	0.00017
Mellette	12	$1,343,958	$21,677	$127,367,000	0.00017
Day	22	$8,213,528	$132,476	$786,332,000	0.00017
Corson	22	$2,178,746	$35,141	$221,122,000	0.00016
Roberts	23	$9,488,190	$153,035	$1,005,396,000	0.00015
Charles Mix	42	$8,485,126	$136,857	$920,018,000	0.00015
Shannon	20	$4,926,733	$79,463	$537,295,000	0.00015
Marshall	16	$4,530,233	$73,068	$564,043,000	0.00013
Codington	29	$21,527,349	$347,215	$2,906,193,000	0.00012
Perkins	34	$2,530,977	$40,822	$351,552,000	0.00012

County	Total Events	Total Damage (inflated to 2012 $)	Annualized Losses	Total Building Exposure	Loss Ratio
Hanson	18	$2,019,246	$32,568	$283,877,000	0.00011
Hughes	12	$13,075,448	$210,894	$1,902,172,000	0.00011
Bon Homme	23	$4,922,708	$79,399	$721,858,000	0.00011
Douglas	24	$1,820,104	$29,357	$324,852,000	0.00009
Walworth	23	$3,350,528	$54,041	$650,420,000	0.00008
Todd	36	$2,248,569	$36,267	$460,277,000	0.00008
Lake	20	$5,907,212	$95,278	$1,341,795,000	0.00007
Clay	30	$5,032,445	$81,168	$1,281,351,000	0.00006
Sanborn	21	$1,049,842	$16,933	$269,355,000	0.00006
Haakon	21	$931,208	$15,019	$254,858,000	0.00006
Brown	77	$14,326,236	$231,068	$3,962,092,000	0.00006
Jackson	19	$682,019	$11,000	$191,703,000	0.00006
Fall River	29	$2,382,926	$38,434	$705,774,000	0.00005
Meade	38	$6,765,296	$109,118	$2,055,433,000	0.00005
Butte	14	$2,083,622	$33,607	$695,462,000	0.00005
Union	42	$4,560,606	$73,558	$1,827,003,000	0.00004
Hutchinson	42	$1,997,638	$32,220	$856,109,000	0.00004
Lyman	36	$728,615	$11,752	$349,785,000	0.00003
Pennington	42	$18,089,266	$291,762	$9,445,117,000	0.00003
Dewey	26	$561,240	$9,052	$297,636,000	0.00003
Sully	20	$320,096	$5,163	$187,729,000	0.00003
Brookings	24	$4,941,762	$79,706	$2,935,763,000	0.00003
Faulk	15	$454,717	$7,334	$270,522,000	0.00003
Harding	17	$224,586	$3,622	$135,105,000	0.00003
Aurora	13	$513,026	$8,275	$312,437,000	0.00003
Minnehaha	38	$27,489,456	$443,378	$17,168,013,000	0.00003
Spink	37	$1,245,846	$20,094	$788,639,000	0.00003
Hyde	10	$270,857	$4,369	$173,924,000	0.00003
Stanley	21	$378,946	$6,112	$266,209,000	0.00002
Moody	10	$827,037	$13,339	$635,480,000	0.00002
Hamlin	17	$773,837	$12,481	$634,202,000	0.00002
Jones	6	$142,378	$2,296	$117,580,000	0.00002
Grant	17	$867,345	$13,989	$803,906,000	0.00002
Lawrence	16	$2,017,929	$32,547	$2,359,878,000	0.00001
Custer	10	$380,726	$6,141	$742,459,000	0.00001
Jerauld	8	$118,852	$1,917	$291,140,000	0.00001
Deuel	18	$189,694	$3,060	$467,637,000	0.00001
Edmunds	18	$140,885	$2,272	$448,245,000	0.00001
Total	**1,655**	**$693,944,511**	**$11,192,653**	**$79,488,700,000**	**n/a**

3.3.10 Windstorms

3.3.10.1 Methodology

To assess the vulnerability of each of South Dakota's counties to windstorm events, the state assigned ratings to three factors that were examined at the county level: prior events, building exposure, and population density. The state then summed the ratings to obtain overall vulnerability scores for each county so that they could be compared and greatest vulnerability determined. This methodology is similar to that used in assessing vulnerability for winter storms. The factors are described below.

3.3.10.2 Vulnerability Factors

Prior Events—This rating is based on the number of past windstorm events experienced by each county between January 1955 and October 2012 according to data from the National Climatic Data Center's Storm Events database (a compilation of storm data from the National Weather Service). For the purposes of this plan, a windstorm event is considered thunderstorm winds or high winds as identified in the National Climatic Data Center's database. In addition, particularly severe events (those with a speed of 70 knots or higher or that caused monetary damage, fatalities, or injuries) were also assessed. (see the description of the windstorm events that affect South Dakota in the Windstorm Hazard Profile).

To develop the prior event rating, the total range of past occurrences was divided into 10 roughly equal ranges as shown in Table 3-71 and Table 3-72. The ranges were numbered 1 through 10 in ascending order.

Table 3-71 Windstorm Prior Event Ratings

# of Past Occurrences	Rating
46-83	1
84-121	2
122-160	3
161-198	4
199-237	5
238-275	6
276-313	7
314-352	8
353-390	9
391-429	10

Table 3-72 Windstorm Prior Event Ratings (Wind speed ≥70 kts)

# of Past Occurrences	Rating
6-11	1
12-18	2
19-24	3
25-31	4
32-38	5
39-44	6

# of Past Occurrences	Rating
45-51	7
52-57	8
58-64	9
65-71	10

Building exposure ratings and population density ratings can be found in Table 3-50 and Table 3-51 respectively.

A fourth factor, past windstorm damage, may be considered for the next plan update based on the availability of information. Currently, county-level damage information is not available for wind. While many of the events in the National Climatic Data Center's Storm Event database are at the county level, there are some events that are regional and for which damage values are for an entire storm and cannot be approximated for each individual affected county.

After rating each of the counties on the factors described above, the three factor ratings were added together to produce a county-level vulnerability rating. The highest possible total vulnerability rating was 30. The total range of vulnerability was divided into three equal ranges as shown in Table 3-73. The ranges were assigned a corresponding level of windstorm vulnerability: moderate, high, and very high.

Table 3-73 Windstorm Vulnerability

Windstorm Vulnerability Range	Windstorm Vulnerability
3-11	Moderate
12-21	High
22-30	Very High

This vulnerability was assigned to each county considering both total windstorm events and those with a wind speed of 70 knots or greater, or that caused damage, injuries, or fatalities.

3.3.10.3 Results

Summary of Prior Event Ratings—The lowest number of recorded windstorm events over this 57-year period was 46 in Lawrence County; the highest was 429 in Meade County. For events of at least 70 knots or that caused property damage, fatalities, or injuries, the least reported was 1 (Lawrence, Hyde, Jones, Buffalo, Hand, McPherson, Campbell, Deuel, and Potter counties) and the most was 71 events in Meade County. For both ratings, only Meade County received a score of 10. Pennington County received a score of 10 for total events and a score of 9 for events of at least 70 knots or that caused damage, injuries, or fatalities. In terms of all events, Lawrence, Douglas, Jerauld, Aurora, Buffalo, Grant, Gregory, Hamlin, Moody, Hyde, Miner, Hanson, Jones, McPherson, Sanborn, Roberts, and Deuel counties received ratings of 1. This category expanded when events were limited to 70 knots or greater or to events that caused damage, injuries, or fatalities, and included Lawrence, Hyde, Jones, Buffalo, Hand, McPherson, Campbell, Deuel, and. In both cases, most counties received ratings of 1, 2, or 3. Roughly 80% of the counties received a rating of 1, 2, or 3 for total events, and roughly 47% of counties received the same ratings for events of at least 70 knots or that caused damage, injuries, or fatalities. The counties that received a prior event rating greater than 4 are shown in Table 3-74 and counties that received a prior event rating greater than 4 for events of at least 70 knots or that caused damage, injuries, or fatalities are shown in Table 3-75.

Table 3-74 Counties with Windstorm Prior Event Ratings Greater Than 4

County	# of Prior Events	Prior Event Rating
Beadle	207	5
Perkins	218	5
Butte	228	5
Brown	243	6
Minnehaha	251	6
Harding	265	6
Pennington	392	10
Meade	429	10

Table 3-75 Counties with Windstorm Prior Event Ratings of ≥70 kts Greater Than 4

County	# of Prior Events	Prior Event Rating
Moody	32	5
Bon Homme	33	5
Day	33	5
Haakon	33	5
Turner	34	5
Clay	34	5
Hutchinson	34	5
Todd	35	5
Davison	36	5
Jackson	36	5
McCook	37	5
Kingsbury	37	5
Harding	38	5
Yankton	42	6
Charles Mix	43	6
Lake	44	6
Lincoln	44	6
Butte	45	7
Perkins	46	7
Brookings	50	7
Beadle	53	8
Pennington	59	9
Minnehaha	66	10
Meade	71	10

Table 3-76 in the Total Windstorm Vulnerability section shows prior event ratings for all South Dakota counties. A spreadsheet that includes the corresponding values can be found in Appendix 3F South Dakota Windstorm Vulnerability.

3.3.10.4 Total Windstorm Vulnerability and Estimate of Potential Loss

According to this methodology, every South Dakota county is vulnerable to windstorm but some counties have a higher risk than others. In addition, the vulnerability can vary slightly based on the severity of windstorm events. In both scenarios, only Minnehaha County has a very high vulnerability. This is largely due to Minnehaha's high ratings for building exposure and population density. In the total windstorm events vulnerability, Pennington and Meade have high vulnerability. When windstorm events of at least 70 knots or that caused damage, injuries, or fatalities are considered, Lincoln, Pennington, and Meade have high vulnerability. The remaining counties have moderate vulnerability for both total events and severe events. Figure 3-70 illustrates the vulnerability of South Dakota counties to windstorm, and Table 3-76 shows all the South Dakota counties ranked by total windstorm vulnerability along with their three vulnerability factor ratings. In general, the counties with the greatest vulnerability to windstorm events are those in the Black Hills region and those with major cities. The results of this assessment are very similar to the results from the 2011 plan.

It is difficult to pick an area of higher vulnerability to windstorms in the state if all windstorm events are examined. Counties where at least 100 events have been recorded are fairly evenly distributed across the state. Counties with at least 150 reported events are centralized in the Black Hills region, and then include the counties of Hughes, Brown, Beadle, Davison and Minnehaha. When counties receiving a past events rating higher than 5 for events of at least 70 knots are plotted, they are distributed in the southeast corner of the state and in the Black Hills region.

3.3.10.5 Future vulnerability

Lincoln County experienced the greatest population gain from 2000 – 2011 of all the counties in South Dakota, followed by McCook. Of the other counties with high vulnerability to windstorms, Pennington and Meade identified increased population at 15.8% gain and 5.5% gain, respectively. Population increases, and the associated growth of development, increases a county's risk to damages and losses from windstorms. In general, livestock are not severely impacted by windstorms although particularly severe events or events that cause a drastic change in the environment (such as wind chill) may incur disproportionate losses in livestock relative to the rest of the hazard events, therefore agricultural counties may also have periodic increases of vulnerability to events.

Figure 3-70 Windstorm Vulnerability

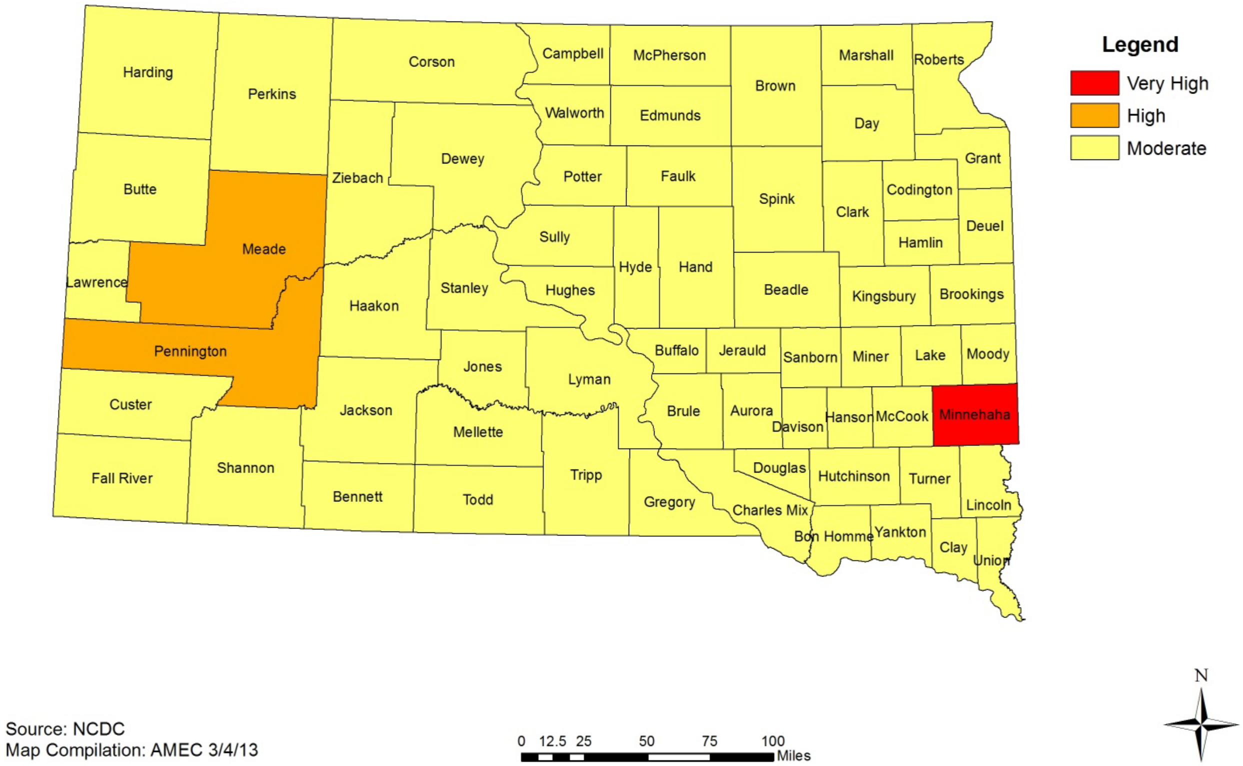


Table 3-76 Vulnerability of South Dakota Counties to Windstorm

County	Prior Event Rating	Building Exposure Valuation Rating	Pop. Density Rating	Windstorm Vulnerability
Minnehaha	6	10	10	Very High
Pennington	10	6	2	High
Meade	10	2	1	High
Brown	6	3	1	Moderate
Lincoln	3	2	4	Moderate
Beadle	5	2	1	Moderate
Davison	3	2	3	Moderate
Harding	6	1	1	Moderate
Hughes	4	2	2	Moderate
Yankton	3	2	3	Moderate
Brookings	3	2	2	Moderate
Butte	5	1	1	Moderate
Codington	3	2	2	Moderate
Perkins	5	1	1	Moderate
Corson	4	1	1	Moderate
Custer	4	1	1	Moderate
Haakon	4	1	1	Moderate
Shannon	4	1	1	Moderate
Union	2	2	2	Moderate
Charles Mix	3	1	1	Moderate

County	Prior Event Rating	Building Exposure Valuation Rating	Pop. Density Rating	Windstorm Vulnerability
Clay	2	1	2	Moderate
Day	3	1	1	Moderate
Dewey	3	1	1	Moderate
Edmunds	3	1	1	Moderate
Jackson	3	1	1	Moderate
Lawrence	1	2	2	Moderate
Lyman	3	1	1	Moderate
Spink	3	1	1	Moderate
Stanley	3	1	1	Moderate
Todd	3	1	1	Moderate
Tripp	3	1	1	Moderate
Walworth	3	1	1	Moderate
Ziebach	3	1	1	Moderate
Bennett	2	1	1	Moderate
Bon Homme	2	1	1	Moderate
Brule	2	1	1	Moderate
Campbell	2	1	1	Moderate
Clark	2	1	1	Moderate
Fall River	2	1	1	Moderate
Faulk	2	1	1	Moderate
Hand	2	1	1	Moderate
Hutchinson	2	1	1	Moderate
Kingsbury	2	1	1	Moderate
Lake	2	1	1	Moderate
Marshall	2	1	1	Moderate
McCook	2	1	1	Moderate
Mellette	2	1	1	Moderate
Potter	2	1	1	Moderate
Sully	2	1	1	Moderate
Turner	2	1	1	Moderate
Aurora	1	1	1	Moderate
Buffalo	1	1	1	Moderate
Deuel	1	1	1	Moderate
Douglas	1	1	1	Moderate
Grant	1	1	1	Moderate
Gregory	1	1	1	Moderate
Hamlin	1	1	1	Moderate
Hanson	1	1	1	Moderate
Hyde	1	1	1	Moderate
Jerauld	1	1	1	Moderate
Jones	1	1	1	Moderate
McPherson	1	1	1	Moderate
Miner	1	1	1	Moderate
Moody	1	1	1	Moderate
Roberts	1	1	1	Moderate
Sanborn	1	1	1	Moderate

To estimate potential losses to wind, historic loss data was analyzed. The National Climatic Data Center data did not lend itself to county by county loss summaries, only a statewide summary. Based on historic loss information presented in the wind hazard profile, South Dakota averages 123.3 windstorms, $2.605 million in wind losses, and roughly two injuries each year. The average cost of a windstorm in South Dakota is $21,137. The state has also experienced 575 events since 1955 with a wind speed of at least 70 knots, which accounted for three deaths and 67 injuries. This averages out to ten particularly severe storms per year with an average yearly cost of $1.385 million. In addition, South Dakota has experienced three windstorms that resulted in a disaster declaration. Of these three events, the event on July 22, 2005 was credited entirely to wind, while the other two events also included damages from flooding and/or tornadoes. The total FEMA disaster relief costs for these three events are estimated at over $121.6 million in 2012 dollars, with an average cost of $40.5 million (also in 2012 dollars.) Based on past events, South Dakota can expect a disaster declaration-level windstorm event every 2,342 events or once approximately every 19 years.

3.3.11 Hazardous Materials

It is difficult to quantify trends in hazardous materials transportation incidents due to their somewhat random nature, but based on historic incidents more than half of the transportation incidents between 1971 and 2012 occurred in Minnehaha and Pennington counties, where the state’s largest cities, Sioux Falls and Rapid City, are located. These counties are trailed by Brown, Codington, and Brookings in terms of numbers of incidents. Based on the information in the hazard profile section, South Dakota experienced 760 transportation incidents involving hazardous materials between 1971 and 2012, an increase of 51 events since the 2011 plan. The total cost of damage associated with these incidents was approximately $6,537,056. This suggests that South Dakota experiences 18 transportation incidents involving hazardous materials and $159,440 in related damage each year. Among these incidents there were 3 deaths and 16 injuries. In total, 357 people were evacuated. 16 of the incidents were rail related, 28 were air, and the remaining 716 were highway. Other concerns noted in the planning process are the transport of nuclear materials, which often occurs without the knowledge of local governments or tribal organizations.

Vulnerability to pipeline incidents was determined solely on the total number of miles of gas or hazardous liquid transmission lines, as detailed in the hazard profile section. Based on this table the top ten counties with the most transmission lines are Lincoln, Minnehaha, Brown, Clark, Spink, Butte, Hutchinson, Union, Harding, and Kingsbury, most of which are located in southeastern/eastern South Dakota. According to the U.S. Department of Transportation’s PHMSA, there were 42 pipeline incidents in South Dakota between 1983 and 2012 (29 years), totaling $12,245,360, which equates to $422,254 in average annual loss. Pennington and Minnehaha each had 8 incidents in this time period, Beadle had 3, and Brown, Clark, Codington, Custer, Decatur, Kingsbury, Lawrence, Lincoln, McCook, Sanborn, Union, Walworth, and Yankton each had 2 or fewer.

3.3.11.1 Future vulnerability

Lincoln, Union, Pennington, and Minnehaha counties experienced the greatest population gains from 2000 – 2011 of all the counties in South Dakota. These counties may continue to see the most hazardous materials incidents throughout the state due to growing populations. Codington County identified construction of new homes indicating an increase in population and development. These growth and development trends must be taken into consideration when assessing vulnerability of jurisdictions to hazardous materials incidents. Although a high vulnerability for Brookings County did not arise in this plan, they may become more vulnerable to hazardous materials as the population increases and the transportation systems expand throughout the county. Southeastern counties are more vulnerable to fixed facility incidents in general due to the number of facilities there. The counties with these facilities are listed in the hazard profile section. Available data does not support further refinement of vulnerability to fixed facility incidents based on historic losses.

3.3.12 Geologic Hazards

Information regarding previous landslides, mudflows, and subsidence throughout the State of South Dakota was too limited, at the time of this plan update, to assess the vulnerability and potential losses by jurisdiction. Limited areas throughout the state are vulnerable to landslides and mudflows as depicted in the hazard profile. Available data does not support further refinement of vulnerability to landslides and mudflows based on historic losses. South Dakota Geological Survey has been updating county studies on swelling soils. Completed studies should be referenced during the next plan update.

A HAZUS-MH annualized earthquake loss scenario was run for the entire state in the 2007 update to this plan. This enabled a consistent comparison of earthquake risk across the state. The annualized expected loss (AEL) addresses key components of risk: the probability of hazard occurring in the study area, the consequences of the hazard (largely a function of building construction type and quality), and the intensity of the hazard event. By annualizing estimated losses, the AEL factors in historical patterns of frequent small events with infrequent larger events to provide a balanced presentation of the risk. In HAZUS-MH, losses are annualized over eight earthquake return periods (100, 200, 500, 750, 1,000, 1,500, 2,000, and 2,500 years).

The results of this scenario indicate annualized building losses (includes building structure, content and income losses) totaling $440,000. 7,693 buildings would be at least moderately damaged, with 55% of the losses sustained by residential buildings. The counties with the highest building losses are Pennington ($110,000), Minnehaha ($59,000), and Lawrence ($26,000), with the remaining counties having $18,000 or less in annualized loss. 420 households could be displaced by earthquakes according to this scenario. No casualties were generated by the scenario.

3.3.12.1 Future vulnerability

Minnehaha, Lincoln, and Pennington were in the top 4 counties that experienced the greatest population gains from 2000 – 2011 of all the counties in South Dakota. Areas with high development will continue to be the areas most vulnerable to structural damage from earthquakes. Site specific investigations and mitigation measures should help to limit future damages from expansive soils and landslides. SDDOT has plans to inventory the known active and/or previously addressed slide locations as part of the Department's overall asset management program. This initiative may not be completed for some time but should be revisited during the next plan update if the data is available.

3.3.13 Agricultural Pest and Diseases

This hazard was added to the plan in 2011 and updated for the 2014 plan. This hazard includes a number of different pests and diseases that could affect the agricultural industry. The types of impacts will vary from year to year and county to county, but it is anticipated that the agricultural industry will continue to suffer losses from the various pests and diseases. Economically, these impacts can total up to a billion dollars in the State. Outside of the economic impacts, some of these have the potential to affect human health as well, as noted in Table 3-6 in the Agricultural Pest and Diseases hazard profile. Average annual crop loss can be loosely estimated based on indemnity data from the RMA. By averaging the indemnities for affected South Dakota counties between 2010 and 2012, the State could expect to receive roughly $605,127 in insect-related indemnities and $1,312,710 in plant disease-related indemnities in any given year.

Annual cattle death loss is more difficult to estimate accurately given the report increments and absence of state level data in 2005 and 2000. Averages of the data from 2011, 1995, and 1991 indicate that South Dakota could expect to lose 60,866 cattle and 120,866 calves to combined predator and non-predator causes in any given year. This includes 7,822 cattle and 27,306 calves lost to digestive problems in any given year, and 17,316 cattle and 29,193 calves lost to respiratory problems in any given year. At a value of $1,133 per head for cattle and $381 per head for calves, South Dakota's cattle industry losses in 2010 totaled $52,384,926 due to respiratory, digestive, and other diseases. Total dollar value per head was not provided in the 1995 and 1991 reports. Additional outreach to the South Dakota Animal Industry Board during 2013 did not yield updated or more specific impact data. Further analysis of the risk and potential loss from these hazards should be considered in future updates to this plan.

3.3.14 Rural Electric Cooperative Considerations

During the 2014 update the Rural Electric Cooperatives (REC) were engaged as participants in the state planning effort. This discussion focuses on the potential hazard risks to RECs. During the 2014 update a REC data collection guide was developed to guide RECs on the information needed for refining vulnerability and loss estimates in future updates. This includes a hazard identification and vulnerability assessment that can be used to help a REC identify its primary risks. The goal of this process is to produce information that may inform the State's hazard mitigation plan in future updates. This process may also help RECs identify possible projects that may be eligible for federal mitigation funding pre or post disaster. These guides were distributed to the RECs and should provide more data collection for integration and analysis in the HMP's next update cycle. In 2013 two of these were filled out by RECs and used to enhance the hazard profiles for winter storm, tornado, and wind, which are also the hazards noted as most significant from the RECs' perspective. Winter storms, wind and tornadoes pose the greatest risk to power lines and facilities operated by the RECs. These hazards can knock down power lines, which tend to be the most vulnerable elements of the electrical grid. To determine how this risk may vary across the various REC's an overlay analysis of REC was done to determine their intersection with high and very high vulnerable counties for Winter Storms, Wind, and Tornadoes identified through the previous methods described. The boundaries of the RECs are displayed in Figure 3-71. The results of the analysis are summarized in Table 3-77.

Figure 3-71 South Dakota Rural Electric Cooperative Boundaries

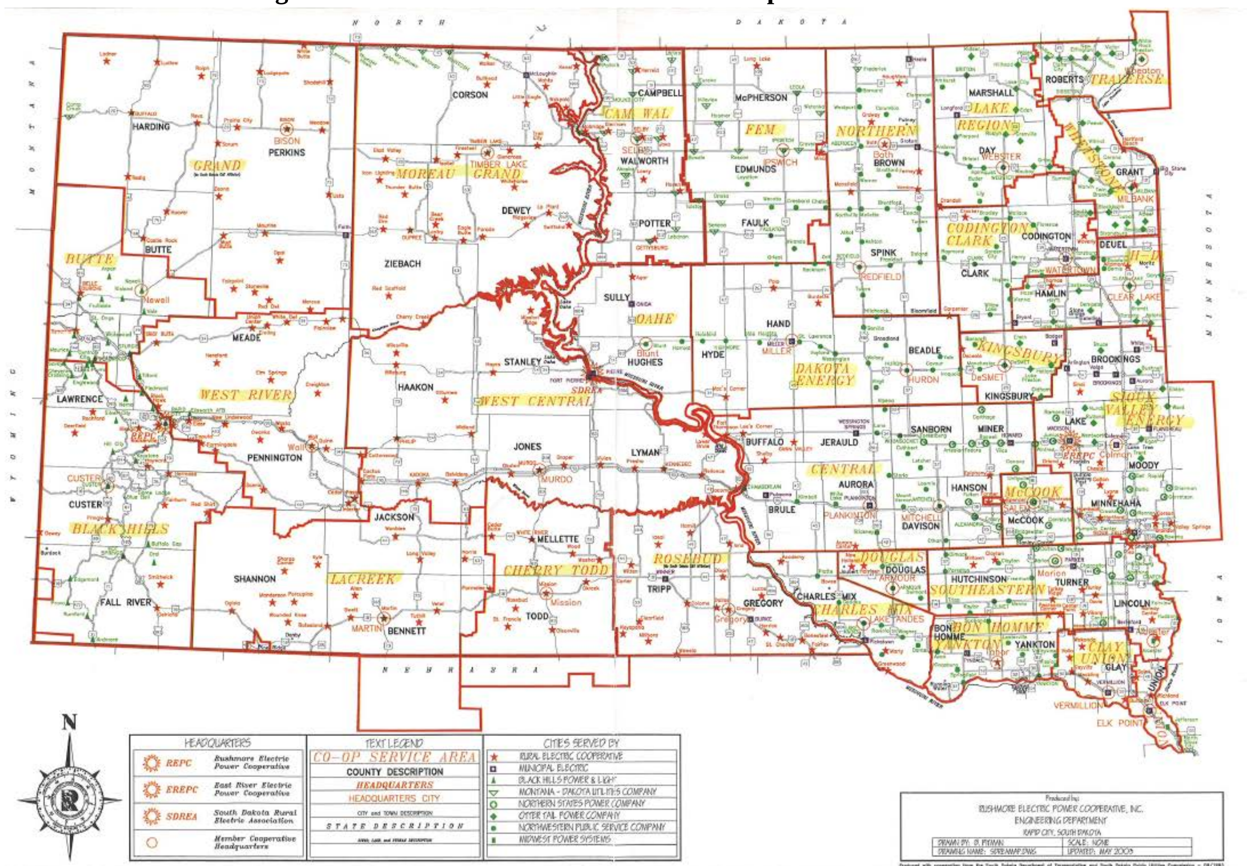


Table 3-77 Rural Electric Cooperative Hazard Vulnerabilities

Rural Electric Cooperative	County	Winter Storm Vulnerability	Wind Storm Vulnerability for events 70 kts or greater*	Tornado Vulnerability for events F1 or greater*
Black Hills Electric Cooperative, Inc	Pennington	High	High	High
Black Hills Power & Light Co	Meade	High	High	Moderate
Black Hills Power & Light Co	Pennington	High	High	High
Butte Electric Cooperative, Inc.	Meade	High	High	Moderate
Central Electric Cooperative Inc.	Davison	High	Moderate	Moderate
Clay-Union Electric Corporation	Lincoln	High	High	High
Clay-Union Electric Corporation	Turner	Moderate	Moderate	High
Grand Electric Cooperative, Inc.	Meade	High	High	Moderate
H-D Electric Cooperative, Inc	Brookings	High	Moderate	Moderate
Kingsbury Electric Cooperative, Inc	Brookings	High	Moderate	Moderate

Rural Electric Cooperative	County	Winter Storm Vulnerability	Wind Storm Vulnerability for events 70 kts or greater*	Tornado Vulnerability for events F1 or greater*
Lake Region Electric Association, Inc.	Brown	Moderate	Moderate	High
MidAmerican Energy	Lincoln	High	High	High
Montana-Dakota Utilities Co	Brown	Moderate	Moderate	High
Northern Electric Cooperative Inc.	Brown	Moderate	Moderate	High
Northwestern Energy	Brown	Moderate	Moderate	High
Northwestern Energy	Davison	High	Moderate	Moderate
Otter Tail Power Co	Brookings	High	Moderate	Moderate
Sioux Falls Municipal Electric and Xcel Energy	Minnehaha	Very High	Very High	Very High
Sioux Valley Energy	Brookings	High	Moderate	Moderate
Sioux Valley Energy	Minnehaha	Very High	Very High	Very High
Southeastern Electric Cooperative, Inc	Lincoln	High	High	High
Southeastern Electric Cooperative, Inc	Minnehaha	Very High	Very High	Very High
Southeastern Electric Cooperative, Inc	Turner	Moderate	Moderate	High
West River Electric Association , Inc.	Meade	High	High	Moderate
West River Electric Association , Inc.	Pennington	High	High	High
XCEL Energy	Lincoln	High	High	High
XCEL Energy	Minnehaha	Very High	Very High	Very High
XCEL Energy	Turner	Moderate	Moderate	High

*Also includes events that caused death or injury, or resulted in recorded financial damage

Based on this analysis notable REC's subject to risk from winter storm, wind, and tornadoes include:

- Black Hills Electric Coop
- Black Hills Power & Light Co.
- Clay-Union Electric Corporation
- MidAmerican Energy
- Sioux Falls Municipal Electric/Xcel Energy
- Sioux Valley Energy
- Southeastern Electric
- West River Electric

In addition wildfire can impact power lines in the Black Hills and parts of southeastern South Dakota (e.g. Lincoln County). The Black Hills, Butte, West River, and Southeastern REC's are more vulnerable to wildfires.

An overlay of power facilities on flood and wildfire hazard areas to identify specific facilities potentially at risk is discussed in the next section and captured in the tables in Appendix 3H.

South Dakota has funded several power line burial projects with HMGP funds in an effort to reduce future disaster losses. Data from disasters spanning (2005-2012) include 164 projects totaling $15.8M federal share. These projects are summarized in Table 3-78 . When comparing the data to Rural Electric Cooperative Hazard Vulnerabilities (Table 3-77), it does not appear that funding for REC mitigation projects is necessarily being spent in the areas with the highest vulnerability to windstorm, winter storm, or tornado. For example Minnehaha, McCook, and Pennington counties each ranked high or very high in vulnerability to at least one of the hazards, but the mitigation project data does not indicate investments in these counties. However, investments have been made in Lincoln, Brookings, Brown, and Davison counties which all had high or very high ranking in at least one of the three hazards. Additional data collection and analysis will be needed to estimate potential dollar losses to the REC's.

Table 3-78 REC Mitigation Funding and Miles of Line Buried by County: 2005-2012

Rural Electric Cooperative	County	Miles	Total Obligated
Central	Aurora	10.5	$452,376
Dakota Energy	Beadle	31.25	$721,257
Kingsbury	Brookings	0	N/A
Northern	Brown	16.25	$1,363,547
Central	Buffalo	3	$154,000
Cam-Wal	Campbell	19.9	$382,086
Codington-Clark	Clark	4	$244,398
Codington-Clark	Codington	3	$207,000
Moreau-Grand	Corson	30	N/A
Central	Davison	17.5	$466,143
Codington-Clark	Day	0	$162,546
H-D	Deuel	4	$132,908
Douglas	Douglas	1.5	$1,082,224
FEM	Edmunds	10	$145,283
FEM	Faulk	3	$216,204
Whetstone	Grant	29.5	$1,297,058
H-D	Hamlin	8	$326,809
Dakota Energy	Hand	19	$453,000
Central	Hanson	19.75	$566,727
Southeastern	Hutchinson	22	$854,493
Kingsbury	Kingsbury	40	$935,538
Southeastern	Lincoln	0	$634,445
West Central	Lyman	0	$1,616,440
FEM	McPherson	4.5	$162,457
Central	Miner	9.5	$193,278
Traverse and Whetstone	Roberts	14	$916,386
Northern	Spink	18.5	$716,014
Oahe	Sully	1.2	$69,237
Cam-Wal	Walworth	8	$347,700
Moreau-Grand	Ziebach	0	$80,396

South Dakota has also used FEMA Public Assistance Section 406 mitigation to fund power line strengthening, burial, and retrofitting as part of project worksheets (PW) during post-disaster reconstruction. The table below summarizes the amount of projects and mitigation funding associated with Section 406 from disasters in 2008-2011 based on information provided by SDOEM. The damage category F mitigation dollars shown for DR1759 and DR1887 in the table below are primarily associated with power line burials or upgrades for RECs. DR1759 included funding for Grand Electric Coop and Butte Electric. DR 1887 included funding for Cam-Wal, Central, Dakota Energy, FEM, Grand, Moreau-Grand, and Whetstone Valley Electric cooperatives. Total mitigation funding from these two disasters is over $11M. Combined with the HMGP funding in the previous table the total includes over $26.8M in mitigation funds for the RECs since 2005.

Table 3-79 FEMA Public Assistance Section 406 Project and Mitigation Funding: 2008-2011

DR#	Type	Year	Damage Category	# of Applicants	# of PW's	Total
1984	Flood	2011	C	8	98	$745,578
1938	Flood	2010	C	12	14	$712,318
1947	Flood	2010	D+E	2	8	$86,870
1887	Winter Storm	2010	F	7	297	$9,596,751
1759	Winter Storm	2008	F	2	3	$1,458,213
						$12,599,729

3.4 ASSESSING VULNERABILITY AND ESTIMATING POTENTIAL LOSSES OF STATE FACILITIES

44 CFR Part 201 Requirement:

[The State risk assessment shall include an overview and analysis of the State's vulnerability to the hazards described in paragraph (c)(2), based on estimates provided in] the State risk assessment. …State owned critical or operated facilities located in the identified hazard areas shall also be addressed….

The State shall update the overview and analysis of vulnerable State owned or operated buildings, critical facilities, and infrastructure, based on available data. The update should reflect acquisition or development of new properties and infrastructure.

44 CFR Part 201 Requirement:

[The State risk assessment shall include an overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in] the State risk assessment. The State shall estimate the potential dollar losses to State-owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.

South Dakota uses the following definitions from the National Infrastructure Protection Plan to define its infrastructure, critical infrastructure, and key resources:

Infrastructure: The framework of interdependent networks and systems comprising identifiable industries, institutions (including people and procedures), and distribution capabilities that provide a reliable flow of products and services essential to the defense and economic security of the United States, the smooth functioning of government at all levels, and society as a whole. Consistent with the definition in the Homeland Security Act, infrastructure includes physical, cyber, and/or human elements.

Critical Infrastructure: Assets, systems, and networks, whether physical or virtual, so vital to the United States that the incapacity or destruction of such assets, systems, or networks would have a debilitating impact on security, national economic security, public health or safety, or any combination.

Key Resources: As defined in the Homeland Security Act, key resources are publicly or privately controlled resources essential to the minimum operations of the economy and the government.

The State Office of Emergency Management has developed a database of Key Resources and Critical Infrastructure that combines state and local facility information. This database addresses a data limitation noted in the 2004 plan. State owned or operated facilities are included in this database, based on input from state agencies. Using a geocoded database of government office buildings in the State from FEMA, OEM staff worked through a Technical Advisory Group (TAG), whose membership represents: Department of Tourism and State Development; Game, Fish and Parks; Bureau of Information and Telecommunication; Department of Public Safety; Department of Revenue and Regulation; Department of Environmental and National Resources; and Department of Transportation, to obtain available information regarding state owned or operated facilities.

Some local facilities are included in this database as well. The county emergency managers have contributed information on the facilities they feel align with the National Infrastructure Protection Plan definitions. Some of this information is sensitive and has restricted public access. A non-restricted version of the GIS database was made available for analysis during this plan's update in 2007, 2010, and 2013. Improvements to the database could include the addition of a building valuation field and a standardized classification of facility type. These improvements are still recommended in 2013. The database included the following types of facilities:

- Educational/School
- Electric power
- Emergency services
- Energy
- Hydro Electric
- Hospitals
- Law Enforcement
- Natural Gas
- Communication
- Airports
- Water Facilities
- Waste Water Facilities
- Processing
- Storage stockpiles
- Local health department offices
- State penitentiary
- State office buildings\facilities

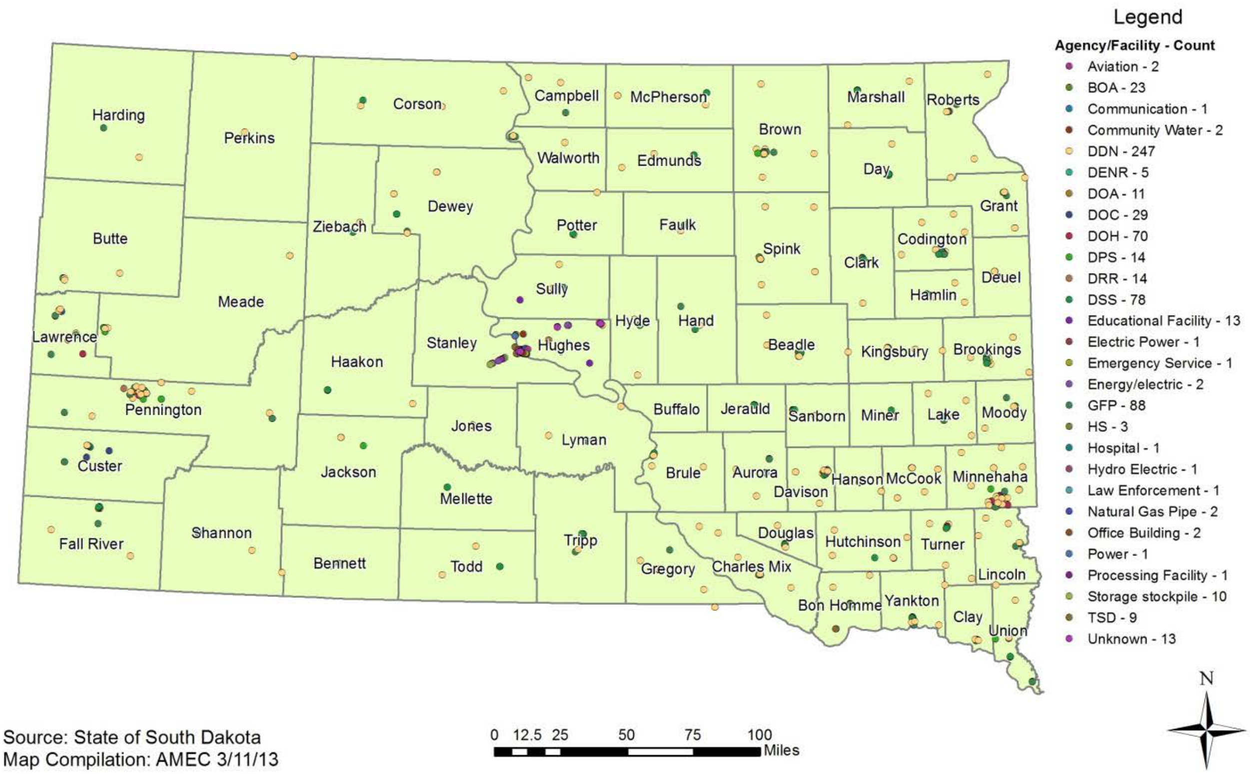
Five other GIS layers available from the South Dakota Department of Transportation contain additional information on utility-specific facilities, including:

- Water
- Communication
- Power
- Natural Gas
- Fuel

The State also provided a state buildings layer in GIS with state owned or leased facilities. The State did not have a complete utility/infrastructure layer, but several GIS layers were available from the South Dakota Department of Transportation. These layers included fuel, power, and natural gas utilities (point locations), and road and railroad networks. Utility networks included fiber optic, electric, natural gas, liquid petroleum, telecommunications, television and other networks. These layers were supplemented with national infrastructure data such as the National Inventory of Bridges and National Inventory of Dams and the Homeland Security Infrastructure Program (HSIP 2010) for the infrastructure vulnerability analysis.

Maps showing the general locations of the state buildings, critical facilities and utility infrastructure are included in Figure 3-72 and Figure 3-73. The scale of these maps is limited by the size constraints of this document. Images can be made available for large scale printing if desired or re-created from GIS.

Figure 3-72 South Dakota State Facilities



Source: State of South Dakota
Map Compilation: AMEC 3/11/13

Figure 3-73 South Dakota Utilities

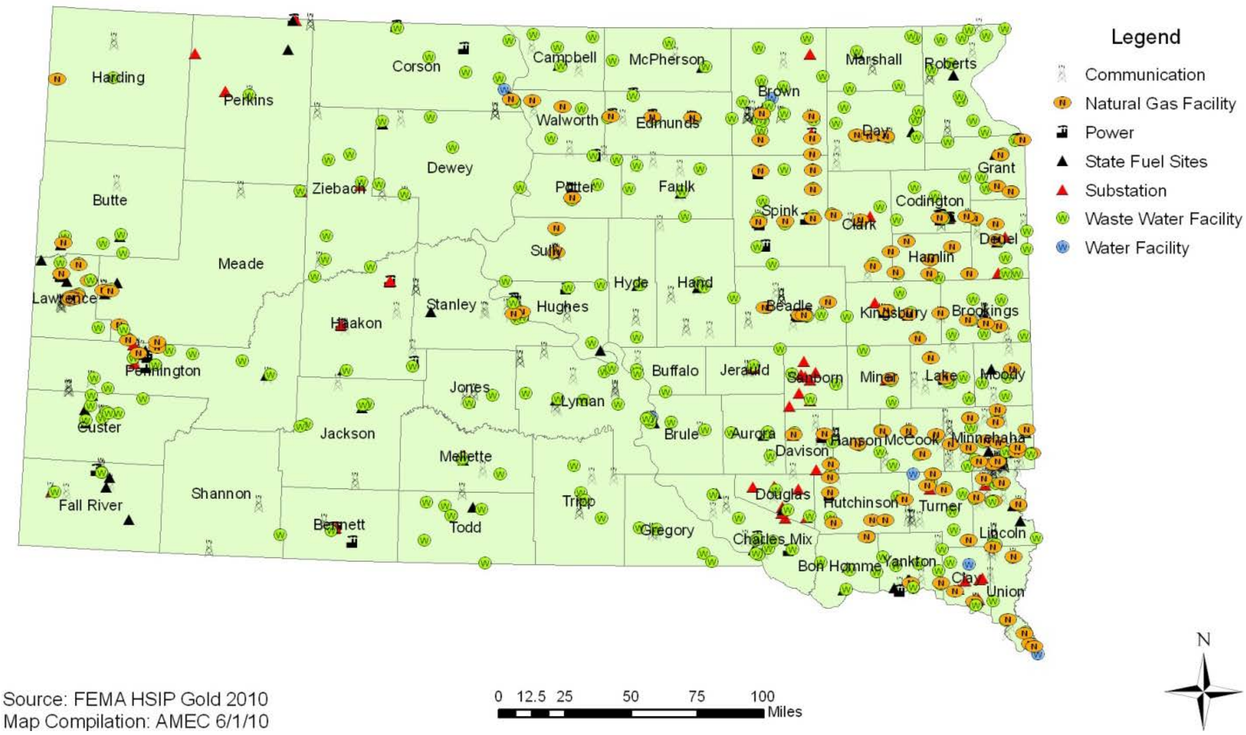


Figure 3-74 South Dakota Utility Infrastructure

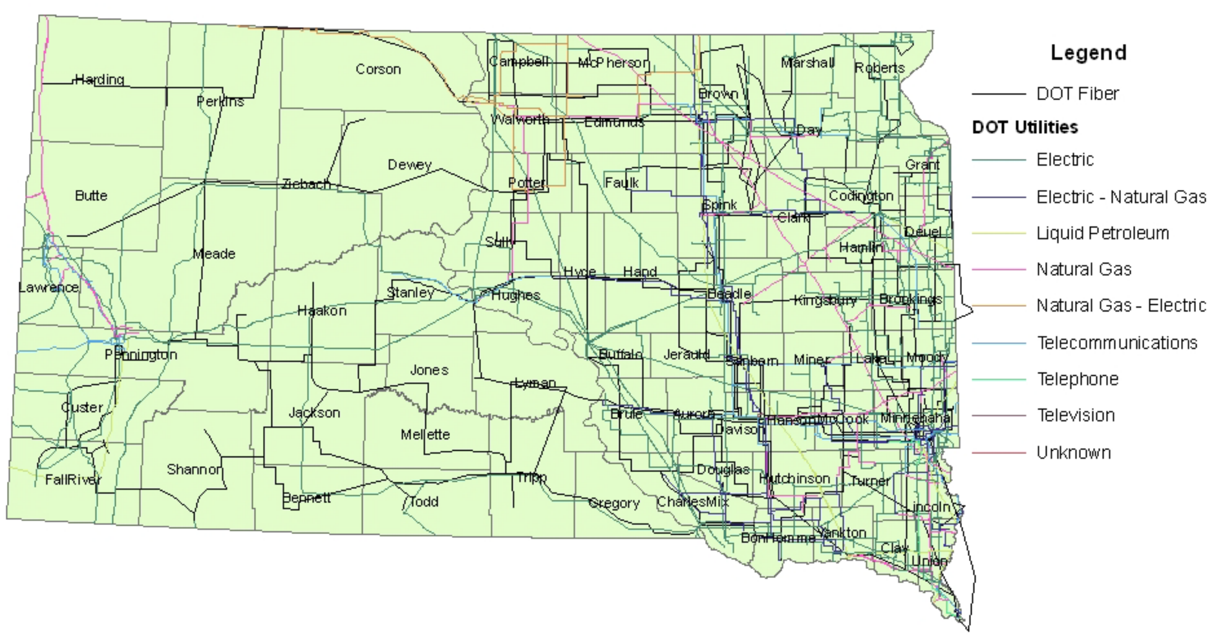
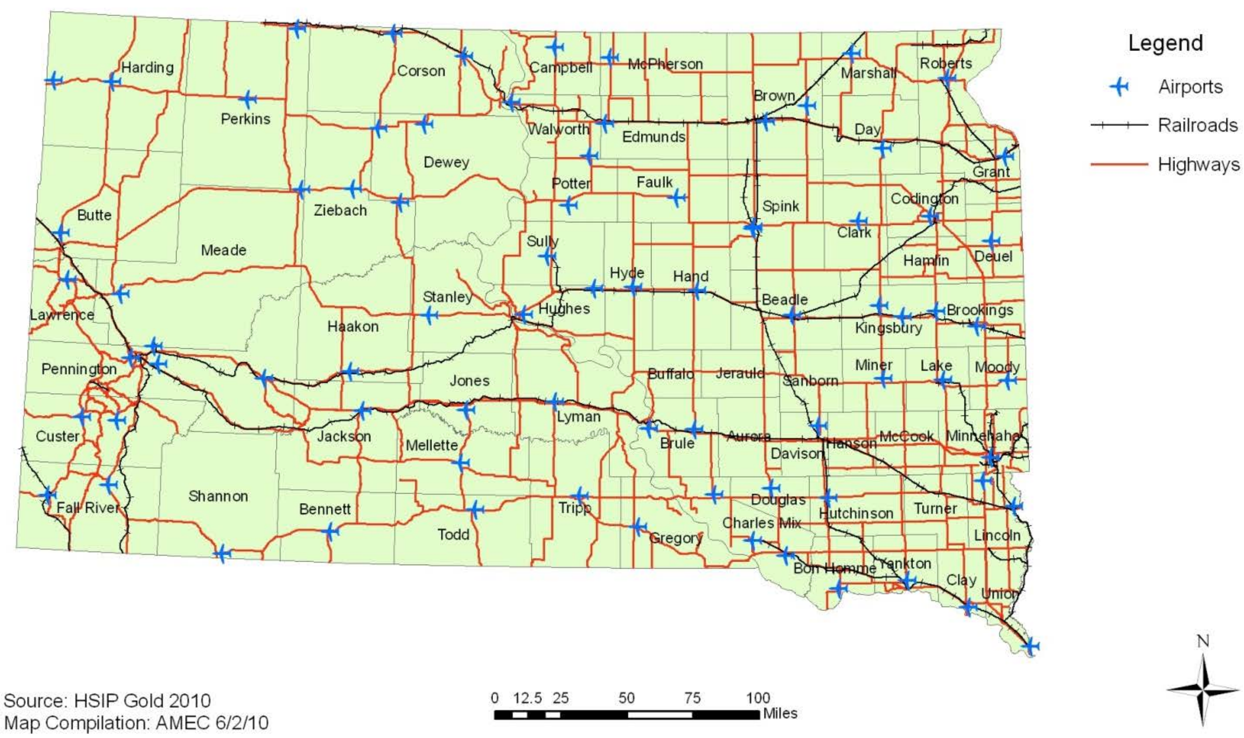


Figure 3-75 South Dakota Transportation Infrastructure



3.4.1 Methodology

The method used to determine vulnerability to state facilities was to overlay facilities data on digital hazard maps, where available, and identify those facilities potentially at risk. This method was used to determine vulnerability to floods and wildfire. For severe weather hazards including winter weather, tornadoes, wind, and drought it is generally accepted that these hazards could strike anywhere in the state at various levels of severity. An exposure analysis was used for these hazards. Exposure analyses are different from loss estimates in that they present facilities that may be exposed to these hazards, but do not attempt to estimate the amount of damages to be incurred during an event. Using the previous county by county risk assessments the numbers of facilities exposed to the high and very high vulnerability counties are quantified, with vulnerabilities discussed in general terms. Available data does not support a detailed vulnerability and loss estimation for impacts on critical facilities from the following identified hazards: hazardous materials, landslides and mudflows, and earthquakes.

Building valuations are not included in the state's GIS-based facility data, thus an estimate of potential losses to state facilities is difficult to quantify. The state's facility data was used for location information to overlay the facilities with the hazard maps. During the 2014 update the following data on state buildings was provided as an estimate of the replacement values of facilities in the state.

Table 3-80 State Owned Building Replacement Value Estimates: 2011-2012

Campus Name	Gross Sq. Ft.	Replacement Value Low	Replacement Value High	Average Cost per Sq. Ft.
Capitol Complex, Pierre	585,818	$174,713,480	$277,461,225	$386
Other buildings, Pierre	369,741	$65,041,873	$90,336,174	$210
HSC, Yankton	377,048	$43,371,028	$60,237,540	$137
MDSP, Springfield	375,365	$42,561,669	$59,113,414	$135
State Training School, Plankinton	154,831	$24,399,209	$33,887,510	$188
SD Penitentiary, Sioux Falls	806,481	$154,706,515	$208,215,388	$225
SDSVI, Aberdeen	65,000	$8,512,593	$11,823,047	$156
SD Developmental Center, Redfield	530,683	$55,699,349	$75,565,475	$124
Star Academy, Custer	169,911	$23,300,353	$32,361,908	$164
SDSD, Sioux Falls	97,955	$11,647,572	$16,177,184	$142
Veteran's Home, Hot Springs	163,141	$18,432,548	$25,600,845	$135
State Fair, Huron	832,742	$27,334,020	$44,190,939	$43
Total	**4,528,716**	**$649,720,209**	**$934,970,649**	**$175**

Source: SHMT

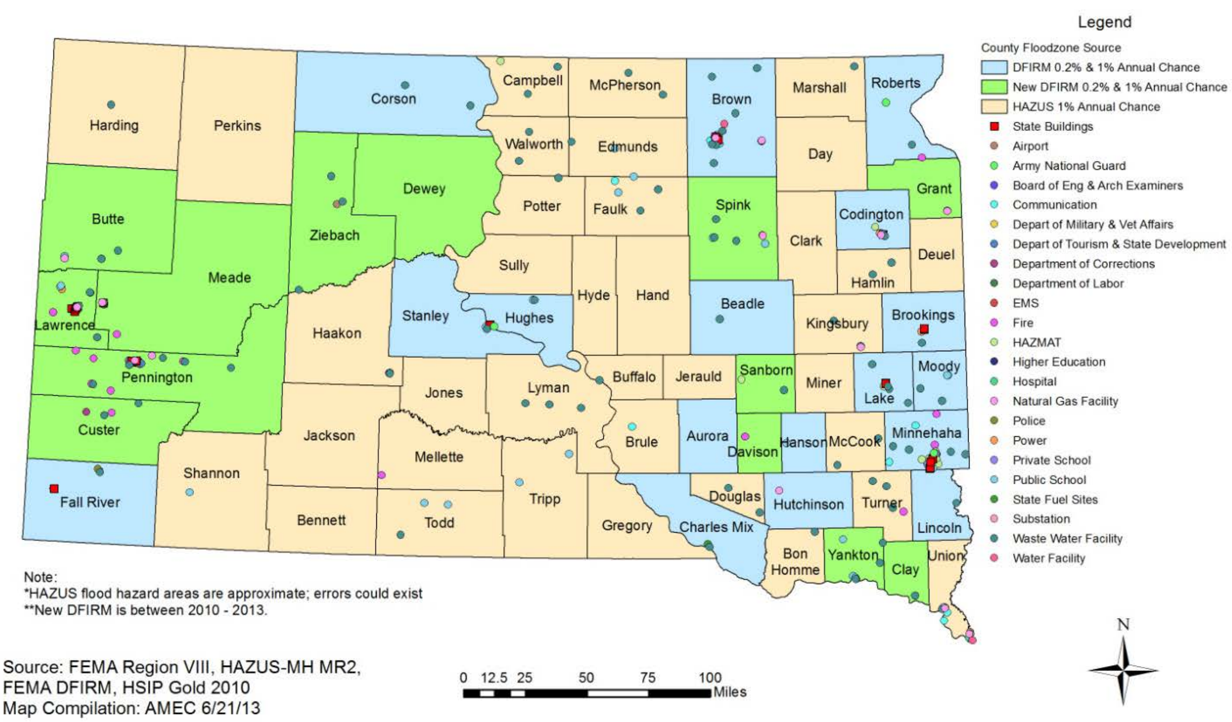
In order to further quantify the value of critical facilities and infrastructure in the state the best available data remains data extracted from HAZUS-MH data sets. HAZUS-MH breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

HAZUS-MH data includes all state owned and operated facilities as part of the total numbers of buildings, square feet, dollars and other pertinent information for each county. This data includes local and private assets such as electrical utility infrastructure maintained by the Rural Electric Cooperatives. The Government category in the building stock inventory includes all facilities owned and operated by the State of South Dakota as well as Schools, Police Departments, Fire Departments and Emergency Operations Centers. Using the exposure analysis approach, the total value of buildings included in these categories total approximately $837 million. Other essential facilities in HAZUS include 832 schools representing $374 million in potential losses, 54 hospitals with 4,538 beds representing $290 million in potential losses, 157 police stations, 278 fire stations and 24 emergency operations facilities representing $196 million, $65 million and $20 million in potential losses respectively. With respect to high potential loss facilities, there are 2,363 dams identified within the region. Of these, 84 of the dams are classified as high hazard. The inventory also includes 161 hazardous materials sites, 0 military installations, and 0 nuclear power plants. These numbers represent collectively state property at risk statewide from any disaster event. In HAZUS-MH there are utility and infrastructure data sets that are considered ‘lifeline’ inventory. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The total value of the lifeline inventory is over $80,019 (millions of dollars). This inventory includes over 11,937 kilometers of highways, 5,122 bridges, and 338,056 kilometers of pipes.

3.4.2 Floods

A GIS overlay analysis was performed to determine vulnerability of critical facilities to flooding. Both the latest available DFIRM (1% and 0.2% annual chance flood zones) and HAZUS-MH modeled base flood extents (in areas where DFIRM was not available) were used. Areas protected by levee were extracted from DFIRM data and also analyzed. Figure 3-76 illustrates critical facilities and their relationship to floodplains. Table 3H-D in Appendix 3H provides details on the numbers of facilities in the floodplain. The results of the 2013 analysis found 215 critical facilities potentially at risk to flooding, based on both HAZUS and DFIRM mapping. Notable critical facilities and state assets at risk include 12 Board of Regents facilities and 3 Army National Guard. All Board of Regents buildings are insured, and where applicable, have flood insurance. Limitations to this analysis include the number of counties with digital floodplains available, and the accuracy of the digital floodplains themselves, with the HAZUS-MH derived floodplains considered the less accurate of the two sources. This analysis does not consider if the building is elevated on fill or by other means, or flood proofed, since this detailed information is not available.

Figure 3-76 South Dakota Critical Facilities and State Assets at Risk to Flooding



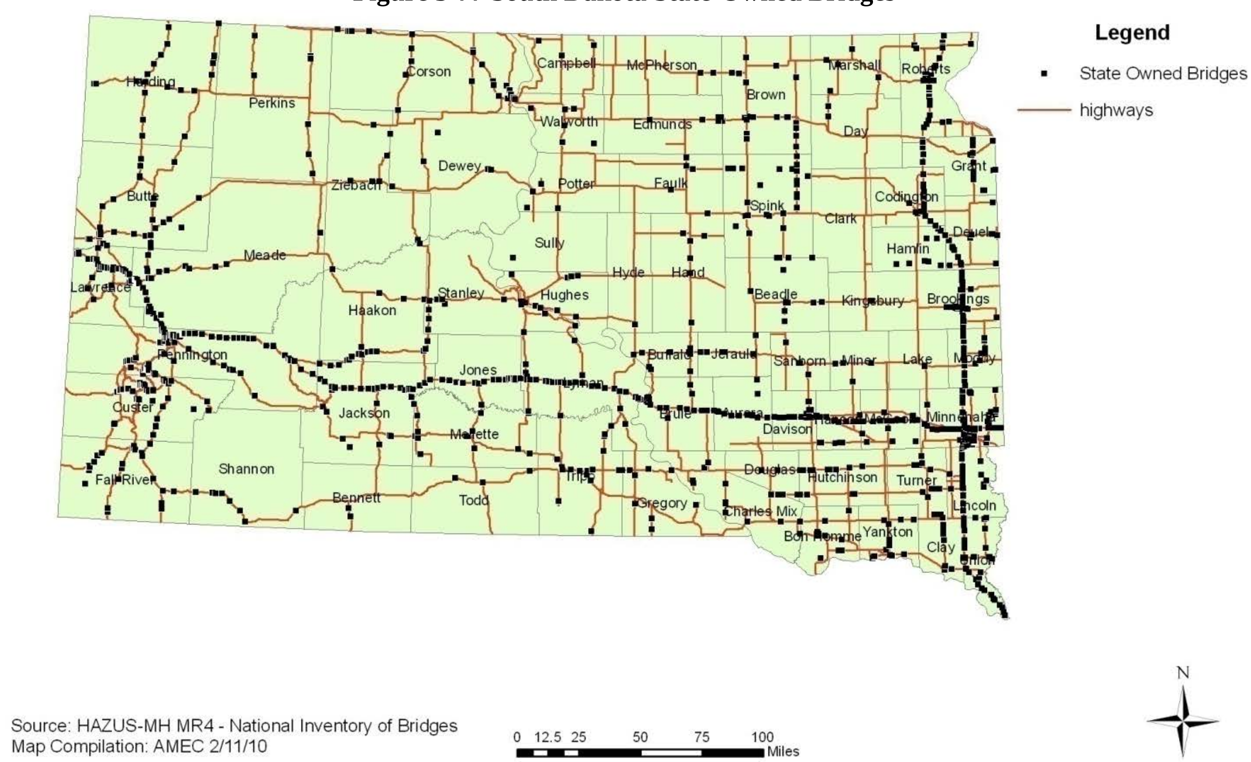
3.4.2.1 Analysis of Dams

According to information from the South Dakota Department of Natural Resources and the National Inventory of Dams, there are approximately 15 high hazard dams in South Dakota that do not have emergency action plans, only one of which is state owned: Brunning No. 1 in Mellette County. The State DNR has made a concerted effort to improve the number of dams with emergency action plans. For example Kroetch dam in Haakon County is a state-owned dam that did not have an EAP in 2007 but now does. The majority of the 15 high hazard dams that do not have plans are federally owned. The largest (based on normal storage volume) of the high hazard dams without emergency action plans are the Sheridan Lake in Pennington County owned by USDA Forest Service and the Oglala and White Clay Dams, both in Shannon County and owned by Oglala Sioux Tribe. Figure 3-9 illustrates the high and significant hazard dams in South Dakota. The State owns 190 of the 2,545 dams in the state. The majority of these dams are low hazard dams, 2,275.

3.4.2.2 Analysis of Scour Critical Bridges

Included with HAZUS-MH is a database of bridges called the National Bridge Inventory (NBI), which was developed by the Federal Highway Administration. One of the database items includes a “scour index” that is used to quantify the vulnerability of bridges to scour during a flood. Bridges with a scour index between 1 and 3 are considered “scour critical,” or a bridge with a foundation element determined to be unstable for the observed or evaluated scour condition. Based on the NBI information submitted to the Federal Highway Administration in March 2013, there are 189 state-owned bridges identified as scour critical and 9 local government bridges. Additionally, there are 2,107 local government owned bridges in the inventory with unknown foundations.

Figure 3-77 South Dakota State-Owned Bridges



During the 2007 update stakeholder meetings it was noted that railroads are vital to the rural farming economy in South Dakota, and that floods have impacted railroad bridges, delaying rail shipments of agricultural supplies for days or weeks. The NBI bridge database does not contain railroad bridges so further analysis of vulnerability could not be determined. Also noted during the planning process were the number of repeated culvert washouts and replacements on gravel roads from multiple flood disasters.

Location and loss information from the FEMA Public Assistance program should be incorporated in future updates to this plan.

According to the 2013 NBI report for South Dakota, the state has 1,193 structurally deficient bridges (85 are state-owned) and 217 functionally obsolete bridges (92 are state-owned).

3.4.3 Wildfire

Analysis of wildfire impacts to critical facilities was done using a wildfire risk layer from SILVIS. GIS was used to identify the critical facilities that lie within a high or moderate wildfire risk zone. A total of 481 facilities were identified statewide. Descriptions of the facilities potentially at risk are listed in Table 3H-E in Appendix 3H.

3.4.4 Tornadoes, Wind, and Winter Storms

An exposure analysis was used to identify the number of critical facilities in the counties most susceptible to tornadoes, wind, and winter storm hazards, based on the assessment of vulnerability by jurisdiction section. Eight counties were identified to have either 'very high' or 'high' vulnerability to one or more of these hazards. The number of facilities in four state facility GIS layers (State Layer, Power, Natural Gas, and Fuel) was quantified in each of these counties. The results are displayed in Table 3-81. Due to the general nature of this exposure analysis individual facilities are not identified, but more detail can be reference in the state's GIS layers. The table also displays overlap in vulnerability to the three hazards, particularly in Minnehaha and Pennington counties. The mitigation strategies for these hazards often overlap as well, and this table indicates where multi-hazard critical facility protection opportunities may lie.

Table 3-81 State Facilities in Counties Vulnerable to Winter Storm, Wind, and Tornado Hazards

County	Winter Storm Vulnerability	Wind Vulnerability for events 70 kts or greater*	Tornado Vulnerability for events F1 or greater*	State Layer Facility Count	Power Facility Count	Natural Gas Facility Count	Fuel Facility Count
Brookings	High	Moderate	Moderate	16	1	3	2
Brown	Moderate	Moderate	High	16	9	5	2
Lincoln	High	High	High	6	2	5	3
Meade	High	High	Moderate	9	3	5	3
Minnehaha	Very High	Moderate	Very High	39	6	14	2
Pennington	High	High	High	36	10	2	3
Turner	Moderate	Moderate	High	9	2	4	0
Davison	High	Moderate	Moderate				

*Also includes events that caused death or injury, or resulted in recorded financial damage

While these counties are considered more vulnerable, tornadoes, wind and winter storms can happen anywhere in the state with considerable impacts. It is noted that Hughes County includes Pierre, the state capital, and has the highest concentration of state owned buildings, facilities and employees. While rated 'moderate' in terms of vulnerability to the three hazards it does lie within Wind Zone III (200 mph design wind speed).

3.4.5 Drought

Available data does not support a detailed vulnerability and loss estimation for drought impacts on critical facilities. Power plants that generate hydroelectric power from dams on the Missouri River can be impacted by drought-reduced reservoir levels. In terms of assets, state parks in South Dakota are likely to suffer the greatest impacts from drought, particularly those that provide water-based recreational activities. Direct losses to the state can include lost revenue from park access fees.

3.4.6 Hazardous Materials

Resources and data did not support a detailed vulnerability and loss estimation for hazardous material impacts on state facilities during the 2007, 2011, and 2014 updates to this plan.

3.4.7 Geologic Hazards

Resources and data did not support a detailed vulnerability and loss estimation for landslides, mudflow, expansive soil, and subsidence impacts on state facilities during the 2007, 2011, and 2014 updates to this plan. History has proven that earthquakes have not caused significant damage in the State of South Dakota. A 2,500 year probabilistic earthquake scenario was run in HAZUS-MH. The results showed no damage to critical facilities. The detailed results of this scenario are included as Appendix 3G. This data is not conclusive to develop a detailed vulnerability and loss estimation for earthquake impacts on state facilities.

3.4.8 Future Vulnerability of State Facilities

At the time this plan was prepared limited information regarding development of new state facilities was available. Significant population increases and decreases are outlined per county in Section 3.3.1 Growth and Development. These trends should be considered as existing facilities are maintained, improved, and or enhanced. The hazard areas identified in this plan are being considered when new state facilities are constructed. For example, a new prison in Rapid City was originally planned to be built within a floodplain. SDOEM has coordinated a new site for the prison outside of the floodplain.

An oil refinery is planned for development in Union County between state highways 48 and 50. This refinery may increase economic development in the county leading to an increase in population and therefore an overall increase in vulnerability to natural hazards. The oil refinery may also cause vulnerability to man-made hazards generated by mishaps at the refinery. Operation of this facility is not projected to begin until 2014.

The former Homestake gold mine in Lead has been chosen by the National Science Foundation as a site for a multipurpose deep underground science and engineering laboratory. The underground laboratory and proposed Sanford Science Education Center will provide education and outreach opportunities.

3.5 RISK ASSESSMENT SUMMARY AND CONCLUSIONS

Although the majority of the state is vulnerable to all the hazards identified and discussed in this section, concerns vary widely between areas of the state and times of the year events might occur. The hazards as identified in Table 3-1 have impacted or have the potential to impact the citizens and governments of the state to one degree or another at any given time. However, based upon the research and analyses conducted for writing this plan, it is evident that floods, winter storms, wildfires, and tornadoes continue to require the most effort and expense in terms of response and recovery activities and their associated costs. During the 2007 update, drought and severe wind were added as significant hazards that affect the state, though losses from drought are difficult to quantify due to data limitations. During the 2011 update a more comprehensive picture of flood vulnerability resulted from the inclusion of statewide HAZUS flood analyses. Additionally the risk to agricultural pests and diseases was introduced as a new hazard. New vulnerability assessment methodologies and data were introduced in 2013. Data on crop loss and livestock death was added to the profiles and vulnerability assessments for agricultural pests and disease, drought, and winter storm. Vulnerability assessments for tornado, wind, and winter storm were enhanced with more detailed analysis on events with higher magnitudes (e.g. tornadoes of F1 or greater), damages, and casualties. Damage estimates were inflated to 2012 dollars. New wildland urban interface data was obtained from the University of Wisconsin and the Federal Wildland Fire Occurrence database to update the wildland fire hazard profile. The flood vulnerability section was enhanced with an analysis of average annualized loss. Vulnerability for the Rural Electric Cooperatives was further analyzed with new data on hazards and completed or planned mitigation projects. The 2014 update also includes new data on Individual Assistance and Public Assistance claims for major disasters that have occurred in South Dakota. As this plan matures, the risk assessment will continue to improve and drive the state's mitigation planning measures, projects, and strategies for future loss reduction.

SECTION 4 MITIGATION STRATEGY AND PROGRESS

4.1 2014 UPDATE HIGHLIGHTS

The goals, objectives, and mitigation actions from the 2011 Plan were reviewed and updated at the March 14, 2013 SHMT and Silver Jackets meeting. Additionally, the participating state agencies and federal agencies provided updates to the capabilities available for implementing and supporting risk reduction activities.

4.1.1 Updates to the Goals and Objectives

While the goals remain the same as documented in the 2011 Plan, the objectives have been modified. The following updates were made to the 2014 objectives:

- **Goal 1** – ***Reduce injuries and loss of life from hazards*** – A new objective to maintain and improve public health and safety outreach programs, such as those currently implemented by the state's Department of Transportation and Department of Public Health, has been added.
- **Goal 2** – ***Reduce damage to existing and future structures within hazard areas*** – The first objective to reduce the number of repetitive loss and non-repetitive loss structures has been modified to include only repetitive loss structures. Repetitive loss structures are a priority in South Dakota and non-repetitive loss properties are included under the third objective. The third objective has been expanded to include reducing structures within the Special Flood Hazard Area and within other identified local flood risk areas that have been identified as high risk areas at both the local and state level.
- **Goal 3** – ***Reduce the losses to critical facilities, utilities, and infrastructure from hazards*** – There were no changes to the objectives identified to reach this goal.
- **Goal 4** – ***Reduce impacts to the economy, the environment, and cultural resources from hazards*** – The first objective has been changed so that reducing the loss to natural resources and cultural resources are two separate objectives. The committee believes that the actions taken to achieve these objectives involve different agencies and processes and the difference between the two types of resources are more clearly defined by splitting them into two objectives. In addition, a fourth objective to reduce economic losses to recreation and tourism has been added.
- **Goal 5** – ***Support and assist local/tribal mitigation capabilities and efforts*** – The objective supporting this goal has been changed to encourage local governments to participate in risk reduction measures. Risk reduction measures may include such programs and policies as floodplain management ordinances and building code adoption that are implemented at the local level. This objective is more focused than the objective in the 2011 Plan that encouraged locals to reduce impacts of incidents.

4.1.2 Revision of the Mitigation Actions

Many of the mitigation actions identified in the 2011 Plan remain ongoing. Several mitigation actions were removed from the Plan for reasons noted below. Ongoing and new mitigation actions are detailed in Section 4.7.

Table 4-1 Removed Mitigation Actions

2011 Mitigation Action	Reason for Removal
Support the proper installation of tie downs on mobile homes through local project applications.	SDOEM receives minimal local project applications for mobile home tie downs. The South Dakota Housing Authority requires all mobile homes to be inspected for tie-downs. Information on tie downs in provided in a severe weather preparedness outreach packet disseminated each spring. A manufactured housing program is administered by the State Fire Marshall's Office.
Support and encourage public education/outreach efforts on electric safety.	A new mitigation action to support and encourage public education/outreach efforts for all hazards awareness and safety has been added to encompass all hazard safety education and outreach programs.
Support and encourage installation of safe rooms in private homes through public outreach efforts.	Supporting the construction of shelters and safe rooms were combined together into 1 mitigation action.
Support the installation of warning sirens through local project applications.	Supporting the installation of warning sirens and NOAA weather radios were combined together into 1 mitigation action.
Support and encourage local policies to require a defensible space between structures and surrounding structures adjacent to forested areas.	Supporting local policies for defensible space and other fire risk reduction projects were combined together into 1 mitigation action.
Support and encourage development of zoning ordinances in local communities to encompass all hazards.	A similar action was added under Goal 5 to support and encourage safer building practices in local communities to reduce risk to all hazards.
Support retrofitting of existing facilities to comply with IBC through local project applications.	A similar action was added under Goal 5 to support and encourage safer building practices in local communities to reduce risk to all hazards.
Support the installation of spoilers through local project applications / Support the improvement to existing power lines through local project applications.	Both of these mitigation actions were combined to create 1 comprehensive mitigation action to support the improvement of existing power lines through local project applications.
Develop outreach material for communities highlighting federal, state, and local regulations regarding development.	A similar action was added under Goal 5 to support and encourage safer building practices in local communities to reduce risk to all hazards. In addition, local outreach conducted by the State is captured in Section 5 of this Plan.
Continue working with and supporting local and tribal mitigation plan development	Working with and supporting local and tribal mitigation plan development and the development of mitigation project grant applications were combined together into 1 mitigation action.

4.1.3 Updates to the Capability Assessment

The State's capability assessment has been updated to include risk reduction policies, programs, and funding opportunities that are implemented by the various state agencies on the SHMT and federal agencies on the Silver Jackets. Each representative at the March 14, 2013 workshop discussed their agency's capabilities to share information with the entire group. In addition they completed a questionnaire answering the following three questions:

1. What programs does your agency provide that support risk reduction activities?
2. What policies does your agency enforce that encourage mitigation measures?
3. What funding opportunities does your agency offer for risk reduction, community resiliency, and mitigation activities?

The State's priority is to support local mitigation efforts. In order to prioritize these needs, an assessment of local capabilities is included in Section 4.7. This section was updated based on the LHMP reviews conducted in 2013. It documents the capabilities counties identified in their local hazard mitigation plans. This section summarizes the risk reduction capabilities and completed and identified mitigation actions noted within the LHMPs.

4.2 SUMMARY OF RISK

The hazards identified in Section 3 have impacted or have the potential to impact the population and governments of the state to one degree or another at any given time. However, based on the research and analysis conducted in the Risk Assessment, it is evident that floods, winter storms, wildfires, and tornadoes continue to require the most effort and expense in terms of response and recovery activities and their associated costs. These hazards also cause the greatest potential risk and vulnerability to REC infrastructure. Thus, a majority of the goals, objectives, and actions outlined in this mitigation strategy are geared toward reducing future risk from these hazards.

In addition, while calculating potential losses to drought is difficult, the Risk Assessment affirms that as of February 2013, South Dakota remains in a drought, with significant negative impacts affecting the agriculture industry, energy industry, plants and wildlife, society and public health, water supply and quality, business and industry, and tourism and recreation as well as increasing fire risk. A substantial increase from 2010 to 2012 in payouts for crop loss due to drought and high heat clarifies that this hazard has had recent devastating impacts on South Dakota's agricultural industry. Based on the seriousness of this impact on the State, a Drought Task Force was established in 2012 and the SHMT has developed mitigation goals, objectives, and actions to address drought in this mitigation strategy.

While geological hazards have been prioritized as limited by the SHMT, the Department of Transportation has spent a significant portion of time stabilizing landslides throughout the state, meaning that they do occur, even as recent as 2012-2013. Based on this threat, goals, objectives, and actions within this mitigation strategy pertain to reducing future risk from this hazard.

The SHMT recognizes that wind, agricultural pests and diseases, and hazardous materials incidents also pose a threat to the State. Those goals, objectives, and actions that pertain to all hazards profiled in this plan are designed to reduce risk from these hazards as well.

4.3 HAZARD MITIGATION GOALS AND OBJECTIVES

44 CFR Part 201 Requirement:
[The State mitigation strategy shall include a] description of State goals to guide the selection of activities to mitigate and reduce potential losses. *[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts and changes in priorities…*

During the March 14, 2013 Workshop with the State Hazard Mitigation Team and the Silver Jackets, the group reviewed the preliminary results of the local and state vulnerability assessments and validated the following five goals. These goals remain relevant from the 2011 Plan. The goals are purposefully applicable to all of the identified hazards and intended to encompass all mitigation needs identified by the local communities.

The goals and objectives for this plan are not prioritized but correlate with the identification of problems and risks that are outlined in detail and summarized in the Hazard Identification and Risk Assessment and also in the Summary of Risk section above.

Table 4-2 Goals and Objectives

Goal 1	**Reduce injuries and loss of life from hazards**
Objective 1.1	***Reduce the number of injuries/fatalities due to all hazards***
Objective 1.2	***Maintain and improve public health and safety outreach activities/programs***

Goal 2	**Reduce damage to existing and future structures within hazard areas**
Objective 2.1	***Reduce the number of repetitive loss structures***
Objective 2.2	***Reduce the number of structures lost by wildfires***
Objective 2.3	***Reduce the number of structures within the Special Flood Hazard Area and other identified local flood risk areas***
Objective 2.4	***Reduce the number of structures/infrastructure at risk to geologic hazards***

Goal 3	**Reduce the losses to critical facilities, utilities, and infrastructure from hazards**
Objective 3.1	***Reduce the number of power outages***
Objective 3.2	***Reduce negative impacts to water supply and sewage treatment systems***
Objective 3.3	***Improve reliability of communications during/following hazard events***

Goal 4	**Reduce impacts to the economy, the environment, and cultural resources from hazards**
Objective 4.1	***Reduce loss to natural resources (i.e. forest and watershed health)***
Objective 4.2	***Reduce impacts to cultural resources (i.e. historical/tribal)***
Objective 4.3	***Reduce agricultural losses***
Objective 4.4	***Reduce economic losses to recreation and tourism***

Goal 5	**Support and assist local / tribal mitigation capabilities and efforts**
Objective 5.1	***Encourage locals to participate in risk reduction measures***

4.4 MITIGATION PROGRESS

Since the development of a State Hazard Mitigation Plan in 2004, South Dakota has achieved outstanding progress in reducing risk to natural hazards. This section presents recent and overall progress accomplished through the framework of the five goals.

Goal 1 – Reduce injury and loss of life from hazards

- Multiple outreach and public education campaigns administered by:
    - Department of Public Safety: Winter weather and severe weather preparedness guides, Twitter announcements for severe weather, distributing information at the State Fair, school safety sessions, safety classes through Extension, work with the Public Utility Commission One Call system, B Ready
    - Department of Transportation: Buckle Up, Save it For Later, Give ‘em a Brake, Don’t Crowd the Plow, temperature warnings, highway construction and hazard notification press releases, safetravelusa.com, 511 Travel Information
    - Department of Agriculture: Drought education
    - Department of Public Health: Flu Campaign
    - National Weather Service: Flood Safety
    - Rural Electric Cooperatives: Electrical safety literature, outreach materials, and public service announcements
- Severe weather preparedness week funded through EMPG. This includes a package of information that goes to schools, local emergency managers, daycares, assisted living centers, and nursing homes. Safe room information is also disseminated from the hazard mitigation office to local emergency managers and floodplain administrators.
- Local tests are conducted on warning sirens and information is distributed to the public.
- SD Office of Homeland Security has purchased warning systems and generators.
- Numerous local shelter and safe room projects have been funded. Funding for Disaster 1984 provided 4 storm shelters, totaling $4,688. Funding for Disaster 1887 offered $615,000 to build a municipal safe room, while Disaster 1984 offered $683,820 to build two municipal safe rooms.
- Numerous warning siren and weather radios have been funded. Funding for Disaster 1984 provided 4 warning sirens and generators, totaling $237,205.

Goal 2 – Reduce damage to existing and future structures

- SDOEM is researching other states for possible floodplain legislation in South Dakota.
- Numerous acquisition and relocation projects have been funded. Various disasters, including 1984, 1915, 1887, and 1886, have allowed for over $4,262,615.25 worth of acquisition and relocation projects to be conducted throughout the State.
- Numerous drainage improvement projects have been funded. Over $10,151,721 of flood mitigation and drainage improvement projects have been funded through disaster 1984, 1887, and 1915 funding.
- Numerous road elevation projects have been funded. $165,938 from disaster 1887 was used to elevate a road in McCook County. In addition, public assistance funds from disaster 1984 attributed to road elevation projects as part of emergency protective measures.
- HAZUS runs have been conducted in every county to determine state owned buildings within flood areas.
- All agencies through the Technical Advisory Group gathered data in preparation for flooding to update critical facilities information.

- South Dakota Department of Agriculture (SDDA) works with local landowners to create a safe zone around property to prevent damage from wildfire.
- SDDA creates fire breaks by cleaning wooded areas.
- SDDA administers the Beat the Beetle campaign.
- The Wildland Fire Divison has an ongoing fuels mitigation program utilizing federal funds to treat approximately 1,500-2,000 acres per year on state and private lands.
- Several communities, including the following counties: Butte, Custer, Perkins, Stanley, Pennington, Meade, Fall River, and Lawrence, as well as Rapid City have Community Wildfire Protection Plans.

Goal 3 – Reduce the losses to critical facilities, utilities, and infrastructure from hazards

- 348 miles of power lines have been buried, with 167 miles pending since last plan update using disaster assistance funding. In addition, rural electric cooperatives (co-ops) also bury lines with their own funding.
- HMGP funds have been used for spoilers to protect power line infrastructure.
- Public Assistance funds in disaster 1887 allowed for hundreds of miles to be upgraded with new conductor as well as being buried.
- Electrical co-ops have adopted new standards that if a line goes down from a storm, they will look into burying the line or putting up #2ACSR line which is lighter and stronger than copper line.
- Numerous generators have been purchased by SDOEM, SDOHS, and SD DENR (for water/wastewater facilities). $629,031.25 of disaster funding from disasters 1702, 1774, 1811, 1887, 1914, and 1984 were used toward the purchase of generators. In addition, EMGP and SHSGP funds have purchased numerous generators within counties to enhance local capabilities when there are power outages. Telephone cooperatives and rural water systems have used their own funds to purchase generators.

> Of the co-ops located in South Dakota and Minnesota, Codington-Clark has the largest percentage of its power lines buried. "We don't build anything new overhead...We would have been devastated in the 2009-2010 ice storm had that decision not been made 35 years ago." -David Eide, General Manger of Codington-Clark Electric Cooperative in Watertown, SD. From *Cooperative Connections*, April 2013

- SD DOT conducts debris removal on state highways and drainage structures.
- State law requires counties and townships to do annual inspections of their culverts to ensure they are functioning properly. A log must be maintained. Considering this law, counties and townships are more aware of problems with culverts, initiating more removal of debris that can cause flooding.
- NRCS funding is available for debris removal.
- Local utilities perform yearly inspections and replace problem areas using their existing budget.
- Rural Electric co-ops work with linemen and tree trimming contractors to ensure trees are within a safe distance to power lines.
- Rural Utilities Service's (RUS) requires inspection of all electrical lines once per year.

- SD DOT performs bridge inspections every two years and culvert inspections every five years.
- SD DENR's Dam Safety Inspection Program requires all high hazard and significant hazard dams to be inspected every three years.
- Training is available to learn how to operate the state's digital radio system. Exercises using the radio are conducted quarterly.

Goal 4 – Reduce impacts to the economy, the environment, and cultural resources from hazards

- South Dakota is considering development of a comprehensive Drought Plan to identify specific measures for reducing the impacts of drought across the State.
- The Drought Task Force provides information to agricultural producers in order for them to make sound crop rotation decisions.
- The SDDA administers campaigns on drought through the Drought Task Force, Extension Service, and Producer Groups.
- The NRCS and Conservation Districts support the Department of Agriculture with drought.
- SD OEM promotes NFIP flood insurance through meetings and ad campaigns.
- South Dakota has the highest adoption of crop insurance in the country.
- The Governor has developed public service announcements to promote tourism and recreation.
- The State Historic Preservation Officer coordinates with the SD OEM on mitigation projects when applicable.

Goal 5 – Support and assist local/tribal mitigation capabilities and efforts

- Outreach and education is conducted at County Commission meetings, Towns & Townships conferences, the Hydrology Conference, and to private businesses.
- Tribal acquisition projects have been funded, as well as two tribal LHMPs.
- Mitigation staff encourage planning and zoning during visits to localities.
- LiDAR data is available to help local officials with planning and zoning decisions/policy.
- The NFIP program reaches out to counties and communities to ensure local enforcement of floodplains is occurring.

4.5 STATE CAPABILITY ASSESSMENT

44 CFR Part 201 Requirement:
[The State mitigation planning process should] be integrated to the extent possible with other ongoing State planning efforts, as well as other FEMA mitigation programs and initiatives.
44 CFR Part 201 Requirement:
[The State mitigation strategy shall include a] discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: • *An evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and]* • *A discussion of State funding capabilities for hazard mitigation projects…*

For true success in reducing the statewide risk to natural hazards, collaboration among state agencies, federal agencies, and the local government is necessary. This section outlines the capabilities of state agencies in the terms of programs, policies, and funding that support the implementation of mitigation activities. It is intended that this section serve as a reference and representatives from these agencies continue to collaborate in reducing risk throughout South Dakota.

The below matrix presents the information gathered from participating state agencies and Silver Jackets representatives at the workshop on March 14, 2013. The capabilities are organized by programs, policies, and funding opportunities. Participating agencies responded to the following three questions:

1. What programs does your agency provide that support risk reduction activities?
2. What policies does your agency enforce that encourage mitigation measures?
3. What funding opportunities does your agency offer for risk reduction, community resiliency, and mitigation activities?

The matrix is a summary of all capabilities identified by participating state and federal agencies. Those capabilities that are **bolded** in the matrix are discussed in more detail in the following sections.

Table 4-3 Summary of State Capabilities

Section in Plan	Agency	Programs	Policies	Funding
4.6.1	US Army Corp of Engineers (Omaha and St. Paul Districts)	-Continuing Authorities Program -General Investigations -Construction General **-Floodplain Management Service Program** -Planning Assistance to States and Tribes -Tribal Partnership Program -Operation and Maintenance **-Silver Jackets** -Drought Assistance	-Executive Order 1198 to avoid spending federal dollars in the floodplain	-General Investigations -Construction General **-Floodplain Management Service Program** -Technical Assistance for Drought, Landslides, Mudslides -Planning Assistance
4.6.2	FEMA Region VIII	**-RiskMAP** **-NFIP** **-HMA**		
4.6.3	Natural Resource Conservation Service	-Drought Assistance		
4.6.4	US Geological Survey	-Flood Inundation Mapping Program -Flood Inundation Mapping Program -Cooperative Water Program -National Streamflow Information Program -WaterUse Program -WaterAlert & WaterNow applications		USGS receives only a portion of the budget from Federal funding, the balance of activities are funding from full or matching dollars from other Federal, State, and local partners.

Section in Plan	Agency	Programs	Policies	Funding
		-Hydrologic Investigation Program -WaterWatch Program -Groundwater Level Monitoring Programs		
4.6.5	National Weather Service	-Severe weather and flood warnings -Weather and flooding safety guides -NOAA radio broadcasts -Storm Spotter training		
4.6.6	US Bureau of Land Reclamation	-WaterSMART Program -Water Conservation Field Services Program -Rural Water Supply Program -Resource Management and Planning -National Irrigation Water Quality Program -Flood Hydrology and Consequences Group -Drought Program -Dam Safety -Building Seismic Safety Program -Snowpack and Reservoir Levels		
4.6.7	Federal Highway Administration			-SD DOT Emergency Relief Program

Section in Plan	Agency	Programs	Policies	Funding
4.5.1	SD Office of Emergency Management	**-Flood Map Modernization** **-NFIP** **-Severe Repetitive Loss Properties** -406 Mitigation -Public Outreach and Education -State Hazard Mitigation Plan	**-Home Mitigation Project Policy** **-Pre-Disaster Mitigation Plan Policy** -Local floodplain ordinances	**-Hazard Mitigation Grant Program** **-Pre-Disaster Mitigation Grant Program** **-Flood Mitigation Assistance** -Public Assistance -Increased Cost of Compliance Coverage -Emergency Management Performance Grant
4.5.7	SD Bureau of Information and Telecommunications	**-GIS Data and Training** -LiDAR data **-State Radio System** **-SD Public Broadcasting** **-Business Continuity**		-BIT is an unfunded agency. Tasks must be funded by the requesting agency.
4.5.10	SD Game, Fish, and Parks	-Private Lands Habitat and Access Strategic Plan -Habitat and Access Programs for Landowners -Wildlife Damage Management	-GFP Commission	
4.5.3	SD Department of Agriculture (SDDA)	**-Drought Task Force** **-Wildland Fire Suppression (Black Hills Protection District and Community Wildfire Protection Plans)** -Grasshopper Management -Pest and Disease Control		

Section in Plan	Agency	Programs	Policies	Funding
		-Conservation (Forest Action Plan) -Soil, wind, water **-Beat the Beetles MPB Black Hills**		
4.5.4	SD Department of Transportation	-SD Strategic Highway Safety Plan -SD DOT Annual Report -SD Statewide Long Range Transportation Plan -DOT Strategic Plan -Safetravelusa.com -511 Travel Information -Public Outreach and Education **-Emergency Relief Program**		**-Emergency Relief Funding**
4.5.2	SD Department of Environment and Natural Resources	-Oil and Gas Initiative -Geologic Information and Maps -Hazardous Waste and Hazardous Waste Manage Firms List -Mineral and Mining -Spills and Spills Database -Watershed Protection -Wellhead Protection -Drinking Water -Ground Water Quality **-Dam Safety**	-Flood Control Project Permitting Requirements -Dam Permitting Requirements	**-Water and Waste Funding**

Section in Plan	Agency	Programs	Policies	Funding
		-Flood Drainage Technical Assistance -Stormwater		
4.5.5	State Historic Preservation Office	-Public education on historic property mitigation -National Historic Preservation Act review and mitigation recommendations	-National Historic Preservation Act – Section 106	**-Deadwood Grant**
4.5.8	SD Office of Risk Management	-Property Insurance -Boiler Insurance -Aviation Insurance -Fidelity Bond -Risk audits of state government buildings -Public entity pool for liability	-Loss Control Committees	-Extraordinary Training Fund
4.5.9	SD Office of Homeland Security	-ACAMS assessments for government buildings, hospitals, and schools -Regional Response Teams		-State Homeland Security Grant for funding of radios, communication towers, generators, shelters, warning sirens, regional response teams
4.5.6	SD Department of Health – Office of Public Health Preparedness and Response	**-Hospital Preparedness Program (HPP)** **-Public Health Emergency Preparedness Program (PHEP)** -SD Department of Health 2020 Plan	-Preparedness Activities – planning, training, and exercises across 15 capabilities for public health and hospital preparedness	-ASPR Funding (HPP) -Center for Disease Control Funding (PHEP)

4.5.1 South Dakota Office of Emergency Management

The State of South Dakota Office of Emergency Management is successful in administering federal mitigation programs. The Hazard Mitigation Grant Program and Pre-Disaster Mitigation Grant Program administered in collaboration with FEMA currently serve the needs of the State for implementing hazard mitigation projects. The State of South Dakota recognizes there is limited funding available for hazard mitigation projects. SDOEM and the State Hazard Mitigation Team administer funds for local projects requiring the local communities to provide the 25% match required for receipt of federal funds. The Hazard Mitigation Grant Program Administrative Plan last updated July 1, 2011 documents the process for the State's administration of hazard mitigation funding. Two policies have been implemented since the adoption of the 2011 Plan. These policies, the Home Mitigation Project Policy and Pre-Disaster Mitigation Plan Policy, address the way in which the State is able to support hazard mitigation projects and planning given limited funding. The following descriptions of programmatic capabilities have been updated as appropriate in 2014.

Hazard Mitigation Grant Program

The State Hazard Mitigation Officer (SHMO) holds applicant briefings throughout the state following each declared disaster. The meetings are an opportunity for sub-applicants to discuss potential projects and applications with the State for consideration under the Hazard Mitigation Grant Program. Projects funded through this program are monitored by the SHMO. Each subapplicant is required to submit quarterly reports to the SHMO detailing the progress of the project and the total amount of funds extended to date. As of August 2011, the SHMT approved the Home Mitigation Project Policy (detailed below) that limits mitigation projects funded by the Hazard Mitigation Grant Program to acquisition projects, with the only exception being if the home is deemed historical by the State Historical Preservation Office.

Home Mitigation Project Policy

The SHMT approved the Home Mitigation Project Policy in August 2011 enforcing that the only home mitigation projects that will be funded by the Hazard Mitigation Grant Program are acquisition projects. The only exception is if the home is deemed to be a historical property by the State Historical Preservation Office, in which case the home is eligible for either relocation or acquisition if the home cannot be relocated. This policy also states that if a homeowner accepts mitigation funds for acquisition or relocation then they are not eligible to receive funds for the same purpose in the future. The program remains a voluntary program for each individual homeowner and each project must have a government entity, such as a county or city government, sponsoring their application. In Day County, specifically the City of Waubay and around Bitter and Blue Dog lakes, all homes must be below the elevation of 1,811 FMSL NGVD29 in order to be eligible for acquisition or relocation.

Pre-Disaster Mitigation Grant Program

As a requirement of the Pre-Disaster Mitigation (PDM) grant program local emergency managers throughout the State have agreed to review the local hazard mitigation plans annually and submit applications for funding as applicable. Similar to the Hazard Mitigation Grant Program, projects funded through PDM are monitored quarterly through an online FEMA-sponsored database and SMARTLINK application. These are competitive non-disaster specific grants. These are sent to the SHMO and then either provided to the SHMT for ranking or sent on to FEMA on the competitive basis.

Pre-Disaster Mitigation Plan Policy

During the April 17, 2012 State Hazard Mitigation Team meeting, the Team discussed the process of updating and allocating funding for the update of the State plan every three years and County plans every five years in order to be in compliance with the Disaster Mitigation Act of 2000. In order to foster the plan updates with limited planning funding, the SHMT decided all applications for mitigation plan funding going forward should be required to have a minimum of two bids and a brief explanation on the selection process. If at least two bids are not submitted with the application, no funding will be considered for the applicant until they can successfully fulfill the requirement.

RiskMAP / National Flood Insurance Program

The State promotes overall flood risk reduction and sound floodplain management practices through its support of FEMA's RiskMAP program and the National Flood Insurance Program (NFIP). The State has designated a State NFIP Coordinator who administers, promotes, and provides training on all aspects of the NFIP, including providing technical assistance to local communities on floodplain management, flood insurance, and map related issues. The State NFIP Coordinator also promotes communities to join the Community Rating System, which provides discounts on flood insurance premiums for communities that go above and beyond the minimum requirements of the NFIP. The State meets with county and city commissioners to maintain awareness, to create a desire to learn more about the programs, and to assist in resolving issues relating to program compliance and floodplain management. Pamphlets and/or manuals are distributed to local officials outlining the NFIP. A Floodplain Administrators Directory and information bulletin are prepared and distributed biannually to local floodplain administrators and FEMA. The NFIP Coordinator conducts approximately 20 Community Assistance Visits each year. The State, along with FEMA, hosts an annual workshop on a variety of floodplain management issues.

Figure 3-56 (created in January of 2013) in Section 3 portrays South Dakota Digital Flood Insurance Rate Map coverage. Thirty counties have effective DFIRMS. This is an increase from 2011 when only seventeen counties had effective DFIRMs and 4 counties were in development.

According to The National Flood Insurance Program Community Status Book at www.fema.gov/fema/csb.shtm, there were a total of 228 communities throughout the State of South Dakota participating in the National Flood Program as of August 2013. This is two more communities than were participating at the time of the last plan update (2011). The list of participating communities is included as Appendix 4A.

The State NFIP Coordinator provides information at commission meetings to communities that currently do not participate in the NFIP Program.

The state has a recommended flood ordinance but it is not official. The process for the state to adopt floodplain legislation is extensive and may not happen for several years. At present, SDOEM encourages floodplain legislation at the local level.

Flood Mitigation Assistance (FMA)

Eligible communities are contacted and informed of the availability of FMA funding, and related technical assistance. The State NFIP Coordinator assists these communities with development of individualized mitigation plans and ensures that communities submit viable, complete FMA applications. These applications are forwarded to FEMA for review. FEMA approved projects are monitored to ensure completion in accordance with project scope and grant agreements. Award letters and funds are distributed by the State to approved communities on a reimbursement basis. Nothing has been awarded in FMA to the state between 2011 and 2013. Funding is in place but FEMA Headquarters has yet to set an application period for FMA and for PDM.

FMA Success Story: FEMA approved the Augustana College diversion channel project in 2005. After the project completion in August 2007 a rain event occurred and the buildings were not flooded.

Severe Repetitive Loss Properties

Fortunately for South Dakota, there is only one property that meets the definition of a “severe repetitive loss” property: a property in Beadle County with three losses. Total payments for this property total $72,899.50.

SDOEM sends out notifications about flood mitigation funding to the all participating NFIP communities and all the County Emergency Managers.

SDOEM Staffing

SDOEM has increased their personnel to include a staff member dedicated to local plan analysis. Another staff member was hired to work on Public Assistance. Members of SDOEM are capable of performing FEMA Benefit Cost Analyses. Trainings are offered periodically for locals. With the additional staff SDOEM is able to provide more site visits to local governments, more outreach and education, and complete project closing paperwork in a timelier manner. SDOEM is experiencing better coordination with FEMA as a result of staff completing and submitting required items on time. SDOEM is providing a better mitigation program to the entire state with the increased staffing resources.

4.5.2 South Dakota Department of Environment and Natural Resources

The mission of DENR is to protect public health and the environment by providing environmental monitoring and natural resource assessment, technical and financial assistance for environmental projects, and environmental regulatory services. Several mitigation related programs, policies, and funding opportunities exist within DENR. These are outlined in the Capabilities Matrix, with the most applicable described below.

South Dakota Dam Safety Program

The South Dakota Dam Safety program is implemented through the South Dakota Department of Environmental and Natural Resources (SDDENR), Water Rights Program. Requirements for dam building, including permitting and the Safety of Dams rules, are administered through DENR. Details on the status of the dams in South Dakota (high hazard, significant hazard, low hazard) are included in Section 3. For more information on the Dam Safety Program, visit http://denr.sd.gov/des/wr/dam.aspx.

Water and Waste Water Funding

The mission of the Division of Financial and Technical Assistance is to evaluate the natural resources of the state and to provide technical and financial assistance for the protection, restoration, and development of those resources. One program found under this division is Water and Waste Funding. Reviews of projects seeking funding through the Board of Water and Natural Resources are conducted through this program. Projects requesting funding must be on the State Water Facilities Plan (http://denr.sd.gov/dfta/wwf/statewaterplan/statewaterplan.aspx). Other funding found through this board includes:

- Small Community Planning Grant Program – Provides small communities with 2,500 people or less with funds to hire a consultant to develop a preliminary engineering study, a rate analysis, or a project specific engineering report.
- Consolidated Water Facilities Construction Program – Provides grants and loans for small water, wastewater, and watershed projects
- Clean Water State Revolving Fund Program – Provides low interest loans for wastewater, storm sewer, and nonpoint source projects
- Drinking Water State Revolving Fund Program – Provides low interest loans for drinking water projects
- Solid Waste Management Program – Provides grants and loans for solid waste and recycling projects
- State Water Resources Management System – Provides grants and loans for projects that have been established by the Legislature as a priority objective for water resources management in South Dakota.

Water and Waste Funding also works with staff from the Rural Development to coordinate state and federal financial assistance when applicants request financial assistance from both agencies. Program staff work with the SD DOT concerning water/wastewater projects that are concurrent with a road project and with the State Revolving Fund concerning water/wastewater projects that are deemed to be green infrastructure type projects. For more information on funding sought through SD DENR's Water and Waste Funding Program, visit http://denr.sd.gov/dfta/wwf/wwf.aspx.

4.5.3 South Dakota Department of Agriculture (SDDA)

SDDA is comprised of seven divisions pertaining to agriculture, conservation and forestry, and wildland fire. Several mitigation related programs exist within the SDDA. These are outlined in the Capabilities Matrix, with the most applicable described below. In addition to encouraging mitigation through programs and policies, the SDDA promotes resiliency amongst ranchers and farmers through public outreach campaigns. The SDDA's Fall 2013 Newsletter, an example of public outreach and education provided by the SDDA, can be found in Appendix 2B.

Drought Task Force

In July of 2012, Governor Daugaard activated the State Drought Task Force. The goal of this task force is to monitor drought conditions by gathering the best, 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. The task force also monitors the impact of drought on economic sectors of the state. Citizens affected by drought are provided with a forum in which they can ask questions about drought conditions and obtain information on help available to them.
(http://drought.sd.gov/)

Black Hills Forest Fire Protection District

The Black Hills Forest Fire Protection District was created in state law in 1941 as a community risk reduction strategy. It was created to protect the Black Hills area from "unusual fire dangers". Therefore all open burning is banned in the District unless a permit is first obtained from either the State of South Dakota or the Black Hills National Forest. The permit process reduces the chances of escaped open fires burning structures and other man-made improvements.

Community Wildfire Protection Plans

The enactment of the Healthy Forests Restoration Act (HFRA) in 2003 provided incentive to communities to develop Community Wildfire Protection Plans. These plans are used by the SD Wildland Fire Suppression Division (SDWFS) and US Fish & Wildlife Service (USF&WS) to give consideration and priorities to local communities with regard to their forest management and hazardous fuel reduction projects. Community Wildfire Protection Plans (CWPP) typically address issues such as wildfire response, hazard mitigation, community preparedness, and/or structure protection. Currently Butte, Custer, Perkins, Stanley, Pennington, Meade, Fall River, and Lawrence counties as well as Rapid City have effective CWPPs. Under these plans, National Fire Plan fuel mitigation grants are administered by the South Dakota Division of Wildland Fire Suppression to meet hazardous fuel reduction projects around "communities at risk" identified in the CWPP's.

South Dakota Forest Action Plans – Assessment and Strategy

South Dakota's forest action plan provides a comprehensive summary of the five forest types that occur in the state and establishes priority landscapes for targeting management resources. These forests are examined in terms of extent, condition, values, threats, ownership, needs, problems, and opportunities. The Statewide Strategy provides direction for addressing the issues and threats facing these forests and details strategies, existing resources, needs, partners, and monitoring (http://www.forestactionplans.org/states/south-dakota).

Beat the Beetles Mountain Pine Beetle Control Plan

The infestation of pine beetles in the Black Hills has led to dead and dying pine trees, which increase the chances of wildfire. This project allows the Black Hills National Forest to implement effective pine beetle mitigation tactics on up to 248,000 acres in critical areas over the next five to seven years. This includes large-scale thinning and timber harvest on up to 122,000 acres. In 2013, State legislature appropriated $2 million for mountain pine beetle suppression (http://legis.state.sd.us/sessions/2013/Bill.aspx?File=HB1050ENR.htm).

4.5.4 South Dakota Department of Transportation

The mission of the SD DOT is to provide a safe, efficient, and effective transportation system. Programs administered under this department include transportation inventory management; road and bridge design, construction, maintenance, and inspection; and public safety outreach campaigns. The below paragraph describes the Emergency Relief Program, one way in which the DOT is involved in mitigation in the State.

Emergency Relief Program

The Emergency Relief Program is administered by the SD DOT in conjunction with the Federal Highway Administration (FHWA). This program helps repair roads on Federal lands and Federal-aid highways, or public highways other than those functionally classified as local roads or rural minor collectors, that have been damaged as a result of a natural disaster. Federal funds administered through this program supplement costs adhered by the State and other agencies. "Although there is no nationwide definitive monetary break point between what is considered routine and extraordinary expenses, the FHWA has determined that eligible ER repair activities in a state in the range of $700,000 (Federal share) or more are usually significant enough to justify approval of ER funds" (Emergency Relief Manual, 2009).

4.5.5 South Dakota State Historic Preservation Office

The State Historic Preservation Office (SHPO) manages the National Register of Historic Places program of the National Park Service in South Dakota. The program surveys, inventories, and registers historic properties; monitors state, federal, and local government activities which affect cultural and historic resources; provides advice on preservation methods; promotes public education on historical properties; and supports municipal and county historic preservation commissions to advance the state's economic, social, and education objectives. The State Historic Preservation Officer reviews state and local project submittals for FEMA grant funding. The State Historic Preservation Office is on the SHMT and conducts the NEPA reviews for mitigation projects. One grant program, described below, could be used toward mitigation projects in the State.

Deadwood Grant
This grant is funded by a portion of the gambling revenue generated in Deadwood, South Dakota. Grants range from $1,000 to $25,000 and are given toward projects that retain, restore, or rehabilitate historic buildings, structures, and archaeology sites for commercial, residential, or public purposes. Rehabilitation projects can include improvements to historical structures that have been damaged by a disaster.

4.5.6 South Dakota Department of Health – Office of Public Health Preparedness and Response

The mission of the Office of Public Health Preparedness and Response is to develop and maintain the relationships, infrastructure, and expertise necessary to prepare for and respond to public health emergencies. A wide range of public health services to prevent disease, promote health, and ensure access to needed, high-quality health care is supported through this office. Two programs are described in detail below.

Hospital Preparedness Program
The primary focus of this program is to provide leadership and funding to enhance the infrastructure of hospitals to plan for, respond to, and recover from mass casualty events. Funding is used to improve surge capacity and enhance community and hospital preparedness for public health emergencies.

Public Health Emergency Preparedness Program (PHEP)
PHEP funding provides approximately $700 million annually to 50 states, four localities, and eight US territories for building and strengthening their abilities to respond to public health incidents. To be eligible for this federal funding, the State has identified 15 public health preparedness capabilities under the following categories that are defined by the Center for Disease Control to help assist state and local

planners in identifying gaps in preparedness, determining specific priorities, and developing plans for building and sustaining capabilities:

- Biosurveillance
- Community Resilience
- Countermeasures and Mitigation
- Incident Management
- Information Management
- Surge Management

4.5.7 South Dakota Bureau of Information and Telecommunications

The SD BIT is an unfunded agency. Tasks taken on by this agency must be funded by the requesting agency. The following programs that support mitigation are administered by the SD BIT.

Geographic Information Systems
State agencies utilize the GIS infrastructure to take advantage of the centrally located data by creating web applications to publish their data to the Internet. GIS is used for many applications from flood prediction and management to tax rate evaluation. Online maps and GIS data are available via the SD GIS website (http://arcgis.sd.gov/server/sdGIS/Data.aspx). GIS informal training is offered to GIS users within the state government. SD BIT has been involved in creating statewide LiDAR data that is used by localities for planning and zoning purposes.

State Radio System
This system includes over 18,000 registered radios that provide public safety communication to South Dakota law enforcement, first responders, public safety and supporting agencies at the local, state, federal, and tribal level.

South Dakota Public Broadcasting (SDPB)
SDPB is a statewide TV and radio broadcaster. It is the statewide point of contact for the Emergency Alert System and Amber-Alert.

Business Continuity
Data storage is provided through a secure and reliable environment by using technologies that provide redundancies and the ability to restore lost or damaged data. Business continuity refers to activities performed daily to maintain service, consistency and recovery for applications defined as critical business functions. Client service includes the Executive, Legislative and Judicial branches as well as Constitutional and Elected Offices.

4.5.8 South Dakota Office of Risk Management

The mission of the SD Office of Risk Management is to efficiently and effectively protect the assets of the state of South Dakota in the conduct of governmental activity. This mission is accomplished through the use of risk management and insurance programs as well as safety and loss techniques. Programs to reduce risk include property, boiler, and aviation insurance; fidelity bonds; risk audits of state government buildings; and a public entity pool for liability. Loss Control Committees are strongly encouraged to be implemented in all areas of state government. The committees are comprised of employees within their agencies. These committees are responsible for reviewing loss history and safety and health concerns in their respected arena. They are also responsible to conduct a walk-through of their buildings and grounds to identify and correct any hazards. The committees normally meet on a quarterly basis. In addition, the Extraordinary Training Fund provides funding toward training programs that can help reduce risk to the state government.

4.5.9 South Dakota Office of Homeland Security

The purpose of the SD OHS is to prevent terrorism, enhance security, and respond effectively to disasters. The Office administers Homeland Security grants to assist city, county, state, and tribal governments secure the resources needed to prevent, respond to, and recover from hazards. These grants have been used to purchase radios, communication towers, generators, shelters, warning sirens, and to support regional response teams. OHS also performs ACAMS assessments for government buildings, hospitals and schools. These assessments help the State, local and tribal governments build critical infrastructure protection programs. Two plans developed by the Office of Homeland Security, the Threat and Hazard Identification and Risk Assessment and the State Homeland Security Strategic Plan, identify the state's capabilities in preparing for human-caused hazards.

4.5.10 South Dakota Game, Fish & Parks

Game, Fish & Parks serves the public in the management and enjoyment of South Dakota's outdoor resources. The Game, Fish & Parks Commission, by legislative mandate, serves as the advocate and liaison between Game, Fish & Parks and its stakeholders – the people of South Dakota. The law enforcement team protects outdoor resources by responding to violations. Game, Fish & Parks actively seeks partnerships for wildlife habitat management and hunting access as well as supporting cooperative research opportunities. Game, Fish & Parks also offers services such as wildlife damage control. A variety of technical resources for managing habitat and maintaining South Dakota's natural resources are available on the South Dakota Game, Fish & Parks website (http://gfp.sd.gov/wildlife/private-land/technical.aspx).

4.5.11 Additional State Programs

SDOEM continues to improve the integration of mitigation practices throughout the state by working with the Rural Electric Cooperatives, other utilities, and additional state agencies on how their goals coincide with the goals of this plan. Examples for consideration include development of a Statewide Floodplain Management Plan, development of transportation policies in hazard prone areas, and other related policy development. In the meantime, the funding mechanisms and project tracking procedures documented in the HMGP Administrative Plan will be followed for all mitigation related projects overseen by SDOEM.

4.6 SILVER JACKETS CAPABILITY ASSESSMENT

For the 2014 plan update, the SHMT teamed with the Silver Jackets to form an interagency committee. In addition to the state agencies described above, the Silver Jackets is comprised of federal agencies dedicated to reducing risk in South Dakota. These federal agencies are outlined in the following subsections.

4.6.1 US Army Corp of Engineers (Omaha and St. Paul Districts)

The Army Corp supports engineering and construction services in the areas of water resources, design, construction, and environmental restoration. They are involved in flood management projects, wetlands restoration, dam and lake projects, drought and flood relief, and disaster preparedness. The capabilities described below showcase the Corps' ability to help mitigate hazards.

Silver Jackets Success Story: The City of Madison and Lake County experienced flooding from intense rain in 2012. The community set up a sub-committee to review all flood risk reduction measures and ideas. The Silver Jackets were involved early in the process meeting with the community regularly since August 2012 to develop a project proposal for a nonstructural assessment. In June 2013 the USACE selected the proposed project to be completed in partnership with Lake County, the City of Madison, and SD OEM. This assessment will be used to prioritize mitigation options, address repetitive loss properties, and provide flood risk reduction guidance to individual home owners. The final results of this effort will be incorporated into a community education and outreach effort, and provide an example for nonstructural mitigation for other communities in South Dakota. The study will provide SD OEM with the benefit of developed outreach materials, an example nonstructural assessment to be used by other communities in the state, and a report that could be used to prioritize mitigation effort in Madison, SD. The City of Madison and Lake County will have an assessment that could be used to prioritize mitigation options, address repetitive loss properties, and provide flood risk reduction guidance to individual home owners.

Floodplain Management Service Program

This program enables the Corp to provide technical services, planning assistance, and guides and pamphlets for floodplain management to help prevent or reduce flood damage by using structural and/or nonstructural mitigation measures. All activities under this program are 100 percent federally funded.

Silver Jackets

The Silver Jackets program provides a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce risks associated with flooding and other natural hazards. The teams are developed and led at the state level with the support of federal partners. In South Dakota, the Silver Jackets team consists of the US Army Corp of Engineers, FEMA Region VIII, USGS, National Weather Service, US Department of the Interior Bureau of Reclamation, South Dakota Office of Emergency Management, South Dakota Department of Environment and Natural Resources, South Dakota Department of Transportation, and South Dakota Bureau of Information and Telecommunications. The programs desired outcomes are:

- Reduce flood risk
- Agencies better understand and leverage each other's programs
- Collaboration between various agencies, coordinated programs, cohesive solutions
- Multi-agency technical resource for state and local agencies
- Mechanism for establishing relationships to facilitate integrated solutions post-disaster

4.6.2 FEMA Region VIII

The agency works in partnership with SDOEM to prepare for, respond to, and recover from disasters. Many federal mitigation funding opportunities, policies, and programs are administered by FEMA and carried out at the state level by SDOEM.

RiskMAP
RiskMAP is a FEMA program that provides communities with flood information and tools that they can use to enhance their mitigation plans and take action to better protect their citizens. More information on RiskMAP, the NFIP, and HMA can be found in the SDOEM profile in the section above.

4.6.3 Natural Resource Conservation Service

The NRCS provides information and assistance to farmers who are affected by the drought in South Dakota. They administer numerous Farm Bill programs that provide technical and financial assistance to farmer and ranchers to install conservation practices.

4.6.4 US Geological Survey

The USGS provides information on South Dakota's rivers, streams, ground water, and water quality. The organization operates an extensive network of stream-gaging stations in the state, many of which form the backbone of flood-warning systems. StreamStats for South Dakota is a web-based GIS program that provides users with access to analytical tools that are useful for water-resources planning and management, and for engineering design applications, such as the design of bridges. This program allows users to obtain streamflow statistics, drainage basin characteristics, and other information on streams. The Flood Inundation Mapping Program is designed to help state and local communities understand flood risks and make cost-effective mitigation decisions. The USGS also heads flood studies and reports on areas of South Dakota that are prone to flooding.

4.6.5 National Weather Service

The NWS has 3 offices in South Dakota, in Sioux Falls, Aberdeen, and Rapid City. They provide severe weather and flood warnings, and offer weather and flooding safety guides. NOAA All-Hazards Weather Radio broadcasts are provided by the NWS, and storm spotter training is also offered through the NWS.

4.6.6 US Bureau of Land Reclamation

The Bureau is the largest wholesaler of water in the country, bringing water to more than 31 million people and providing one out of five Western farmers with irrigation water for 10 million acres of farmland that produce 60% of the nation's vegetables and 25% of its fruits and nuts. The Bureau is also the second largest producer of hydroelectric power in the western US.

The Bureau is a water management agency with a Strategic Plan outlining numerous programs, initiatives and activities that will help the Western states, Native American tribes, and others meet new water needs and balance the multitude of competing uses of water in the West. Their mission is to assist in meeting the increasing water demands of the West while protecting the environment and the public's investment in these structures. Programs, initiatives and activities include:

- WaterSMART Program
- Water Conservation Field Services Program
- Rural Water Supply Program
- Resource Management and Planning
- National Irrigation Water Quality Program
- Flood Hydrology and Consequences Group
- Drought Program
- Dam Safety
- Building Seismic Safety Program
- Snowpack and Reservoir Levels

4.6.7 Federal Highway Administration

The South Dakota FHWA division office provides leadership and guidance to the SD DOT in planning, construction, and maintenance of transportation projects. They help to ensure that roads, bridges, and tunnels are safe and continue to support economic growth and environmental sustainability. The SD DOT Emergency Relief Program is funded through the FHWA.

4.7 LOCAL CAPABILITY ASSESSMENT

44 CFR Part 201 Requirement:
[The State mitigation strategy shall include] a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.

The State reviewed all of the FEMA – approved local mitigation plans at the time of this plan update (2014). The FEMA – approved local mitigation plans at that time covered all 66 counties throughout the state, including the Rosebud Sioux Tribe and the Standing Rock Tribe. Table 4-4 presents a summary of the common policies and programs identified in the local mitigation plans.

Table 4-4 Summary of Local Capabilities

Policy/Program	# of counties
NFIP / Strict development regulation in flood hazard zones	43
Outdoor/Indoor Warning System	43
Regular Training for Emergency Responders	40
Building Code	28
Local Emergency Operations Plans	27
Fire Bans and Public Water Restrictions during Dry Periods	27
Equipment to handle fire/wildfire	24
Regular Dam and Culvert Inspections and Maintenance	24
Public Awareness Campaigns/CERT/Citizen Corp	24
Designated Storm Shelters	24
Weather Spotters	22
Zoning/Planning Commission	21
Equipment for Winter Storm Response	21
Mutual Aid Agreements with other Fire Departments	21

A complete inventory of the capabilities identified in the local plans is included in Appendix 4B. SDOEM recognizes that many of the listed capabilities are more effective for disaster response than hazard mitigation. The State Hazard Mitigation Officer continues to work with the local communities on improving the local hazard mitigation plans.

The State Hazard Mitigation Officer is working with every county to ensure development of a FEMA approved mitigation plan for each county in the state. The SD SHMO has overseen several power line burial projects, drainage improvement, community safe rooms, acquisitions, road grade elevation projects.

4.7.1 Local Mitigation Actions

As part of the 2014 Plan Update and the local plan rollup, completed and identified mitigation actions at the local level were summarized. The summary table below shows how localities in South Dakota are mitigating risk and how they plan to mitigate risk in the future. This summary is new for the 2014 Plan Update and therefore only the 44 plans that were updated since the last Plan Update are included in the table below. Future plan updates will include additional local plans as they become updated.

Table 4-5 Summary of Local Mitigation Actions

Completed Mitigation Actions	**# of counties**
Stormwater Improvement/Drainage and Culvert Improvement	11
Powerline Burial/Improvement	11
Generator/Power Backup	10
Flood Control/Management	9
New Warning System/Warning System Improvement	8
Debris Clean Out	7
Tree Removal/Trimming	6
Improve Data/Mapping Capabilities	6
Improve Emergency Communication Capabilities	6
New Storm Shelter	4
Purchase of Winter Storm/Firefighting/EMS Equipment	4
Completion of Hazard Specific Mitigation Plan (i.e. CWPP, HazMat, Dam)	4
Wastewater Infrastructure Improvement	3
Road Infrastructure Improvement	3
Firefighter/Flood Manager/Volunteer Training/Exercises/Certification	3
Passage of Hazard Specific Mitigation Policy	3
Elevation/Acquisition/Relocation	1
Wetland Preservation	1
Identified Mitigation Actions	**# of counties**
Stormwater Improvement/Drainage and Culvert Improvement	38
Powerline Burial/Improvement	34
Flood Control and Management Projects	32
Generator/Power Backup	32
Firefighter/Flood Manager/Volunteer/GIS Training/Exercises/Certification	31
Public Awareness and Education Campaigns	31
Storm Shelter/Tornado Safe Room	29
New Warning System/Warning System Improvement	28

Continued NFIP Compliance/Encourage NFIP Participation/CRS	27
Land Use Policies/Zoning Enforcement/Building Code/Drainage Ordinance/Wildfire Policy	24
Improve/Create Mapping and/or Facility and Data Inventory (Infrastructure, Critical Facilities, Flood, Vulnerable Populations)	24
Controlled Burns/Burn Bans/Vegetation Management/Firebreaks/Defensible Space	22
Improvement to Emergency Communication System	21
Purchase/Improvement of EMS Equipment (Fire, Ambulance, Police)	20
StormReady	14
Software/Technology Improvements for Data Analysis	12
Debris Removal	12
Tree Removal	9
Implement/Improve 911 Emergency/First Responder System	9
Promote NFIP/Flood Insurance to nonparticipating communities	8
Create partnerships with non-profits, private organizations/citizens, neighboring emergency managers, and transportation agencies	8
Elevation/Acquisition/Relocation/Floodproofing	8
Develop Severe Weather Preparedness Plans (mass sheltering, business continuation, debris removal)/Conservation Plans/HazMat Plans	7
Improve traffic safety/road improvements	6
Install Stream Gages	2
Install Snow fence/Plant Living Wind/Snow breaks	2

4.8 MITIGATION ACTIONS

44 CFR Part 201 Requirement:
[The State plan shall include an] identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified. *[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts and changes in priorities….*

Many of the mitigation actions identified in the 2011 Plan remain ongoing. The progress of these ongoing mitigation actions is documented in Section 4.4, which highlights progress to date for each of the plan goals. Several mitigation actions were removed from the Plan. These are presented along with the reason for their removal in Section 4.1.2.

This section presents the current ongoing and new mitigation actions as confirmed by the SHMT during the 2014 update process. The mitigation actions are listed in a matrix, organized by goal. The matrix includes an action number, the action priority, status, potential funding sources, the responsible department and space for noting progress as this plan is monitored. SD OEM will coordinate an annual joint meeting of the SHMT and Silver Jackets to review the matrix of mitigation actions and discuss progress made or opportunities to pursue progress of each action.

The State Hazard Mitigation Team has confirmed these actions with the understanding that approval of this plan does not obligate the State to complete each project before the required update in 2017. The State Hazard Mitigation Team understands that the 2017 plan update must demonstrate progress in statewide mitigation efforts. This progress may be in the form of the actions listed below or additional actions that assist in reaching the goals and objectives outlined in this plan.

Mitigation Action Prioritization

During the 2014 update, the SHMT and Silver Jackets members reviewed the STAPLE E criteria shown below to evaluate and identify priority levels for the hazard mitigation actions. The overall priority of the SHMT for the 2014 – 2017 period is to improve the quality of hazard mitigation planning efforts for local and tribal governments. The SHMT will continue to support a diverse range of mitigation actions to ensure a comprehensive approach to reducing risk to all hazards across the entire state.

Based on group consensus from the SHMT and Silver Jackets members, each action was assigned a level of priority (High, Medium, Low) as described below.

- **High** priority actions strongly support reduction of high risk hazards, achieve hazard mitigation goals as outlined in this plan, and eliminate or greatly lessen the impact of future incidents. These may also include actions that have a higher possibility for implementation in the near term (i.e. funding is available or current political feasibility supports the action).

- **Medium** priority actions may be educational, outreach, or maintenance actions. They may include small mitigation projects that would minimize severity but not mitigate hazards completely. Medium priority actions are less urgent but still significant towards improving the State's resiliency.

- **Low** priority actions are generally the responsibility of the local community. The State supports these projects, but is often unable to provide the authority to implement them.

Table 4-6 STAPLE/E Criteria

STAPLE/E Review and Selection Criteria
Social
• Is the proposed action socially acceptable to the State or jurisdiction and surrounding community? • Are there equity issues involved that would mean that one segment of the State and/or community is treated unfairly? • Will the action cause social disruption?
Technical
• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action in light of other State or jurisdiction goals?
Administrative
• Can the State or jurisdiction implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political
• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal
• Is the State or jurisdiction authorized to implement the proposed action? • Are there legal side effects? Could the activity be construed as a taking? • Will the State or jurisdiction be liable for action or lack of action? • Will the activity be challenged?
Economic
• What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs taken into account? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? • How will this action affect the fiscal capability of the State or jurisdiction? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity? • Does the action contribute to other State or jurisdiction goals? • What benefits will the action provide?
Environmental
• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?

Table 4-7 South Dakota 2014 -2017 Mitigation Strategy

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
1	1-1	Support the construction and operation of hardened shelters / safe rooms through local project applications.	High	Ongoing	HMGP CDBG PDM FMA Local Private	SDOEM FEMA GF&P HUD Tribal, Local Gov't Private Citizens	
1	1-2	Support the installation of outdoor warning sirens and NOAA weather radios through local project applications.	High	Ongoing	HMGP CDBG EMPG Local SHSGP	SDOEM FEMA SDOHS NWS Tribal, Local Gov't Private Businesses/Citizens	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
1	1-3	Coordinate public outreach/education regarding shelter locations and warning systems. Develop brochures, websites, news briefs, and other media to notify the public of shelter locations and what sounds to expect from the warning systems.	Medium	Ongoing	EMPG PDM HMGP Local Gov't Private Businesses	SD OEM Tribal, Local Gov't NWS	
1	1-4	Support and encourage public education/outreach efforts for all hazards awareness and safety.	High	Ongoing – Updated to include all hazards for 2014		SD OEM Tribal, Local Gov't	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
2	2-1	Coordinate with South Dakota Building Code Association to integrate floodplain management ordinances into local building codes.	Medium	Ongoing	No funding Needed	SD OEM Tribal, Local Gov't FEMA	
2	2-2	Improve the state facilities database by capturing classification and valuation information.	Low	Ongoing		SD BIT Risk Management	
2	2-3	Support the purchase and relocation of structures within floodplains and other hazard prone areas through local project applications.	High	Ongoing	HMGP PDM FMA Local USACE	SD OEM Tribal, Local Gov't USACE FEMA	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
2	2-4	Support and encourage flood control projects through local project applications.	High	Ongoing	HMGP PDM FMA SD DENR Local USACE	SD DENR SD OEM Tribal, Local Gov't USACE SD GOED FEMA	
2	2-5	Support and encourage elevation of structures in flood prone areas through local project applications.	High	Ongoing	HMGP PDM FMA DENR Local USACE CDBG	SD OEM Tribal, Local Gov't USACE FEMA	
2	2-6	Coordinate with all state departments and agencies through surveys and other mechanisms to identify structures in hazard areas and their replacement values.	Medium	Ongoing	RiskMAP/FEMA	SHMT members SD OEM Tribal, Local Gov't FEMA Silver Jackets	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
2	2-7	Support and encourage fire risk reduction projects such as the installation of fire breaks / fuel breaks and the creation of defensible space between structures and forested areas through local project applications.	Medium	Ongoing	SDDA HMGP PDM USFS SD GF&P BLM Private Citizens	SD OEM Tribal, Local Gov't SDDA USFS SD GF&P Private Citizens	
2	2-8	Support and encourage communities to participate in Firewise, develop CWPPs, and participate in other fire protection programs to minimize risk to wildfire.	Medium	Ongoing	SDDA USFS BLM Private Citizens	SDDA USFS SD GF&P Private Citizens SD OEM Tribal, Local Gov't FEMA	
2	2-9	Support bank stabilization and other geohazard risk reduction through local project applications.	High	New for 2014		SD GF&P SD OEM Tribal, Local Gov't FEMA SD DOT Coast Guard USACE SD DENR NRCS	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
3	3-1	Support the improvement to existing power lines through local project applications. (i.e. power line burial, spoiler installation)	High	Ongoing	HMGP PDM Local Utilities REC	PUC SD OEM Tribal, Local Gov't REC FEMA	
3	3-2	Encourage the purchase of generators for backup power to critical infrastructure / storm shelters and conduct regular testing for preparedness.	High	Ongoing	HMGP PDM Local Utilities EMPG SHSGP	PUC SD DOH REC SD OEM Tribal, Local Gov't SD OHS FEMA	
3	3-3	Encourage removal of debris in waterways (i.e. near bridges, culverts, within stream channels).	High	Ongoing	Local	Tribal, Local Gov't SD DENR Water Districts Local Watershed Districts NRCS	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
3	3-4	Support and encourage drainage improvement projects through local applications (i.e. proper sizing)	High	New for 2014		SD OEM Tribal, Local Gov't SD DENR SD GOED Local Watershed Districts Water Districts	
3	3-5	Support and encourage routine inspections of existing utilities and infrastructure for damage and weaknesses.	High	Ongoing	Local Utilities REC Local	PUC REC Tribal, Local Gov't	
3	3-6	Maintain the State digital radio system through regular training and exercises.	Medium	New for 2014		SD OEM Tribal, Local Gov't SD BIT	
4	4-1	Encourage agricultural modifications to lessen the impacts of drought such as crop rotation, drought resistant crops, no till, etc.	Medium	Ongoing	Private Citizens SDDA	SDDA Private Citizens Tribal, Local Gov't USDA	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
4	4-2	Promote insurance – Many different forms of insurance are available to cover damages incurred by the various natural hazards. The State will encourage residents, farmers, and business owners to purchase insurance appropriate for their risk.	Medium	Ongoing	No Funding Needed	DORR - Insurance SD OEM Tribal, Local Gov't FEMA USDA SDDA	
4	4-3	Coordinate with the State Historic Preservation Officer and Tribal Historic Preservation Officer (as applicable) on all projects.	High	New for 2014	No Funding Needed	SHPO USACE SD OEM THPO FEMA	
4	4-4	Release statewide campaigns to promote tourism and recreation.	Low	New for 2014		SD Dept of Tourism and State Development SD GF&P SD GOED	

Goal	Action #	Mitigation Action	Priority	Status	Potential Funding Source(s)	Responsible Department(s)*	Progress Notes
5	5-1	Support and continue public outreach efforts regarding methods to reduce losses due to natural hazards.	Medium	Ongoing	EMPG	SD OEM Tribal, Local Gov't SD OHS SD DOH NWS SDDA USDA FEMA NRCS	
5	5-2	Continue working with local/tribal governments to develop approvable hazard mitigation plans and eligible mitigation project grant applications.	High	Ongoing	PDM HMGP	SD OEM FEMA SD Tribal Relations	
5	5-3	Support and encourage safer building practices in local communities to reduce risk to all hazards.	Medium	New for 2014	No Funding Needed	SD OEM Tribal, Local Gov't DORR	

*The current representative on the State Hazard Mitigation Team for the noted Responsible Departments will be contacted for updates and progress reports on the mitigation actions.

4.9 FUNDING SOURCES

44 CFR Part 201 Requirement:

[The State mitigation strategy shall include an] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.

Throughout development of the 2014 Plan update, the SHMT identified many potential sources of funding to implement risk reduction or mitigation activities. Many of these have been listed in prior iterations of this plan, but several have been added as a result of the update planning process. The funding sources were identified through SHMT and Silver Jackets awareness of state and federal agencies as well as the comprehensive review of local hazard mitigation plans.

Potential funding sources for implementing mitigation activities include:

- **Bioterrorism Funding**
- **Bureau of Indian Affairs (BIA)**
- **Bureau of Land Management (BLM)**
- **CoBank**
- **Community Development Block Grants (CDBG)**
- **Cooperative Finance Corporation (CFC)**
- **DHS Emergency Management Performance Grants (EMPG)**
- **Economic Development Administration Local Emergency Planning Committees (LEPC)**
- **Federal Housing Administration (FHA)**
- **FEMA Assistance to Firefighters Grant Program**
- **FEMA Flood Mitigation Assistance Program (FMA)**
- **FEMA Hazard Mitigation Grant Program (HMGP)**
- **FEMA Pre-Disaster Mitigation Grant Program (PDM)**
- **FEMA RiskMAP**
- **James River Water Development District** – new for 2014 Plan Update
- **Law Enforcement Grant** – new for 2014 Plan Update
- **Local Government Funding**
- **National Weather Service**
- **Office of Domestic Preparedness (ODP)**
- **Private Sector Funding (from citizens and/or businesses)**
    - **Private Electric Companies**
    - **Local Utilities**
- **Randall Resource Conservation and Development Office** – new for 2014 Plan Update
- **Red Cross**
- **Resource Conservation and Development District Funding (RCD)**
- **Rural Development Grant and Loan Program (RD)**
- **Rural Electric Association (REA)**
- **Rural Electric Cooperatives (RECs)**
- **Rural Utility Service (RUS) loans**

- **Rural Water Systems (RWS)**
- **Salvation Army**
- **School District**
- **Siouxland Interstate Metropolitan Planning Council (SIMPCO)**
- **Small Business Administration Disaster Assistance Program (SBA)**
- **Small Community Planning Grant** – new for 2014 Plan Update
- **South Central Water Development District** – new for 2014 Plan Update
- **South Dakota Department of Agriculture (SDDA)**
- **South Dakota Department of Economic Development (SDDED)**
- **South Dakota Department of Environment and Natural Resources (DENR)**
- **South Dakota Department of Game, Fish and Parks (GF&P)**
- **South Dakota Department of Transportation Funding Programs (DOT)**
- **South Dakota Office of Emergency Management (SDOEM)**
- **State Electric Commission**
- **State Homeland Security Grant Program (SHSGP)**
- **Transportation Enhancement funds for living snow fence projects**
- **United States Coast Guard**
- **United States Corps of Engineers (USCOE)**
- **United States Department of Agriculture (USDA)**
- **United States Forest Service (USFS)**
- **United States Geological Survey (USGS)**

SECTION 5 LOCAL MITIGATION PLANNING COORDINATION

5.1 LOCAL FUNDING AND TECHNICAL ASSISTANCE

44 CFR Part 201 Requirement:
[The section on the Coordination of Local Mitigation Planning must include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans. *The updated plan must describe:* ▪ *The funding and technical assistance the State has provided since approval of the previous plan to assist local jurisdictions in completing approvable mitigation plans; and* ▪ *How the State will continue to provide this funding and technical assistance for new plans as well as local plan updates.*

Funding and technical assistance provided by SDOEM includes provision of funds, plan development assistance, technical assistance for developing risk assessments, G318 trainings for hazard mitigation planning, benefit/cost analysis training, and tribal planning assistance.

The State Hazard Mitigation Officer (SHMO) works with each of the state's counties to support local mitigation plan development. The SHMO performs a preliminary review of each plan prior to submitting it to FEMA. At the time of 2014 State Plan preparation, 66 counties and 2 tribal governments had FEMA approved hazard mitigation plans or plans in the process of being updated. It is the SHMO's goal to support every county in the state with plan development, ensuring it meets FEMA's requirements, and supporting the maintenance and updates of these plans. The SHMO will continue regular meetings with each county in order to ensure maintenance and required updates for all local plans are performed.

As documented in the Hazard Mitigation Grant Program Administrative Plan dated November 16, 2010, the SHMO coordinates review of each project application for funding eligibility in FEMA's Hazard Mitigation Assistance programs. The State Hazard Mitigation Team (SHMT) serves as a review and prioritization panel for the Hazard Mitigation Grant Program (HMGP).

The SHMT objectively reviews a project application in terms of federal criteria and the pre-determined state goals (such as the mitigation actions prioritized in Section 4). They look at the priority level of the project type, based on the priorities in Section 4, review the benefit cost analysis, and determine whether the project will help achieve the State's identified goals. Currently, the SHMT is encouraging a more diverse range of project applications than solely power line burials.

As noted in Section 4, the SHMT used the STAPLE/E Selection Criteria to prioritize the mitigation actions. These criteria are also referred to during review of project applications. Further details regarding the State of South Dakota's policies on providing funding are explained in the Hazard Mitigation Grant Program Administrative Plan which was undergoing revision at the time of this plan update.

5.1.1 Recent Technical Assistance and Funding (SHMO activities since the 2011 update)

SDOEM in collaboration with the SHMT awards mitigation grant funds and completes the required paperwork and monitoring process for those funds. In addition, the State Hazard Mitigation Officer has coordinated multiple technical assistance activities. These include trainings for flood planning assistance and awareness, Benefit Cost Analysis, and Tribal planning assistance. While it is unreasonable to document all of the SHMO's coordinated activities over a three year period, the following provides an understanding of the types of activities that have been coordinated.

January 29-30, 2013: G318 Local Mitigation Planning Workshop in Chamberlain

Regional Meetings

February 4, 2013 – Region 2, Watertown
February 6, 2013 – Region 6, Mitchell
February 7, 2013 – Region 3, Gettysburg
February 14, 2013 – Region 5, Chamberlain

February 12-13, 2013: ASFPM Refresher Course in Chamberlain

August 13 – 15, 2013: Applicant Briefings for Disaster Declarations 4115, 4125, and 4137 were held in Sioux Falls, Chamberlain, Mobridge, and Deadwood.

Ongoing: Various trips to local governments to inform them of mitigation programs. These are resulting in more interest across the state for mitigation grants.

5.2 LOCAL PLAN INTEGRATION

44 CFR Part 201 Requirement:
[The section on the Coordination of Local Mitigation Planning must include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.   *[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities….*

Local hazard mitigation plans covering all 66 counties and 2 tribal governments were reviewed and integrated into this plan. Each local plan was reviewed for the following components:

- Hazards
- Local Capabilities
- Goals
- Estimated Losses
- Growth and Development Trends
- Funding Sources

Section 3.1 discusses the consideration of the hazards identified in the local plans. Section 4.7 discusses the common capabilities identified in the local plans. The estimated losses, where provided, were integrated into the Risk Assessment (Chapter 3 of this plan). Table 3-29 in Section 3.3 summarizes the growth and development trends identified in the local plans. The funding sources identified in the local plans are presented in Section 4.9.

5.3 PRIORITIZING LOCAL ASSISTANCE

44 CFR Part 201 Requirement:
[The section on the Coordination of Local Mitigation Planning must include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs which should include: ▪ *Consideration for communities with the highest risks,* ▪ *Repetitive loss properties, and* ▪ *Most intense development pressures.* *Further that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.* *[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities….*

The State Hazard Mitigation Team recognizes, based on the risk assessment in this plan, that some counties are more vulnerable to certain hazards than others. Table 5-1summarizes the most vulnerable counties and RECs for each of the identified hazards in the 2014 Plan update. In addition to the criteria discussed in Section 5.1 the State will consider the results of the vulnerability assessment as shown.

Table 5-1 Summary of Vulnerability (2014)

Natural Hazard (in order of priority)	Most Vulnerable Counties	Most Vulnerable RECs
Flood	<u>Potential Losses</u>: Minnehaha, Union, Yankton, Pennington, Codington, Lawrence, Brown <u>Loss Ratio</u>: Union, Yankton, Fall River, Campbell <u>DFIRM Loss Estimation</u>: Minnehaha, Pennington, Codington, Brown <u>NFIP Greatest Losses</u>: Codington, Union, Hamlin <u>Repetitive Loss Dollars</u>: Codington, Day, Hamlin <u>Severe Repetitive Loss Dollars</u>:	

Natural Hazard (in order of priority)	Most Vulnerable Counties	Most Vulnerable RECs
	Beadle Future Growth: Minnehaha, Union, Yankton, Pennington	
Winter Storm	Prior Events, Building Exposure, and population density: Minnehaha, Pennington, Brookings, Davison, Meade, Lincoln	XCEL Energy (Minnehaha), XCEL Energy (Lincoln), West River Electric Association, Inc. (Pennington and Meade), Southeastern Electric Cooperative (Minnehaha and Lincoln), Sioux Valley Energy (Brookings and Minnehaha), Sioux Falls Municipal Electric and XCEL Energy, Otter Tail Power Co, Northwestern Energy (Davison), MidAmerican Energy, Kingsbury Electric Cooperative, H-D Electric Cooperative, Grand Electric Cooperative, Clay-Union Electric Corp (Lincoln), Central Electric Cooperative, Butte Electric Cooperative, Black Hills Power and Light Co (Meade and Pennington), Black Hills Electric Cooperative
Wildfire	Building and Population Exposure: Pennington, Lawrence, Meade, Hughes, Custer, Butte	The Black Hills, Butte, West River, and Southeastern REC's
Drought	All Counties South Dakota Crop Losses Due to Drought in 2012: Hutchinson, Bon Homme, Charles Mix, Lincoln, McCook	
Tornado	Prior Events, Building Exposure, Population Density, and Past Tornado Damage: Minnehaha , Brown, Lincoln, Pennington, Turner	Black Hills Electric Cooperative, Black Hills Power and Light Co (Pennington), Clay Union Electric Corp (Lincoln and Turner), Lake Region Electric Association, MidAmerican Energy, Montana-Dakota Utilities, Northern Electric Cooperative, Northwestern Energy (Brown), Sioux Falls Municipal Electric and XCEL Energy, Sioux Falls Energy (Minnehaha), Southeastern Electric Cooperative (Lincoln, Minnehaha,

Natural Hazard (in order of priority)	Most Vulnerable Counties	Most Vulnerable RECs
		Turner), West River Electric Association, XCEL Energy (Lincoln, Minnehaha, Turner)
Windstorm	Prior Events, Building Exposure, and Population Density: Minnehaha, Pennington, Meade	Black Hills Electric Cooperative, Black Hills Power and Light (Meade and Pennington), Butte Electric Cooperative, Clay-Union Electric Corporation (Lincoln), Grand Electric Cooperative, MidAmerican Energy, Sioux Falls Municipal Electric and XCEL Energy, Sioux Valley Energy (Minnehaha), Southeastern Electric Cooperative (Lincoln and Minnehaha), West River Electric Association (Meade and Pennington), XCEL Energy (Lincoln, Minnehaha, Turner)
Hazardous Materials	Number of Transportation Incidents: Minnehaha, Pennington, Brown, Codington, Brookings Counties with the most gas or hazardous liquid transmission lines: Lincoln, Minnehaha, Brown, Clark, Spink, Butte, Hutchinson, Union, Harding, Kingsbury	
Geologic Hazards	Highest Building Losses: Pennington, Minnehaha, Lawrence	
Agricultural Pests and Diseases	Agricultural Pests and Diseases as Identified Hazard (from Local Risk Rollup): Todd, Pennington, Mellette, Harding USDA Disaster Designation for Losses Related to Insects and Disease in 2012: Campbell, Corson, Harding, Perkins USDA Disaster Designation for Losses Related to Grasshoppers in 2011: Jackson and Todd	

The State will continue to prioritize assisting communities in developing and maintaining FEMA approved local mitigation plans. The information gathered in this plan is available to the local communities for use and consideration.

5.3.1 Local Plan Review Process

Local hazard mitigation plans are submitted to SDOEM either electronically or mailed hard copy. Once they are received, SDOEM begins the review process. If there are any findings for corrections SDOEM either calls or sends an email to the submitting jurisdiction. Staff keep track of where each plan is within the review process. They are reviewed in the order they are received, and within 30 days of receipt, unless there or circumstances requiring an expedited review. The number of plans submitted each quarter varies based on the update schedule for each plan.

Once SDOEM finds a plan to be complete and compliant with the requirements they submit it to FEMA Region VIII for their review. FEMA has 45 days to provide comments back to the state or send up an approvable pending adoption letter. If revisions are required by FEMA, SDOEM notifies the submitting jurisdiction via email and offers to host a conference call to discuss the necessary revisions. All correspondence and notifications from SDOEM are distributed electronically.

SECTION 6 PLAN MAINTENANCE PROCEDURES

6.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

44 CFR Part 201 Requirement:
[The Standard State Plan Maintenance Process must include an] established method and schedule for monitoring, evaluating and updating the plan. *The updated plan must include:* • *an analysis of whether the previously approved plan's method and schedule for monitoring, evaluating, and updating the plan worked, and what elements or processes, if any, were changed; and* • *the method and schedule to be used over the next three years to monitor, evaluate, and update the plan.*

The State Hazard Mitigation Team has a successful process for meeting and implementing mitigation actions after every declared disaster. During the milestone workshop of the SHMT in preparing this plan update, each of the SHMT agencies reviewed and reported on progress for the mitigation actions. This proved to be a very successful process and resulted in quality reports of mitigation progress across the state agencies. Additionally, the South Dakota Silver Jackets provided input into this 2014 plan regarding their progress and capabilities for implementing mitigation within South Dakota.

The Silver Jackets meet regularly. On an annual basis, during a regular meeting of the Silver Jackets, the entire SHMT will be invited to collaboratively review this plan and make note of progress as well as items to update.

SDOEM will continue to annually review applications for submittal for PDM grants. In addition the SHMT will continue to convene following every declared disaster event. Every three years, as required by DMA 2000, the State will submit an updated Hazard Mitigation Plan to FEMA for review and approval.

The SHMO maintains a list of submitted project applications for each declared disaster. At every meeting of the SHMT, the team will review the identified priorities in compared to previously funded projects and discuss overall mitigation progress. This will inform ongoing prioritization decisions for funding additional projects. SDOEM did not use the summary Mitigation Action Matrix within the 2011 plan for tracking mitigation progress. Section 4.8 of this plan includes a revised mitigation action matrix noting the responsible agencies and potential funding sources for each action. It is intended that SDOEM will update the Progress Notes column on an annual basis as they collaborate with the Silver Jackets and the SHMT to review the plan.

The State Hazard Mitigation Officer is responsible for organizing the State Hazard Mitigation Team meetings, documenting the discussed revisions, and reporting to FEMA on a regular basis the intended updates to the Hazard Mitigation Plan. The SHMO will be responsible for coordinating development of the required plan update.

6.2 Monitoring Progress of Mitigation Activities

44 CFR Part 201 Requirement:
[The Standard State Plan Maintenance Process must include a] • *System for monitoring implementation of mitigation measures and project closeouts* • *System for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy* *The update must:* • *Describe any modifications to the State's system used to track the initiation, status, and completion of mitigation activities;* • *Discuss if mitigation actions were implemented as planned; and* • *Indicate who will be responsible for continued management and maintenance of the monitoring system, including the timeframe for carrying out future reviews.*

The State Hazard Mitigation Team will review local mitigation project applications using the following tools to prioritize approval and implementation: 1) HMGP Project Evaluation Sheet, 2) STAPLE/E Criteria, and 3) vulnerability assessment results noting hazard priorities for each county. The first two tools will help the SHMT identify effective, cost-beneficial projects. The third tool allows the SHMT to prioritize funds to those geographic areas with the most need. As necessary, the SHMT will coordinate with additional relevant and interested state agencies.

The progress of mitigation activities will be monitored through ongoing grants application and management processes.The progress of funded projects are tracked via a quarterly reporting system. In addition they are physically inspected every two years while under construction. The State follows project closeout procedures as outlined in the HMGP Administrative Plan. These procedures require the sub-grantee to request closeout of the project by letter addressed to the SHMO. The SHMO coordinates via letters to and from FEMA for preparation of final notice that the project was completed in accordance with FEMA approvals. Project closeout procedures are included in this plan as Appendix 6A. The State of South Dakota intends to follow these project closeout procedures for all State supported mitigation projects relevant to this plan. In addition a monthly report is generated for the governor's office noting the progress of all mitigation projects.

The 2011 plan pledged that the SHMO will, on an ongoing basis, correlate the prioritized mitigation project types with the submitted project applications. Given the additional staffing within SDOEM, they have been able to track in a more organized manner the number of applications and funded projects. This information was used to report on the overall mitigation progress in Section 4.

Prior to the three-year required plan update, in addition to the regular SHMT meetings, core members of SDOEM will perform a thorough review of this plan and note at a minimum the following:

- out-dated information,
- completed mitigation projects,
- significant hazard events from 2014 – 2017,
- newly desired mitigation actions,

- revisions to the State Hazard Mitigation Team,
- status of communities with FEMA approved local mitigation plans,
- etc.

The notes and observations compiled during the SHMT meetings and the thorough review by SDOEM will be used to facilitate a complete update of this plan for submission to FEMA in 2017.

In addition to updating this hazard mitigation plan, the State's HMGP Administrative plan is updated as necessary following every declared disaster. This activity is coordinated by the SHMO.

6.3 SUMMARY OF SUGGESTIONS FOR UPDATING THE 2017 PLAN

The State Hazard Mitigation Team recognizes that this plan is a living document. To facilitate quality improvements to this plan during future updates, this section includes a summary of suggested improvements identified during the 2013-2014 planning process.

1. Develop a graphical summary of the risk assessment which may serve as a tool for developing local hazard mitigation plans. The summary should be brief and clearly identify which hazards are of most concern to each county.
2. Develop state specific guidance to assist local mitigation planners with developing risk assessments and identifying appropriate mitigation actions. This guidance would identify data and resources available by the State.
3. Document losses due to disaster events and report them within the Risk Assessment as appropriate.

Appendix 2A

Meeting Materials

South Dakota Silver Jackets Meeting
06 December 2012
10:00 – 12:00 Central Time
Location: Media Room, SD State Emergency Operations Center
1302 E Highway 14 Pierre, SD

Conference Call # 1 866-939-8416
Pin Number 9243888#

Open Statements (Titze)

Roll Call

State Hazard Mitigation Plan Update (Bauder)

Review and Approval 06 September 2012 Meeting Minutes

City of Madison & Lake County, SD Section 22 Request (Blankers)

LiDAR Project Update (Nelson)

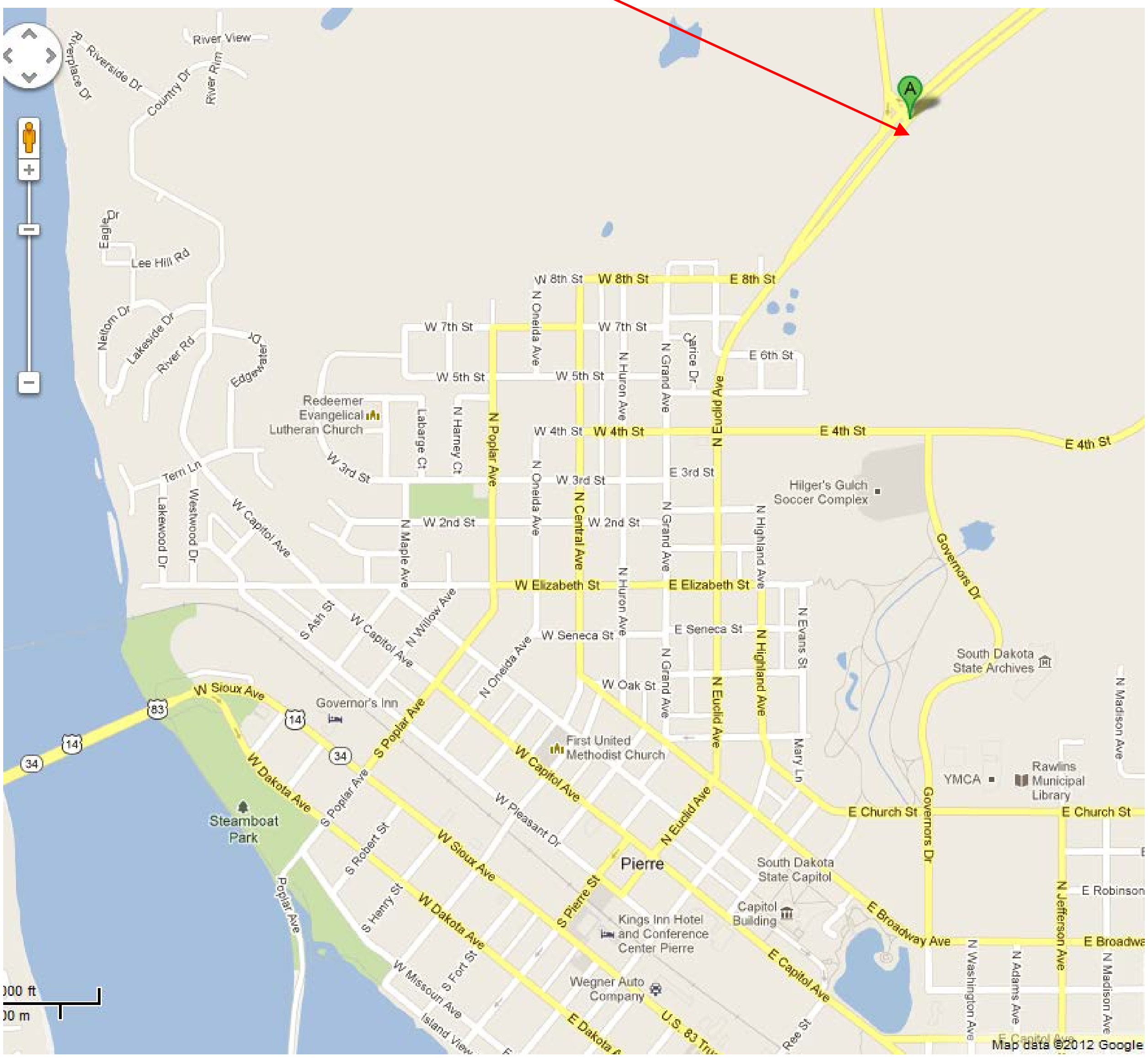
Risk Map Discovery Meetings

Agency Updates and Round Table Disscussion

Next Meeting (location, face-to-face, conference call, date)

Closing Statements

Meeting Location:
Media Room, SD State Emergency Operations Center
1302 E Highway 14 Pierre, SD



Capabilities Assessment Worksheet

Name:		**Agency**	
Email:		**Phone:**	

1. What programs does your agency provide that support risk reduction activities?

2. What policies does your agency enforce that encourage mitigation measures?

3. What funding opportunities does your agency offer for risk reduction, community resiliency, and mitigation activities?

Mission Statement	*To reduce the impacts to life and property from hazards through a long term sustainable statewide mitigation strategy while maintaining economic vitality.*
Comments:	
Goal 1 Objectives	1. **Reduce injuries and loss of life from hazards** 1. Reduce the number of injuries/fatalities by severe weather related hazards
Comments:	
Goal 2 Objectives	**2. Reduce damage to existing and future structures within hazard areas** 1. Reduce the number of repetitive and non-repetitive loss structures 2. Reduce the number of structures lost by wildfires 3. Reduce the number of structures within the Special Flood Hazard Area 4. Reduce the number of structures /infrastructure at risk to geologic hazards
Comments:	

Goal 3 Objectives	**3. Reduce the losses to critical facilities, utilities, and infrastructure from hazards** 1. Reduce the number of power outages 2. Reduce negative impacts to water supply and sewage treatment systems 3. Improve reliability of communications during/following hazard events
Comments:	
Goal 4 Objectives	**4. Reduce impacts to the economy, the environment, and cultural resources from hazards** 1. Reduce loss to environment and cultural resources 2. Reduce agricultural losses
Comments:	
Goal 5 Objectives	**5. Support and assist local/tribal mitigation capabilities and efforts** 1. Encourage locals to participate in reducing impacts of incidents
Comments:	

Goal	Problem Statements
1	**Effective storm sheltering:** There are an insufficient number of existing shelters / safe rooms in hazardous areas. • Many communities throughout the state have inadequate warning systems. • The public may not understand what the warning siren sounds indicate and where to go for shelters. • Tourist populations need to be considered.
1	**Electrical safety:** Severe weather often causes fallen power lines which present significant safety concerns.
	Any other problems regarding injuries or loss of life due to hazard events?
2	**Built structures in hazard prone areas:** Throughout the State, built structures are located in floodplains and within close proximity to the forest. • Not all structures susceptible to high risk hazards such as floods and wildfires are identified. The State Bureau of Administration does not have a database of all State owned and leased facilities. • Local planning and zoning are not strict enough or are non-existent in communities. Many communities have adopted the International Building Codes (IBC) but have existing structures built prior to the enforcement of these standards. • A statewide floodplain regulation does not exist. • Many agencies forget to contact other agencies before beginning a project to ensure it will comply with their regulations.
	Any other problems regarding damage to existing and future structures in hazard areas?
3	**Power outages:** Severe weather often causes power outages, resulting in loss of communication and infrastructure operation. • Cordless telephones, cell phone towers, and land line phone systems rely on power. The state radio communication towers also have to run on backup power during a power outage.

Goal	Problem Statements
3	**Aging infrastructure:** Much of the State's utility infrastructure is older, was not designed for long term use, and is therefore susceptible to damage.
3	**Infrastructure monitoring:** Local agencies need to monitor infrastructure such as bridges and culverts on a regular basis to stay abreast of any blockages or maintenance requirements.
	Any other problems regarding critical facilities, utilities, and infrastructure being impacted by hazard events?
4	**Agriculture challenges:** The State has been in a drought for many years so soil nutrients are limited.
4	**Self reliance:** Many communities and property owners do not have insurance on their property.
	Any other problems regarding economic, environmental, or cultural resources impacts from hazard events?
5	**Public education:** The public always need to be reminded of the hazards in their communities in order to be self-prepared.
5	**Local hazard mitigation plans:** Local/tribal governments have been discouraged with regard to hazard mitigation projects due to participation requirements and changing rules/regulations. Local/Tribal governments lack the personnel and experience to meet hazard mitigation plan requirements.
	Any other problems regarding local/tribal mitigation capabilities and efforts?

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
1	**Effective storm sheltering**		
	Support the construction of hardened shelters / safe rooms through local project applications.	Numerous projects funded.	
	Support the installation of warning sirens and NOAA weather radios through local project applications.	Numerous projects funded.	
	Coordinate public outreach/education regarding shelter locations and warning systems. Develop brochures, websites, news briefs, and other media to notify the public of shelter locations and what sounds to expect from the warning systems.	Severe weather preparedness week funded through EMPG. This is a package of information that goes to schools, EM's, daycare, assisted living centers and nursing homes. Also, State Fair outreach at SDOEM booth. Safe room information also disseminated from hazard mitigation office to EM's and FPA's. Locals test sirens and inform the public.	
1	**Electrical safety**		
	Support and encourage public education/outreach efforts on electric safety.	Working with One Call, PUC. Individual COOPs have literature and outreach materials. Participate in State Fair. Conduct school safety sessions. Safety classes through Extension. Messages from EOC during winter storms via Twitter and other avenues.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
2	**Built structures in hazard prone areas**		
	Support and encourage development of zoning ordinances in local communities to encompass all hazards.	Mitigation staff encourage planning and zoning during their visits. LIDAR data to help local officials do better planning and zoning.	
	Coordinate with South Dakota Building Code Association to integrate floodplain management ordinances into local building codes.	Researching other states for possible legislation in SD	
	Develop outreach material for communities highlighting federal, state, and local regulations regarding development.	The NFIP program reaches out to counties and communities to ensure local enforcement of floodplains is occurring.	
	Support retrofitting of existing facilities to comply with IBC through local project applications.		
	Improve the state facilities database by capturing classification and valuation information.	Replacement costs are available for university buildings. OEM is continuing to work with the BOA on obtaining the replacement costs for state owned critical facilities.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
2	**Built structures in hazard prone areas**		
	Support the proper installation of tie downs on mobile homes through local project applications.	South Dakota Housing Authority requires all mobile homes to be inspected for tie-downs. Put information in severe weather preparedness outreach packet each spring.	
	Support the purchase and relocation of structures within floodplains and other hazard prone areas through local project applications.	Numerous acquisitions and relocation projects funded.	
	Support and encourage flood control projects through local project applications.	Numerous drainage improvement projects funded.	
	Support and encourage elevation of structures in flood prone areas through local project applications.	Road elevation projects funded.	
	Coordinate with all state departments and agencies through surveys and other mechanisms to identify structures in hazard areas and their replacement values.	Have run HAZUS on all counties within the state and have identified State buildings with in flood areas. Working with the Bureau of Administration to obtain $$ amount of building replacement. All agencies through TAG gathered data in preparation for flooding to update critical facilities information.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
2	**Built structures in hazard prone areas**		
	Support and encourage fire risk reduction projects such as the installation of fire breaks / fuel breaks and the creation of defensible space between structures and forested areas through local project applications.	SD DOA works with local landowners to make a safe zone around their property. Also, they clean up wooded areas to act as fire breaks. WFS has an ongoing fuels mitigation program utilizing federal funds to treat approximately 1500-2000 acres per year on state and private lands.	
	Support and encourage communities to participate in Firewise, develop CWPPs, and participate in other fire protection programs to minimize risk to wildfire.	The following communities have CWPPs: Butte County Meade County Custer County Fall River County Perkins County Rapid City Stanley County Lawrence County Pennington County	
3	**Power outages**		
	Continue support of power line burial through local project applications. Increases reliability of buried power lines mitigates loss of communication during hazard event.	348 miles of power lines buried, with 167 miles pending since last plan update.	
	Support the installation of spoilers through local project applications.	HMGP funds have been used for spoilers to protect powerline infrastructure.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
3	**Power outages**		
	Support the improvement to existing power lines through local project applications.	Public Assistance funds in disaster 1887 allowed for hundreds of miles to be upgraded with new conductor as well as being buried. Coops have adopted new standards that if line goes down from a storm that they will look at burying the line or putting up #2ACSR line which is lighter and stronger than the old copper line.	
	Encourage the purchase of generators for backup power and regular testing for preparedness.	Numerous generator purchases funded.	
3	**Aging infrastructure**		
3	**Infrastructure monitoring**		
	Encourage removal of debris near bridges and culverts.	DOT does debris removal on state highways. Counties and Townships are aware of the state law requiring inspections which now makes them aware of problems with their culverts and allows them to remove debris that can cause flooding problems.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
3	**Infrastructure monitoring**		
	Support and encourage routine inspections of existing utilities and infrastructure for damage and weaknesses.	Local utilities as ongoing maintenance do yearly inspections and replace problem areas with their existing budget. REA: completed on a regular bases. COOPs work with lineman and tree trimming contractors to ensure trees are at safe distance. RUS requires inspection of all electrical lines once per year. DOT bridge inspections every two years. DENR's Safety Dam Inspection Program inspects all High Hazard and Significant Hazard dams every three years. State law requires counties and townships to do annual inspections on their culverts to ensure they are functioning properly. They must maintain a log.	
4	**Agriculture challenges**		
	Encourage crop rotation and drought resistant crops.	Drought Task Force is giving more information to producers in order for them to make sound crop rotation decisions.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
4	**Self reliance**		
	Promote insurance – Many different forms of insurance are available to cover damages incurred by the various natural hazards. The State will encourage residents, farmers, and business owners to purchase insurance appropriate for their risk.	The NFIP program campaigns to promote people to purchase flood insurance. Numerous meetings are held throughout the year to promote this. Ad campaigns are also ongoing throughout the year, especially when we near spring when flooding in prominent. South Dakota has the highest adoption of crop insurance in the country. Public Assistance funds require insurance on anything that is insurable that was damaged over $5,000.	
5	**Public education**		
	Support and continue public outreach efforts regarding methods to reduce losses due to natural hazards.	Outreach through the State Fair and working with county emergency managers and local floodplain coordinators. B Ready Campaign. Extension service. Twitter preparedness messages. Severe weather and winter weather preparedness campaign.	
5	**Local hazard mitigation**		
	Continue working with local/tribal governments to develop approvable hazard mitigation plans and eligible mitigation project grant applications.	Tribal acquisition project funded. Two tribal LHMPs funded.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Are there additional mitigation actions that should be added to the State Hazard Mitigation Plan?

Meeting Record

Subject:	*South Dakota State Hazard Mitigation Plan Update – 2014*	**Date & Time:**	Thursday March 14, 2013 10:15 am – 4:30 pm CDT
Location:	**DCI Building 1302 E Hwy 14 Classroom A & B**		
Purpose:	*State Hazard Mitigation Team (SHMT) and Silver Jackets Workshop*		
Attendees:	State Hazard Mitigation Team Silver Jackets **(refer to attached sign in sheet)**		

	Discussion Items	Lead
1	*Introduction / State Hazard Mitigation Plan Update process* • Review of plan update requirements for FEMA approval. **Refer to attached Power Point Presentation**	Corinne Bartshire
2	*Summary of Local Hazard Mitigation Plans (LHMPs)* • Presentation of LHMP reviews including identified hazards, local goals, capabilities, projects, and funding sources **Refer to attached Power Point Presentation**	Janna Newman
3	*Updates to Hazard Identification and Risk Assessment* • Presentation of updated hazard profiles and vulnerability assessments. • Discussion of additional data available to augment the HIRA. • Q&A regarding assessment methodologies. **Refer to attached Power Point Presentation – Comments captured will be integrated into revised draft of the HIRA update.**	Jeff Brislawn
4	*Hazard Prioritization* • Presentation of online survey results. • Collaborative re-evaluation of hazard priorities and rankings. **Participants agreed on revised hazard prioritization which incorporates local plan reviews and survey results. Geological Hazards have changed from Moderate to Limited planning consideration. Summer Storm will be added as budget allows or in future updates for Moderate planning consideration.**	Corinne Bartshire
5	*Mission Statement / Goals and Objectives* • Review and discussion to modify the 2011 State Hazard Mitigation Plan mission statement, goals, and objectives as	Corinne Bartshire

	necessary. **Refer to attached Power Point Presentation and Revised Mitigation Strategy.**	
6	*Mitigation Actions* • Present online survey responses. • Review current mitigation actions and progress achieved. • Identify projects to showcase as mitigation success stories. • Identify additional (new) mitigation actions. • Review STAPLE/E criteria. **Refer to attached Power Point Presentation and Revised Mitigation Strategy.**	Corinne Bartshire
7	*Capabilities Assessment* • Review the existing capabilities for each agency to fund or support risk reduction activities. • Discuss process for ongoing review and monitoring of SHMP **Information collected from participants will be incorporated in draft update of the capabilities assessment and circulated for review.**	Janna Newman
8	*Public / Local Outreach* • Summarize outreach efforts to date and discuss opportunities to continue collecting public input through September 2013. **The State would like to issue a press release when the public review draft is available for review. Encourage participating agencies on SHMT and Silver Jackets to post a note on their websites announcing and linking to the public review draft.**	Corinne Bartshire
9	*Wrap Up and Next Steps* • Address questions • Collect any additional HIRA, Mitigation Strategy, and Capabilities Assessment information from SHMT and Silver Jackets members. • Develop an Administrative Review Draft Plan • Review, Revise, and Disseminate Public Review Draft Plan (Fall 2013)	Corinne Bartshire

South Dakota State Hazard Mitigation Plan
Workshop Sign In Sheet
March 14, 2013

Initial for 3/14	Last	First	Organization	Email	Phone
	Anderson	Mark	USGS		
CMB	Bartshire	Corinne	Dewberry	cbartshire@dewberry.com	916-380-3776
JB	Bauder	Jason	SDOEM	Jason.Bauder@state.sd.us	605-773-3231
	Beck	Lynn	DENR		
	Behm	Randy	US Army Corps of Engineers, Omaha District		
LJB	Blankers	Lowell	US Army Corps of Engineers, Omaha District	lowell.j.blankers@usace.army.mil	402-995-2323
X	Brislawn	Jeff	AMEC	jeff.brislawn@amec.com	
	Buchanan	Brooke	FEMA Region VIII		
	Buddie	Matt	FEMA Region VIII		
	Christopherson	Martin	SDOEM		
	Cobb	Jay	NRCS		
KF	Fridley	Kevin	SD Department of Agriculture	Kevin.Fridley@state.sd.us	605.773.3796
	Gillispie	Michael	NWS		
KNG	Goeden	Kevin	SD DOT		
PH	Hoskinson Olson	Paige	SD State Historic Preservation	Paige.Olson@state.sd.us	605 773-6004
	Humphrey	Jason	SD DOT		
	Kittle	Randy	SD Game, Fish, and Parks		
RL	LaBrie	Rick	SD DOH		
	Land	Sarah	SDOEM		
	Long	Richard	US Bureau of Reclamation		
	Lott	John	SD Game, Fish, and Parks		
	Marton	Kevin	SD DOT		
KLM	McIntosh	Kim	DENR	Kim.McIntosh@state.sd.us	773-3296

South Dakota State Hazard Mitigation Plan
Workshop Sign In Sheet
March 14, 2013

Initial for 3/14	Last	First	Organization	Email	Phone
EN	Nelson	Erik	SD Bureau of Information and Telecommunications		
	Nettleton	Jeffrey	US Bureau of Reclamation		
X	Newman	Janna	Dewberry	jnewman@dewberry.com	617-531-0789
IP	Paul	Ian	ORM	ian.paul@state.sd.us	605-773-5879
	Petriamali	Ryan	FEMA Region VIII		
X	Poppen	Jim	SDOEM	jim.poppen@state.sd.us	605-773-8095
NLP	Prince	Nicole	SDOEM	Nicole.Prince@state.sd.us	605-773-3231
MR	Rath	Mark	DENR		
	Rohlf	John	FHA		
	Schultz	Laurie	SD DOT		
js	Snyder	June	SD Office of Homeland Security		
[illegible]	Titze	Tina	SDOEM	Tina.Titze@state.sd.us	605-773-3231
	Todey	Dennis	SD Office of Climate and Weather		
	Tsu	Virginia	FHA		
X	Turman	Kristi	SDOEM	kristi.turman@state.sd.us	605-773-3231
	Williamson	Joyce	USGS		
	Zien	Terry	US Army Corps of Engineers, St. Paul District		
X	Dokken	Jack	SD OEM	jack.dokken@state.sd.us	
LD	DeMers	Lance	SDDOT	lance.demers@state.sd.us	

State of South Dakota
Multi-Hazard Mitigation Plan

State Hazard Mitigation Team and Silver Jackets Workshop
March 14, 2013

Dewberry

Welcome & Introductions

State Hazard Mitigation Team and Silver Jackets Workshop
March 14, 2013

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Meeting Agenda

1. SHMP Update Requirements
2. Local Hazard Mitigation Plan Review
3. Updated Hazard Identification and Risk Assessment
4. Lunch Break
5. Hazard Prioritization
6. Mission Statement / Goals and Objectives
7. Mitigation Actions
8. Capabilities Assessment
9. Public / Local Outreach
10. Wrap Up and Next Steps

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1. Plan Update Requirements

- Comprehensive planning process / foster relationships
  - Description of who is involved and how the plan is prepared
  - Established method for monitoring and updating the plan
- Hazard Identification and Risk Assessment update
  - Hazard profiles, vulnerabilities, potential losses, development trends
- Focus on mitigation strategy and actions
  - Goals, progress, evaluation of actions, implementation plan
- Improve mitigation capabilities
  - Discussion of current policies, programs, and capabilities to support LHMPs and reduce risk statewide
- Approval by FEMA and Adoption

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FEMA Recommended Revisions

Recommendation		2013 Approach
Develop strategies for including federal partners in the next update process.	✓	Partner with and engage the South Dakota Silver Jackets
Develop more examples (beyond RECs) of state planning programs that could be integrated with this planning process. Examples are with the State Forestry and the development of CWPPs, or with SDDOT and road/infrastructure planning, or with other State acquisition programs, if any.		Reviewing current CWPPs. FOR DISCUSSION (roads? Energy assurance?)

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Summarize/document the joint FEMA and other federal agency post-disaster mitigation efforts		FOR DISCUSSION
Consider developing maps that show the hazard probability rankings by county.	✓	Pending for updated HIRA
Consider developing a standard loss estimate procedure that can be shared with the Planning Districts.		Develop County reference Annex for applicable hazards.
Consider determining the important aspects of each local mitigation plan that can be summarized in order to show progress in plan development/content statewide.	✓	Local Hazard Mitigation Plan roll up.

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Develop further the analysis of the significant growth that is occurring in the WUI areas of the Black Forest (Rapid City, Pennington and Meade Counties) and the high growth (Minnehaha, Lincoln, Hanson, Todd Counties) in the flood prone areas.		Addressed in HIRA. Suggest State comments during plan reviews.
Consider developing an analysis of whether existing regulations can prevent future growth in known hazard areas, specifically in Pennington, Meade, Lincoln, Hanson, and Todd Counties.		Same as above.

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Describe the State strategy for incorporating local risk assessment data into the State-wide risk assessment as plans are received. Consider strategizing where risk assessment funds should be steered based on information from the local plans.		LHMP roll up – identify areas needing improved risk assessments.
Improve the discussion on development changes in relation to loss estimates to show a better correlation between these effects and the loss estimates for each of the hazards in the next update. Consider summarizing the loss information found in the local plans that are experiencing growth (Pennington, Meade, Lincoln, Hanson, and Todd Counties).		Incorporated in HIRA update

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Consider extracting and manually entering each state facility into a spreadsheet and then use the User-defined Facilities Module within HAZUS-MH to estimate losses. Although more labor intensive, this would provide the State with a more complete estimate of potential dollar losses to State owned buildings.		Defer to future updates. Pending improvement of State Facilities database.
Describe the total funding available from each disaster and how the funds were utilized. If all available funding was not utilized, explain why not.		Summaries provided by OEM

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Develop a Statewide Floodplain Management Plan, which may include policies restricting new infrastructure in hazard prone areas.		Defer to future updates.
Develop a mitigation strategy to protect critical assets, such as tourist areas from the wildfire threat.		Include in mitigation actions.
Provide a discussion of the state funding capabilities and provide more details on how they work. Include positive and negative aspects.		FOR DISCUSSION
Expand the discussion on non-government sources of funding.		FOR DISCUSSION

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Describe how increased staffing and new state funding sources have affected the state's capability for mitigating hazards.		FOR DISCUSSION
Provide specific examples of how local capabilities have changed.		Local Hazard Mitigation Plan roll up.

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Update plan to show improved capabilities through mitigation efforts at the local level. Consider including success stories.		Local Hazard Mitigation Plan roll up. Survey responses.
Consider developing a yearly summary report that describes which projects were completed, the funding source, and lessons learned. Over time, develop a system for tracking losses avoided through mitigation funding.		FOR DISCUSSION
Consider providing a summary of how actions in local plans align to the actions in the State Plan.		FOR DISCUSSION

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
Discuss how regional planning districts have successfully used limited funding to develop county plans throughout their regions.		FOR DISCUSSION
Describe the flow/progress of plan review in the state, including how many are typically received in a month or quarter, how they are recorded/tracked, etc.	✓	Info provided by SDOEM
The plan should be clear regarding the method to prioritize applications for all mitigation programs.		FOR DISCUSSION

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FEMA Recommended Revisions (cont)

Recommendation		2013 Approach
The plan evaluation should assess whether goals and objectives address current and expected conditions, the nature or magnitude of risks has changed, current resources are appropriate for implementing the plan, outcomes have occurred as expected, and agencies and other partners participated as originally proposed.		FOR DISCUSSION
Describe the method and schedule the SHMT will use to complete the next full plan update.		FOR DISCUSSION

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2. LHMP Roll Up

- 66 Counties with LHMPs in State
- 36 Counties with updated local plans since last SHMP update
- Roll Up of the following information:
  - Hazard Identification
  - Local Capabilities to Mitigate Hazards
  - Potential Losses
  - Development and Growth Trends
  - Hazard Mitigation Goals
  - Hazard Mitigation Actions (Completed and Identified)
  - Funding Sources

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2. LHMP Roll Up – Hazard Identification

Hazard	Number of Counties
Severe Winter Storm	66
Flooding	64
Wildfire	60
Drought	44
Tornado	41
Hazardous Materials Incident	40
Terrorism	39
Summer Storm	31
Windstorm	26
Civil Disturbance	22

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2. LHMP Roll Up – Local Capabilities

Capability	Number of Counties
Training for Emergency Responders	45
Warning System	42
NFIP/Regulation in SFHA	40
Dam and Culvert Inspection	27
Fire Bans/Public Water Restriction	27
Public Awareness Campaigns	26
Building Code	24
EOP	24
Storm Shelters	23
Weather Spotters	23

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2. LHMP Roll Up – Potential Loss Examples

- Total and Average Annualized Crop Losses due to Winter Weather, Summer Storms, and Flooding
  - Example: Aurora County = $1,063,398 in crop loss due to winter weather from 2000-2008
- Flood losses calculated by finding the total amount of land and improvement values within the SFHA
  - Example: Bon Homme County - Total Amount of Land and Improvement Values in the SFHA for Avon, Springfield, Tabor, and Tyndall = $2,610,247
- Flood/Tornado losses calculated by using HAZUS MH
  - Example: Lincoln County – Includes building damage loss and contents damage loss to flooding = $14,101,000
- Total Exposure Value – Includes building and contents values for all property or critical facilities in County
  - Example: Brule County = $140,560,762 (owner occupied, non-owner occupied, commercial, and utility values within entire county)

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2. LHMP Roll Up – Development and Growth Trends

- Population increase/decrease
- Areas of residential, commercial, industrial, infrastructure growth
- Areas where growth will increase vulnerability to hazards and how the County is addressing increased vulnerability

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2. LHMP – Hazard Mitigation Goals

Goal	Number of Counties
Reduce injuries and the loss of life	29
Reduce flood damage to flood prone properties and structures	28
Reduce the loss of property	28
Reduce the loss of power	24
Reduce damage to critical facilities/infrastructure	18
Increase Disaster Mitigation Capabilities	9
Minimize Economic Impact	8
Increase Public Awareness and Education and Promote Preparedness	7
Maintain and Update Communication and Emergency Warning Systems	5

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2. LHMP Roll Up – Hazard Mitigation Actions (Completed)

Completed Mitigation Action	Number of Counties
Stormwater Improvement/Drainage and Culvert Improvement	10
Flood Control and Management Projects	8
Generator/Power Backup	8
Powerline Burial/Improvement	8
Debris Clean Out	7
Tree Removal/Trimming	6
Purchase of Hazard Mitigation Equipment	5
New Warning System/Warning System Improvement	5
Improve Emergency Communication Capabilities	4

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2. LHMP Roll Up – Hazard Mitigation Actions (Identified)

Identified Mitigation Action	Number of Counties
Stormwater and Sewer Improvement/Drainage and Culvert Improvement	31
Powerline Burial/Improvement	27
Generator/Power Backup	27
Flood Control and Management Projects (elevation of roads and bridges, maintenance of levees and dams, etc.)	25
Storm Shelter/Tornado Safe Room	25
Public Awareness and Education Campaigns	23
New Warning System/Warning System Improvement	22
Continued NFIP Compliance/Encourage NFIP Participation/CRS	22
Improve Mapping/Create Maps/Create Critical Facility Inventory	20
Land Use Policies/Zoning Enforcement/Building Code/Drainage Ordinance	19

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2. LHMP Roll Up – Funding Sources

Funding Source	Number of Counties
Local	45
Community Development Block Grant	36
Federal/FEMA	31
USDA Rural Development Grant and Loan Program	30
SD DOT	29
SD Department of Environment and Natural Resources	28
FEMA Assistance to Firefighters Grant Program	27
SD OEM	24
Economic Development Administration	22
State	16

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3. HIRA Update

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Risk Assessment Update Requirements

- Assess vulnerability by jurisdiction
- Assess vulnerability of State Facilities and Infrastructure
- Estimate potential losses by Jurisdiction
  - County level
- Estimate potential losses of State Facilities and infrastructure
- Growth and Development trends

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Approach

- Update hazard events/profiles
- Focus data on losses to the State
- Identify risk from hazards by county and quantify, where possible, potential losses
- Analyze potential losses to state facilities in hazard areas, where data supports (i.e. flood, wildfire)
- Use best available data and note limitations
- Address recommendations for improvement from FEMA plan review 2010, where feasible

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Identified Hazards & Prioritization

Hazard Type and Ranking	**Planning Consideration**
• Floods	Significant
• Severe Winter Storms	Significant
• Drought	Significant
• Tornadoes	Significant
• Wildfires	Significant
• Geohazards	Moderate
• Wind	Moderate
• Ag Pest/Diseases	Moderate
• Hazardous Materials	Moderate

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Highlights of Risk Assessment Update 2013

- Updated hazard events/profiles
- Updated state facilities risk analysis
- Updates to Tornado, Wind and Winter Storm Vulnerability, losses inflated to 2012 dollars
- New livestock and crop loss data for ag disease/pest, drought, and winter storm profiles
- Expanded Rural Electric Cooperative Vulnerability Analysis
- FEMA Region VIII Disaster Data and HAZUS Average Annualized Loss data analysis
- Updated wildfire data from Univ. of Wisconsin SILVIS lab and Federal Wildland Fire Occurrence database

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Recent Disaster Declarations

- Severe Storms and Flooding May 13, 2011
- Floods March 10, 2010
- Severe Winter Storm April 2, 2010
- Severe Winter Storm January 20, 2010
- Severe Winter Storm December 23rd, 2010
- Severe Storms and Flooding June 2009
- Severe Winter Storm November 2008
- Severe Storms and Flooding June 2008
- Severe Winter Storm May 2008
- Severe Storms and Flood, Tornadoes and Flooding June 2007

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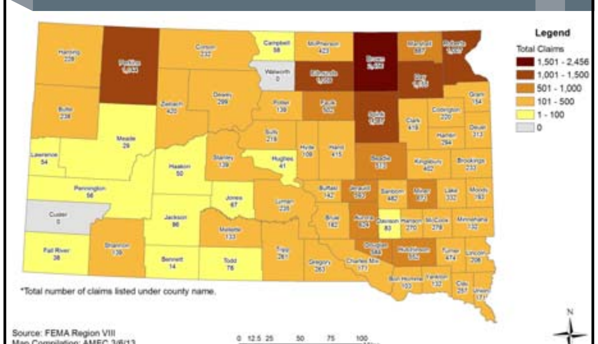
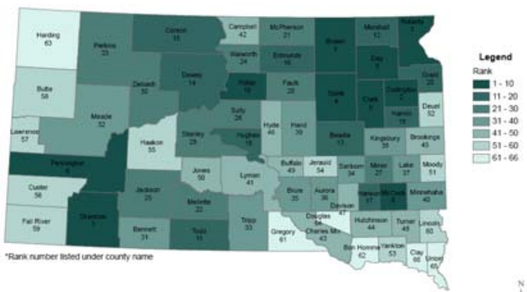
FEMA Public Assistance Claims (2009-2012)



FEMA Individual Assistance Claims (1993-2009)



FEMA Public Assistance Claims

Claims Summary for FEMA Disaster Declarations 1759, 1774, 1811, 1844, 1886, 1887, 1914, 1915, 1929, 1938, and 1947

Categories	**Total Requested (100% PWs)**	**Federal Share Requested (75% of total)**	**Non-Federal Share (25% of total)**
Debris Removal	$5,831,419	$4,373,565	$1,457,855
Protective Measures	$60,198,373	$45,148,781	$15,049,592
Roads and Bridges	$54,548,619	$40,911,472	$13,637,148
Water Control Facilities	$3,730,907	$2,798,181	$932,727
Public Buildings	$866,765	$650,074	$216,691
Public Utilities	$85,250,253	$63,937,690	$21,312,563
Recreational or Other	$686,781	$515,086	$171,695
Total PWs	**$211,113,118**	**$158,334,847**	**$52,778,271**
Grantee Admin Cost*	$0	$0	$0
Subgrantee Admin Cost*	$0	$0	$0
State Management*	$421,482	$414,414	$7,068
Total Administrative Cost*	$421,482	$414,414	$7,068
Grand Total	**$211,534,600**	**$158,749,261**	**$52,785,339**

FEMA Public Assistance Claims

- Majority of PA funding is for public utilities damage and emergency protective measures.
- Detailed data on PA claims was obtained for disaster declarations 1844, 1886, 1887, 1914, 1915, 1929, 1938, and 1947.
  - 494 public utilities claims.
    - 403 claims involving downed power lines, broken power poles, or disrupted electrical distribution/transmission lines
    - 62 claims involving water, wastewater, or sewage
    - 13 claims involving communication lines or towers
    - 16 claims categorized as "other"

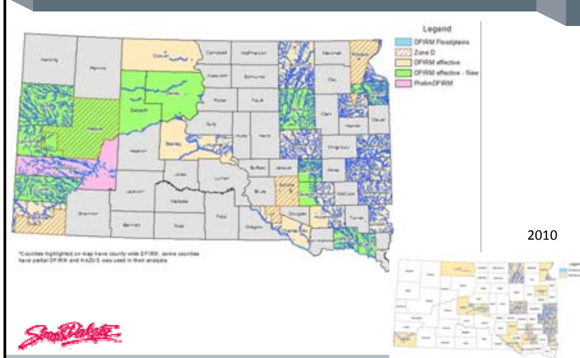
Population Change 2000-2011 as indicator of growth and development trends

- Lincoln County 93.9% gain!

Flood Risk Assessment

- Updated profile with events since 2010
  - 2012 Flooding in Madison (1 fatality)
  - 2011 Missouri River and statewide flooding (FEMA-DR-1984)
  - 2010 FEMA DR 2328 and 1915
- Estimating Vulnerability and Potential losses
  - New Digital Flood Insurance Rate Maps (DFIRM) for several counties
  - Overlay of DFIRM and HAZUS flood layers on Critical Facilities
  - Repetitive Loss/ Severe Repetitive Loss insurance claim data
  - Average Annualized Loss data from FEMA based on national HAZUS Study

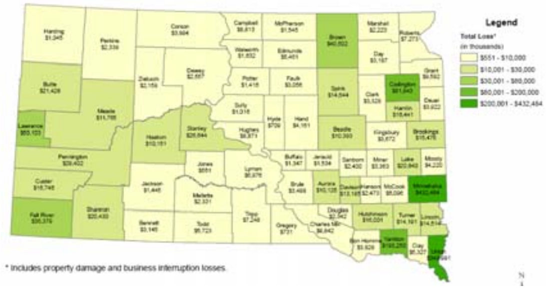
Effective DFIRMs



HAZUS Floodplains

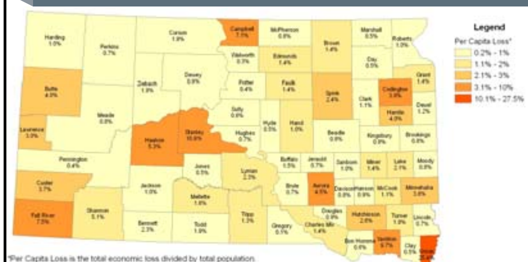
Source: FEMA Region VIII, HAZUS-MH MR2
Map Compilation: AMEC 4/15/10

HAZUS Building and Income Loss



* Includes property damage and business interruption losses.

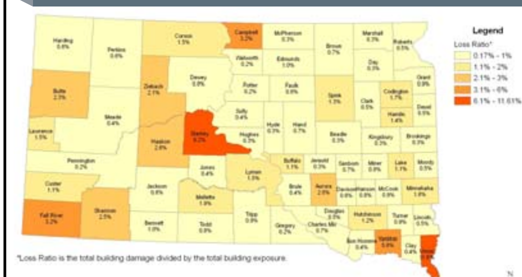
HAZUS Flood Per Capita Loss



*Per Capita Loss is the total economic loss divided by total population.

Source: HAZUS-MH MR4
Map Compilation: AMEC 4/15/10

HAZUS Flood Loss Ratio



*Loss Ratio is the total building damage divided by the total building exposure.

Source: HAZUS-MH MR4
Map Compilation: AMEC 4/15/10

HAZUS Flood Average Annualized Loss

- In 2009-2010 FEMA Hazus Flood Average Annualized Loss (AAL) study for the continental US using the MR4 release of Hazus-MH
- HAZUS Level 1 methodology with national datasets.
- Limitation: loss estimates judged to be high in most areas
- AAL total losses for the state are estimated to be $ 45M
- Based on updated NCDC data alone AAL is $15.5 M, and about $1M based on NFIP claims data.
- Based on the previous HAZUS Level 1 studies done in the 2010 plan (including buildings, contents and economic loss) the 1% annual chance flood = $1.7 billion in flood losses for the state.
- Existing level 1 HAZUS for the 1% annual chance flood (100-year) still valid for statewide relative risk comparison.

Average Annualized Loss by Census Block

Source: FEMA Region VIII
Map Compilation: AMEC 3/6/13

Repetitive Losses and NFIP Claims

- "Any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978."
- 181 properties meet FEMA's definition, $6.7 million in claims
- Up from 81 properties and $2.8 million in claims in 2010
- Codington County
  - Watertown 37 properties, 6 mitigated
- Hamlin County
  - 41 properties, 1 mitigated
- Day County
  - 21 properties, none mitigated
- Minnehaha County
  - 9 County, 8 in Dell Rapids, 1 mitigated
- Brown County
  - Aberdeen – 13 properties, 1 mitigated

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Counties with Levees

14 Corp levees: 12 with a "minimally acceptable" inspection rating, 2 "Unacceptable" in Brown and Minnehaha Counties

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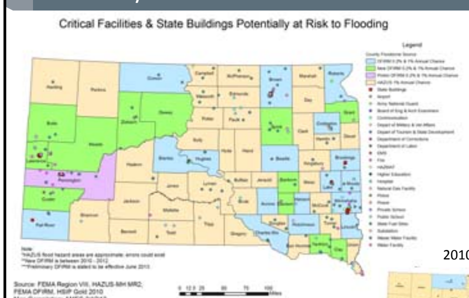
State Facilities

2013 Analysis DFIRM and HAZUS



2010 Analysis

Notable State buildings potentially at risk: 12 Board of Regents buildings, 3 Army National Guard

Critical Facilities in Flood Hazard Areas

Critical Facilities	Count
Airport	2
Army National Guard	3
Board of Regents	12
Communication	18
Department of Environment & Natural Resources	1
Department of Agriculture	2
Department of Health	1
Department of Human Services	2
Department of Labor	1
Department of Public Safety	1
Department of Revenue	1
Department of Social Services	1
Department of Transportation	1
EMS	8
Fire	15
HAZMAT	11
Hospital	1
Natural Gas Facility	9
Office of the Attorney General	1
Police	3
Power	5
Private School	2
Public School	31
State Fuel Sites	2
Waste Water Facility	79
Water Facility	2
Total	**215**

Facilities protected by Levees based on available DFIRM

Critical Facilities	Count
Depart of Tourism & State Development	1
Airport	1
Army National Guard	1
Depart of Military & Vet Affairs	1
Department of Health	1
EMS	5
HAZMAT	12
Higher Education	1
Natural Gas Facility	1
Private School	4
Public School	7
Fire	4
Communication	2
Total	**41**

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Dams

Dam Numbers

2007 (HAZUS-NID Database 1999)
- 84 HIGH hazard
- 153 SIGNIFICANT hazard
- 42 have no emergency action plans (EAP

2009 (State Dams Database)
- 84 HIGH hazard
- 155 SIGNIFICANT hazard
- 18 have no emergency action plans

2012 (State Dams Database)
- 84 HIGH hazard
- 155 SIGNIFICANT hazard
- 65 have EAPs
- 17 have no emergency action plans

Recent event:
Rose Hill Dam failure in Hand County – 2010
- Heavy Rains
- Owned by Game, Fish and Parks Dept

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Severe Winter Storm Risk Assessment

- Update profiles with events since 2010
  - NCDC
  - Includes Extreme Cold Impacts
- Winter Storm vulnerability combines:
  - Population Density
  - Past Winter Storm Occurrences 1993-2012
  - Total Building Stock Exposure (HAZUS)
- Estimating potential losses
  - Total average annual losses, based on past events, for state: $6.9 million
  - $3.3 million in winter-related crop loss indemnities each year

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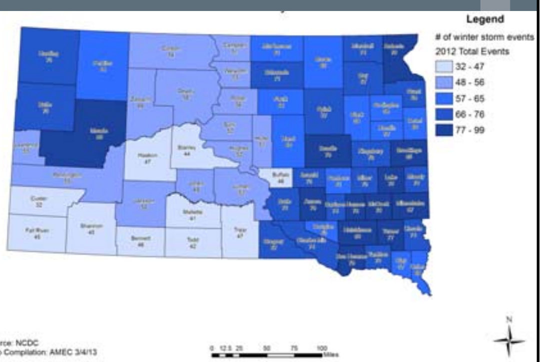
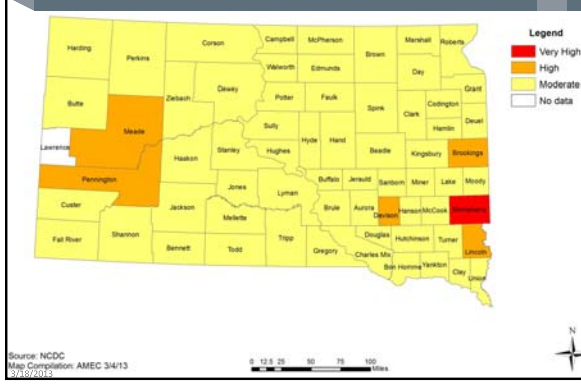
Winter Storm Events 1993-2012



Winter Storm Vulnerability



Wildfire Risk Assessment

- Update profiles with events since 2010, including recent events
- Estimating Vulnerability using available data resources
  - New WUI data from SILVIS
  - Incident data from Federal Wildland Fire Occurrence database
- Estimating Potential losses to counties with Wildland Urban Interface and Wildland Urban Intermix areas

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Wildfire Historic Data

- Between 1974 and 2012, South Dakota received 21 Fire Management Assistance declarations from FEMA
  - 2 since last update: Myrtle Fire (July 20, 2012) and Wellnitz Fire (September 1, 2012)
- Federal Wildland Fire Occurrence data for 1980-2011
  - 163 fires ≥ 1,000 acres in size
    - Burned a total of 890,405 acres
    - 75% from human causes, 25% natural causes
    - Most occurrences west of the Missouri, especially in Black Hills region

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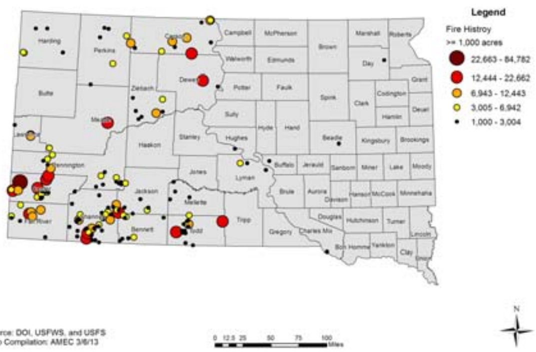
Wildfire Events >= 1,000 acres (1980-2011)



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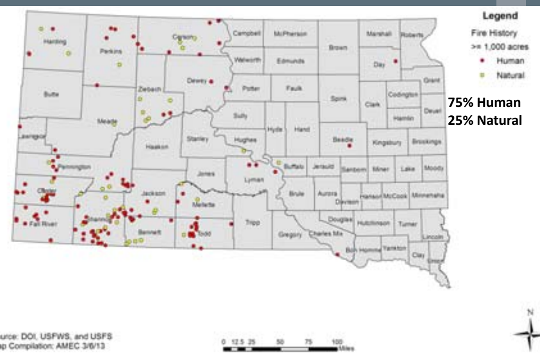
Wildfire Historic Data - Causes



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Wildfire Vulnerability and Loss Estimation

- Using SILVIS Lab (U of Wisconsin) Wildland Urban Interface/Intermix mapping to Census Blocks
- Data includes housing unit and population estimations to determine exposure in moderate and high risk zones
- Apply median household cost (Census) to determine value of property at risk
- Identify critical facilities in high and moderate risk areas
- Federal Communities at Risk list (near flammable federal lands)

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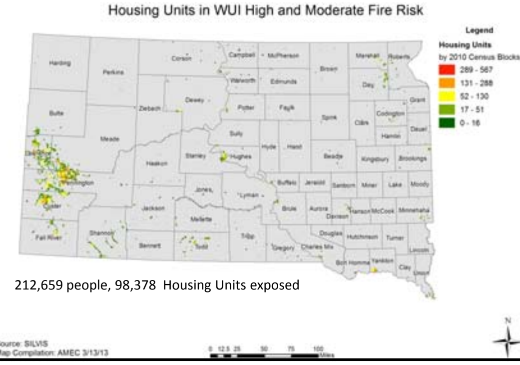
Census Blocks with High and Moderate Fire Risk

Housing Units in WUI High and Moderate Fire Risk



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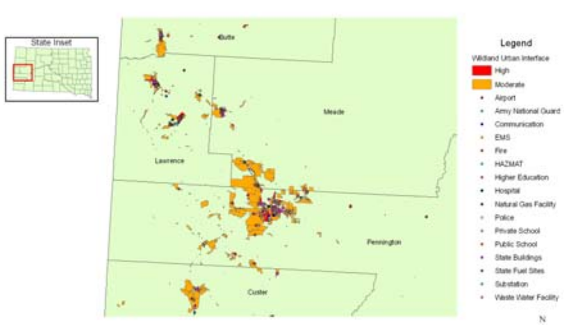
Wildfire Risk & Critical Facilities



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Drought

- Profile updated, improved water situation between 2008 and 2011, dry conditions returned in 2012
- Entire state vulnerable
- Extreme Heat included in profile
- New data on crop losses from RMA
  - $838,876,036 in indemnities in 2012 (3x as much as losses in 2002)
  - Highest indemnities in Hutchinson, Bon Homme, Charles Mix, Lincoln, and McCook
- Other losses/impacts not well documented and difficult to quantify
  - Recreation
  - Municipalities/Water restrictions
  - Natural resources

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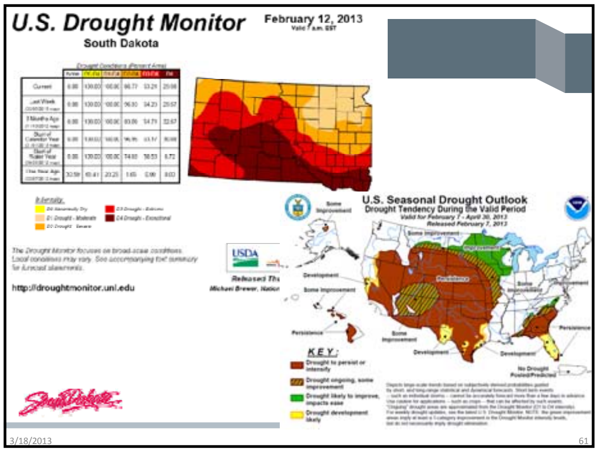

Tornado Risk Assessment

- Update profiles with events since 2010
  - NCDC
  - Tornado paths maps
  - Expanded criteria to include F1+ events and those that caused casualties or damages

Estimating potential losses

- Calculate average annual losses, based on past events, by county
- Rank counties by exposure to tornado loss by combining
  - Population Density
  - Past Tornado Occurrences 1950-2012
  - Past Tornado Damage, adjusted for inflation to 2012$
  - Total Building Stock Exposure (HAZUS)

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Tornado Paths

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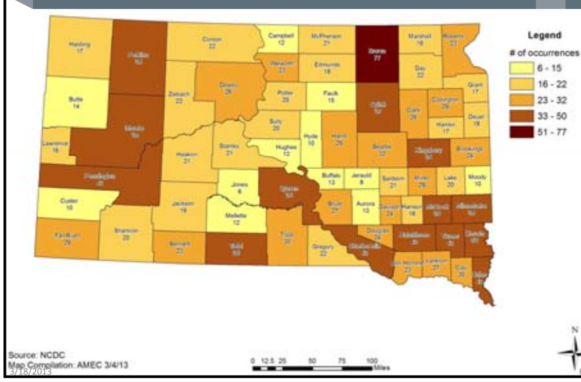
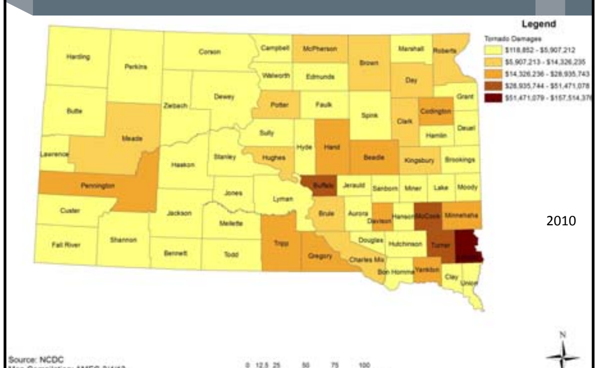
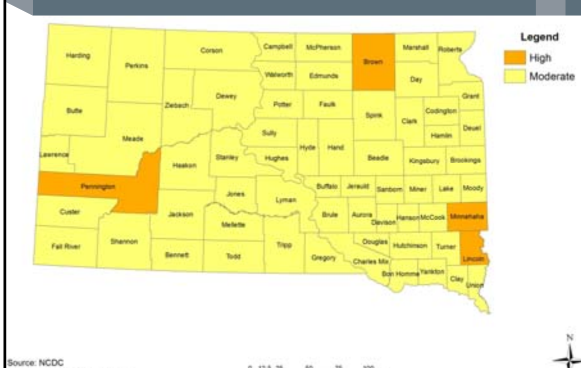
Tornado Occurrences 1950-2012



Tornado Damage 1950-2012



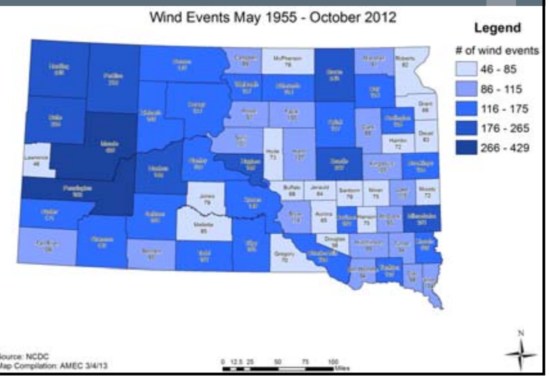
Tornado Vulnerability



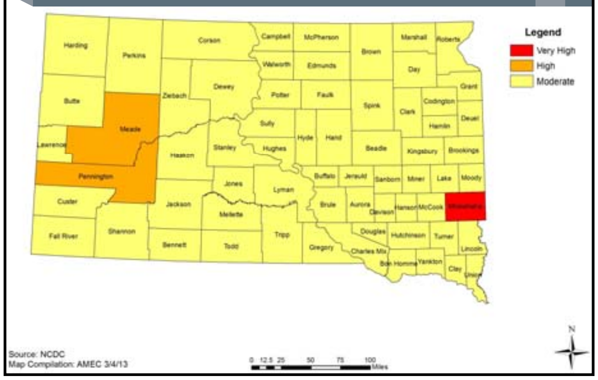
Severe Wind Risk Assessment

- Profile events since 1955-2012
  - NCDC
  - Inflated damages to 2012 $
- Wind vulnerability combines:
  - Population Density
  - Past Wind events 1955-2012
  - Total Building Stock Exposure (HAZUS)
- Estimating potential losses
  Total average annual losses, based on past events, for state: $2.6 million

Wind Events



Wind Vulnerability



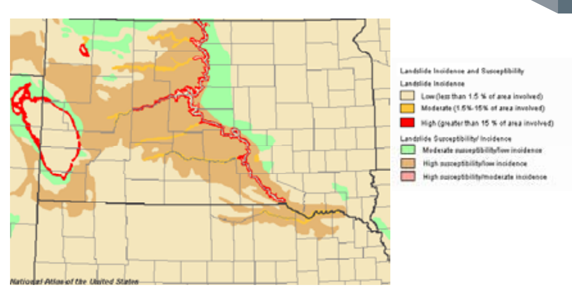
Hazardous Materials

- South Dakota experienced 760 transportation incidents involving hazardous materials between 1971 and 2012.
- The total cost of damage associated with these incidents is approximately $6,537,056.
- Average 18 transportation incidents per year
- Average $159,440 in related damage each year

Geologic Hazards Risk Assessment

- Includes expansive soils, subsidence, landslide, mudflow, and earthquake
- Extensive Expansive Soils distribution
- Subsidence (sinkhole) potential with Karst terrain in Black Hills, SE
- Landslides in Black Hills and Missouri River Bluff counties
- Lawrence County landslide along Highway 14A near Cheyenne Crossing in 2012-2013
- 4 earthquakes since last update
  - August 9, 2011, magnitude 3.4 near Hughes/Stanley County border
  - November 14, 2011, magnitude 4.0 in Fall River County
  - November 15, 2011, magnitude 3.3 in Fall River County
  - January 16, 2012, magnitude 3.0 near Custer/Fall River/Shannon border
- Limited impact data – Need information

Landslide Hazard



Swelling Soil Potential

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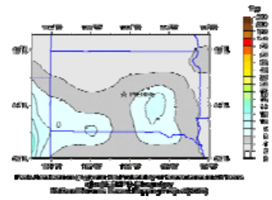
Earthquake Risk Assessment

- Sept 25, 2009 M 5.0 30 miles NW of Belle Fourche
- HAZUS Statewide 2500 year earthquake probabilistic run (worst case)
  (2% chance of occurrence in 50 years)
  $432 million in building losses
  9,000 buildings at least moderately damaged
  87 completely damaged
  $584 million in utility and lifeline losses



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Agricultural Diseases and Pests

- Hazard profile enhance with data on crop loss and livestock death
- Some diseases mitigated with vaccinations
- 2005 Anthrax outbreak
- Often coincide with drought and wet cycles
- Grasshoppers
  - Bad year in 2009, continued infestation in 2010
  - 2011, Jackson and Todd primary counties for USDA disaster declaration involving grasshoppers
  - 4 grasshopper plagues in 122 years (3.2% annual chance)
  - Smaller events every 10 years

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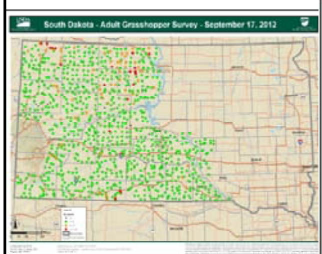
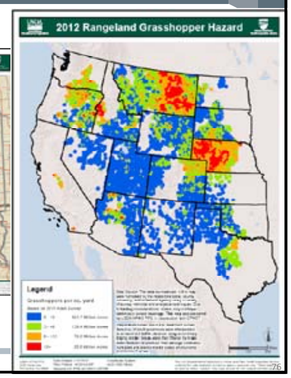
Grasshopper Hazard Mapping





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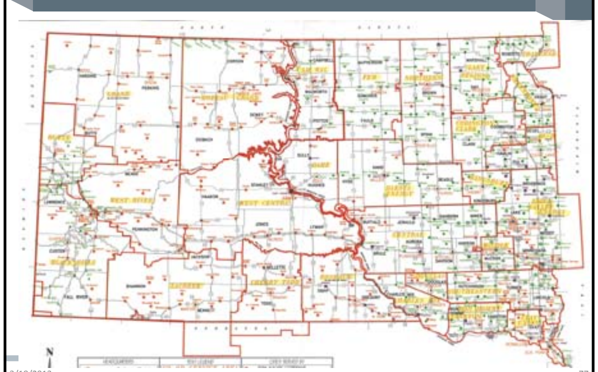
Rural Electric Cooperatives



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Rural Electric Cooperative Vulnerability Analysis

- Overlay of District Boundaries to determine intersection with high and very high vulnerable counties for Winter Storms, Wind, and Tornadoes
- Overlay of flood and wildfire hazard areas to identify specific facilities potentially at risk
- Notable Coop's subject to notable multi-hazard risk
  - Black Hills Electric Coop
  - Black Hills Power & Light Co.
  - Clay-Union Electric Corporation
  - MidAmerican Energy
  - Sioux Falls Municipal Electric/Xcel Energy
  - Sioux Valley Energy
  - Southeastern Electric
  - West River Electric
- $15.8 M invested in 164 mitigation projects (power line burial) in 30 counties

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Utility Infrastructure

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Power, Gas and Water/WW Facilities

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Average Annual Losses Summary

• Floods	$45.9 million (AAL), $15.5 million (NCDC), $1 million (NFIP)
• Tornadoes	$11.2 million
• Severe Winter Storms	$6.9 million
• Wind	$2.6 million
• Wildfires	$1.6 million
• Drought	Unknown (millions annually)
• Geohazards	Unknown
• Earthquake	$440k
• Haz Mat	$422k

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Summary

- Southeast and Black Hills counties high risk to floods, wildfires, tornadoes, wind and winter storms
  - These areas are also experiencing the highest growth
- Improved estimates of vulnerability and loss to jurisdictions and state critical facilities
- Incorporation and analysis of disaster data
- Refined REC vulnerability analysis
  - State is wisely investing in power line burial projects
- Some data limitations remain
  - Winter weather, drought, geohazards, ag pest and wind loss estimation
  - Wildfire hazard mapping
- Will have more/improved info from local mitigation plan HIRA rollup
- Read the draft HIRA and let us know of any additional information, hazard impacts, damage losses etc.

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3. HIRA Update – Climate Change

Survey Respondents
- 40% Concerned
- 60% Not Concerned

Comments:
- Strong concerns of wild land fires
- We are hotter and dryer than normal
- Effects to agricultural production
- Increased occurrence of more severe storm and weather events

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Lunch Break!

State Hazard Mitigation Team and Silver Jackets Workshop

March 14, 2013

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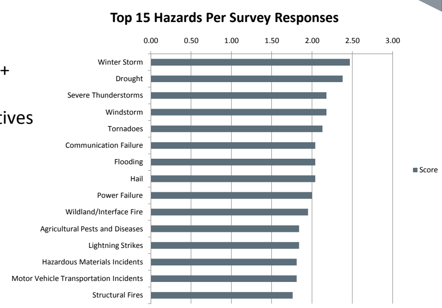
4. Hazard Prioritization

45 hazards rated by 80+ local representatives



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2. LHMP Roll Up – Hazard Identification

Hazard	Number of Counties
Severe Winter Storm	66
Flooding	64
Wildfire	60
Drought	44
Tornado	41
Hazardous Materials Incident	40
Terrorism	39
Summer Storm	31
Windstorm	26
Civil Disturbance	22

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4. Hazard Prioritization

Switch to prioritization worksheet

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5. Mission Statement

To reduce the impacts to life and property from hazards through a long term sustainable statewide mitigation strategy while maintaining economic vitality.

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5. Goals / Objectives

1. **Reduce injuries and loss of life from hazards**
   1. Reduce the number of injuries/fatalities due to all hazards
   2. Maintain and Improve public health and safety outreach activities/programs
2. **Reduce damage to existing and future structures within hazard areas**
   1. Reduce the number of repetitive structures
   2. Reduce the number of structures lost by wildfires
   3. Reduce the number of structures within the Special Flood Hazard Area and other identified local flood risk areas
   4. Reduce the number of structures /infrastructure at risk to geologic hazards
3. **Reduce the losses to critical facilities, utilities, and infrastructure from hazards**
   1. Reduce the number of power outages
   2. Reduce negative impacts to water supply and sewage treatment systems
   3. Improve reliability of communications during/following hazard events
4. **Reduce impacts to the economy, the environment, and cultural resources from hazards**
   1. Reduce loss to natural resources (i.e. forest and watershed health)
   2. Reduce agricultural losses
   3. Reduce impacts to cultural resources (i.e. historical/tribal)
   4. Reduce economic losses to recreation and tourism
5. **Support and assist local/tribal mitigation capabilities and efforts**
   1. Encourage locals to participate in risk reduction measures

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5. Silver Jackets Goals

1. Establish an interagency administrative mechanism to ensure pre-and post-disaster **collaboration**...
2. Establish regularly scheduled forums to examine flooding and other hazards and to **identify potential risk management mitigation measures**.
3. Develop and maintain a common **information matrix on State and Federal programs** which identifies funding and resource limitations and opportunities.
4. Provide a unified set of recommendations on agency programs that could be combined or amended to create integrated, comprehensive and **sustainable** solutions.

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5. Silver Jackets Goals

5. Periodically review progress in implementing high priority actions identified in the State's hazard mitigation plans.
6. Jointly develop and deliver a unified flooding and other hazard outreach message to better communicate and advise counties, communities and the general public.
7. Jointly provide specific input to agencies on barriers that their existing programs, policies or processes present to effectively manage flooding and other hazards.
8. Meet on a schedule determined by the members to prioritize needs, coordinate responses, identify gaps, and minimize duplication of effort.
9. Catalog and share information on past and future projects and initiatives.

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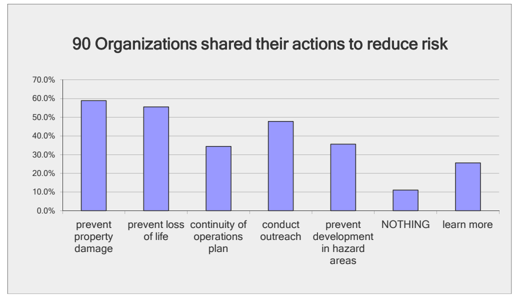
6. Mitigation Actions per Survey Responses



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6. Mitigation Actions per Survey Responses

- Safe rooms / Tornado shelter
- Sewer replacement
- Home buyouts
- Floodplain ordinance
- Power line burial
- Pine beetle forest mitigation
- Building code adoption
- Floodplain mapping update
- Warning sirens
- Drainage improvement
- Fuels reduction
- Drought planning
- Diversify water supply
- Stream bank stabilization
- Public education

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6. Prominent Concerns per Survey

~50% selected each option:

- Warning citizens of impending natural and human-caused incidents
- Loss of power and utilities
- Providing shelter, food, and water to citizens and cleaning up after a disaster
- Property damage/Crop damage

Other concerns:

- providing assistance to local units of government
- Travel conditions – providing transportation needs
- Flooding/wildfires
- Property and economic damage due to Pine Bark Beetle infestation
- Drought condition & water table levels
- Immediate life safety for citizens and responders
- Long Term disruptions of Infrastructures
- Resources to respond to events
- Liability due to loss that may be attributed to the negligence or acts of employees

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6. Desired Actions per Survey Responses

- Power outage exercises
- Debris removal and management plan
- Build CERTs
- Storm shelters
- Flood control projects (higher burms, dykes)
- Warning sirens
- Drainage improvement
- Drought planning
- ACAMS assessments
- Stream bank stabilization
- Training
- Generators
- Shelter drills and prepositioned supplies

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6. Mitigation Strategy Update

Switch to Mitigation Action Workbook

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7. Capability Assessment

- Mitigation Policies:
  - Home Mitigation Project Policy
  - Pre-Disaster Mitigation Plan Policy
- Mitigation Programs:
  - Flood Map Modernization/NFIP
  - Dam Safety Program
  - Black Hills Forest Fire Protection District
  - Forest Action Plan
  - Community Wildfire Protection Plans (CWPPs)
- Funding:
  - Hazard Mitigation Grant Program
  - Pre-Disaster Mitigation Grant Program
  - Flood Mitigation Assistance
- Personnel Resources:
  - GIS Analysts, Floodplain Managers, Engineers, Planners

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7. Capability Assessment

Discussion of additional risk reduction programs, policies, and funding opportunities

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8. Public / Local Outreach

- Reference survey handout
- Email distribution and announcements
- 106 responses
- 80% local government respondents
- 10% State agency respondents
- How do we reach the private sector and community based organizations?
- What would be useful information from them?
- Other avenues to request input?
- Other information that would be helpful?

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Questions / Open Discussion

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9. Next Steps

- Complete HIRA
- Draft Mitigation Strategy for review
- Draft Capabilities Assessment for review
- Data collection follow up / Additional outreach
- Develop an Administrative Review Draft Plan
- Public Review Draft Plan (Late Summer 2013)

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Thank you for your participation!

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HAZARD RANKING WORKSHEET - SOUTH DAKOTA (March 14, 2013)

Hazard Type	Probability	Impact: Affected Area	Impact: Primary Impact	Impact: Secondary Impacts	Local Plans	Survey Rating	Local Plans Score	Survey Score	Total Score	Hazard Planning Consideration
FLOODING	4	4	2	3	64	1.75	9.70	5.82	64.31	Significant
Flooding					64	2.04				
Dam Failure*					14	1.45				
WINTER STORMS (including Extreme Cold)	4	4	2	3	66	2.47	10.00	8.23	67.03	Significant
WILDFIRES	4	2	4	3	60	1.95	9.09	6.50	62.79	Significant
DROUGHT (including Extreme Heat)	4	3	2	4	44	2.38	6.67	7.93	61.00	Significant
TORNADOES	4	1	4	4	41	2.13	6.21	7.10	58.11	Significant
WIND	4	2	2	2	26	2.18	3.94	7.27	43.21	Moderate
AGRICULTURAL PESTS/DISEASES	3	3	1	4	2	1.84	0.30	6.13	37.04	Moderate
HAZARDOUS MATERIALS*	4	1	1	3	40	1.81	6.06	6.03	36.09	Moderate
Summer Storm	4	2	2	2	31	1.94	4.70	6.47	43.16	Moderate
Hail					20	2.04				
Lightning Strikes					14	1.84				
Power Failure*	3	3	3	3	7	2	1.06	6.67	43.73	Moderate
Communication Failure*	2	4	2	3	6	2.04	0.91	6.80	32.11	Moderate
GEOLOGICAL HAZARDS	3	2	1	2	14	1.18	2.12	3.93	25.85	Limited
Earthquake	2	1	1	1	14	1.05				
Expansive Soils	3	UNK	UNK	UNK	1	1.34				
Landslides					11	1.15				
Mudflow					11	1.17				
Terrorism*	1	1	3	3	39	1.26	5.91	4.20	18.91	Limited
Civil Disturbance*	2	1	3	3	22	1.42	3.33	4.73	25.67	Limited
Motor Vehicle Transportation Incidents*	2	1	2	1	4	1.81	0.61	6.03	17.44	Limited
Structural Fires*	1	1	4	3	8	1.76	1.21	5.87	17.28	Limited

*Non-natural hazards are profiled in the South Dakota THIRA as Dam Failure, Accidental Hazardous Materials Release, Armed Attack, Conventional Bomb/IED, Cyber Attack

The probability of each hazard is determined by assigning a level, from unlikely to highly likely, based on the likelihood of occurrence from historical data. The total impact value includes the affected area, primary impact and secondary impact levels of each hazard. Each level's score is reflected in the matrix. The Local Plans column reflects the number of local plans which included the identification of the hazard. The Local Plans Score is a conversion to a 10 point scale (# of plans divided by 66 total plans and multiplied by 10). The Survey Rating is the average rating based on the survey responses using a 3 point scale. The Survey Score is the Survey Rating converted to a 10 point scale (rating divided by 3 then multiplied by 10). The total score for each hazard is the probability score multiplied by it's importance factor times the sum of the impact level scores multiplied by their importance factors plus the Local Plans Score and the Survey Score. Based on this total score, the hazards are separated into four categories based on the hazard level they pose to the communities: Significant, Moderate, Limited, None.

NOTE: Summer Storm was recognized during the Survey and Local Plan Reviews as a hazard for consideration. With that input the SHMT has identified it for Moderate planning consideration.

Probability Importance 2.0

Based on estimated likelihood of occurrence from historical data

Probability	Score
Unlikely	1
Somewhat Likely	2
Likely	3
Highly Likely	4

Affected Area Importance 0.8

Based on size of geographical area of community affected by hazard

Affected Area	Score
Isolated	1
Small	2
Medium	3
Large	4

Primary Impact Importance 0.7

Based on percentage of damage to typical facility in community

Impact	Score
Negligible - less than 10% damage	1
Limited - between 10% and 25% damage	2
Critical - between 25% and 50% damage	3
Catastrophic - more than 50% damage	4

Secondary Impacts Importance 0.5

Based on estimated secondary impacts to community at large

Impact	Score
Negligible - no loss of function, downtime, and/or evacuations	1
Limited - minimal loss of function, downtime, and/or evacuations	2
Moderate - some loss of function, downtime, and/or evacuations	3
High - major loss of function, downtime, and/or evacuations	4

Total Score = Probability x Impact, where:

Probability = (Probability Score x Importance)

Impact = (Affected Area + Primary Impact + Secondary Impacts), where:

Affected Area = Affected Area Score x Importance

Primary Impact = Primary Impact Score x Importance

Secondary Impacts = Secondary Impacts Score x Importance

Hazard Planning Consideration

Total Score	(Range)	Distribution	Hazard Level
0.0	28.0	5	Limited
28.1	56.0	6	Moderate
56.1	84.0	5	Significant

DRAFT Mitigation Strategy – March 14, 2013

Mission Statement	*To reduce the impacts to life and property from hazards through a long term sustainable statewide mitigation strategy while maintaining economic vitality.*
NOTE: The following goals are not prioritized.	
Goal 1 Objectives	1. **Reduce injuries and loss of life from hazards** 1. Reduce the number of injuries/fatalities due to all hazards 2. Maintain and Improve public health and safety outreach activities/programs
Goal 2 Objectives	**2. Reduce damage to existing and future structures within hazard areas** 1. Reduce the number of repetitive loss structures 2. Reduce the number of structures lost by wildfires 3. Reduce the number of structures within the Special Flood Hazard Area and other identified local flood risk areas 4. Reduce the number of structures /infrastructure at risk to geologic hazards
Goal 3 Objectives	**3. Reduce the losses to critical facilities, utilities, and infrastructure from hazards** 1. Reduce the number of power outages 2. Reduce negative impacts to water supply and sewage treatment systems 3. Improve reliability of communications during/following hazard events
Goal 4 Objectives	**4. Reduce impacts to the economy, the environment, and cultural resources from hazards** 1. Reduce loss to natural resources (i.e. forest and watershed health) 2. Reduce impacts to cultural resources (i.e. historical / tribal) 3. Reduce agricultural losses 4. Reduce economic losses to recreation and tourism
Goal 5 Objectives	**5. Support and assist local/tribal mitigation capabilities and efforts** 1. Encourage locals to participate in risk reduction measures

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
1	Support the construction and operation of hardened shelters / safe rooms through local project applications.	Numerous projects funded.	
1	Support the installation of outdoor warning sirens and NOAA weather radios through local project applications.	Numerous projects funded.	
1	Coordinate public outreach/education regarding shelter locations and warning systems. Develop brochures, websites, news briefs, and other media to notify the public of shelter locations and what sounds to expect from the warning systems.	Severe weather preparedness week funded through EMPG. This is a package of information that goes to schools, EM's, daycare, assisted living centers and nursing homes. Also, State Fair outreach at SDOEM booth. Safe room information also disseminated from hazard mitigation office to EM's and FPA's. Locals test sirens and inform the public. Office of Homeland Security also funds purchase of warning systems.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
1	Support and encourage public education/outreach efforts for all hazards awareness and safety.	Working with One Call, PUC. Individual COOPs have literature and outreach materials. Participate in State Fair. Conduct school safety sessions. Safety classes through Extension. Messages from EOC during winter storms via Twitter and other avenues. Flu campaign Public Health outreach campaigns DOT, Highway Patrol, Highway Safety (buckle up, save it for later, give 'em a brake, don't crowd the plow) Dept of Ag – drought Winter Weather Preparedness B. Ready Severe Weather Preparedness NWS – Flood safety	
2	Coordinate with South Dakota Building Code Association to integrate floodplain management ordinances into local building codes.	Researching other states for possible legislation in SD	
2	Improve the state facilities database by capturing classification and valuation information.	Replacement costs are available for university buildings. OEM is continuing to work with the BOA on obtaining the replacement costs for state owned critical facilities. *There might be a list of state buildings that is 2 years old.*	BIT – Erik Nelson

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
2	Support the purchase and relocation of structures within floodplains and other hazard prone areas through local project applications.	Numerous acquisitions and relocation projects funded.	
2	Support and encourage flood control projects through local project applications.	Numerous drainage improvement projects funded.	
2	Support and encourage elevation of structures in flood prone areas through local project applications.	Road elevation projects funded.	
2	Coordinate with all state departments and agencies through surveys and other mechanisms to identify structures in hazard areas and their replacement values.	Have run HAZUS on all counties within the state and have identified State buildings with in flood areas. Working with the Bureau of Administration to obtain $$ amount of building replacement. All agencies through TAG gathered data in preparation for flooding to update critical facilities information.	
2	Support and encourage fire risk reduction projects such as the installation of fire breaks / fuel breaks and the creation of defensible space between structures and forested areas through local project applications.	SD DOA works with local landowners to make a safe zone around their property. Also, they clean up wooded areas to act as fire breaks. WFS has an ongoing fuels mitigation program utilizing federal funds to treat approximately 1500-2000 acres per year on state and private lands. Beat the Beetle campaign List of actions may be provided by Wildland Fire. Several unfunded applications for defensible space	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
2	Support and encourage communities to participate in Firewise, develop CWPPs, and participate in other fire protection programs to minimize risk to wildfire.	The following communities have CWPPs: Butte County Meade County Custer County Fall River County Perkins County Rapid City Stanley County Lawrence County Pennington County	
2	Support bank stabilization and other geohazard risk reduction through local project applications.		
3	Support the improvement to existing power lines through local project applications. (i.e. power line burial, spoiler installation)	348 miles of power lines buried, with 167 miles pending since last plan update. HMGP funds have been used for spoilers to protect powerline infrastructure. Public Assistance funds in disaster 1887 allowed for hundreds of miles to be upgraded with new conductor as well as being buried. Coops have adopted new standards that if line goes down from a storm that they will look at burying the line or putting up #2ACSR line which is lighter and stronger than the old copper line.	
3	Encourage the purchase of generators for backup power to critical infrastructure / storm shelters and conduct regular testing for preparedness.	Numerous generator purchases funded by SD OEM and SD OHS.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
3	Encourage removal of debris in waterways (i.e. near bridges, culverts, within stream channels).	DOT does debris removal on state highways. Counties and Townships are aware of the state law requiring inspections which now makes them aware of problems with their culverts and allows them to remove debris that can cause flooding problems. NRC funding available.	
3	Support and encourage drainage improvement projects through local applications (i.e. proper sizing)	State law requires counties and townships to do annual inspections on their culverts to ensure they are functioning properly. They must maintain a log.	
3	Support and encourage routine inspections of existing utilities and infrastructure for damage and weaknesses.	Local utilities as ongoing maintenance do yearly inspections and replace problem areas with their existing budget. REA: completed on a regular bases. COOPs work with lineman and tree trimming contractors to ensure trees are at safe distance. RUS requires inspection of all electrical lines once per year. DOT bridge inspections every two years. DENR's Safety Dam Inspection Program inspects all High Hazard and Significant Hazard dams every three years.	
3	Maintain the State digital radio system through regular training and exercises.	Trainers are available. Exercises are conducted quarterly.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
4	Encourage agricultural modifications to lessen the impacts of drought such as crop rotation, drought resistant crops, no till, etc.	Drought Task Force is giving more information to producers in order for them to make sound crop rotation decisions. Dept of Ag campaigns through the Drought Task Force, Extensions, etc. NRCS supports. Conservation districts support.	Dept of Ag – Kevin Fridley
4	Promote insurance – Many different forms of insurance are available to cover damages incurred by the various natural hazards. The State will encourage residents, farmers, and business owners to purchase insurance appropriate for their risk.	The NFIP program campaigns to promote people to purchase flood insurance. Numerous meetings are held throughout the year to promote this. Ad campaigns are also ongoing throughout the year, especially when we near spring when flooding in prominent. South Dakota has the highest adoption of crop insurance in the country. Public Assistance funds require insurance on anything that is insurable that was damaged over $5,000.	
4	Coordinate with the State Historic Preservation Officer and Tribal Historic Preservation Officer (as applicable) on all projects.		
4	Release statewide campaigns to promote tourism and recreation.	The Governor developed Public Service Announcements promoting tourism / recreation.	

Items to consider for each Action:

1. What additional progress are you aware of?
2. What else can be done to move this action forward?
3. What capabilities does your agency have to assist?

Goal	Mitigation Actions	Progress	Champion
5	Support and continue public outreach efforts regarding methods to reduce losses due to natural hazards.	Outreach through the State Fair and working with county emergency managers and local floodplain coordinators. B Ready Campaign. Extension service. Twitter preparedness messages. Severe weather and winter weather preparedness campaign is distributed to all schools. Outreach/education is conducted at County Commission Annual Meeting, Towns & Townships Conference, Hydrology Conference, and to private businesses.	
5	Continue working with local/tribal governments to develop approvable hazard mitigation plans and eligible mitigation project grant applications.	Tribal acquisition project funded. Two tribal LHMPs funded.	
5	Support and encourage safer building practices in local communities to reduce risk to all hazards.	Mitigation staff encourage planning and zoning during their visits. LIDAR data to help local officials do better planning and zoning. The NFIP program reaches out to counties and communities to ensure local enforcement of floodplains is occurring. Note progress from LHMP roll up. (Building codes, development ordinances)	

Appendix 2B

Survey and Outreach Materials

Mitigation Program

SD Department of Public Safety

The Difference Between Section 404 and Section 406 Hazard Mitigation Measures.

The Stafford Act provides for two types of funding for hazard mitigation measures: statewide mitigation programs (Section 404) and mitigation for disaster-damaged facilities (Section 406) The differences are as follows:

HMGP Section 404– Separate program administered by the state. Applies to structural and non-structural measures; such as planning, property acquisition, and drainage projects. Projects ARE NOT disaster specific and applicants can be statewide. The State receives 15% of the assistance paid out through the disaster for mitigation projects.

Section 406 Mitigation - Administered by the FEMA Public Assistance (PA) Program and applies only to damaged infrastructure. Must apply to the damaged element of the facility, therefore it is disaster specific and only applies to disaster applicants for PA. No program-wide limits on funds, but each project must be cost-effective and approved by FEMA.

You do not have to wait for a disaster to submit an HMGP application.

SD Office of Emergency Management

SD Department of Public Safety
118 W. Capitol
Pierre, SD 57501

Phone: (605) 773.3231
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@sdemergencymgmt

500 copies printed at $.24 per copy

Office of Emergency Management

Mitigation Program

South Dakota Emergency Management

Preparedness Response Mitigation Recovery

Tel: (605) 773.3231

Mitigation Program

Mitigation

Is defined as lessening or eliminating the effects of natural disasters on people and property. A mitigation project can go a long way in preventing loss of life and property damage for future events.

HAZARD MITIGATION ASSISTANCE (HMA)

The Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) programs present a critical opportunity to reduce the risk to individuals and property from natural hazards while simultaneously reducing reliance on federal funds.

Grant Programs under the HMA

Hazard Mitigation Grant Program (HMGP)

Pre-Disaster Grant Program (PDM)

Flood Mitigation Assistance (FMA)

Repetitive Flood Claims (RFC)

Severe Repetitive Loss (SRL)

HAZARD MITIGATION GRANT PROGRAM

(HMGP: Section 404 Mitigation)

The HMGP is authorized by Section 404 of the Roberts T. Stafford Disaster Relief and Emergency Assistance Act, as amended (the Stafford Act), Title 42, United States Code (U.S.C) 5170c. HMGP funds become available after a presidential disaster declaration has been declared in the state. Forty-five to ninety days from declaration date, the State office will conduct applicant briefings across the state to notify everyone that funding is available. These funds are available statewide and projects **DO NOT** have to be disaster specific. All applications are due to the state ten months from the declaration date and subsequently are presented to the state hazard mitigation team to evaluate and select projects that will be submitted to FEMA. The State must have projects submitted to FEMA one year from the disaster declaration date. Once submitted to FEMA, they have one year to approve or deny the projects. Once approved by FEMA, the applicant is notified of the award and has three years to complete the work.

Eligible Projects

Eligible projects are from a jurisdiction that has a FEMA approved Pre-Disaster Mitigation Plan (PDM). Applicants can be from the following:

- ◊ State and Local Governments
- ◊ Certain Private Non-Profit organizations or institutions
- ◊ Tribal Governments

All mitigation projects must be cost effective, be both engineering and technically feasible, and meet Environmental Planning and Historic Preservation requirements in accordance with HMA Unified Guidance. Cost effective means a benefit cost analysis (BCA) needs to be greater than one. Also, they need a detailed scope of work and good cost estimates. Work CAN NOT be completed before the grant award, unless pre-authorized. NOTE: It is highly recommended to have an engineer involved at the VERY beginning of the development stages of the application.

Examples of projects:

- ♦ Acquisitions and Relocations of structures from hazard-prone areas
- ♦ Drainage Improvement; storm drainage, channel restoration, and bank stabilization
- ♦ Safe Rooms
- ♦ Generators and Warning Sirens
- ♦ Hazard Mitigation Planning
- ♦ Power line burials

This grant program is a 75% federal share and 25% local cost share. The local cost share can be hard or soft match.

Remember that mitigation projects may not stop at a jurisdictional boundary; therefore, a project can be multi-jurisdictional. One jurisdiction needs to take the lead and be the applicant but the cost share of 25% can be divided between all jurisdictions involved.

The local match CAN NOT come from another federal source unless it loses federal identity.

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Creating a More Resilient South Dakota

Since 2005, the State of South Dakota has spent close to $40 million on strengthening infrastructure and reducing risk to damage from natural hazard events such as floods, winter storms, and wildfires. Approximately 348 miles of powerlines were buried, preventing power outages due to severe weather. Approximately $630,000 was used to purchase generators and $1 million went toward the construction of safe rooms. Other mitigation projects throughout the State include:

- Drainage and Road Improvement Projects
- Flood Risk Reduction
- Storm Shelters
- Warning Systems

Please help us continue to prioritize projects that help your community by responding to this survey:

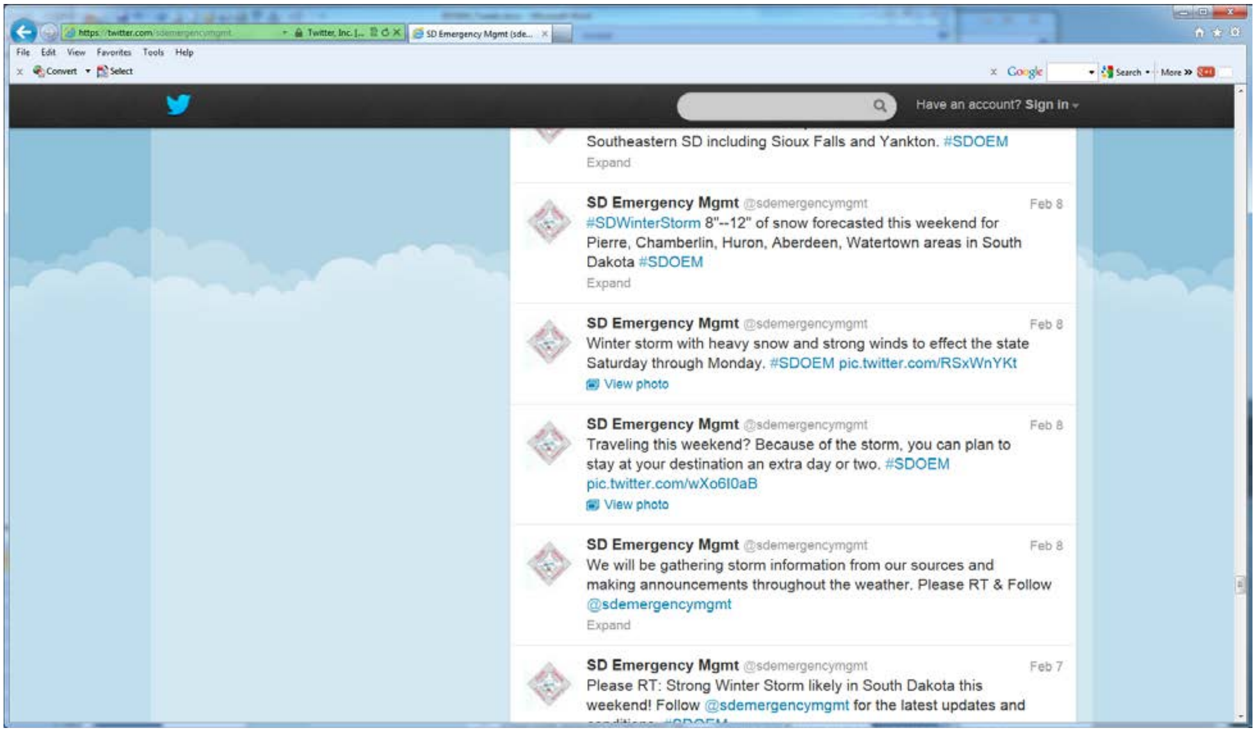
http://www.surveymonkey.com/s/2014SDSHMP

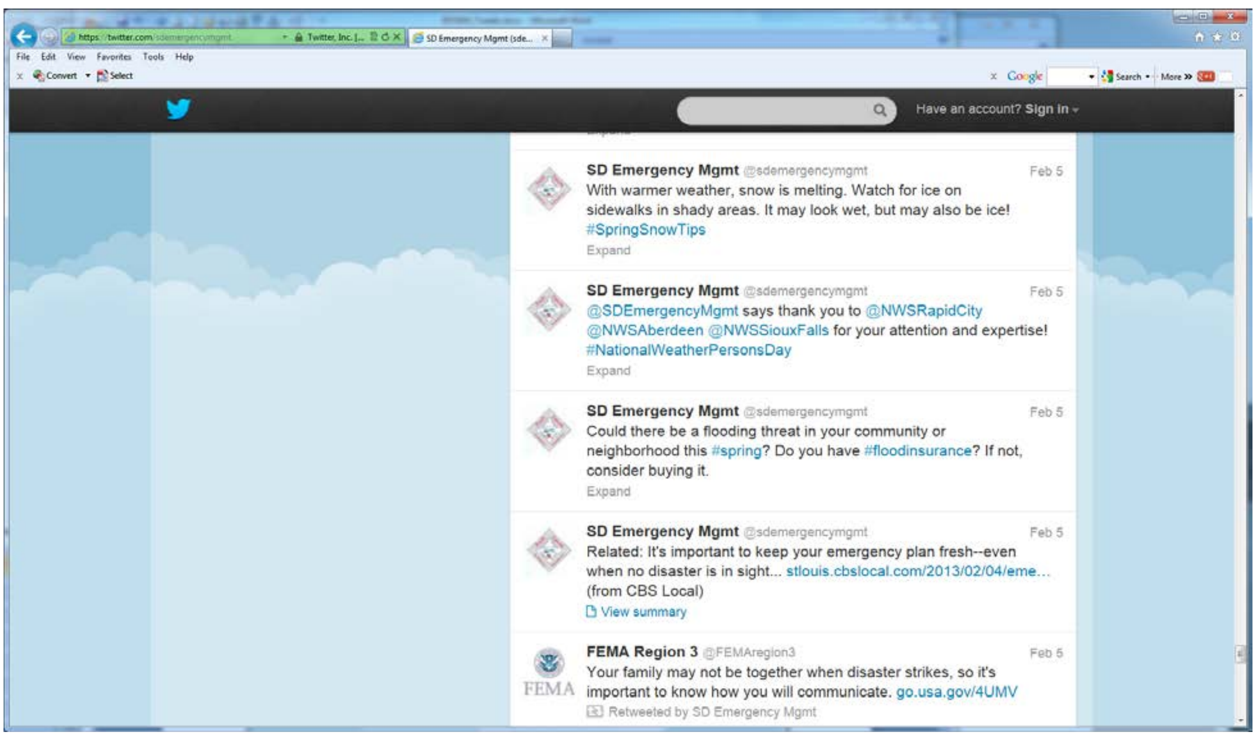
At the website below, you may download and review the current *South Dakota State Hazard Mitigation Plan* which outlines the identified risks and vulnerabilities to natural hazards throughout South Dakota and presents mitigation actions to create more resilient communities. http://dps.sd.gov/emergency_services/emergency_management/documents/2011_SHMP_000.pdf

The FEMA compliant *South Dakota State Hazard Mitigation Plan* allows the State to continue receiving funding through the Hazard Mitigation Assistance programs and to be eligible for public assistance funding following a presidentially declared disaster. Input from local communities, private organizations, and the public help ensure the Plan addresses the variety of risks throughout South Dakota. For more information, please contact: Nicole Prince at nicole.prince@state.sd.us or 605.773.2618.

Thank you for your participation!

SDOEM Twitter Notifications regarding the SHMP





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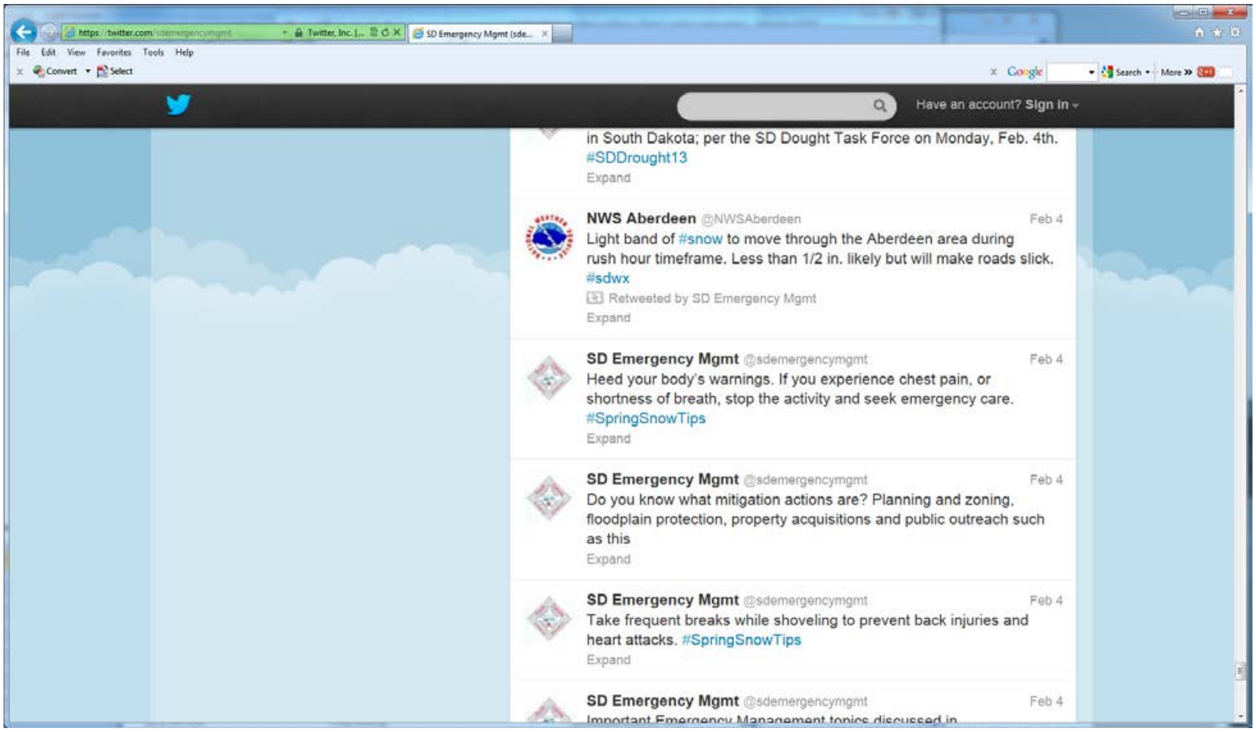

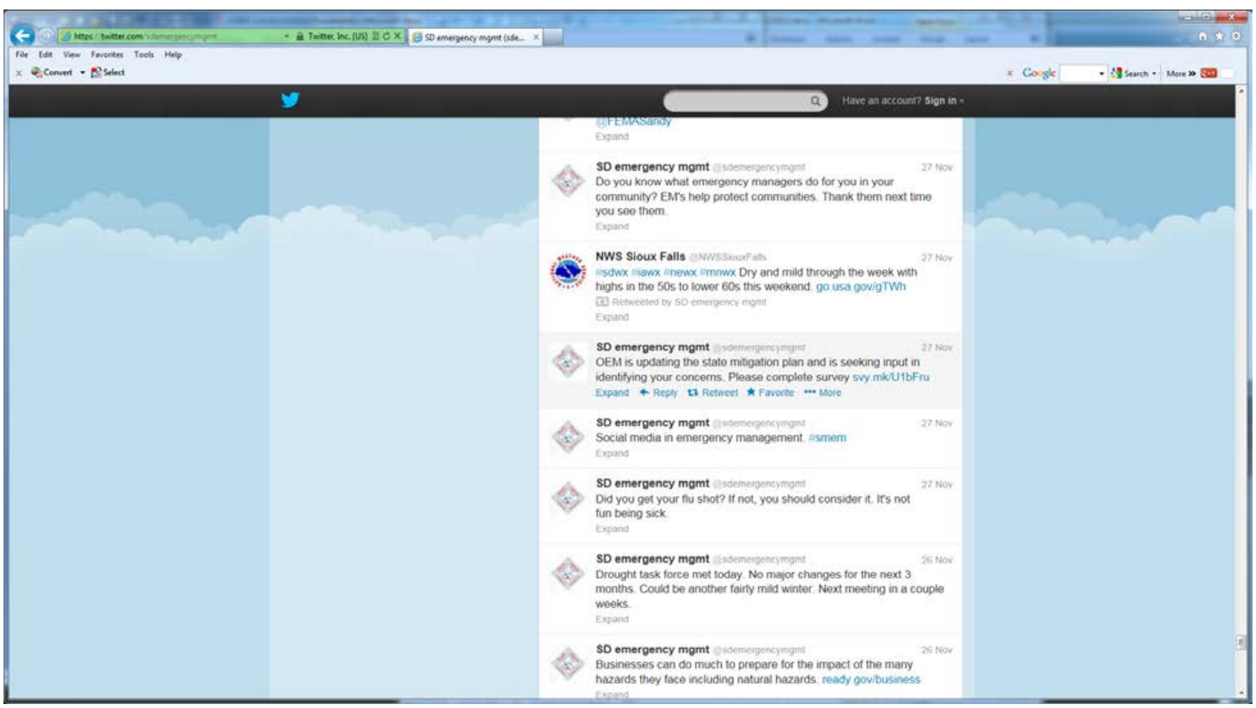

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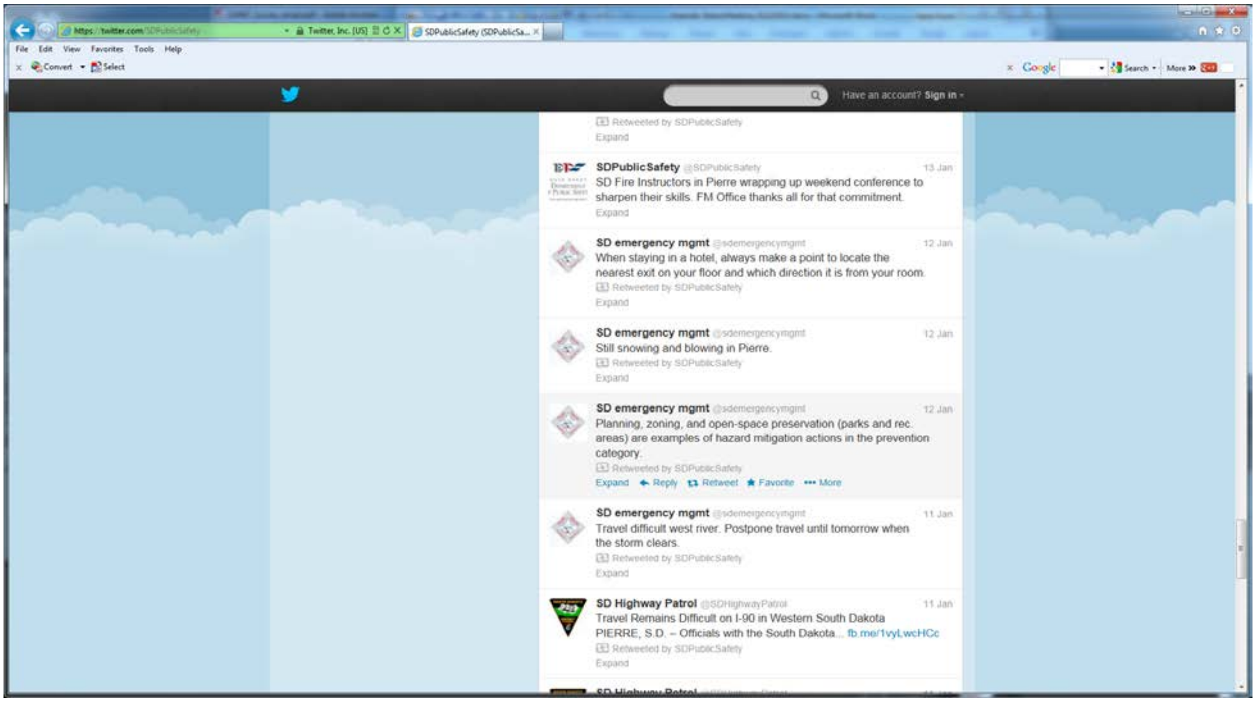

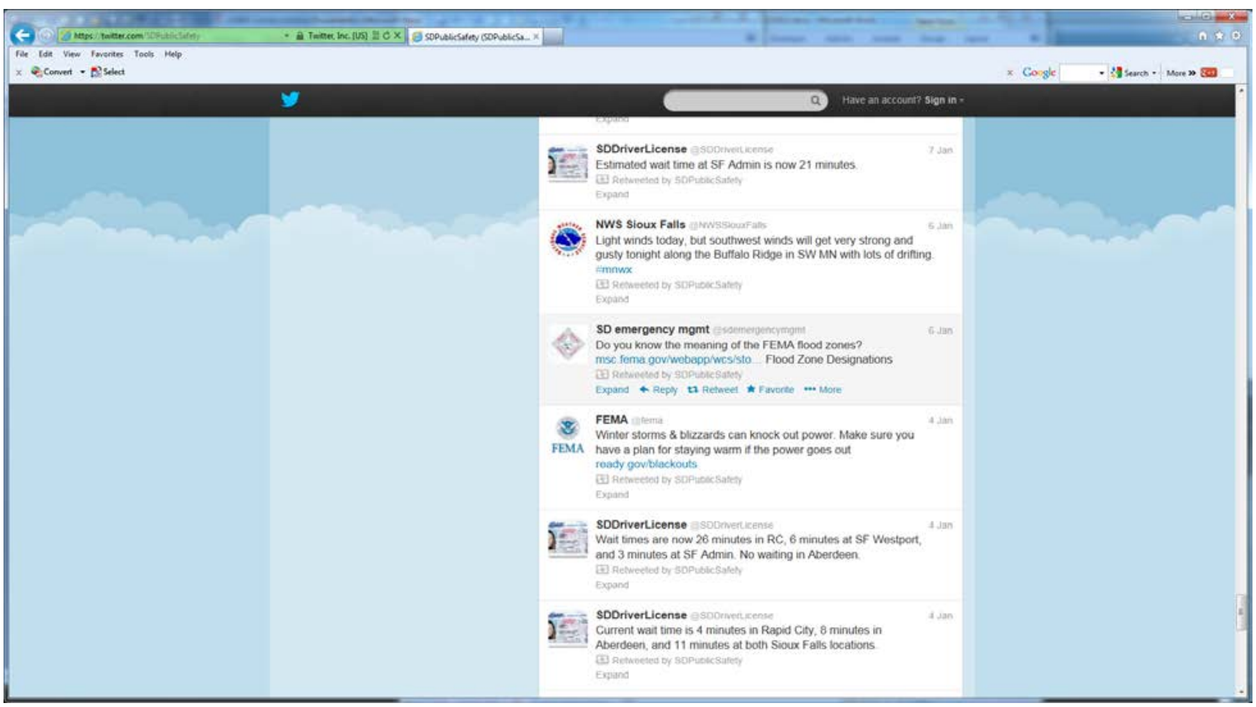

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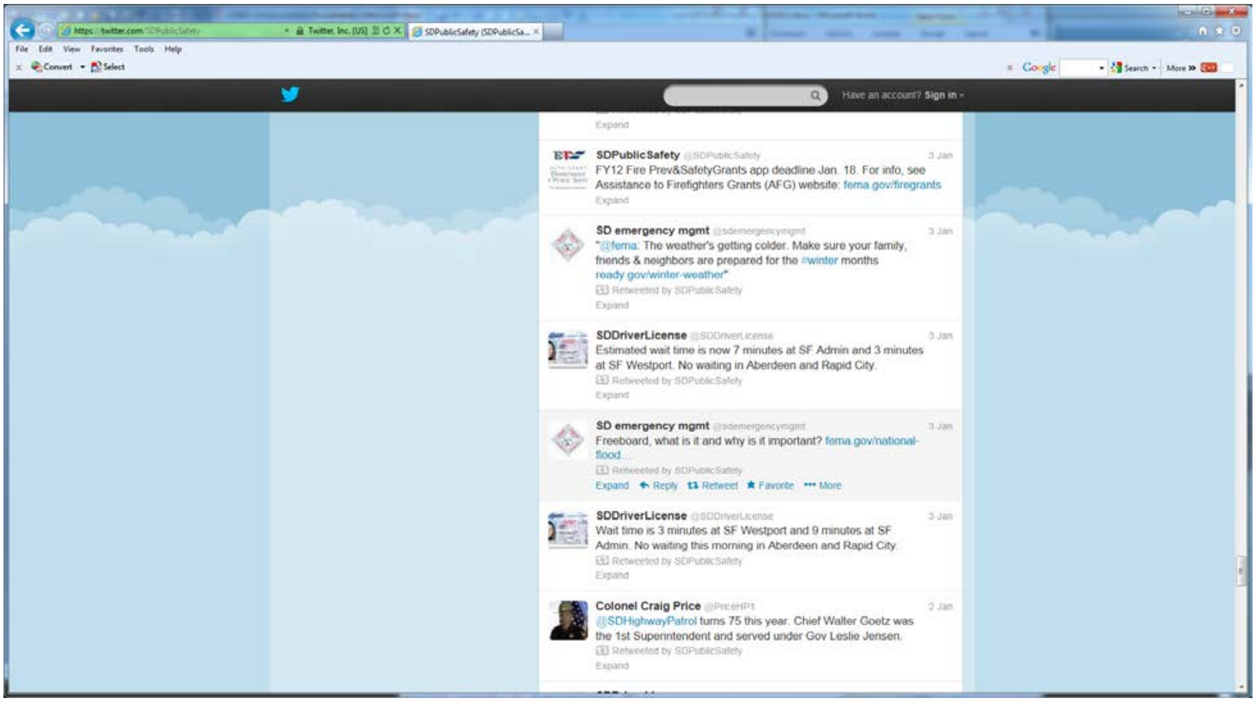

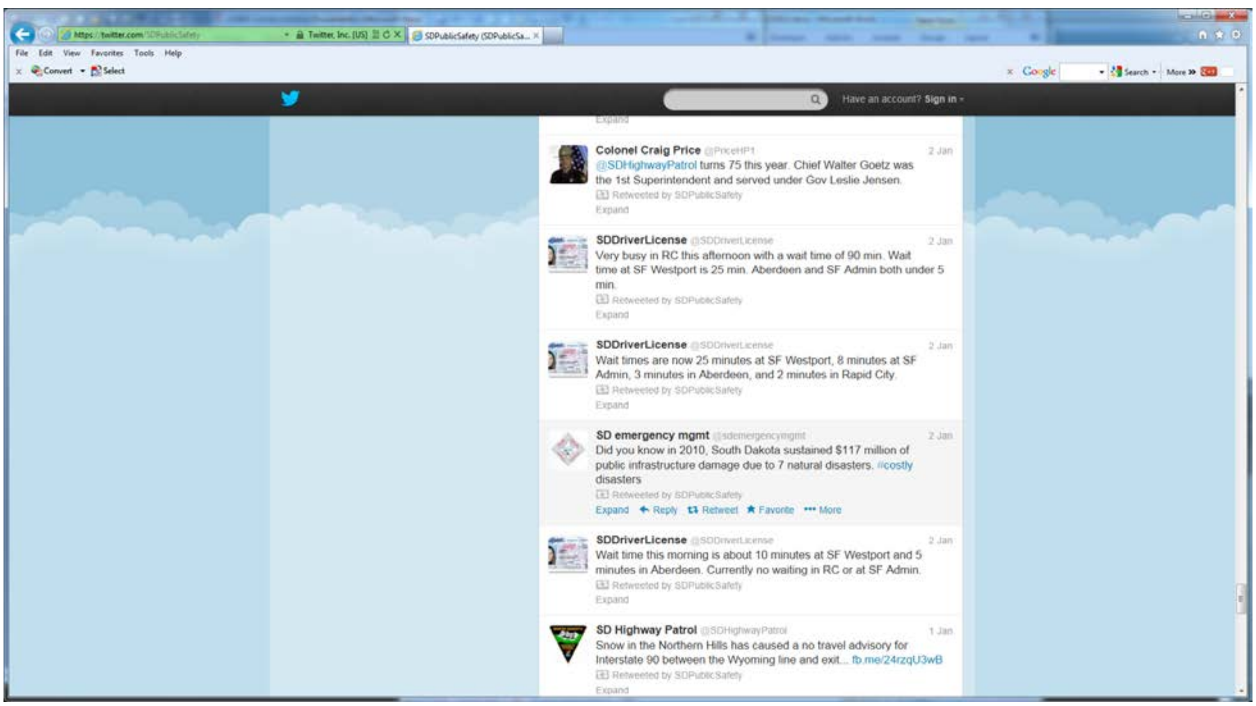

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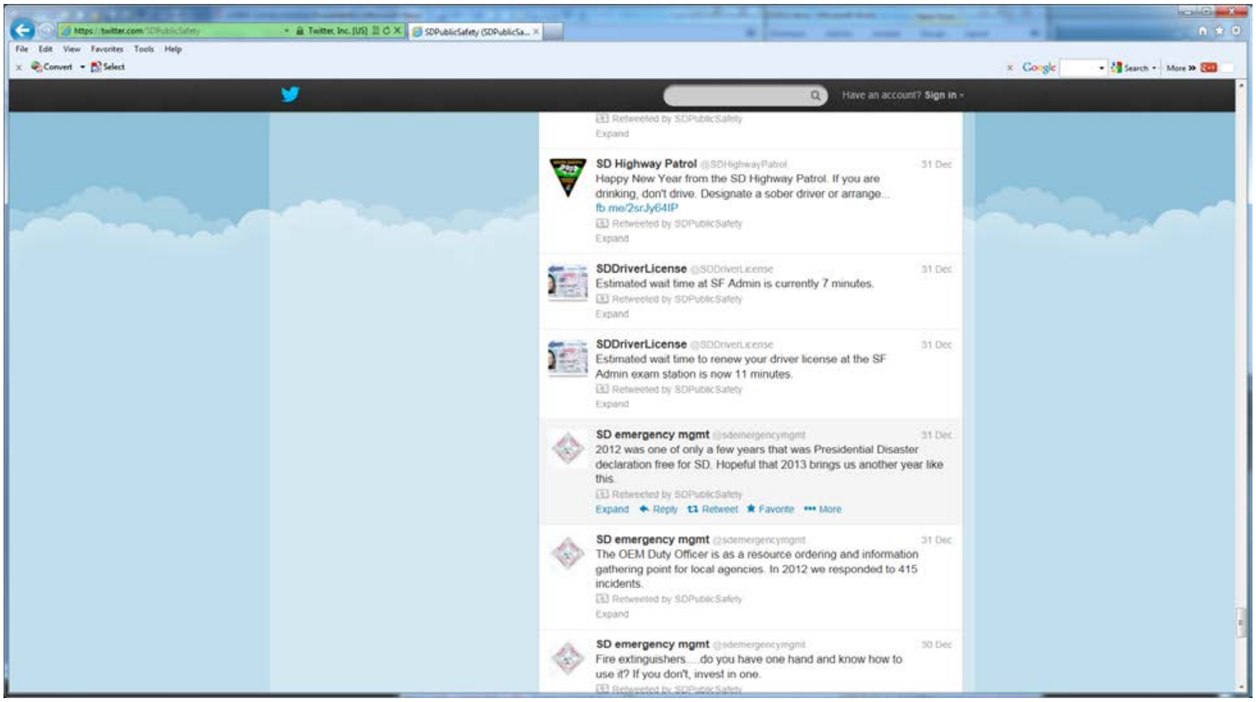

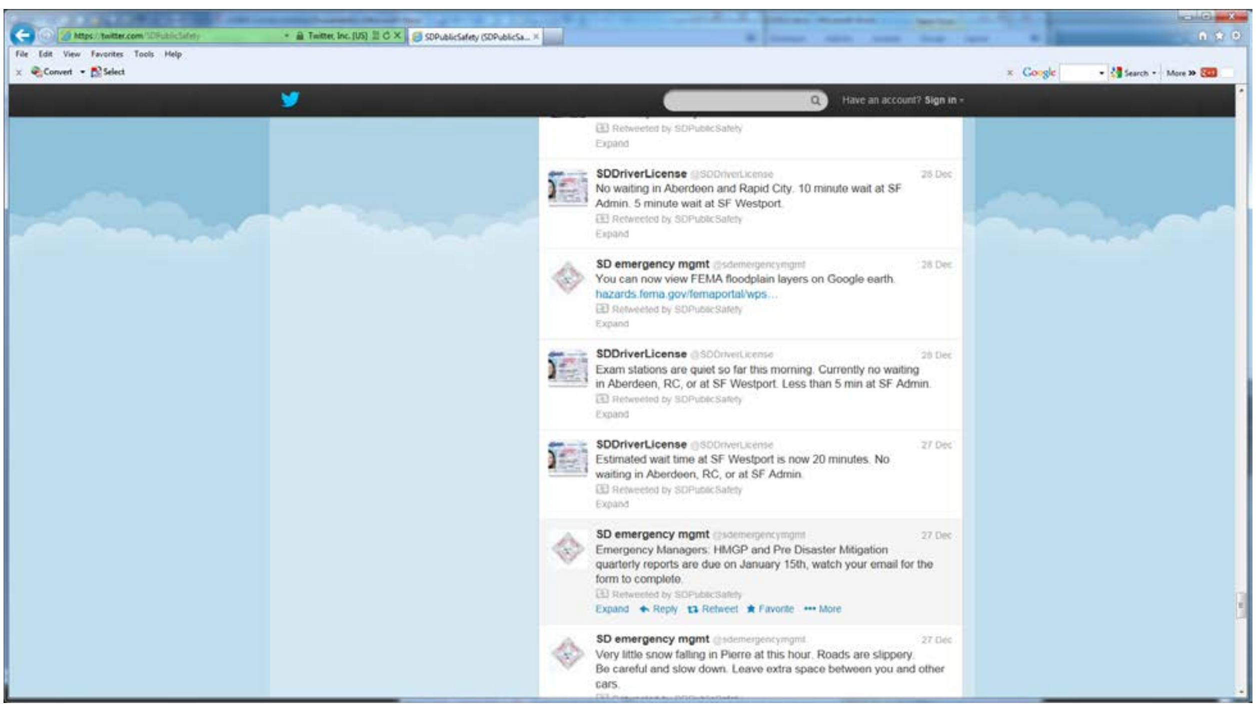

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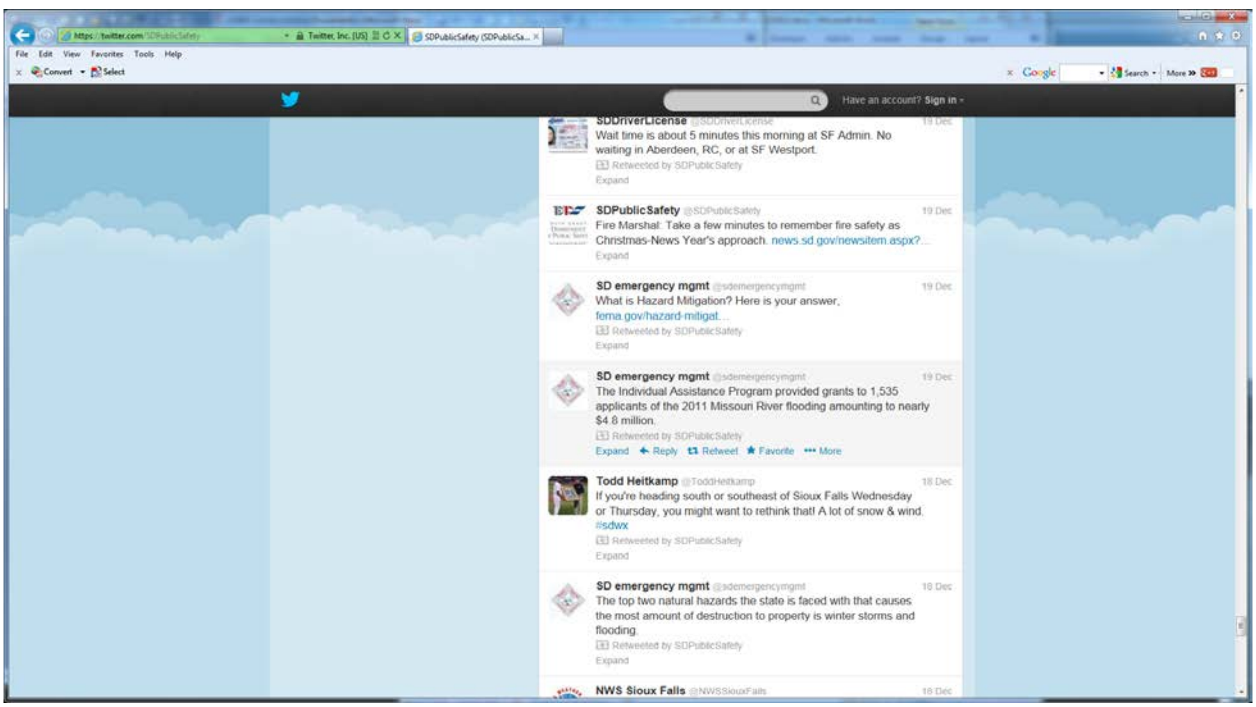

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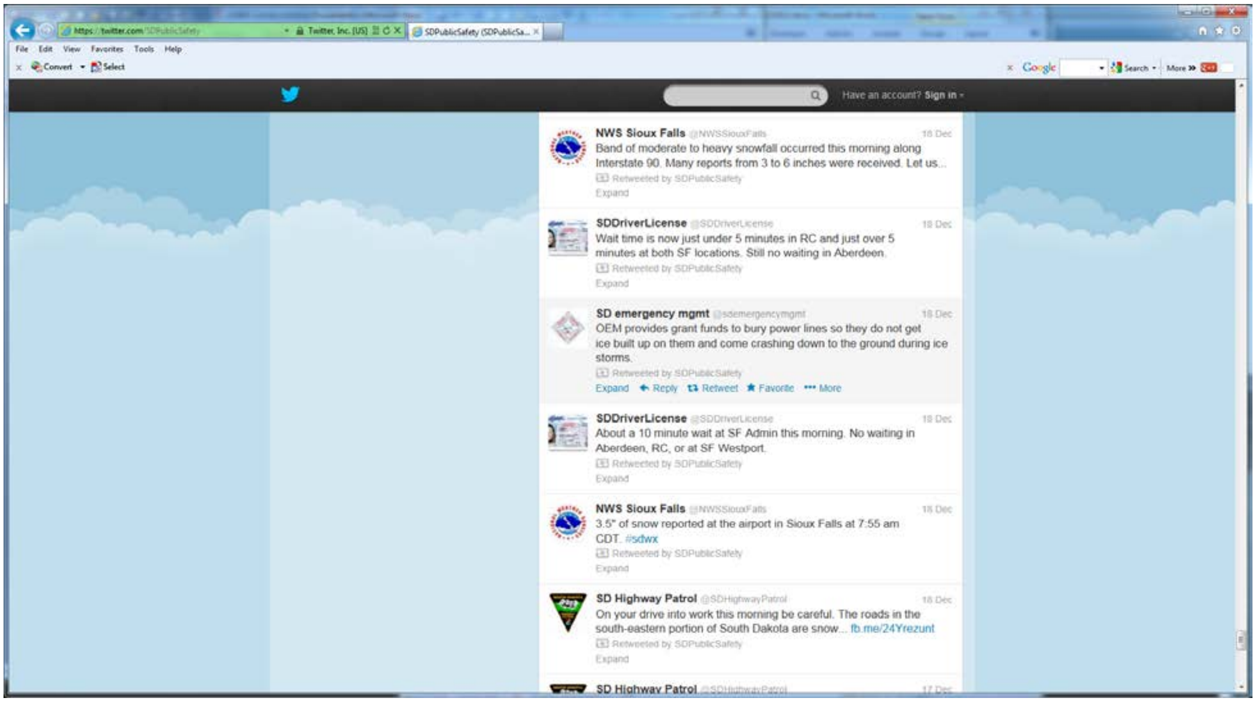

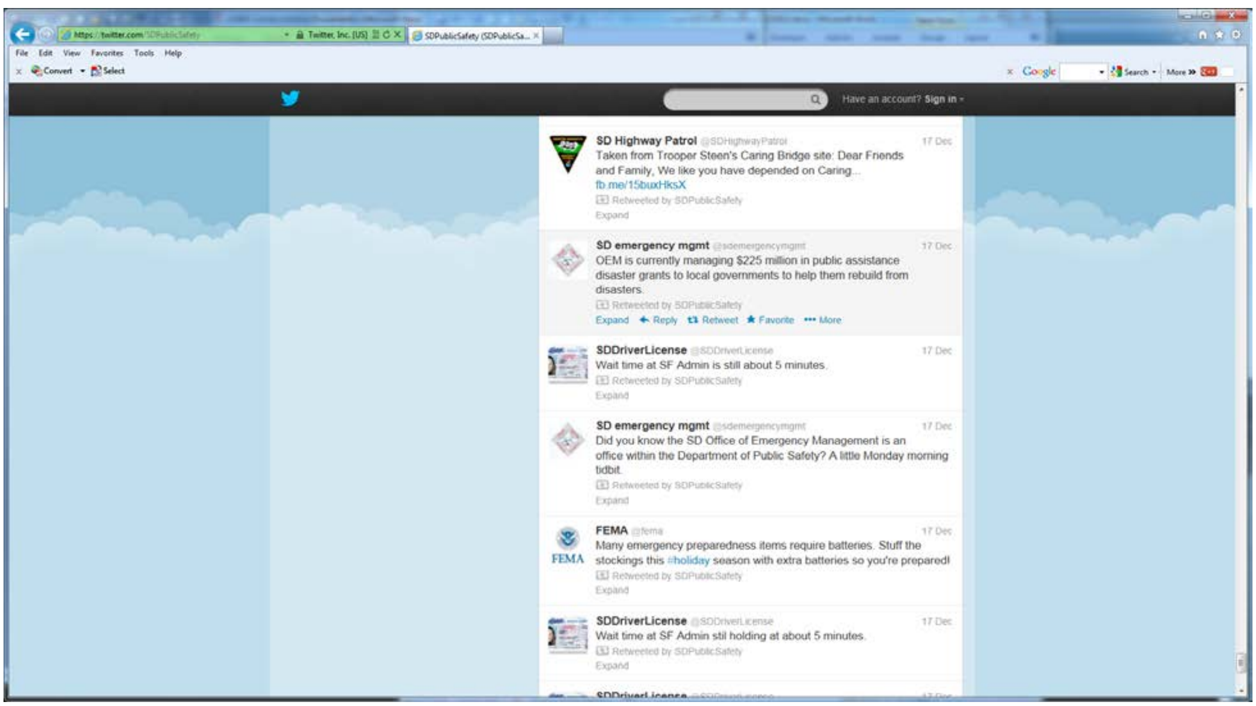

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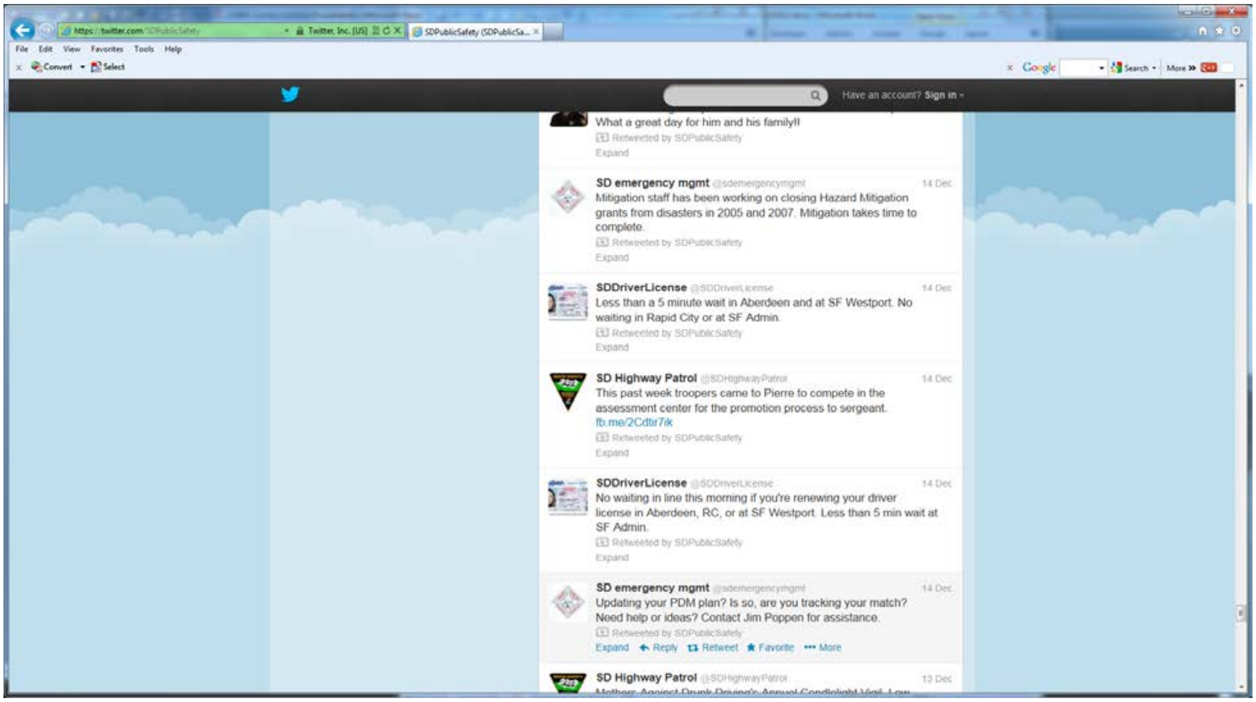

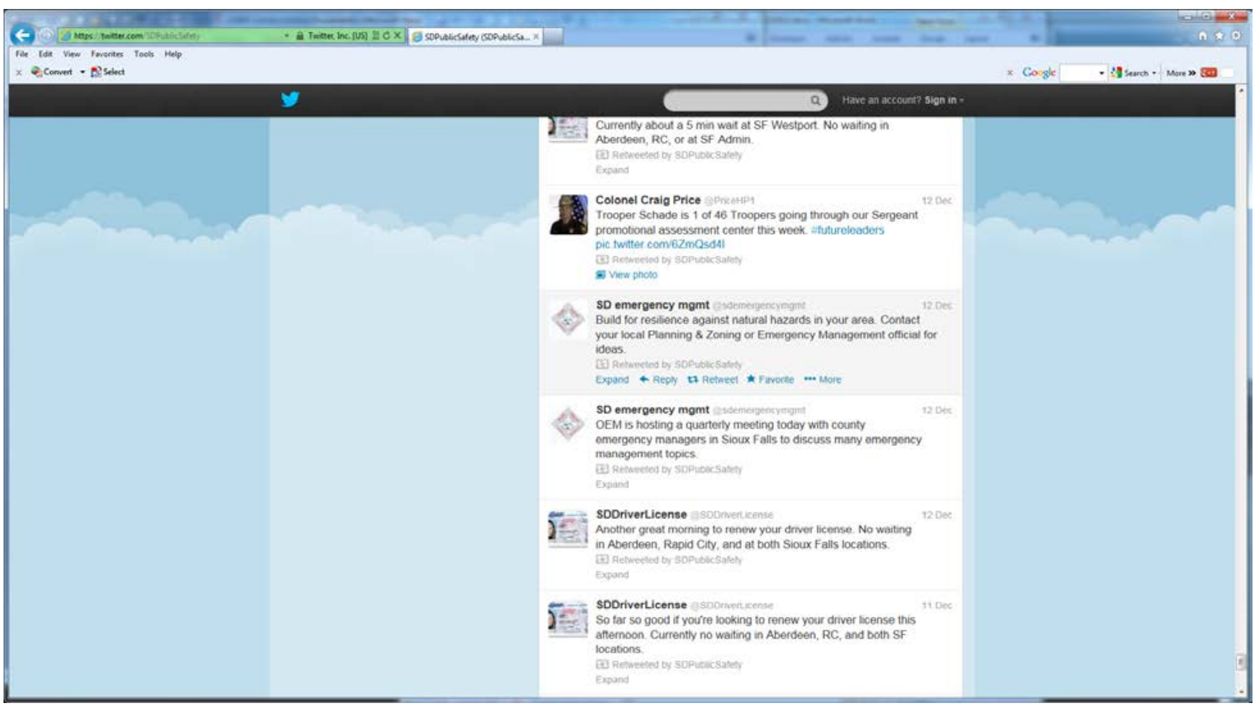

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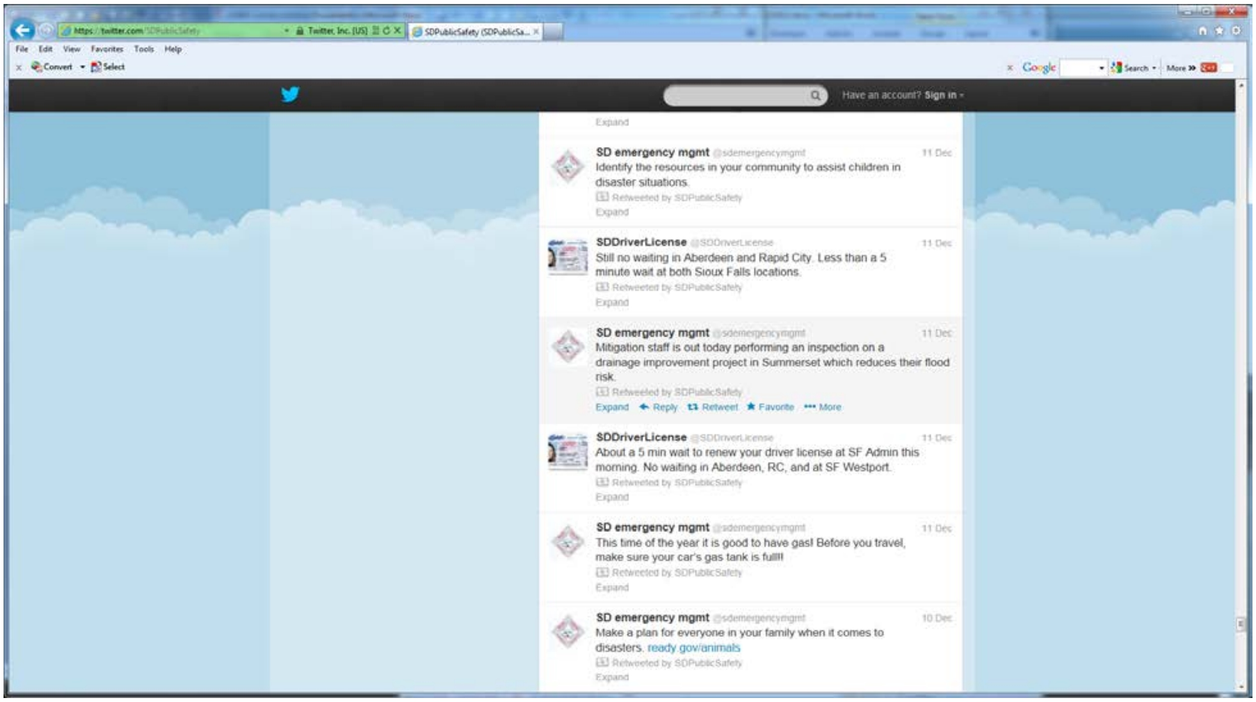

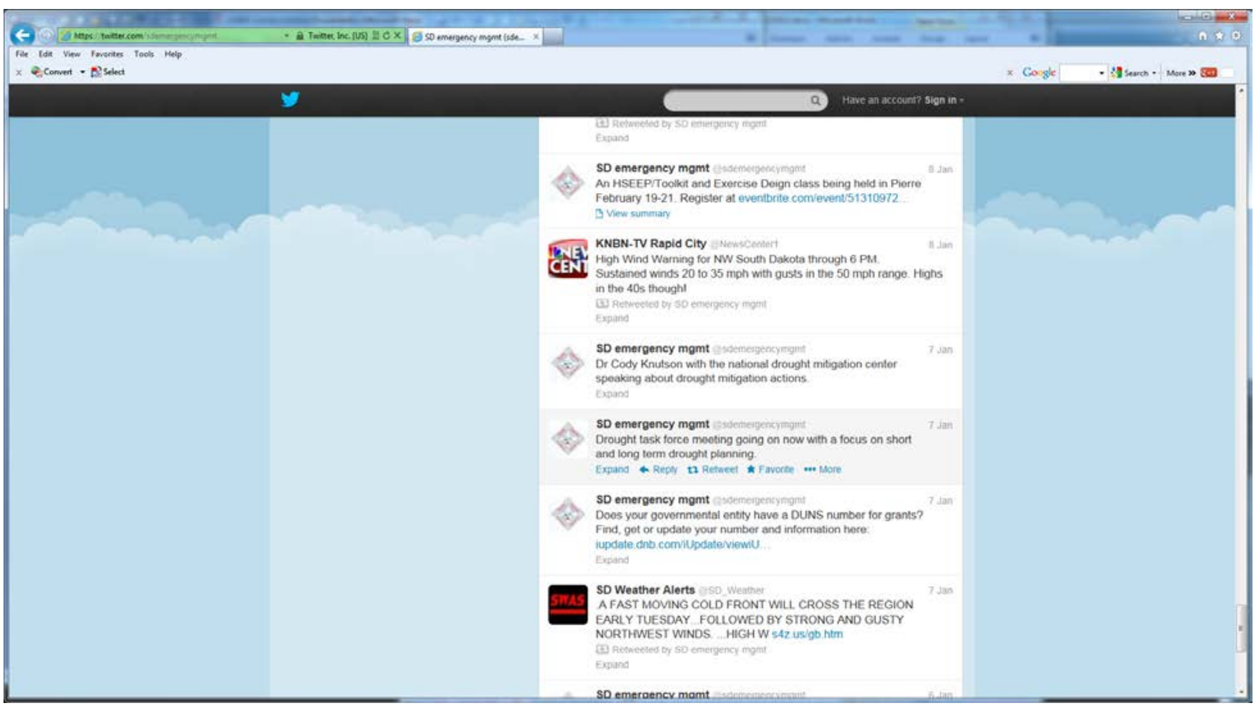

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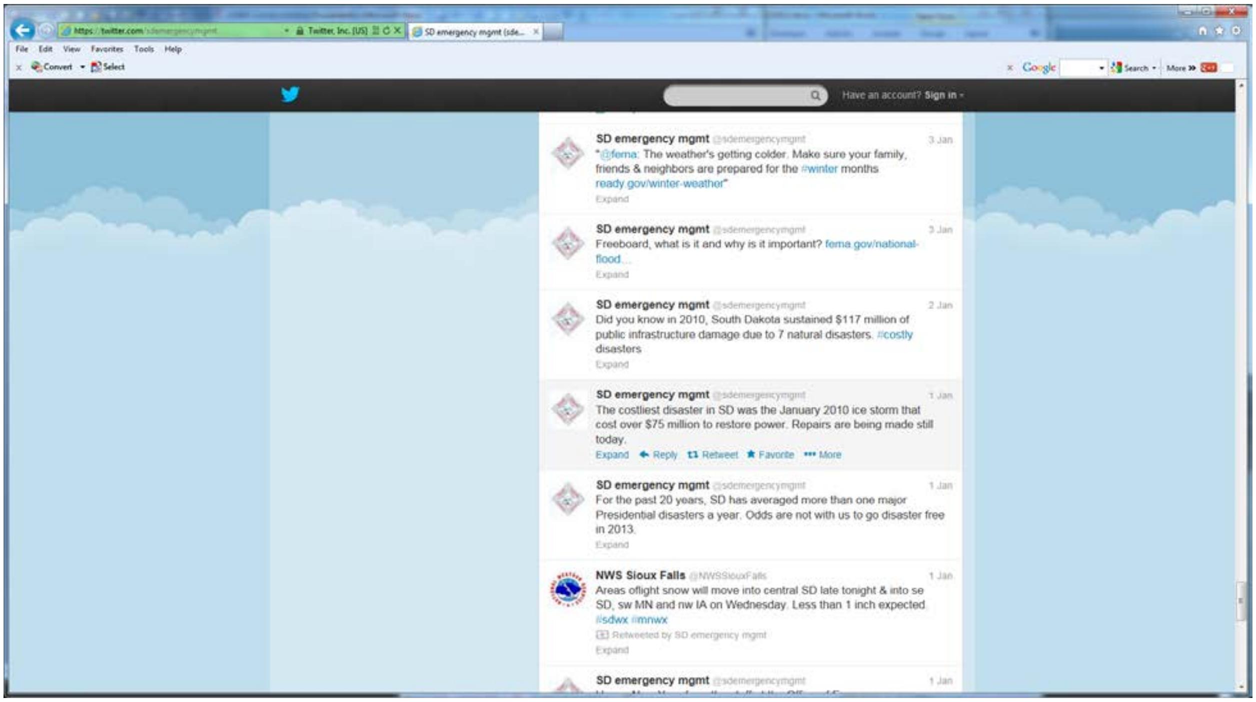

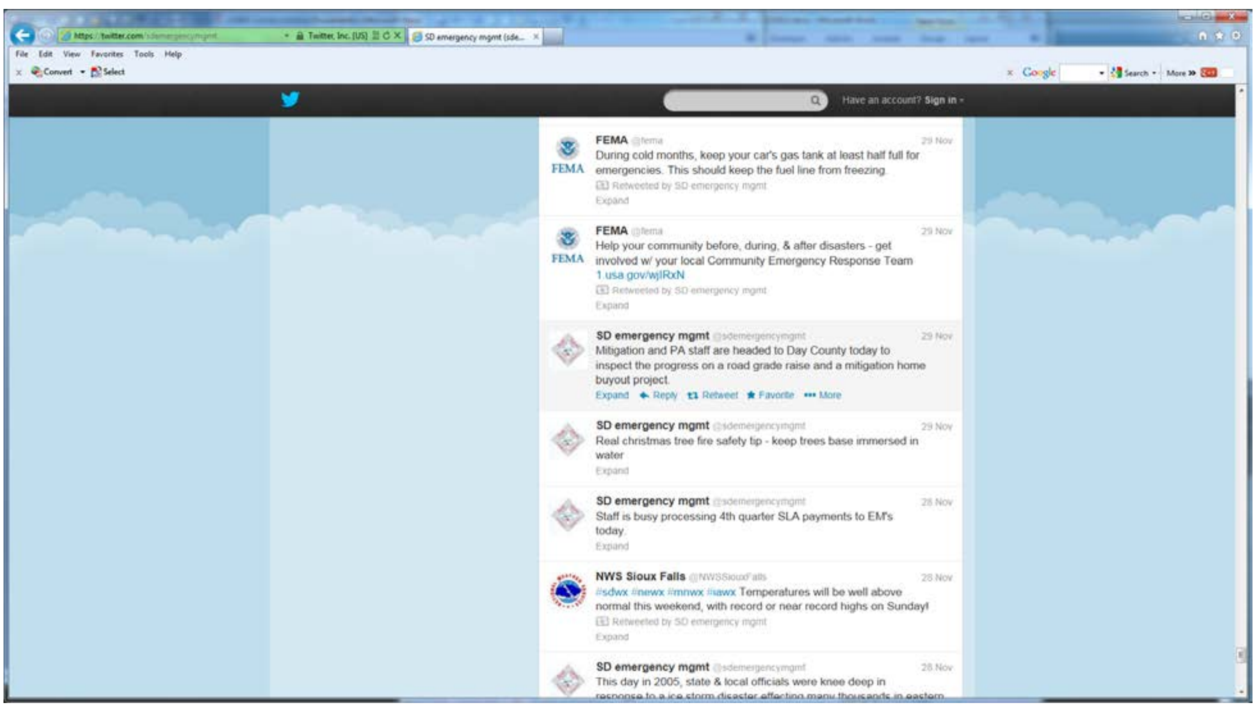

Bartshire, Corinne

From:	Prince, Nicole [Nicole.Prince@state.sd.us]
Sent:	Monday, January 14, 2013 12:43 PM
To:	Bauder, Jason; Fridley, Kevin; Humphrey, Jason; Kittle, Randy; LaBrie, Rick; Lott, John; Olson, Paige; Paul, Ian; Rath, Mark; Schultz, Laurie (DOT); Titze, Tina; Todey, Dennis; Turman, Kristi
Cc:	Bartshire, Corinne; 'Williams, KevinW (KevinW.Williams@fema.dhs.gov)'; Poppen, Jim; Bauder, Jason; Christopherson, Martin
Subject:	State Hazard Mitigation Team - Survey

Good afternoon everyone,

As a representative of your agency, with interest in creating a more resilient South Dakota, we kindly request your continued cooperation as the South Dakota Office of Emergency Management (SDOEM) and State Hazard Mitigation Team update the South Dakota Multi-Hazard Mitigation Plan. We would like to take the time to complete the survey by Jan. 28th this information will be used at the team meeting in March.

With this plan in place, since 2005, the State of South Dakota has spent close to $40 million on strengthening infrastructure and reducing risk to damage from natural hazard events such as floods, winter storms, and wildfires. Input from state agencies, local communities, private organizations, and the public help ensure the Plan addresses the variety of risks throughout South Dakota.

Please help us continue to prioritize projects that increase resiliency by responding to this survey by January 25, 2013: http://www.surveymonkey.com/s/2014SDSHMP

You may download and review the current South Dakota State Hazard Mitigation Plan:
http://dps.sd.gov/emergency_services/emergency_management/documents/2011_SHMP_000.pdf

If you have any questions regarding the survey, you may contact Corinne Bartshire at (916) 380-3776 or cbartshire@dewberry.com.
Ongoing comments and suggestions regarding hazard mitigation may be directed to Nicole Prince, State Hazard Mitigation Officer, at (605) 773-2618 or Nicole.prince@state.sd.us.

We sincerely appreciate your time and cooperation,
Corinne and Nicole

Nicole Prince, CFM
SD State Hazard Mitigation Officer
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118 W Capitol Ave
Pierre, SD 57501
605-773-3231

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Bartshire, Corinne

From: Bauder, Jason [Jason.Bauder@state.sd.us]
Sent: Tuesday, February 05, 2013 2:30 PM
To: sdrea.coop, karla.steele; Albert Schmidt; 'Bosworth Mary (Mary.Bosworth@rcgov.org)'; 'Brad Solon'; 'Dan Jennissen (danj@co.pennington.sd.us)'; 'David Green (dgreen@custercountysd.com)'; 'David Muck'; 'Donald Weigel'; 'Frank Maynard (frem@gwtc.net)'; Erpenbach, Jake; jschmitt siouxfalls.org; 'Jon Peters (gis@lincolncountysd.org)'; 'Kent Johnson'; 'Michael Gutenkauf'; 'Michael McMahon (mmcmahon@boxelder.us)'; Prince, Nicole; 'Robin Bobzien'; 'Ryan Hegg (ryan.hegg@cityofmadisonsd.com)'; 'Shannon Schultz'; 'Sharon Pruess(sharon.pruess@ci.pierre.sd.us)'; 'Stu Nelson'; Titze, Tina; 'Tonya Vig'; '(bruldoe@midstatesd.net)'; 'Administrator City of Hartford (cityhall@hartfordsd.us)'; 'Beadle County Emergency Manager (tomm.bcmgmt@midconetwork.com)'; 'Bon Homme County Emergency Manager (bhem@hcinet.net)'; 'Bonnie Nielsen Town of Pickstown (bnielsen@charles-mix.com)'; 'Brittany Smith, City of Philip'; 'Brookings County Floodplain Manager (rhill@brookingscountysd.gov)'; 'Building Inspector City of Mitchell (jhegg@cityofmitchell.org)'; 'Building Inspector City of Watertown (kbucholz@watertownsd.us)'; 'Building Official City of Lead (denniss@cityoflead.com)'; 'Building Official City of Yankton (jmorrow@cityofyankton.org)'; 'Campbell County Emergency Manager (larrygoehring@valleytel.net)'; 'Charles Mix County Emergency Manager (gallfam@cme.coop)'; 'Cheyenne River Indian Reservation (kevin.keckler@yahoo.com)'; 'City Administrator City of Dell Rapids (cityadmin@cityofdellrapids.com)'; VanDerWerff, Roland; 'City Administrator City of Worthing (jeff@cityofworthing.com)'; 'City Engineer City of Vermillion (josed@cityofvermillion.com)'; 'City of Alexandria Finance Officer (mgcityofalec@triotel.net)'; 'City of Alpena Mayor (alpenasd@santel.net)'; unitelsd.com, armourcity; Groft, Carol; 'City of Aurora Finance Officer (aurorasd@itctel.com)'; 'City of Avon Finance Officer (cityavon@gwtc.net)'; 'City of Baltic Finance Officer (balticcityfo@midconetwork.com)'; 'City of Belle Fourche City Engineer (snafus@bellefourche.org)'; 'City of Big Stone City Floodplain Administrator (bigstonecity@midconetwork.com)'; 'City of Blunt Finance Officer (cityofblunt@venturecomm.net)'; cityofbrandon.org, bread; 'City of Bridgewater, Finance Office'; 'City of Britton Finance Officer (cityhall@brittonsd.com)'; 'City of Bruce Finance Officer (cityofbruce@mediacombb.net)'; 'City of Burke Mayor (burkecc@gwtc.net)'; 'City of Canistota Zoning Department (canistotamaint@unitelsd.com)'; 'City of Canova Mayor (lightning@triotel.net)'; 'City of Canton Floodplain Administrator (karen.leffler@cantonsd.org)'; 'City of Castlewood Finance Officer (castcity@itctel.com)'; 'City of Chamberlain City Engineer (chamberlaingp@midstatesd.net)'; 'City of Clark Finance Officer (clarkfinanceofficer@itctel.com)'; 'City of Colman Finance Officer (cityofcolman@iw.net)'; 'City of Colome Finance Officer (dakotamum@yahoo.com)'; 'City of Colton Mayor (erik.miller@coltonsd.com)'; 'City of Columbia Finance Officer (columbiacity@nvc.net)'; 'City of Dupree (dcouncil@lakotanetwork.com)'; 'City of Edgemont (city@gwtc.net)'; 'City of Hill City (bmcmacken@hillcitysd.org)'; 'City of Howard (howardsd@alliancecom.net)'; 'City of Ipswich (ipswichfo@valleytel.net)'; 'City of Montrose, Finance Officer (montrose@goldenwest.net)'; 'City of Plankinton (planknsd@heartlandpower.org)'; 'City of Salem, Finance Officer (citysalem@triotel.net)'; 'City of Sturgis (rbush@sturgisgov.com)'; 'City of Tea (cityoftea@iw.net)'; 'City of Valley Springs (vspringcity@alliancecom.net)'; 'City of Wagner (developwagner@hcinet.net)'; 'cityadmin@cityofflandreau.com'; 'Clay County Zoning Administrator (cynthia.aden@claycountysd.org)'; 'Codington County Planning & Zoning (planning.codcoext@midconetwork.com)'; 'Dan Hanson (dhanson@cityofbrookings.org)'; 'Dan Sudrla (planningzoning@davisoncounty.org)'; 'David Paulson (clarkdoe@itctel.com)'; 'Day County Commissioner (ricktobin99@yahoo.com)'; 'daycodoe@itctel.com'; 'Deuel County Zoning Administrator (dczoning@itctel.com)'; 'Dewey County Auditor (adele.enright@state.sd.us)'; 'DOE, Buffalo County (buffcodoe@hotmail.com)'; 'DOE, Butte County (polly@buttesd.org)'; 'Edmunds County Planning & Zoning (doe.edco@midconetwork.com)'; 'Engineer City of Huron (mwever@huronsd.com)'; 'Finance Officer City of Corsica (corsicacity@siouxvalley.net)'; 'Finance Officer City of De Smet (desmetcity@mchsi.com)'; 'Finance Officer City of Estelline (estellsd@heartlandpower.org)'; Sonya Hespe; 'Finance Officer City of Eureka (eureka@valleytel.net)'; 'Finance Officer City of Frankfort (frfortsd@nrctv.com)'; of Garretson, City; 'Finance Officer City of Gettysburg (cogburg@venturecomm.net)'; 'Finance Officer City of Gregory (gregcity@gwtc.net)'; 'Finance

To: Officer City of Groton (grotonsd@grotonsd.net)'; 'Finance Officer City of Hecla (heclasd@heartlandpower.org)'; 'Finance Officer City of Highmore (highmore@venturecomm.net)'; 'Finance Officer City of Hosmer (berry@valleytel.net)'; 'Finance Officer City of Hudson (cityofhudson@alliancecom.net)'; 'Finance Officer City of Irene (irenecityhall@iw.net)'; 'Finance Officer City of Kadoka (kadokacity@goldenwest.net)'; 'Finance Officer City of Lake Andes (cityhall@cme.coop)'; 'Finance Officer City of Lake Preston (lakepreston@mchsi.com)'; 'Finance Officer City of Marion (marionsd@gwtc.net)'; 'Finance Officer City of McIntosh (mcintosh@sdplains.com)'; 'Finance Officer City of Menno (menocity@gwtc.net)'; 'Finance Officer City of Midland (midland@gwtc.net)'; 'Finance Officer City of Mount Vernon (mtvernoncity@santel.net)'; 'Finance Officer City of New Underwood (cnuofc@gwtc.net)'; 'Finance Officer City of Onida (cityofonida@venturecomm.net)'; 'Finance Officer City of Parker (jeanned@iw.net)'; 'Finance Officer City of Platte (platte@midstatesd.net)'; 'Finance Officer City of Presho (preshocity@kennebectelephone.com)'; 'Finance Officer City of Redfield (cityhall@redfield-sd.com)'; 'Finance Officer City of Rosholt (jgrosholt@venturecomm.net)'; 'Finance Officer City of Scotland (scotcity@gwtc.net)'; 'Finance Officer City of Selby (cityofselby@venturecomm.net)'; 'Finance Officer City of Sinai (curt2tam@yahoo.com)'; 'Finance Officer City of Sisseton (sisseton@venturecomm.net)'; 'Finance Officer City of Springfield (spfdchbr@gwtc.net)'; 'Finance Officer City of Tyndall (tyndalsd@heartlandpower.org)'; 'Finance Officer City of Volga (nicole@volgacity.com)'; 'Finance Officer City of Webster (mail.cityofwebster@midconetwork.com)'; 'Finance Officer City of Wessington Springs (wessprsd@venturecomm.net)'; 'Finance Officer City of Whitewood (whitewood@rushmore.com)'; 'Finance Officer City of Winner (cityofwinner@gwtc.net)'; 'Finance Officer City of Woonsocket (citywoonsocket@santel.net)'; 'Finance Officer North Sioux City (tonya.rubida@northsiouxcity-sd.gov)'; 'Finance Officer Town of Artesian (townartesian@santel.net)'; 'Finance Officer Town of Bison (bison@sdplains.com)'; 'Finance Officer Town of Buffalo (townofbuffalo@sdplains.com)'; 'Finance Officer Town of Butler (gsichmeller@nvc.net)'; 'Finance Officer Town of Cavour (jakebird@santel.net)'; 'Finance Officer Town of Chancellor (chancellorsd@iw.net)'; 'Finance Officer Town of Conde (ctyconde@nvc.net)'; 'Finance Officer Town of Cresbard (mnipp@cresbardsd.com)'; 'Finance Officer Town of Davis (knock4joa@iw.net)'; 'Finance Officer Town of Delmont (delmontfinance@midstatesd.net)'; 'Finance Officer Town of Doland (kam@nvc.net)'; 'Finance Officer Town of Eagle Butte (sjganje@dakota2k.net)'; 'Finance Officer Town of Florence (tof@itctel.com)'; 'Finance Officer Town of Frederick (cityoffrederick@nvc.net)'; 'Finance Officer Town of Humboldt (finance@humboldtsd.com)'; 'Finance Officer Town of Kennebec (kennebecsd@kennebectelephone.com)'; 'Finance Officer Town of Keystone (emtblonde@yahoo.com)'; 'Finance Officer Town of Langford (townoflangford@venturecomm.net)'; 'Finance Officer Town of Lebanon (dr_griese@hotmail.com)'; 'Finance Officer Town of Monroe (shanah@iw.net)'; 'Finance Officer Town of Oldham (djjensen@alliancecom.net)'; 'Finance Officer Town of Olivet (jherman@gwtc.net)'; 'Finance Officer Town of Pierpont (kholler@venturecomm.net)'; 'Finance Officer Town of Pollock (townofpollock@valleytel.net)'; 'Finance Officer Town of Revillo (sdjohns@sstel.net)'; 'Finance Officer Town of Roslyn (roslyn@midco.net)'; 'Finance Officer Town of South Shore (townsouthshore@sstel.net)'; 'Finance Officer Town of Tabor (townoftabor@hcinet.net)'; 'Finance Officer Town of Tulare (tulare@venturecomm.net)'; 'Finance Officer Town of Veblen (veblencity@tnics.com)'; 'Finance Officer Town of Wessington (finance@venturecomm.net)'; 'Finance Officer Town of Westport (westportcity@nrctv.com)'; 'Finance Officer Town of White (whitesd@heartlandpower.org)'; 'Finance Officer Town of Wolsey (wolseysd@santel.net)'; 'Floodplain Administrator City of Custer (ctyplan@gwtc.net)'; 'Floodplain Administrator City of Gary (citygary@itctel.com)'; 'Floodplain Administrator Standing Rock Sioux Tribe (jsmith@standingrock.org)'; 'Floodplain Administrator Town of Egan (egancity@mcisweb.com)'; 'gary.vetter@browncounty.sd.gov'; Atyeo-Gortmaker, Krista; Waterbury, Jim; 'Haakon County Auditor (haakon@gwtc.net)'; 'Hamlin County Emergency Manager (hamcoem@itctel.com)'; 'Hand County Zoning Administrator (assessor.handcoem@midconetwork.com)'; 'Hanson County Director of Equalization (hansoncodoe@triotel.net)'; 'hsinspect@hs-sd.org'; 'Hughes County Zoning (randy.kleinschmidt@co.hughes.sd.us)'; 'Hutchinson County Planning & Zoning (hutzone@gwtc.net)'; 'Hyde County Equalization (hydedoe@venturecomm.net)'; Wilson, Vicki; 'Jeanette Sinkular (bjsink@gwtc.net)'; Peterson, Cindy (WS-Auditor); 'Jerry Doyle (jdoyle@iw.net)'; 'Jim Hulbert (jchulbert@mncomm.com)'; 'Joshua Atherton (bristolcity@nvc.net)'; 'kettwigj@sstel.net'; 'Kevin Jens (ctywaub@itctel.com)'; Albrecht, Jennifer; 'Lake County Zoning Department (lakezoning@lakecountysd.com)'; 'Lawrence County Planning Department (avogt@lawrence.sd.us)'; 'Lyman County Auditor

To: (auditor@lymancounty.org)'; 'Marshall County Zoning Director (mcdirector@venturecomm.net)'; 'Martha Wierzbicki (marthaw@bellefourche.org)'; 'Mayor City of Faulton (timbormann@lawyer.com)'; 'Mayor City of Herreid (cityofherreid@valleytel.net)'; 'Mayor City of Isabel (isabeltown@lakotanetwork.com)'; 'Mayor City of Philip (philip@gwtc.net)'; 'Mayor City of Rosecoe (cityofroscoe@venturecomm.net)'; 'Mayor City of Summerset (dfink@summerset.us)'; 'Mayor City of Twin Brooks (dale@sstel.net)'; 'McCook County Zoning (vsojk@triotel.net)'; 'Meade County Planning & Zoning (brich@meadecounty.org)'; 'Miner County Equalization (minercodoe@alliancecom.net)'; 'Minnehaha County Planning Department (sanderson@minnehahacounty.org)'; 'Moody County Terry Albers (mcem@moodycounty.net)'; 'Planning & Zoning Town of Harrisburg (harctypz@iw.net)'; 'Potter County Emergency Manager (sautner2000@yahoo.com)'; 'Public Works City of Deadwood (jimr@cityofdeadwood.com)'; 'Public Works City of Fort Pierre (bradl@fortpierre.com)'; 'Richard Haugen (RHaugen@brookingscountysd.gov)'; 'Rick Schlechter'; 'Roberts County Equalization (roberteq@venturecomm.net)'; 'Ron Blachford (handcohwy@yahoo.com)'; 'Sanborn County Equalization (sancodoe@santel.net)'; 'Sarah Caron'; 'Spink County Floodplain Administrator (ltebben.spinkem@nrctv.com)'; 'Stanley County Equalization (scdoe@midconetwork.com)'; 'Stephanie Ganschow (cvillecity@hcinet.net)'; 'Sully County Equalization (sullyequal@venturecomm.net)'; 'THOMAS DRAKE'; Toennies, Kelly; 'Town of Hermosa (twnhrmsa@custercountysd.com)'; 'Town of Mission Hill (missionhill@svtv.com)'; 'Town of Trent Council (trenttown@goldenwest.net)'; 'Town of Utica (townofutica@yahoo.com)'; 'Town of Volin (townofvolin@iw.net)'; 'Town of Willow Lake (cityofwl@itctel.com)'; 'Town President City of Raymond (rareis@itctel.com)'; 'Town President City of Warner (david.fair@browncounty.sd.gov)'; 'Town President Town of Buffalo Gap (hbesco@hotmail.com)'; 'Town President Town of Fulton (fultontown@santel.net)'; Torrance, Linda; 'Town President Town of Orient (cgupman@live.com)'; 'Town President Town of Seneca (khoefert@venturecomm.net)'; 'Town President Town of Wakonda (ronaldp@iw.net)'; 'Town President Town of White Rock (rudy@venturecomm.net)'; 'Tribal Chairperson Yankton Sioux Tribe (bobbycournoyer@yahoo.com)'; 'Tripp County Equalization (ritatrco@gwtc.net)'; 'Turner County Equalization (turncodoe@iw.net)'; iw.net, uczoning; 'Utilities Superintendent City of Elkton (bubba1@itctel.com)'; 'Walworth County (pudwill@sbtc.net)'; 'Yankton County Planning & Zoning (pat@co.yankton.sd.us)'; Longbrake, Cindy; 'Zoning Department Town of Spencer (spencer@triotel.net)'
Cc: Bartshire, Corinne
Subject: State Hazard Mitigation Plan update survey

As a representative of your agency, with interest in creating a more resilient South Dakota, we kindly request your continued cooperation as the South Dakota Office of Emergency Management (SDOEM) and State Hazard Mitigation Team update the South Dakota Multi-Hazard Mitigation Plan. Please complete this survey as well as sending this out to all your partners within your organization.

With this plan in place, since 2005, the State of South Dakota has spent close to $40 million on strengthening infrastructure and reducing risk to damage from natural hazard events such as floods, winter storms, and wildfires. Input from state agencies, local communities, private organizations, and the public help ensure the Plan addresses the variety of risks throughout South Dakota.

Please help us continue to prioritize projects that increase resiliency by responding to this survey by February 28 , 2013: http://www.surveymonkey.com/s/2014SDSHMP.

You may download and review the current South Dakota State Hazard Mitigation Plan:
http://dps.sd.gov/emergency_services/emergency_management/documents/2011_SHMP_000.pdf

If you have any questions regarding the survey, you may contact Corinne Bartshire at (916) 380-3776 or cbartshire@dewberry.com. Ongoing comments and suggestions regarding hazard mitigation may be directed to Nicole Prince, State Hazard Mitigation Officer, at (605) 773-3231 or Nicole.prince@state.sd.us.

We sincerely appreciate your time and cooperation,

Jason Bauder
SD Office of Emergency Management
118 West Capitol Avenue, Pierre, SD 57501
605.773.3231 | www.oem.sd.gov
Follow OEM on twitter

Bartshire, Corinne

From: Prince, Nicole [Nicole.Prince@state.sd.us]
Sent: Tuesday, February 05, 2013 2:27 PM
To: 'Bob Wilcox - County Comm.'; Bartshire, Corinne; DPS-OEM CO EM; DPS-OEM TRIBAL EM; Board of Regents ; LaPlante, JR; Van Gerpen, Patty; Lauseng, Mark; SD Municipal League - Yvonne Taylor; State Geologist; Town & Township Assocation
Cc: Bauder, Jason
Subject: State Hazard Mitigation Plan update survey

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We sincerely appreciate your time and cooperation,
Nicole

Nicole Prince, CFM
SD State Hazard Mitigation Officer
Office of Emergency Management
118 W Capitol Ave
Pierre, SD 57501
605-773-3231

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2014 South Dakota State Multi-Hazard Mitigation Plan Survey

The State of South Dakota continues to increase long term resiliency of our communities through the implementation of hazard mitigation projects. We thank you for taking the time to help prioritize these actions by responding to this survey. All members of the public, local organizations, and state agencies are welcome to respond. Please answer each question to the best of your ability.

*1. Please provide your contact information.

Last Name: ______

First Name: ______

Title: ______

Organization: ______

Email Address: ______

Phone Number: ______

2. Please indicate who you are representing for the purposes of this survey. (You may respond to the survey more than once if you wish to respond on behalf of an organization in addition to yourself as a public resident.)

- ☐ County/Local Government
- ☐ Council of Government
- ☐ University Extension
- ☐ Utility Provider
- ☐ State Agency
- ☐ Public Resident
- ☐ Private Sector Business
- ☐ Non-profit Organization
- ☐ Community-based Organization
- ☐ Professional Association
- ☐ Other (please specify) ______

3. Have you reviewed the 2011 State Hazard Mitigation Plan available on SDOEM's website?

It may be found at: http://dps.sd.gov/emergency_services/emergency_management/documents/2011_SHMP.pdf

- ◯ Yes
- ◯ Not Yet

The State Hazard Mitigation Plan is updated every three years. This survey provides an opportunity for you / your organization to inform the 2014 update of the plan. Any questions you have regarding the process, or this survey, may be emailed directly to Corinne Bartshire (cbartshire@dewberry.com, 916.380.3776) or Nicole Prince (nicole.prince@state.sd.us, 605.773.2618).

Please continue to the next page to provide your input on hazard risk and how we can continue becoming more resilient.

2014 South Dakota State Multi-Hazard Mitigation Plan Survey

4. Please rate each of the following hazards on a scale of 1 (no concern) to 3 (high concern) indicating the level of threat each presents to the operation of your organization/residence. (leave rating blank for hazards that are not applicable)

	1. Low Threat	2. Moderate Threat	3. High Threat
Acquifer/Water Supply Contamination	○	○	○
Agricultural Pests and Diseases	○	○	○
Aviation Incident	○	○	○
Bio-Terrorism	○	○	○
Civil Disturbances	○	○	○
Climate Change	○	○	○
Communication Failure	○	○	○
Communications Isolation	○	○	○
Dam or Levee Failure	○	○	○
Drought	○	○	○
Earthquakes	○	○	○
Expansive Soils	○	○	○
Explosion	○	○	○
Flooding	○	○	○
Fuel Shortage	○	○	○
Hail	○	○	○
Hazardous Materials Incidents	○	○	○
Hostage / Violence	○	○	○
Infectious Diseases / Epidemic	○	○	○
Landslides	○	○	○
Lightning Strikes	○	○	○
Man-Made Hazards	○	○	○
Mass Casualty Incident	○	○	○
Motor Vehicle Transportation Incidents	○	○	○
Mudflows / Debris Flows	○	○	○
National Security Emergency	○	○	○
Natural Caused mass evacuation	○	○	○
Natural Gas Failure	○	○	○
Nuclear Incident	○	○	○
Power Failure	○	○	○
Railway Incident	○	○	○
Seasonal Population Shift	○	○	○
Severe Thunderstorms	○	○	○
Sewer Failure	○	○	○
Shortage of critical materials	○	○	○

Structural Failure			
Structural Fires			
Subsidence			
Technological Hazards			
Terrorism			
Tornadoes			
Transportation Incidents			
Utility Mishap			
Wildland/Interface Fire			
Windstorm			
Winter Storm			

Please list any additional hazards that present a threat to the operation of your organization.

The State's mission for hazard mitigation planning is: "to reduce the impacts to life and property from hazards through a long term sustainable statewide mitigation strategy while maintaining economic vitality." Please help us, through your responses to the next questions, ensure the statewide mitigation strategy accounts for your concerns.

5. What are your or your organization's most prominent concerns regarding natural or human-caused hazards?

- [ ] Warning citizens of impending natural and human-caused incidents
- [ ] Loss of power and utilities
- [ ] Providing shelter, food, and water to citizens and cleaning up after a disaster
- [ ] Property damage/Crop damage
- [ ] Other (please specify)

6. Is climate change a concern to you and/or your organization?

- [ ] No
- [ ] Yes

If yes, please describe why.

7. What are you or your organization doing to reduce risk of damage from natural and human-caused hazards? (select all that apply)

- [ ] My organization has taken actions to prevent or minimize property damage.
- [ ] My organization has taken actions to prevent loss of life.
- [ ] My organization has developed a continuity of operations plan to prevent business interruption.
- [ ] My organization conducts outreach activities to promote awareness of relevant natural and human-caused hazards.
- [ ] My organization has implemented policies to prevent development in hazardous zones.
- [ ] My organization is not doing anything to prevent or minimize damage from natural or human-caused hazards.
- [ ] My organization would like to learn more about how we can help increase resiliency.
- [ ] Other (please specify)

8. Does your organization interact with SDOEM or other state agencies regarding mitigation actions or projects that reduce future damage from hazard events?

- ( ) Yes
- ( ) No, but we would like more information on opportunities available through SDOEM for increasing resiliency.
- ( ) Not Applicable

9. Please list three projects implemented by your organization over the past 5 years that you consider the most worthwhile for reducing damages from a natural or human-caused hazard event.

a.

b.

c.

10. What projects would help you or your organization reduce risk to future damage from hazard events?

11. Are you interested in receiving future correspondance from SDOEM regarding the 2014 Hazard Mitigation Plan Update? (if yes, please be sure you provide an email address in Question #1)

- ( ) Yes
- ( ) No

2014 South Dakota State Multi-Hazard Mitigation Plan Survey

Please recommend up to three additional organizations to complete this survey and participate in the State's comprehensive hazard mitigation strategy.

12. Please enter contact information for an additional organization you recommend to complete this survey.

Last Name:

First Name:

Title:

Organization:

Email Address:

Phone Number:

13. Please enter contact information for an additional organization you recommend to complete this survey.

Last Name:

First Name:

Title:

Organization:

Email Address:

Phone Number:

14. Please enter contact information for an additional organization you recommend to complete this survey.

Last Name:

First Name:

Title:

Organization:

Email Address:

Phone Number:

Thank you for taking the time to complete this survey. If you have any questions regarding this survey you may contact Corinne Bartshire at 916.380.3776 or cbartshire@dewberry.com

SOUTH DAKOTA
DEPARTMENT OF PUBLIC SAFETY
prevention — protection — enforcement

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Emergency Management
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State Fire Marshal
State 9-1-1 Coordination

Emergency Management

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Welcome to the Office of Emergency Management.

With an interest in creating a more resilient South Dakota, we kindly request your continued cooperation as the South Dakota Office of Emergency Management (SDOEM) and State Hazard Mitigation Team update the South Dakota Multi-Hazard Mitigation Plan.

With this plan in place, since 2005, the state of South Dakota has spent close to $40 million on strengthening infrastructure and reducing risk of damage from natural hazard events, such as floods, winter storms, and wildfires. Input from state agencies, local communities, private organizations, and the public help ensure the plan addresses the variety of risks throughout South Dakota.

Please help us continue to prioritize projects that increase resiliency by responding to this survey: http://www.surveymonkey.com/s/2014SDSHMP.

From left, Krisi Turman (director of the Office of Emergency Management), Jonathan Nesladek, Tina Titze, Rone Mielke, and Lt. Col. Orson Ward

Emergency Management Assistant Director Receives Patriot Award

Tina Titze, Assistant Director of the South Dakota Office of Emergency Management (OEM), recently received the Service Member Patriot Award from the United States Department of Defense.

Titze earned the honor for her support as a citizen employer of South Dakota Army National Guardsman member Jonathan Nesladek, an OEM employee.

The Patriot Award is given to citizen employers who offer their employee soldiers flexible schedules, time off prior to and after deployments, leaves of absence if needed and consideration of needs of family members.

"I am honored to accept the Patriot Award on behalf of all of the employees in OEM," Titze said. "When Jonathan is called away, his duties are covered by others in the office, so the award truly belongs to all of them. Coming from a military family and having a brother as a full-time member of the National Guard, I understand the sacrifices they make to allow the rest of us to enjoy the freedoms we sometimes take for granted. I am proud of Jonathan and proud to support him in this way."

Nesladek said he is honored to be part of an agency that "makes it so smooth to transition from one uniform to another. Not only does OEM support me as one soldier, but because of it, the whole organization is supported."

South Dakota Department of Agriculture

Fall 2013 Newsletter

Surviving Black Hills Wildfire 101 by David Hettick, Southern Hills Service Forester

"I moved here for the trees" and "I want the area to be natural" are two of the most common responses I hear from landowners new to the area.

Many new landowners think the Black Hills have always been heavily forested with ponderosa pine. Pictures from the Custer Expedition and other early documentation from around the turn of the century show a much different world.

Paul Horsted's comparison photos are a wonderful teaching tool when it comes to comparing the forest we have become accustom to and consider normal and healthy today with "Mother Nature's" plan.

The first thing people notice is the trees, or should I say, the lack of trees in the 1874 photos. Fires, both natural and those set by Native Americans for improving wildlife habitat, thinned the pines; as did the native mountain pine beetle.

European settlement of the region brought with it fire suppression. Unfortunately, in our zeal to tame nature, we failed to realize we can only postpone wildfire with suppression. Fire suppression inadvertently created high fuel concentrations allowing fires to frequently burn with greater intensities today than a century ago.

Topography, weather and fuel had traditionally been the main considerations when it came to wildfire suppression. However, today, wildfire managers have to add the human component.

Weather and topography cannot be changed, but the amount and type of combustibles we have is the one thing we can modify to reduce wildfire intensity. Treating ground and ladder fuels, and increasing spacing between trees can help keep a wildfire on the ground where it is less intense and easier to control.

We want space between the tops and branches of coniferous trees. The steepness of the slope, structures and soils found on the site help a resource professional determine just how much thinning you need.

Basic fire knowledge can go a long way in helping reduce your risk of devastation during a wildfire event if you are thinking about building a new home.

The site at the top of the mountain with the best vista is not the safest location with an approaching wildfire. Fire burns more intensely on steep slopes because rising warm air (convection) carries burning embers and dries out the vegetation in front of the main fire. Likewise, avoid building sites at the head of narrow, steep drainages that form chimneys. South and west facing slopes are hotter and drier. Use fire resistant building materials, and have access roads designed to handle larger emergency vehicles.

In my career, the Black Hills area has changed dramatically. I've watched the land go from a rural ranch setting to a populated and developed area. Grazing cows have been replaced by houses, subdivisions and small communities, but wildfire will still be a part of the Black Hills environment for the foreseeable future.

The unpredictability of weather and fire behavior mean no house or forest can ever be considered completely safe. However, by understanding some basic fire principles and implementing recommended pre-fire practices, the odds of survivability for property and the lives of firefighters protecting your property are vastly improved.

South Dakota Wildland Fire Update

The SD Wildland Fire Division resources had a busy summer supporting fire suppression efforts in multiple states.

The Bear Mountain and Black Hat Hand Crews, Engine Crews from the Lead, Rapid City, Hot Springs and Custer State Park Field Offices, and division employees serving as single resources have accepted these out-of-state assignments.

Rocky Mountain Incident Management Team C was also assigned out-of-state and continues to be available.

Division firefighters have responded to the following states: Colorado, Wyoming, Montana, Idaho, Oregon, California, Arizona, New Mexico, Nebraska, North Dakota, and Alaska.

East Peak Fire in Colorado where SD Firefighters responded.

SDDA Fall Happenings

Sept. 17, 2:15 p.m. MDT: Ag Development County Site Analysis Presentation, Spearfish Holiday Inn Convention Center
Sept. 28: Women's Expo, SD State Fairgrounds, Huron
Oct. 4-6: SD Barrel Racing Finals, SD State Fairgrounds, Huron
Oct. 6-12: Fire Prevention Week
Nov. 19: Beginning Farmer/Rancher Symposium, SDSU, Brookings

SDDA Presents Harvesting with the Ag Stars

It's harvest time in South Dakota. The state's producers now get to see their hard work pay off. The SD Dept. of Agriculture (SDDA) has invited SD legislators to take part in this crucial part of agriculture and learn first hand from our producers about this incredible industry that offers much to our state.

Each legislator participating will ride along with a producer in their area during harvest and learn more about the industry, its challenges and its successes. This is a great time for our legislators to hear from their rural constituents.

Agriculture is more than a job to these producers--it is a career, a tradition, a passion and a way of life. The longevity of South Dakota's family farms shows the dedication and resiliency our farmers and ranchers possess. Legislators participating in this event will surely take home key points for the upcoming session.

Agriculture is South Dakota's #1 industry, with an economic impact of $21.4 billion per year and over 122,000 peopled employed. South Dakota's farm and ranch families take great pride in being stewards of the land and providing the world safe, nutritious and healthy food.

SDDA Ag Policy Update

This month, SD Secretary of Ag Lucas Lentsch and Director of Policy Courtney De La Rosa traveled to Asheville, NC to attend the National Association of State Departments of Agriculture (NASDA) Annual Meeting. Major topics in agriculture were discussed, including the implementation of the Food Safety Modernization Act (FSMA), the future of the Farm Bill, Country of Origin Labeling (COOL), animal health and welfare and consumer outreach.

Your Department of Agriculture is actively involved in advocating for the passage of a comprehensive five year Farm Bill. Both the House and Senate versions of the bill currently include important provisions for crop insurance, extending USDA's State Agricultural Mediation Program until 2018, increasing funding for the Specialty Crop Block Grant Program and invasive species programs and reauthorizating the Healthy Forest Reserve Program.

For more information on legislation SDDA is tracking, contact Katie Konda at 605.773.5425.

BOARD ELECTIONS

Ms. Terri LaBrie, Loan Administrator for SDDA, was recently elected President of the National Council of State Ag Finance Programs (NCOSAFP) at the annual meeting, Aug. 11, 2013 in Des Moines, IA.

Division Spotlight: Ag Services

Bio-Control Program by Ron Moehring, SDDA Specialist

The biological control program of the South Dakota Department of Agriculture (SDDA) is a diverse one.

Classic biological control is using an insect or pathogen to control an unwanted plant or pest. SDDA became active in biological control early on. We now have very diverse bio-control programs in the state. Bio-control for noxious weeds like Common mullein, Dalmatian toadflax and Spotted knapweed are a few.

SDDA only collects insects from previously released sites and transports them to other sites with-in the state to release them. For other noxious weeds like Leafy spurge, we hold major collections, inviting state, federal, and tribal landowners, land holding agencies and county weed and pest boards to participate.

With the help of participants, we collect the insects from the field, separate them from other insects, weeds, seeds and other debris and package them. The agents are then divided and given at no cost to the participants. The cost savings to landowners in the past 10 years, just for the insects, is well over a million dollars. The benefit of the controlled spurge far exceeds this amount.

We also work with USDA APHIS on new bio-control agents such as the stem borer for Yellow toadflax. After exhaustive testing to show they are safe for field releases, we acquire these insects from USDA and release and monitor them at selected sites around the state. If the insects become established, we collect and re-distribute them to other areas.

SDDA also cooperates with the Nebraska Department of Agriculture, Niobrara NE School District and Mike Durfee State Prison along with many other partners, in two insect rearing facilities located at the Yankton Trusty unit. This unique program utilizes prison inmates to raise insects for release on Purple loosestrife and Spotted knapweed.

While bio-control is an important part of integrated weed control, it is not a silver bullet and may not always work in every situation. A good example is Canada thistle bio-control. Insects were released in the 1980s and surveys have found they spread nearly everywhere in the state, but their control activity was limited.

Weeds are not the only pest that bio-control is being used on. In the past, parasites were released to control alfalfa weevils. Agents have also been released to control soybean aphids and other plant pests.

SDDA will continue to work with USDA and others to find new bio-control agents for noxious weeds and pests. For more information on the SDDA bio-control program, contact Ron Moehring at 605.773.3724 or agmail@state.sd.us

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NEWS RELEASE
Department of Public Safety
118 W. Capitol Ave. • Pierre, SD 57501 • (605) 773-3178 • fax: (605) 773-3018 • www.state.sd.us/dps

FOR IMMEDIATE RELEASE: Tuesday, Sept. 3, 2013
CONTACT: Terry Woster, Public Information Officer, 605-773-3178

State Hazard Mitigation Plan Available for Public Comment

PIERRE, S.D. – South Dakota's Office of Emergency Management is seeking public comments on its updated State Hazard Mitigation Plan, a document that identifies strategies to reduce or eliminate risk of damage from natural disasters.

States must have a hazard mitigation plan in place to qualify for presidential disaster declarations. The plan must be updated every three years to maintain eligibility for federal hazard mitigation assistance.

"South Dakota residents face natural hazard events such as winter storms and flooding each year,'' said Jason Bauder, mitigation and recovery manager for OEM. "In the past five years, the State Hazard Mitigation Plan has enabled South Dakota to receive 13 presidential disaster declarations. That has resulted in financial assistance for projects that reduce future risk, such as establishing storm shelters, making drainage improvements, burying power lines and installing flood control measures.''

A draft of the updated plan is available at www.oem.sd.gov. Public comments on the draft plan are being received through Oct. 18, 2013. Those comments will be considered as OEM develops a final plan. Comments may be submitted directly to the state's consultant in the process: Corinne Bartshire, cbartshire@dewberry.com, or by calling 916-380-3776.

The State Hazard Mitigation Plan is developed and maintained through leadership of the Office of Emergency Management with ongoing collaboration and input by the State Hazard Mitigation Team and the South Dakota Silver Jackets, a state-federal program involved in planning and implementing measures to reduce risks of flooding and other natural hazards.

Those groups assess the state's risk from agricultural pests and diseases, floods, winter storms, wildfire, drought, tornadoes, hazardous material spills and geologic hazards.

The plan summarizes risk reduction progress and identifies ongoing and potential future activities necessary to continue mitigation efforts that reduce risks of damage due to disasters.

S.D. seeks public comment on hazard mitigation plan

Sep. 5, 2013 6:41 AM | 0Comments

A house on Dave Reinschmidt's family farm is protected by a levee near Wagner, S.D., in 2011. Argus Leader file photo

Written by
Associated Press

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News Updates

PIERRE — The South Dakota Office of Emergency Management is seeking public comments on its updated hazard mitigation plan, a document that identifies strategies to reduce or eliminate the risk of damage from natural disasters.

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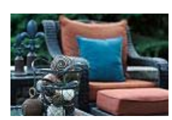
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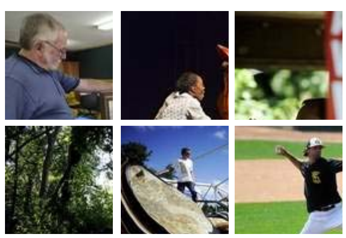

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SD Seeks Public Comment on Hazard Mitigation Plan

September 5, 2013
(Associated Press)

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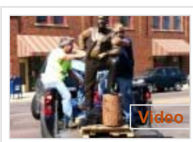

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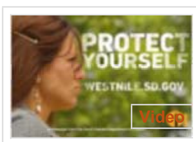

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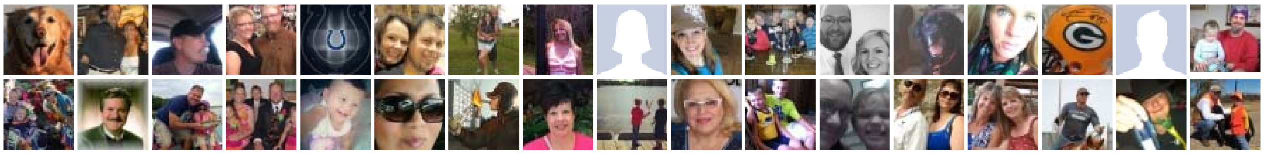

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SD Seeks Public Comment On Hazard Mitigation Plan

by Associated Press
September 05, 2013 9:04 AM
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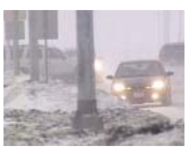

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'Mad Men,' 'S.H.I.E.L.D' Actors To Attend Festival
The lineup is taking shape for the South Dakota Film Festival later ...

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Boots Retiring as USD Basketball Coach Sep. 3

KDLT Sports Stories

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State Seeks Comments On South Dakota Hazard Plan

September 5, 2013, 6:35 AM

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9/2/2013 11:08 AM
A 17-year-old has been arrested in connection with the death of a 5-year-old boy whose body was found a western Iowa ravine.

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One Dead After Car Versus Motorcycle Crash (/newsdetail.cfm/one-dead-after-car-versus-motorcycle-crash/?id=152657)

8/31/2013 11:17 AM
A man died in a car versus motorcycle crash on Interstate 90 near Spearfish on Friday, August 30.

Full Story (/newsdetail.cfm/one-dead-after-car-versus-motorcycle-crash/?id=152657)

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New Details In Reported Sioux Falls Rape (/newsdetail.cfm/new-details-in-reported-sioux-falls-rape/?id=152778)

9/4/2013 10:44 AM
Sioux Falls Police say the rape that was reported to happen in downtown Sioux Falls early Sunday morning actually did not happen in that area.

Full Story (/newsdetail.cfm/new-details-in-reported-sioux-falls-rape/?id=152778) | Watch (/videoarchive/?videofile=130904rape12)

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Police Release Name Of Man Who Drowned While Netting Minnows (/newsdetail.cfm/police-release-name-of-man-who-drowned-while-netting-minnows/?id=152617)

8/30/2013 9:55 AM
Authorities in Codington County have identified a 56-year-old man who drowned while netting minnows in a slough near Henry.

Full Story (/newsdetail.cfm/police-release-name-of-man-who-drowned-while-netting-minnows/?id=152617)

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Police Looking For Rape Suspect (/newsdetail.cfm/police-looking-for-rape-suspect/?id=152729)

9/3/2013 11:33 AM
Sioux Falls police are looking for a man they say violently raped a woman over the weekend.

Full Story (/newsdetail.cfm/police-looking-for-rape-suspect/?id=152729)

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ACT 50th Anniversary Dance Gala (http://events.keloland.com/ACT_50th_Anniversary_Dance_Gala/281367744.html?utm_source=www.keloland.com&utm_medium=eventshomepagewidget&utm_campaign=widget&utm_content=eventlink)

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ADVISORIES & CLOSINGS

SD seeks public input on hazard mitigation plan

Thursday, 05 September 2013 06:40

PIERRE, S.D. (AP) _ The South Dakota Office of Emergency Management is seeking public comments on its updated hazard mitigation plan, a document that identifies strategies to reduce or eliminate the risk of damage from natural disasters. States must have hazard mitigation plans in place to qualify for presidential disaster declarations. Jason Bauder of the Office of Emergency Management says the state's plan has enabled South Dakota to get 13 presidential disaster declarations in the past five years. He says that has led to funding for risk-reduction projects that include storm shelters, drainage improvements and flood control measures. Officials assess risks from agricultural pests and diseases, floods, winter storms, wildfire, drought, tornadoes and hazardous material spills. Public comments on the draft plan can be made until Oct. 18. It is available online at www.oem.sd.gov AP-WF-09-05-13 0926GMT<

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Rapid City, SD 57709

South Dakota seeks public comment on hazard mitigation plan

Posted: Sep 05, 2013 6:02 AM PDT
Updated: Sep 05, 2013 6:06 AM PDT

The South Dakota Office of Emergency Management is seeking public comments on its updated hazard mitigation plan, a document that identifies strategies to reduce or eliminate the risk of damage from natural disasters.

States must have hazard mitigation plans in place to qualify for presidential disaster declarations.

Jason Bauder of the Office of Emergency Management says the state's plan has enabled South Dakota to get 13 presidential disaster declarations in the past five years. He says that has led to funding for risk-reduction projects that include storm shelters, drainage improvements and flood control measures.

Officials assess risks from agricultural pests and diseases, floods, winter storms, wildfire, drought, tornadoes and hazardous material spills.

Public comments on the draft plan can be made until Oct. 18. It is available online at www.oem.sd.gov

News 1:15 PM THU SEPTEMBER 5, 2013

South Dakota Office Of Emergency Management Seeks Public Opinion On Updated Hazard Mitigation Plan

By KATHLEEN SERIE

The South Dakota Office of Emergency Management has updated its hazard mitigation plan, and is making the draft available for public comment.

Nicole Prince is the State Hazard Mitigation Officer.

0:29 | 0:30

"The hazard mitigation plan is a plan that's put together of all the stakeholders in the state to talk about or express the vulnerabilities- hazards- and potential mitigations activities in the state," says Prince. "This plan makes the state eligible for mitigation and for disaster declarations for public assistance to be brought into the state after a presidential disaster declaration."

Prince says the plan is updated every 3 years. She says a major change in this draft includes the implementation of more mitigation projects throughout the state.

Prince says once the public review period is finished, the comments are evaluated and incorporated into a final plan that will go to FEMA in the next few months. This plan must be approved by April of 2014.

The public can comment on the draft until October 18th by visiting the Office of Emergency Management's website.

TAGS: Presidential Disaster Declaration (/term/presidential-disaster-declaration) Office of Emergency Management (/term/office-emergency-management) Hazard Mitigation Plan (/term/hazard-mitigation-plan)

Newman, Janna

From: Prince, Nicole [Nicole.Prince@state.sd.us]
Sent: Friday, September 06, 2013 5:44 PM
To: 'jlee@butteelectric.com'
Cc: Bauder, Jason; Bartshire, Corinne
Subject: State Hazard Mitigation Plan comment period 3

Good afternoon,

We are pleased to announce the draft of the 2014 South Dakota State Hazard Mitigation Plan is now available for your review and comment. Please download the plan from our website (www.oem.sd.gov) and submit any comments or suggestions you have to our consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776. Comments are welcome through October 18, 2013.

South Dakota residents face natural hazard events such as severe winter storms and flooding on an annual basis. In the last 5 years, the State Hazard Mitigation Plan has enabled the State to receive 13 presidential disaster declarations leading to financial assistance for projects that reduce future risk such as storm shelters, drainage improvements, power line burial, and flood control. This plan is updated every three years to maintain eligibility for the federal hazard mitigation assistance programs.
The State Hazard Mitigation Plan is developed and maintained through the leadership of South Dakota's Office of Emergency Management with ongoing collaboration and input by the State Hazard Mitigation Team and the South Dakota Silver Jackets. Together, these groups evaluated South Dakota's risk to agricultural pests and diseases, flood, winter storm, wildfire, drought, tornado, hazardous materials spills, and geologic hazards.

The comprehensive mitigation strategy summarizes risk reduction progress to date and identifies ongoing and potential future activities to continue building resiliency to natural hazard events throughout the state. Your suggestions for enhancing this strategy are welcome!

Thank you for your help! Please share this message with your colleagues, family, and friends.

Nicole Prince, CFM
SD State Hazard Mitigation Officer
Office of Emergency Management
118 W Capitol Ave
Pierre, SD 57501
605-773-3231

Follow OEM on Twitter

Newman, Janna

From:	Prince, Nicole [Nicole.Prince@state.sd.us]
Sent:	Friday, September 06, 2013 5:22 PM
To:	'janice@secog.org'; 'Luke Muller (luke@1stdistrict.org)'; 'Ted Haeder (Ted@1stdistrict.org)'; 'Todd Kays'; 'Greg Henderson (Greg.Henderson@districtiii.org)'; 'GREG MAAG (Greg@1stdistrict.org)'; 'Harry Redman (Harry.Redman@districtiii.org)'; 'John Clem (John.Clem@districtiii.org)'; 'Eric Ambroson (Eric.Ambroson@districtiii.org)'; 'eric@necog.org'; 'jennifer@necog.org'; 'Blaise Emerson (bemerson@tie.net)'; 'Marlene Knutson (MKnutson@csded.org)'; 'Justin Otsea (justin@csded.org)'; 'Seth Hyberger (seth@secog.org)'
Cc:	Bartshire, Corinne; Bauder, Jason
Subject:	State Hazard Mitigation Plan comment period - interested stakeholders

Good afternoon everyone!

We are pleased to announce the draft of the 2014 South Dakota State Hazard Mitigation Plan is now available for your review and comment. Please download the plan from our website (www.oem.sd.gov) and submit any comments or suggestions you have to our consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776. Comments are welcome through October 18, 2013.

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Nicole

Nicole Prince, CFM
SD State Hazard Mitigation Officer
Office of Emergency Management
118 W Capitol Ave
Pierre, SD 57501
605-773-3231

Follow OEM on Twitter

Newman, Janna

From: Bauder, Jason [Jason.Bauder@state.sd.us]
Sent: Friday, September 06, 2013 5:12 PM
Cc: Bartshire, Corinne; Macy, Marc
Subject: State Hazard Mitigation Plan comment period 2

Floodplain administrators and Certified Floodplain Managers,

We are pleased to announce the draft of the 2014 South Dakota State Hazard Mitigation Plan is now available for your review and comment. Please download the plan from our website (www.oem.sd.gov) and submit any comments or suggestions you have to our consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776. Comments are welcome through October 18, 2013.

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Thank you for your help! Please share this message with your colleagues, family, and friends.

Jason Bauder
SD Office of Emergency Management
118 West Capitol Avenue, Pierre, SD 57501
605.773.3231 | www.oem.sd.gov

Newman, Janna

From:	Prince, Nicole [Nicole.Prince@state.sd.us]
Sent:	Friday, September 06, 2013 4:16 PM
To:	'Bob Wilcox - County Comm.'; Bartshire, Corinne; 'Board of Regents '; LaPlante, JR; Van Gerpen, Patty; Lauseng, Mark; 'SD Municipal League - Yvonne Taylor'; 'State Geologist'; 'Town & Township Assocation '; sdrea.coop, karla.steele
Cc:	Bauder, Jason; Poppen, Jim; Christopherson, Martin
Subject:	RE: State Hazard Mitigation Plan update survey

We are pleased to announce the draft of the 2014 South Dakota State Hazard Mitigation Plan is now available for your review and comment. Please download the plan from our website (www.oem.sd.gov) and submit any comments or suggestions you have to our consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776. *Comments are welcome through October 18, 2013*.

South Dakota residents face natural hazard events such as severe winter storms and flooding on an annual basis. In the last 5 years, the State Hazard Mitigation Plan has enabled the State to receive 13 presidential disaster declarations leading to financial assistance for projects that reduce future risk such as storm shelters, drainage improvements, power line burial, and flood control. This plan is updated every three years to maintain eligibility for the federal hazard mitigation assistance programs.

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The comprehensive mitigation strategy summarizes risk reduction progress to date and identifies ongoing and potential future activities to continue building resiliency to natural hazard events throughout the state. Your suggestions for enhancing this strategy are welcome!

Thank you for your help! Please share this message with your members.
Sincerely,
Nicole Prince

Nicole Prince, CFM
SD State Hazard Mitigation Officer
Office of Emergency Management
118 W Capitol Ave
Pierre, SD 57501
605-773-3231

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Newman, Janna

From: Bauder, Jason [Jason.Bauder@state.sd.us]
Sent: Thursday, September 05, 2013 9:01 AM
To: DPS-OEM CO EM; DPS-OEM TRIBAL EM
Cc: ALL STAFF-DPS/OEM; Bartshire, Corinne
Subject: public comment period on updated state hazard mitigation plan
Attachments: SD2014SHMP_PublicReviewFlyer_v3.pdf

Please see the attached flyer which will tell you about the public comment period on the State Hazard Mitigation Plan which we have been working on for the last year. OEM welcomes any and all comments on our updated draft plan.

Jason Bauder
SD Office of Emergency Management
118 West Capitol Avenue, Pierre, SD 57501
605.773.3231 | www.oem.sd.gov

Newman, Janna

From: Bauder, Jason [Jason.Bauder@state.sd.us]
Sent: Tuesday, September 03, 2013 12:40 PM
To: Bauder, Jason; Fridley, Kevin; Humphrey, Jason; Kittle, Randy; LaBrie, Rick; Lott, John; Olson, Paige; Paul, Ian; Rath, Mark; Titze, Tina; Todey, Dennis; Turman, Kristi
Cc: Bartshire, Corinne
Subject: State mitigation plan comment period
Attachments: SD2014SHMP_PublicReviewFlyer_v3.pdf

State Hazard Mitigation Team,
The complete draft of the 2014 State Hazard Mitigation Plan is now available for your review. Thank you, again, for the valuable time and collaboration you put into developing this updated plan. Please download the plan from our website (**www.oem.sd.gov**) and send any additional comments / suggestions for revisions directly to our consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776 by October 18, 2013.
We would also appreciate your assistance in promoting the public review period. Attached is a flyer you may distribute throughout your agencies and to the public that you work with on a regular basis. You are also encouraged to post notifications on your agency website, Facebook, and/or Twitter feeds. The more comments, the more resilient to natural hazards the State can become. Be sure to notify Corinne Bartshire of any outreach actions you take (web postings, flyer distributions, email distributions, etc) so that she may document them in the final version of the plan.

Let us know if you have any questions. Congratulations and thank you for your help!

Jason Bauder
SD Office of Emergency Management
118 West Capitol Avenue, Pierre, SD 57501
605.773.3231 | www.oem.sd.gov

Newman, Janna

From: Bauder, Jason [Jason.Bauder@state.sd.us]
Sent: Tuesday, September 03, 2013 12:44 PM
To: 'Blankers, Lowell J NWO'; 'Behm, Randall L NWO'; 'Brooke Buchanan'; Humphrey, Jason; 'Jay Cobb'; 'Jeffrey Nettleton'; 'John.Rohlf@dot.gov'; 'Joyce Williamson'; Goeden, Kevin; Marton, Kevin; McIntosh, Kim; Schultz, Laurie (DOT); Beck, Lynn; 'Mark Anderson'; Rath, Mark; 'Mathew S. Buddie'; 'Mike Gillispie'; Prince, Nicole; Kittle, Randy; 'Richard Long'; 'Ryan Pietramali (ryan.pietramali@dhs.gov)'; Titze, Tina; 'Virginia Tsu'; 'Zien, Terry R MVP'; Macy, Marc; Marsh, Christopher
Cc: Bartshire, Corinne
Subject: State hazard mitigation plan comment period
Attachments: SD2014SHMP_PublicReviewFlyer_v3.pdf

Silver Jacket Team members,
The complete draft of the 2014 State Hazard Mitigation Plan is now available for your review. Thank you, again, for the valuable time and collaboration you put into developing this updated plan. Please download the plan from our website (www.oem.sd.gov) and send any additional comments / suggestions for revisions directly to our consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776 by October 18, 2013.

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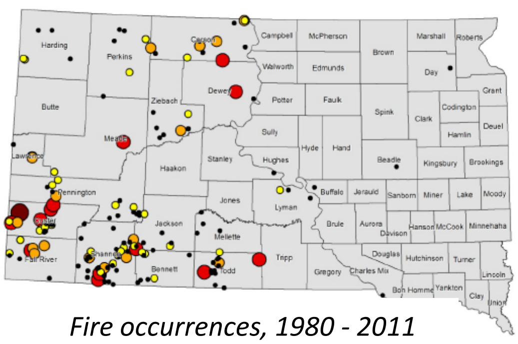
Jason Bauder
SD Office of Emergency Management
118 West Capitol Avenue, Pierre, SD 57501
605.773.3231 | www.oem.sd.gov

DRAFT 2014 State Hazard Mitigation Plan

Broken power poles due to ice storm, April 2013

South Dakota residents face natural hazard events such as severe winter storms, ice storms, and flooding on an annual basis. In the last 5 years, the State Hazard Mitigation Plan has enabled the State to receive 13 presidential disaster declarations leading to financial assistance for projects that reduce future risk such as storm shelters, drainage improvements, power line burial, and flood control.

This plan is updated every three years to maintain eligibility for the federal hazard mitigation assistance programs. **Your review of the draft plan and comments are welcome through October 18, 2013.** Please submit any comments or questions you have directly to the State's consultant: Corinne Bartshire at cbartshire@dewberry.com or 916.380.3776



Fire occurrences, 1980 - 2011

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The comprehensive mitigation strategy summarizes risk reduction progress to date and identifies ongoing and potential future activities to continue building resiliency to natural hazard events throughout the state. Your suggestions for enhancing this strategy are welcome!

Please do not hesitate to contact Nicole Prince at the Office of Emergency Management with any questions regarding the State Hazard Mitigation Plan. She can be reached at nicole.prince@state.sd.us or 605.773.2618.

Download the DRAFT 2014 State Hazard Mitigation Plan:

www.oem.sd.gov

Send your comments by October 18, 2013 to cbartshire@dewberry.com

Thank you for helping to make South Dakota a safer place to live, play, and work.

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75°F

SD SEEKS PUBLIC COMMENT ON HAZARD MITIGATION PLAN

PIERRE, S.D. (AP) - The South Dakota Office of Emergency Management is seeking public comments on its updated hazard mitigation plan, a document that identifies strategies to reduce or eliminate the risk of damage from natural disasters.

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Public comments on the draft plan can be made until Oct. 18. It is available online at www.oem.sd.gov

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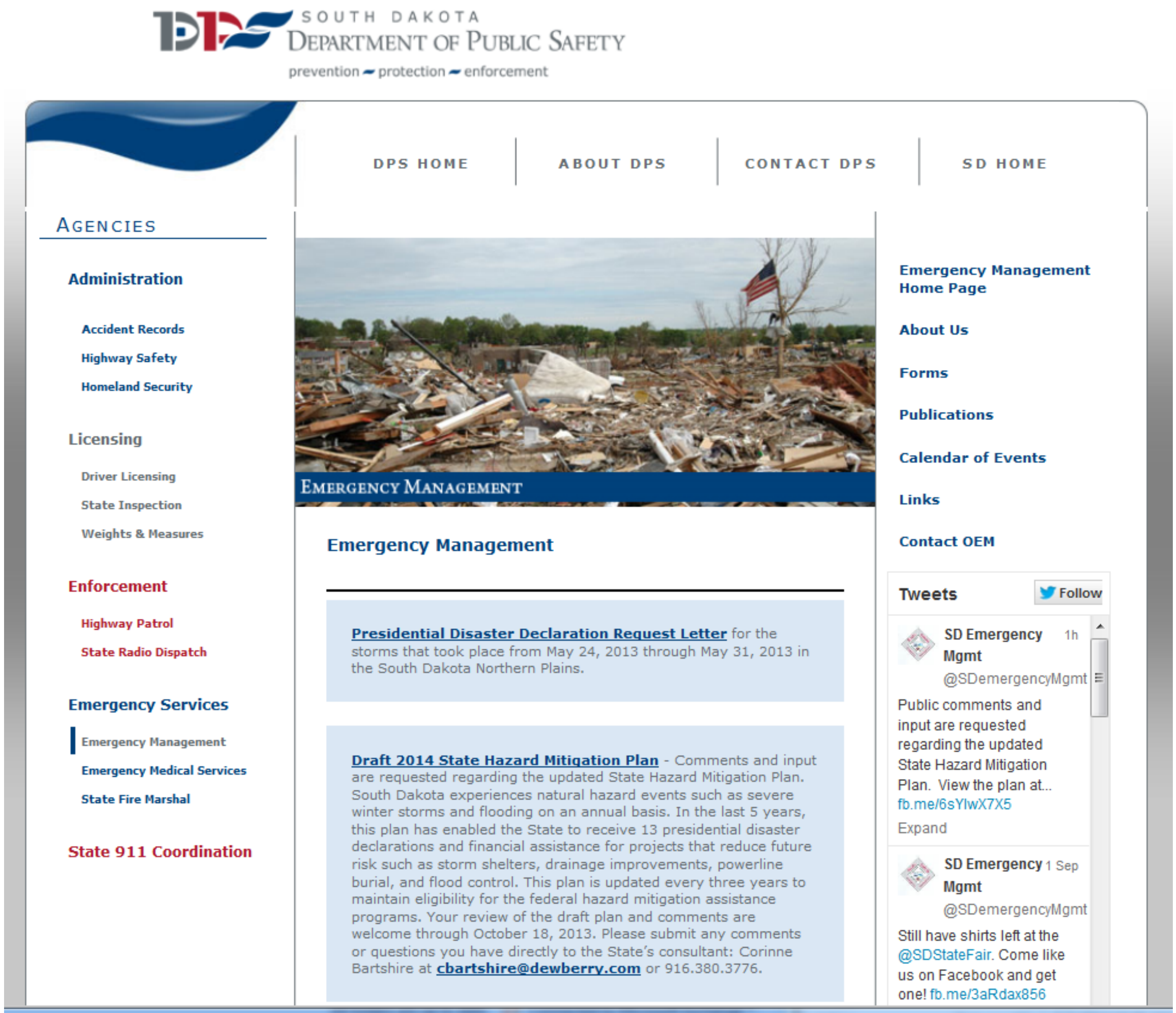

SDOEM website on September 3, 2013

SDOEM Facebook post on September 3, 2013.

SDOEM Twitter post on September 3, 2013

Appendix 3A. South Dakota Population and Growth by County

County	2011 Population	Population Change 2000-2011	Population Change (%) 2000-2011	2011 Population Density	Population Density Change (%) 2000-2011	2011 Housing Units	Housing Units Change 2000-2011	Housing Units Change (%) 2000-2011	2011 Housing Units Density	Housing Units Density Change (%) 2000-2011
Aurora	2,694	-364	-11.9%	3.8	-12.0%	1,326	28	2.2%	1.9	2.2%
Beadle	17,550	527	3.1%	13.9	3.3%	8,314	108	1.3%	6.6	1.3%
Bennett	3,441	-133	-3.7%	2.9	-3.6%	1,255	-23	-1.8%	1.1	-1.8%
Bon Homme	6,983	-277	-3.8%	12.4	-3.7%	2,913	-94	-3.1%	5.2	-3.1%
Brookings	32,226	4,006	14.2%	40.7	14.2%	13,472	1,896	16.4%	17.0	16.4%
Brown	36,822	1,362	3.8%	21.5	4.1%	16,956	1,095	6.9%	9.9	6.9%
Brule	5,283	-81	-1.5%	6.5	-1.1%	2,445	173	7.6%	3.0	7.6%
Buffalo	1,988	-44	-2.2%	4.2	-1.2%	606	4	0.7%	1.3	0.7%
Butte	10,259	1,165	12.8%	4.6	12.5%	4,671	612	15.1%	2.1	15.1%
Campbell	1,427	-355	-19.9%	1.9	-19.6%	982	20	2.1%	1.3	2.1%
Charles Mix	9,208	-142	-1.5%	8.4	-1.4%	3,832	-21	-0.5%	3.5	-0.5%
Clark	3,628	-515	-12.4%	3.8	-11.9%	1,698	-182	-9.7%	1.8	-9.7%
Clay	14,051	514	3.8%	34.1	4.0%	5,632	194	3.6%	13.7	3.6%
Codington	27,442	1,545	6.0%	39.9	5.8%	12,484	1,160	10.2%	18.1	10.2%
Corson	4,022	-159	-3.8%	1.6	-4.0%	1,532	-4	-0.3%	0.6	-0.3%
Custer	8,338	1,063	14.6%	5.4	14.5%	4,686	1,062	29.3%	3.0	29.3%
Davison	19,651	910	4.9%	45.1	4.9%	8,884	791	9.8%	20.4	9.8%
Day	5,741	-526	-8.4%	5.6	-8.0%	3,630	12	0.3%	3.5	0.3%
Deuel	4,359	-139	-3.1%	7.0	-2.8%	2,189	17	0.8%	3.5	0.8%
Dewey	5,421	-551	-9.2%	2.4	-9.4%	1,974	-159	-7.5%	0.9	-7.5%
Douglas	2,972	-486	-14.1%	6.9	-13.3%	1,431	-22	-1.5%	3.3	-1.5%
Edmunds	4,056	-311	-7.1%	3.6	-5.2%	1,968	-54	-2.7%	1.7	-2.7%
Fall River	6,981	-472	-6.3%	4.0	-5.7%	4,211	399	10.5%	2.4	10.5%
Faulk	2,367	-273	-10.3%	2.4	-8.2%	1,116	-119	-9.6%	1.1	-9.6%
Grant	7,250	-597	-7.6%	10.6	-7.3%	3,516	60	1.7%	5.2	1.7%
Gregory	4,216	-576	-12.0%	4.2	-11.3%	2,508	103	4.3%	2.5	4.3%
Haakon	1,907	-289	-13.2%	1.1	-12.2%	1,008	6	0.6%	0.6	0.6%
Hamlin	5,978	438	7.9%	11.8	7.7%	2,770	144	5.5%	5.5	5.5%

County	2011 Population	Population Change 2000-2011	Population Change (%) 2000-2011	2011 Population Density	Population Density Change (%) 2000-2011	2011 Housing Units	Housing Units Change 2000-2011	Housing Units Change (%) 2000-2011	2011 Housing Units Density	Housing Units Density Change (%) 2000-2011
Hand	3,423	-318	-8.5%	2.4	-7.8%	1,810	-30	-1.6%	1.3	-1.6%
Hanson	3,376	237	7.6%	7.8	7.1%	1,167	-51	-4.2%	2.7	-4.2%
Harding	1,269	-84	-6.2%	0.5	-5.4%	721	-83	-10.3%	0.3	-10.3%
Hughes	17,292	811	4.9%	23.3	4.8%	7,696	641	9.1%	10.4	9.1%
Hutchinson	7,257	-818	-10.1%	8.9	-10.1%	3,321	-196	-5.6%	4.1	-5.6%
Hyde	1,394	-277	-16.6%	1.6	-16.3%	698	-71	-9.2%	0.8	-9.2%
Jackson	3,169	239	8.2%	1.7	8.1%	1,188	15	1.3%	0.6	1.3%
Jerauld	2,085	-210	-9.2%	4.0	-7.9%	1,062	-105	-9.0%	2.0	-9.0%
Jones	1,003	-190	-15.9%	1.0	-15.2%	586	-28	-4.6%	0.6	-4.6%
Kingsbury	5,179	-636	-10.9%	6.2	-10.2%	2,707	-17	-0.6%	3.3	-0.6%
Lake	11,567	291	2.6%	20.5	2.9%	5,554	272	5.1%	9.9	5.1%
Lawrence	24,312	2,510	11.5%	30.4	11.7%	12,956	2,529	24.3%	16.2	24.3%
Lincoln	46,793	22,662	93.9%	81.1	91.0%	18,665	9,534	104.4%	32.3	104.4%
Lyman	3,806	-89	-2.3%	2.3	-2.7%	1,712	76	4.6%	1.0	4.6%
Marshall	4,597	21	0.5%	5.5	-31.2%	2,514	-48	-1.9%	3.0	-1.9%
McCook	5,556	-276	-4.7%	9.7	88.1%	2,493	110	4.6%	4.3	4.6%
McPherson	2,452	-452	-15.6%	2.2	-37.5%	1,425	-40	-2.7%	1.3	-2.7%
Meade	25,546	1,293	5.3%	7.4	5.5%	11,022	873	8.6%	3.2	8.6%
Mellette	2,067	-16	-0.8%	1.6	-1.1%	835	11	1.3%	0.6	1.3%
Miner	2,359	-525	-18.2%	4.1	-18.1%	1,305	-103	-7.3%	2.3	-7.3%
Minnehaha	171,752	23,471	15.8%	212.8	15.6%	72,772	12,535	20.8%	90.2	20.8%
Moody	6,475	-120	-1.8%	12.5	-1.5%	2,824	79	2.9%	5.4	2.9%
Pennington	102,815	14,250	16.1%	37.0	15.8%	45,421	8,172	21.9%	16.4	21.9%
Perkins	3,001	-362	-10.8%	1.0	-10.1%	1,717	-137	-7.4%	0.6	-7.4%
Potter	2,364	-329	-12.2%	2.7	-11.0%	1,462	-298	-16.9%	1.7	-16.9%
Roberts	10,286	270	2.7%	9.3	2.9%	4,902	168	3.5%	4.5	3.5%
Sanborn	2,392	-283	-10.6%	4.2	-10.6%	1,159	-61	-5.0%	2.0	-5.0%
Shannon	13,928	1,462	11.7%	6.7	10.9%	3,628	505	16.2%	1.7	16.2%
Spink	6,470	-984	-13.2%	4.3	-12.8%	3,107	-245	-7.3%	2.1	-7.3%
Stanley	3,022	250	9.0%	2.1	8.8%	1,387	110	8.6%	1.0	8.6%
Sully	1,375	-181	-11.6%	1.4	-11.2%	843	-1	-0.1%	0.8	-0.1%

County	2011 Population	Population Change 2000-2011	Population Change (%) 2000-2011	2011 Population Density	Population Density Change (%) 2000-2011	2011 Housing Units	Housing Units Change 2000-2011	Housing Units Change (%) 2000-2011	2011 Housing Units Density	Housing Units Density Change (%) 2000-2011
Todd	9,822	772	8.5%	7.1	8.1%	3,162	396	14.3%	2.3	14.3%
Tripp	5,615	-815	-12.7%	3.5	-12.0%	3,065	29	1.0%	1.9	1.0%
Turner	8,332	-517	-5.8%	13.5	-5.9%	3,951	99	2.6%	6.4	2.6%
Union	14,651	2,067	16.4%	31.8	16.3%	6,362	1,017	19.0%	13.8	19.0%
Walworth	5,575	-399	-6.7%	7.9	-6.0%	2,978	-166	-5.3%	4.2	-5.3%
Yankton	22,612	960	4.4%	43.4	4.7%	9,690	850	9.6%	18.6	9.6%
Ziebach	2,852	333	13.2%	1.5	15.3%	994	115	13.1%	0.5	13.1%

Source: U.S. Census Bureau

Appendix 3B. HAZUS 100 Year Flood Summary Detail

County Name	Population	Building Damage Count	Building Damage Loss ($K)	Building Exposure ($K)	Percent Building Damage	Contents Damage Loss ($K)	Contents Exposure ($K)	Percent Contents Loss	Total Direct Econ Bldg Loss ($K)	Per Capita Loss ($)	Short Term Shelter Needs	Displaced Population
Aurora	2,867	17	3,914	192,008	2.0%	5,561	124,059	4.5%	10,125	3,532	101	481
Beadle	15,878	6	3,673	1,140,956	0.3%	6,000	785,184	0.8%	10,393	655	64	387
Bennett	3,393	0	1,165	121,952	1.0%	1,808	77,157	2.3%	3,145	927	2	71
Bon Homme	7,079	7	1,815	439,005	0.4%	1,870	289,434	48.9%	3,828	541	37	117
Brookings	29,668	7	4,563	1,762,160	0.3%	9,953	1,183,412	0.8%	15,476	522	383	943
Brown	35,154	71	16,502	2,361,052	0.7%	22,083	1,615,566	1.4%	40,502	1,152	854	1,785
Brule	5,205	1	1,423	359,042	0.4%	1,813	242,365	0.7%	3,498	672	19	151
Buffalo	2,142	1	645	59,844	1.1%	631	41,010	1.5%	1,347	629	30	79
Butte	9,593	24	9,890	424,525	2.3%	10,891	273,830	4.0%	21,428	2,234	271	892
Campbell	1,352	37	3,393	106,582	3.2%	5,017	71,024	7.1%	8,813	6,518	124	383
Charles Mix	8,906	4	4,020	542,879	0.7%	5,337	385,775	1.4%	9,842	1,105	46	232
Clark	3,436	2	1,208	253,750	0.5%	1,880	172,779	1.1%	3,328	969	45	159
Clay	13,605	18	2,952	787,934	0.4%	2,268	498,107	0.5%	5,327	392	88	248
Codington	26,317	221	28,917	1,684,272	1.7%	48,403	1,230,471	3.9%	81,843	3,110	2,301	3,027
Corson	4,136	16	2,089	137,273	1.5%	1,711	88,402	1.9%	3,894	941	285	446
Custer	7,811	6	5,092	462,408	1.1%	10,476	282,818	3.7%	16,746	2,144	44	257
Davison	18,931	24	6,417	1,159,549	0.6%	6,297	772,127	0.8%	13,185	696	216	530
Day	5,526	5	1,649	484,855	0.3%	1,386	307,022	0.5%	3,187	577	10	157
Deuel	4,276	2	1,386	287,842	0.5%	2,256	184,891	1.2%	3,922	917	34	154
Dewey	5,931	3	1,532	185,425	0.8%	981	115,356	0.9%	2,557	431	31	166
Douglas	2,945	5	984	191,287	0.5%	1,163	136,333	0.9%	2,342	795	14	152
Edmunds	4,034	30	2,718	274,727	1.0%	2,526	177,453	1.4%	5,461	1,354	156	293
Fall River	7,145	92	14,007	434,042	3.2%	20,735	275,507	7.5%	36,379	5,092	250	525
Faulk	2,255	4	1,275	162,503	0.8%	1,592	111,483	1.4%	3,056	1,355	94	179
Grant	7,101	22	4,422	488,046	0.9%	4,652	322,886	1.4%	9,592	1,351	97	415

County Name	Population	Building Damage Count	Building Damage Loss ($K)	Building Exposure ($K)	Percent Building Damage	Contents Damage Loss ($K)	Contents Exposure ($K)	Percent Contents Loss	Total Direct Econ Bldg Loss ($K)	Per Capita Loss ($)	Short Term Shelter Needs	Displaced Population
Gregory	4,084	0	474	277,213	0.2%	254	186,244	0.1%	731	179	-	44
Haakon	1,819	13	3,761	146,783	2.6%	5,756	109,343	5.3%	10,151	5,581	78	303
Hamlin	5,660	18	5,398	388,992	1.4%	9,963	250,564	4.0%	16,441	2,905	31	387
Hand	3,274	9	2,083	296,103	0.7%	1,931	202,183	1.0%	4,161	1,271	39	197
Hanson	3,609	0	1,368	175,231	0.8%	1,029	111,737	0.9%	2,473	685	3	94
Harding	1,145	0	504	82,331	0.6%	516	54,129	1.0%	1,045	913	2	43
Hughes	16,746	7	3,195	1,124,701	0.3%	5,319	780,813	0.7%	8,871	530	297	611
Hutchinson	7,250	29	5,799	503,541	1.2%	9,436	358,305	2.6%	16,001	2,207	646	957
Hyde	1,424	0	292	104,891	0.3%	370	71,114	0.5%	709	498	-	39
Jackson	2,711	0	702	117,513	0.6%	723	75,716	1.0%	1,445	533	3	69
Jerauld	1,982	0	591	173,814	0.3%	833	120,597	0.7%	1,534	774	8	77
Jones	1,024	1	288	70,695	0.4%	243	48,339	0.5%	551	538	-	17
Kingsbury	5,394	0	1,366	397,000	0.3%	2,080	265,171	0.8%	3,672	681	48	281
Lake	11,693	72	8,740	802,854	1.1%	11,306	543,394	2.1%	20,840	1,782	664	1,128
Lawrence	23,524	72	20,631	1,420,311	1.5%	28,237	943,068	3.0%	50,103	2,130	504	979
Lincoln	39,713	26	7,275	1,526,898	0.5%	6,826	1,004,113	0.7%	14,514	365	210	524
Lyman	3,811	13	3,267	210,965	1.5%	3,329	142,040	2.3%	6,876	1,804	38	145
Marshall	4,320	0	1,062	345,298	0.3%	1,052	224,483	0.5%	2,223	515	7	143
McCook	5,671	18	3,257	374,493	0.9%	2,680	242,410	1.1%	6,096	1,075	65	252
McPherson	2,480	0	628	186,748	0.3%	815	131,351	0.6%	1,545	623	4	95
Meade	23,989	8	4,808	1,269,102	0.4%	6,458	789,678	0.8%	11,765	490	106	469
Mellette	1,982	14	1,501	79,167	1.9%	817	50,927	1.6%	2,331	1,176	109	223
Miner	2,435	9	1,527	180,686	0.8%	1,685	119,490	1.4%	3,363	1,381	66	159
Minnehaha	179,180	719	162,527	10,171,077	1.6%	252,358	7,016,387	3.6%	432,484	2,414	6,159	7,482
Moody	6,414	2	2,072	392,198	0.5%	1,949	248,960	0.8%	4,220	658	9	216
Pennington	98,533	88	13,624	5,606,639	0.2%	14,685	3,848,985	0.4%	29,402	298	724	1,379
Perkins	2,900	0	1,293	210,653	0.6%	982	145,019	0.7%	2,339	807	-	76

County Name	Population	Building Damage Count	Building Damage Loss ($K)	Building Exposure ($K)	Percent Building Damage	Contents Damage Loss ($K)	Contents Exposure ($K)	Percent Contents Loss	Total Direct Econ Bldg Loss ($K)	Per Capita Loss ($)	Short Term Shelter Needs	Displaced Population
Potter	2,123	0	537	255,587	0.2%	781	204,883	0.4%	1,416	667	1	44
Roberts	9,851	8	2,903	612,941	0.5%	3,991	401,423	1.0%	7,273	738	36	320
Sanborn	2,447	0	1,121	166,987	0.7%	1,121	107,751	1.0%	2,400	981	3	142
Shannon	13,637	34	8,180	321,592	2.5%	11,173	218,211	5.1%	20,430	1,498	492	1,214
Spink	6,664	15	6,474	484,402	1.3%	7,554	312,052	2.4%	14,644	2,197	217	572
Stanley	2,703	131	14,974	162,796	9.2%	11,356	103,953	10.9%	26,644	9,857	340	666
Sully	1,356	0	502	114,641	0.4%	456	74,970	0.6%	1,016	749	1	42
Todd	10,167	9	2,227	277,272	0.8%	3,458	185,432	1.9%	5,723	563	105	314
Tripp	5,681	31	3,470	392,821	0.9%	3,446	274,410	1.3%	7,248	1,276	86	265
Turner	8,366	12	5,659	606,311	0.9%	7,748	409,118	1.9%	14,191	1,696	39	391
Union	14,131	867	119,836	1,031,826	11.6%	203,473	800,039	25.4%	349,991	24,768	3,451	4,428
Walworth	5,238	0	780	393,371	0.2%	786	263,677	0.3%	1,632	312	-	63
Yankton	21,835	713	81,492	1,464,392	5.6%	105,103	1,081,598	9.7%	193,250	8,850	2,614	3,328
Ziebach	2,542	8	1,403	66,932	2.1%	749	39,623	1.9%	2,158	849	75	191
TOTAL	**804,194**	**3,571**	**633,242**	**47,491,686**	**1.3%**	**910,117**	**32,326,151**	**3%**	**1,623,118**	**126,423**	**22,876**	**40,598**

Source: HAZUS-MH MR4

Appendix 3C. South Dakota Flood Insurance Policies and Losses by County

County	# of Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Aurora	9	$548,800	$3,777	0	$0
Beadle	19	$3,680,100	$9,777	21	$327,076
Bon Homme	4	$700,000	$1,261	0	$0
Brookings	204	$24,926,400	$142,972	80	$803,195
Brown	427	$79,706,800	$321,675	482	$3,284,315
Brule	4	$1,285,000	$2,833	2	$142,021
Butte	67	$6,777,200	$34,629	12	$11,834
Charles Mix	9	$577,200	$4,057	4	$265,077
Clark	13	$1,624,200	$5,277	11	$184,850
Clay	24	$5,865,500	$8,402	12	$45,954
Codington	704	$117,001,800	$441,127	425	$5,749,018
Corson	1	$200,000	$902	0	$0
Custer	106	$15,885,700	$64,658	41	$560,642
Davison	48	$7,181,700	$27,824	13	$85,072
Day	49	$7,839,800	$47,638	252	$3,860,321
Deuel	1	$47,000	$401	1	$3,758
Douglas	5	$443,000	$3,266	1	$520
Edmunds	7	$1,855,000	$2,544	4	$2,980
Fall River	24	$2,616,900	$13,409	1	$25
Faulk	1	$350,000	$405	2	$5,206
Grant	40	$5,574,900	$33,499	24	$206,990
Gregory	3	$350,000	$798	2	$161,998
Haakon	18	$1,701,800	$13,949	2	$0
Hamlin	104	$21,926,700	$48,686	345	$4,187,791
Hand	6,	$1,598,300	$3,060	3	$76,119
Hanson	7	$870,100	$5,377	3	$30,480
Hughes	95	$21,453,000	$79,333	80	$666,910
Hutchinson	19	$1,861,000	$10,589	9	$95,129

County	# of Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Hyde	0	$0	$0	1	$0
Jerauld	1	$350,000	$405	0	$0
Kingsbury	6	$902,000	$5,537	33	$365,002
Lake	220	$35,348,100	$125,397	152	$1,419,607
Lawrence	244	$42,363,200	$214,666	36	$235,036
Lincoln	1,368	$365,609,300	$1,209,959	118	$1,961,278
Lyman	8	$736,700	$13,414	3	$117,254
Marshall	9	$2,020,000	$3,449	11	$144,192
McCook	30	$4,505,900	$18,848	11	$41,756
Meade	151	$22,490,700	$129,781	14	$25,523
Miner	1	$350,000	$365	0	$0
Minnehaha	1,416	$360,469,000	$1,234,734	235	$2,518,709
Moody	35	$3,904,700	$27,146	58	$455,782
Pennington	484	$91,303,400	$483,449	97	$209,427
Potter	1	$28,000	$154	0	$0
Roberts	70	$11,207,700	$44,454	58	$584,782
Sanborn	9	$1,873,000	$11,518	14	$46,953
Spink	48	$7,906,100	$31,737	69	$921,480
Stanley	147	$37,169,000	$114,219	110	$2,444,199
Sully	3	$910,000	$1,113	5	$22,793
Todd	7	$817,100	$4,415	2	$1,362
Turner	18	$1,521,400	$10,198	12	$77,189
Union	518	$159,709,000	$310,108	394	$4,311,300
Yankton	101	$19,270,300	$57,243	48	$353,891
Ziebach	1	$210,000	$343	3	$3,427
State Total:	**6,914**	**$1,505,422,500**	**$5,384,736**	**3,316**	**$37,018,223**

Source: FEMA NFIP Policy and Claims Report for South Dakota; produced November 20, 2012.

Appendix 3D. South Dakota Winter Storm Vulnerability

County	2012 Total Events	2012 Prior Event Rating	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Population Density Rating	Total Vulnerability	Winter Storm Vulnerability
Aurora	78	7	$312,437	1	2,093.90	3.8	1	9	Moderate
Beadle	78	7	$1,916,945	2	1,503.93	13.9	1	10	Moderate
Bennett	46	3	$195,828	1	1,184.71	2.9	1	5	Moderate
Bon Homme	78	7	$721,858	1	1,444.43	12.4	1	9	Moderate
Brookings	85	8	$2,935,763	2	521.16	40.7	2	12	High
Brown	65	5	$3,962,092	3	860.52	21.5	1	9	Moderate
Brule	76	7	$596,509	1	1,101.04	6.5	1	9	Moderate
Buffalo	46	3	$100,061	1	563.70	4.2	1	5	Moderate
Butte	75	7	$695,462	1	861.14	4.6	1	9	Moderate
Campbell	51	3	$174,844	1	1,097.49	1.9	1	5	Moderate
Charles Mix	74	7	$920,018	1	1,307.31	8.4	1	9	Moderate
Clark	59	4	$421,929	1	681.46	3.8	1	6	Moderate
Clay	57	4	$1,281,351	1	1,125.96	34.1	2	7	Moderate
Codington	58	4	$2,906,193	2	981.75	39.9	2	8	Moderate
Corson	54	4	$221,122	1	1,557.00	1.6	1	6	Moderate
Custer	32	1	$742,459	1	1,712.98	5.4	1	3	Moderate
Davison	74	7	$1,924,360	2	570.31	45.1	3	12	High
Day	67	6	$786,332	1	1,863.91	5.6	1	8	Moderate
Deul	60	5	$467,637	1	1,014.96	7.0	1	7	Moderate
Dewey	56	4	$297,636	1	2,302.49	2.4	1	6	Moderate
Douglas	63	5	$324,852	1	2,671.37	6.9	1	7	Moderate
Edmunds	71	6	$448,245	1	1,641.94	3.6	1	8	Moderate
Fall River	45	2	$705,774	1	708.43	4.0	1	4	Moderate
Faulk	64	5	$270,522	1	741.56	2.4	1	7	Moderate
Grant	68	6	$803,906	1	832.24	10.6	1	8	Moderate
Gregory	67	6	$456,957	1	526.23	4.2	1	8	Moderate

County	2012 Total Events	2012 Prior Event Rating	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Population Density Rating	Total Vulnerability	Winter Storm Vulnerability
Haakon	47	3	$254,858	1	792.21	1.1	1	5	Moderate
Hamlin	57	4	$634,202	1	1,739.92	11.8	1	6	Moderate
Hand	60	5	$493,566	1	1,810.53	2.4	1	7	Moderate
Hanson	78	7	$283,877	1	1,006.82	7.8	1	9	Moderate
Harding	73	6	$135,105	1	838.07	0.5	1	8	Moderate
Hughes	52	3	$1,902,172	2	412.19	23.3	2	7	Moderate
Hutchinson	80	7	$856,109	1	708.63	8.9	1	9	Moderate
Hyde	51	3	$173,924	1	957.60	1.6	1	5	Moderate
Jackson	50	3	$191,703	1	733.68	1.7	1	5	Moderate
Jerauld	73	6	$291,140	1	574.20	4.0	1	8	Moderate
Jones	49	3	$117,580	1	471.38	1.0	1	5	Moderate
Kingsbury	73	6	$656,453	1	1,136.64	6.2	1	8	Moderate
Lake	79	7	$1,341,795	1	1,388.56	20.5	1	9	Moderate
Lawrence*	55	4	$2,359,878	2	435.56	30.4	2	8	Moderate
Lincoln	74	7	$2,523,166	2	519.39	81.1	4	13	High
Lyman	53	4	$349,785	1	2,469.69	2.3	1	6	Moderate
Marshall	74	7	$564,043	1	2,870.48	5.5	1	9	Moderate
McCook	79	7	$612,248	1	1,612.45	9.7	1	9	Moderate
McPherson	61	5	$314,202	1	1,436.61	2.2	1	7	Moderate
Meade	99	10	$2,055,433	2	807.15	7.4	1	13	High
Mellette	41	2	$127,367	1	577.28	1.6	1	4	Moderate
Miner	73	6	$297,868	1	3,470.98	4.1	1	8	Moderate
Minnehaha	87	8	$17,168,013	10	1,961.27	212.8	10	28	Very High
Moody	70	6	$635,480	1	563.28	12.5	1	8	Moderate
Pennington	55	4	$9,445,117	6	1,027.87	37.0	2	12	High
Perkins	64	5	$351,552	1	812.90	1.0	1	7	Moderate
Potter	56	4	$456,830	1	431.80	2.7	1	6	Moderate
Roberts	79	7	$1,005,396	1	460.54	9.3	1	9	Moderate

County	2012 Total Events	2012 Prior Event Rating	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Population Density Rating	Total Vulnerability	Winter Storm Vulnerability
Sanborn	61	5	$269,355	1	434.51	4.2	1	7	Moderate
Shannon	45	2	$537,295	1	1,258.71	6.7	1	4	Moderate
Spink	67	6	$788,639	1	969.68	4.3	1	8	Moderate
Stanley	44	2	$266,209	1	617.06	2.1	1	4	Moderate
Sully	52	3	$187,729	1	688.50	1.4	1	5	Moderate
Todd	42	2	$460,277	1	2,776.55	7.1	1	4	Moderate
Tripp	47	3	$658,946	1	817.24	3.5	1	5	Moderate
Turner	77	7	$1,007,884	1	569.32	13.5	1	9	Moderate
Union	60	5	$1,827,003	2	507.23	31.8	2	9	Moderate
Walworth	55	4	$650,420	1	622.69	7.9	1	6	Moderate
Yankton	70	6	$2,540,290	2	800.04	43.4	3	11	Moderate
Ziebach	49	3	$104,699	1	2,249.90	1.5	1	5	Moderate

Source: U.S. Census Bureau (2010), 2011 American Community Survey estimates, National Climatic Data Center Storm Events Database, HAZUS-MH MR4

*The NCDC database reflects no documented ice and snow events for Lawrence County. However, there are thirteen recorded events listed as impacting either all of the state, the Black Hills region, or the western part of the State which, presumably, includes this county. In addition, there are eleven events not counted above that impacted the three counties surrounding Lawrence, so it would be reasonable to assume Lawrence was also impacted. As such, 55 events are recorded for this county.

Appendix 3E. South Dakota Tornado Vulnerability

County	2012 Total Events	2012 Prior Event Rating	Total Damages	Total Damages Rating	2012 Prior Events ≥F1	2012 Prior Event Rating ≥F1	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Pop. Density Rating	Total Vuln.	Tornado Vuln.	Total Vuln. ≥F1	Tornado Vuln. ≥F1
Aurora	13	2	$513,026	1	4	2	$312,437	1	2,093.90	3.8	1	5	Moderate	5	Moderate
Beadle	32	5	$21,846,842	2	16	6	$1,916,945	2	1,503.93	13.9	1	10	Moderate	11	Moderate
Bennett	23	4	$3,231,730	1	10	4	$195,828	1	1,184.71	2.9	1	7	Moderate	7	Moderate
Bon Homme	23	4	$4,922,708	1	15	6	$721,858	1	1,444.43	12.4	1	7	Moderate	9	Moderate
Brookings	24	4	$4,941,762	1	10	4	$2,935,763	2	521.16	40.7	2	9	Moderate	9	Moderate
Brown	77	10	$14,326,236	1	29	10	$3,962,092	3	860.52	21.5	1	15	High	15	High
Brule	27	4	$12,031,035	1	12	5	$596,509	1	1,101.04	6.5	1	7	Moderate	8	Moderate
Buffalo	13	2	$40,991,510	3	3	2	$100,061	1	563.70	4.2	1	7	Moderate	7	Moderate
Butte	14	2	$2,083,622	1	10	4	$695,462	1	861.14	4.6	1	5	Moderate	7	Moderate
Campbell	12	2	$3,142,331	1	8	3	$174,844	1	1,097.49	1.9	1	5	Moderate	6	Moderate
Charles Mix	42	6	$8,485,126	1	25	9	$920,018	1	1,307.31	8.4	1	9	Moderate	12	Moderate
Clark	26	4	$11,402,416	1	16	6	$421,929	1	681.46	3.8	1	7	Moderate	9	Moderate
Clay	30	4	$5,032,445	1	14	5	$1,281,351	1	1,125.96	34.1	2	8	Moderate	9	Moderate
Codington	29	4	$21,527,349	2	10	4	$2,906,193	2	981.75	39.9	2	10	Moderate	10	Moderate
Corson	22	3	$2,178,746	1	4	2	$221,122	1	1,557.00	1.6	1	6	Moderate	5	Moderate
Custer	10	2	$380,726	1	9	4	$742,459	1	1,712.98	5.4	1	5	Moderate	7	Moderate
Davison	24	4	$20,572,249	2	13	5	$1,924,360	2	570.31	45.1	3	11	Moderate	12	Moderate
Day	22	3	$8,213,528	1	7	3	$786,332	1	1,863.91	5.6	1	6	Moderate	6	Moderate
Deuel	18	3	$189,694	1	7	3	$467,637	1	1,014.96	7.0	1	6	Moderate	6	Moderate
Dewey	26	4	$561,240	1	8	3	$297,636	1	2,302.49	2.4	1	7	Moderate	6	Moderate
Douglas	24	4	$1,820,104	1	8	3	$324,852	1	2,671.37	6.9	1	7	Moderate	6	Moderate
Edmunds	18	3	$140,885	1	7	3	$448,245	1	1,641.94	3.6	1	6	Moderate	6	Moderate
Fall River	29	4	$2,382,926	1	15	6	$705,774	1	708.43	4.0	1	7	Moderate	9	Moderate
Faulk	15	3	$454,717	1	8	3	$270,522	1	741.56	2.4	1	6	Moderate	6	Moderate

County	2012 Total Events	2012 Prior Event Rating	Total Damages	Total Damages Rating	2012 Prior Events ≥F1	2012 Prior Event Rating ≥F1	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Pop. Density Rating	Total Vuln.	Tornado Vuln.	Total Vuln. ≥F1	Tornado Vuln. ≥F1
Grant	17	3	$867,345	1	8	3	$803,906	1	832.24	10.6	1	6	Moderate	6	Moderate
Gregory	22	3	$22,208,895	2	9	4	$456,957	1	526.23	4.2	1	7	Moderate	8	Moderate
Haakon	21	3	$931,208	1	12	5	$254,858	1	792.21	1.1	1	6	Moderate	8	Moderate
Hamlin	17	3	$773,837	1	7	3	$634,202	1	1,739.92	11.8	1	6	Moderate	6	Moderate
Hand	29	4	$19,966,516	2	13	5	$493,566	1	1,810.53	2.4	1	8	Moderate	9	Moderate
Hanson	18	3	$2,019,246	1	11	4	$283,877	1	1,006.82	7.8	1	6	Moderate	7	Moderate
Harding	17	3	$224,586	1	6	3	$135,105	1	838.07	0.5	1	6	Moderate	6	Moderate
Hughes	12	2	$13,075,448	1	6	3	$1,902,172	2	412.19	23.3	2	7	Moderate	8	Moderate
Hutchinson	42	6	$1,997,638	1	20	7	$856,109	1	708.63	8.9	1	9	Moderate	10	Moderate
Hyde	10	2	$270,857	1	2	1	$173,924	1	957.60	1.6	1	5	Moderate	4	Moderate
Jackson	19	3	$682,019	1	11	4	$191,703	1	733.68	1.7	1	6	Moderate	7	Moderate
Jerauld	8	2	$118,852	1	2	1	$291,140	1	574.20	4.0	1	5	Moderate	4	Moderate
Jones	6	1	$142,378	1	3	2	$117,580	1	471.38	1.0	1	4	Moderate	5	Moderate
Kingsbury	39	6	$12,048,831	1	16	6	$656,453	1	1,136.64	6.2	1	9	Moderate	9	Moderate
Lake	20	3	$5,907,212	1	13	5	$1,341,795	1	1,388.56	20.5	1	6	Moderate	8	Moderate
Lawrence	16	3	$2,017,929	1	10	4	$2,359,878	2	435.56	30.4	2	8	Moderate	9	Moderate
Lincoln	50	7	$157,514,376	10	21	8	$2,523,166	2	519.39	81.1	4	23	High	24	High
Lyman	36	5	$728,615	1	16	6	$349,785	1	2,469.69	2.3	1	8	Moderate	9	Moderate
Marshall	16	3	$4,530,233	1	9	4	$564,043	1	2,870.48	5.5	1	6	Moderate	7	Moderate
McCook	39	6	$44,441,499	3	23	8	$612,248	1	1,612.45	9.7	1	11	Moderate	13	Moderate
McPherson	21	3	$13,099,466	1	11	4	$314,202	1	1,436.61	2.2	1	6	Moderate	7	Moderate
Meade	38	5	$6,765,296	1	20	7	$2,055,433	2	807.15	7.4	1	9	Moderate	11	Moderate
Mellette	12	2	$1,343,958	1	4	2	$127,367	1	577.28	1.6	1	5	Moderate	5	Moderate
Miner	29	4	$5,017,096	1	16	6	$297,868	1	3,470.98	4.1	1	7	Moderate	9	Moderate
Minnehaha	38	5	$27,489,456	2	21	8	$17,168,013	10	1,961.27	212.8	10	27	High	30	Very High
Moody	10	2	$827,037	1	6	3	$635,480	1	563.28	12.5	1	5	Moderate	6	Moderate

County	2012 Total Events	2012 Prior Event Rating	Total Damages	Total Damages Rating	2012 Prior Events ≥F1	2012 Prior Event Rating ≥F1	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Pop. Density Rating	Total Vuln.	Tornado Vuln.	Total Vuln. ≥F1	Tornado Vuln. ≥F1
Pennington	42	6	$18,089,266	2	17	6	$9,445,117	6	1,027.87	37.0	2	16	High	16	High
Perkins	34	5	$2,530,977	1	15	6	$351,552	1	812.90	1.0	1	8	Moderate	9	Moderate
Potter	20	3	$8,462,831	1	12	5	$456,830	1	431.80	2.7	1	6	Moderate	8	Moderate
Roberts	23	4	$9,488,190	1	15	6	$1,005,396	1	460.54	9.3	1	7	Moderate	9	Moderate
Sanborn	21	3	$1,049,842	1	9	4	$269,355	1	434.51	4.2	1	6	Moderate	7	Moderate
Shannon	20	3	$4,926,733	1	10	4	$537,295	1	1,258.71	6.7	1	6	Moderate	7	Moderate
Spink	37	5	$1,245,846	1	13	5	$788,639	1	969.68	4.3	1	8	Moderate	8	Moderate
Stanley	21	3	$378,946	1	11	4	$266,209	1	617.06	2.1	1	6	Moderate	7	Moderate
Sully	20	3	$320,096	1	8	3	$187,729	1	688.50	1.4	1	6	Moderate	6	Moderate
Todd	36	5	$2,248,569	1	11	4	$460,277	1	2,776.55	7.1	1	8	Moderate	7	Moderate
Tripp	30	4	$18,830,914	2	15	6	$658,946	1	817.24	3.5	1	8	Moderate	10	Moderate
Turner	42	6	$51,471,078	4	22	8	$1,007,884	1	569.32	13.5	1	12	Moderate	14	High
Union	42	6	$4,560,606	1	14	5	$1,827,003	2	507.23	31.8	2	11	Moderate	10	Moderate
Walworth	23	4	$3,350,528	1	12	5	$650,420	1	622.69	7.9	1	7	Moderate	8	Moderate
Yankton	27	4	$28,935,743	2	15	6	$2,540,290	2	800.04	43.4	3	11	Moderate	13	Moderate
Ziebach	22	3	$1,671,568	1	8	3	$104,699	1	2,249.90	1.5	1	6	Moderate	6	Moderate
			$693,944,511				**$79,488,700**								

Source: U.S. Census Bureau (2010), 2011 American Community Survey estimates, National Climatic Data Center Storm Events Database, HAZUS-MH MR4

Appendix 3F. South Dakota Wind Vulnerability

County	2012 Total Events	2012 Prior Event Rating	2012 Total Events >70kts	2012 Prior Event Rating >70kts	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Pop. Density Rating	Total Vuln.	Windstorm Vulnerability	Total Vuln. >70kts	Windstorm Vulnerability >70 knots
Aurora	65	1	26	4	$312,437	1	2,093.90	3.8	1	3	Moderate	6	Moderate
Beadle	207	5	53	8	$1,916,945	2	1,503.93	13.9	1	8	Moderate	11	Moderate
Bennett	95	2	16	2	$195,828	1	1,184.71	2.9	1	4	Moderate	4	Moderate
Bon Homme	94	2	33	5	$721,858	1	1,444.43	12.4	1	4	Moderate	7	Moderate
Brookings	128	3	50	7	$2,935,763	2	521.16	40.7	2	7	Moderate	11	Moderate
Brown	243	6	30	4	$3,962,092	3	860.52	21.5	1	10	Moderate	8	Moderate
Brule	114	2	20	3	$596,509	1	1,101.04	6.5	1	4	Moderate	5	Moderate
Buffalo	68	1	7	1	$100,061	1	563.70	4.2	1	3	Moderate	3	Moderate
Butte	228	5	45	7	$695,462	1	861.14	4.6	1	7	Moderate	9	Moderate
Campbell	89	2	9	1	$174,844	1	1,097.49	1.9	1	4	Moderate	3	Moderate
Charles Mix	128	3	43	6	$920,018	1	1,307.31	8.4	1	5	Moderate	8	Moderate
Clark	88	2	16	2	$421,929	1	681.46	3.8	1	4	Moderate	4	Moderate
Clay	98	2	34	5	$1,281,351	1	1,125.96	34.1	2	5	Moderate	8	Moderate
Codington	128	3	17	2	$2,906,193	2	981.75	39.9	2	7	Moderate	6	Moderate
Corson	175	4	20	3	$221,122	1	1,557.00	1.6	1	6	Moderate	5	Moderate
Custer	171	4	23	3	$742,459	1	1,712.98	5.4	1	6	Moderate	5	Moderate
Davison	150	3	36	5	$1,924,360	2	570.31	45.1	3	8	Moderate	10	Moderate
Day	124	3	33	5	$786,332	1	1,863.91	5.6	1	5	Moderate	7	Moderate
Deuel	83	1	10	1	$467,637	1	1,014.96	7.0	1	3	Moderate	3	Moderate
Dewey	124	3	23	3	$297,636	1	2,302.49	2.4	1	5	Moderate	5	Moderate
Douglas	56	1	19	3	$324,852	1	2,671.37	6.9	1	3	Moderate	5	Moderate
Edmunds	134	3	16	2	$448,245	1	1,641.94	3.6	1	5	Moderate	4	Moderate
Fall River	106	2	22	3	$705,774	1	708.43	4.0	1	4	Moderate	5	Moderate
Faulk	100	2	19	3	$270,522	1	741.56	2.4	1	4	Moderate	5	Moderate

County	2012 Total Events	2012 Prior Event Rating	2012 Total Events >70kts	2012 Prior Event Rating >70kts	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Pop. Density Rating	Total Vuln.	Windstorm Vulnerability	Total Vuln. >70kts	Windstorm Vulnerability >70 knots
Grant	69	1	12	2	$803,906	1	832.24	10.6	1	3	Moderate	4	Moderate
Gregory	70	1	22	3	$456,957	1	526.23	4.2	1	3	Moderate	5	Moderate
Haakon	188	4	33	5	$254,858	1	792.21	1.1	1	6	Moderate	7	Moderate
Hamlin	72	1	18	2	$634,202	1	1,739.92	11.8	1	3	Moderate	4	Moderate
Hand	107	2	7	1	$493,566	1	1,810.53	2.4	1	4	Moderate	3	Moderate
Hanson	75	1	27	4	$283,877	1	1,006.82	7.8	1	3	Moderate	6	Moderate
Harding	265	6	38	5	$135,105	1	838.07	0.5	1	8	Moderate	7	Moderate
Hughes	189	4	30	4	$1,902,172	2	412.19	23.3	2	8	Moderate	8	Moderate
Hutchinson	99	2	34	5	$856,109	1	708.63	8.9	1	4	Moderate	7	Moderate
Hyde	73	1	6	1	$173,924	1	957.60	1.6	1	3	Moderate	3	Moderate
Jackson	159	3	36	5	$191,703	1	733.68	1.7	1	5	Moderate	7	Moderate
Jerauld	64	1	23	3	$291,140	1	574.20	4.0	1	3	Moderate	5	Moderate
Jones	79	1	6	1	$117,580	1	471.38	1.0	1	3	Moderate	3	Moderate
Kingsbury	105	2	37	5	$656,453	1	1,136.64	6.2	1	4	Moderate	7	Moderate
Lake	115	2	44	6	$1,341,795	1	1,388.56	20.5	1	4	Moderate	8	Moderate
Lawrence	46	1	6	1	$2,359,878	2	435.56	30.4	2	5	Moderate	5	Moderate
Lincoln	135	3	44	6	$2,523,166	2	519.39	81.1	4	9	Moderate	12	High
Lyman	149	3	15	2	$349,785	1	2,469.69	2.3	1	5	Moderate	4	Moderate
Marshall	91	2	18	2	$564,043	1	2,870.48	5.5	1	4	Moderate	4	Moderate
McCook	95	2	37	5	$612,248	1	1,612.45	9.7	1	4	Moderate	7	Moderate
McPherson	79	1	9	1	$314,202	1	1,436.61	2.2	1	3	Moderate	3	Moderate
Meade	429	10	71	10	$2,055,433	2	807.15	7.4	1	13	High	13	High
Mellette	85	2	17	2	$127,367	1	577.28	1.6	1	4	Moderate	4	Moderate
Miner	75	1	26	4	$297,868	1	3,470.98	4.1	1	3	Moderate	6	Moderate
Minnehaha	251	6	66	10	$17,168,013	10	1,961.27	212.8	10	26	Very High	30	Very High
Moody	72	1	32	5	$635,480	1	563.28	12.5	1	3	Moderate	7	Moderate

County	2012 Total Events	2012 Prior Event Rating	2012 Total Events >70kts	2012 Prior Event Rating >70kts	Total Building Exposure ($000)	Building Exposure Valuation Rating	Land Area (square miles)	Population Density	Pop. Density Rating	Total Vuln.	Windstorm Vulnerability	Total Vuln. >70kts	Windstorm Vulnerability >70 knots
Pennington	392	10	59	9	$9,445,117	6	1,027.87	37.0	2	18	High	17	High
Perkins	218	5	46	7	$351,552	1	812.90	1.0	1	7	Moderate	9	Moderate
Potter	93	2	10	1	$456,830	1	431.80	2.7	1	4	Moderate	3	Moderate
Roberts	82	1	14	2	$1,005,396	1	460.54	9.3	1	3	Moderate	4	Moderate
Sanborn	79	1	27	4	$269,355	1	434.51	4.2	1	3	Moderate	6	Moderate
Shannon	161	4	26	4	$537,295	1	1,258.71	6.7	1	6	Moderate	6	Moderate
Spink	127	3	26	4	$788,639	1	969.68	4.3	1	5	Moderate	6	Moderate
Stanley	130	3	19	3	$266,209	1	617.06	2.1	1	5	Moderate	5	Moderate
Sully	101	2	13	2	$187,729	1	688.50	1.4	1	4	Moderate	4	Moderate
Todd	151	3	35	5	$460,277	1	2,776.55	7.1	1	5	Moderate	7	Moderate
Tripp	153	3	29	4	$658,946	1	817.24	3.5	1	5	Moderate	6	Moderate
Turner	94	2	34	5	$1,007,884	1	569.32	13.5	1	4	Moderate	7	Moderate
Union	104	2	31	4	$1,827,003	2	507.23	31.8	2	6	Moderate	8	Moderate
Walworth	127	3	18	2	$650,420	1	622.69	7.9	1	5	Moderate	4	Moderate
Yankton	125	3	42	6	$2,540,290	2	800.04	43.4	3	8	Moderate	11	Moderate
Ziebach	155	3	27	4	$104,699	1	2,249.90	1.5	1	5	Moderate	6	Moderate

Source: U.S. Census Bureau (2010), 2011 American Community Survey estimates, National Climatic Data Center Storm Events Database, HAZUS-MH MR4

Appendix 3G. HAZUS Earthquake Scenario

HAZUS-MH: Earthquake Event Report

Region Name: *SouthDakota_EQ*

Earthquake Scenario: *2500 year earthquake*

Print Date: *March 14, 2008*

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 66 county(ies) from the following state(s):

South Dakota

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 76,933.72 square miles and contains 235 census tracts. There are over 290 thousand households in the region and has a total population of 754,844 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 240 thousand buildings in the region with a total building replacement value (excluding contents) of 38,357 (millions of dollars). Approximately 98.00 % of the buildings (and 80.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 50,114 and 21,607 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 240 thousand buildings in the region which have an aggregate total replacement value of 38,357 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 77% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 54 hospitals in the region with a total bed capacity of 4,538 beds. There are 841 schools, 122 fire stations, 157 police stations and 24 emergency operation facilities. With respect to HPL facilities, there are 2,363 dams identified within the region. Of these, 84 of the dams are classified as 'high hazard'. The inventory also includes 161 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 71,721.00 (millions of dollars). This inventory includes over 11,896 kilometers of highways, 5,122 bridges, 338,056 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	5,122	2,373.70
	Segments	1,429	40,007.60
	Tunnels	0	0.00
		Subtotal	**42,381.30**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	1,176	2,136.20
	Tunnels	0	0.00
		Subtotal	**2,136.20**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	20	19.40
		Subtotal	**19.40**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	152	737.30
	Runways	175	4,840.70
		Subtotal	**5,578.00**
		Total	**50,114.90**

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	3,380.60
	Facilities	7	207.50
	Pipelines	0	0.00
		Subtotal	**3,588.00**
Waste Water	Distribution Lines	NA	2,028.30
	Facilities	341	20,212.40
	Pipelines	0	0.00
		Subtotal	**22,240.80**
Natural Gas	Distribution Lines	NA	1,352.20
	Facilities	1	1.00
	Pipelines	0	0.00
		Subtotal	**1,353.20**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	12	1,174.80
		Subtotal	**1,174.80**
Communication	Facilities	134	11.90
		Subtotal	**11.90**
		Total	**28,368.70**

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	2500 year earthquake
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	2,500.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.50
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	136	0.06	18	0.09	8	0.09	1	0.15	0	0.12
Commercial	2,471	1.17	375	1.79	215	2.70	47	4.85	3	3.97
Education	17	0.01	3	0.01	2	0.02	0	0.03	0	0.04
Government	123	0.06	17	0.08	10	0.12	1	0.13	0	0.22
Industrial	187	0.09	26	0.12	16	0.20	3	0.36	0	0.23
Other Residential	27,440	13.01	6,262	29.94	4,456	55.93	449	45.90	23	26.56
Religion	111	0.05	15	0.07	8	0.10	2	0.18	0	0.24
Single Family	180,494	85.55	14,203	67.89	3,252	40.83	473	48.42	60	68.63
Total	210,979		20,919		7,966		977		88	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	172,520	81.77	12135	58.01	1,878	23.58	116	11.85	0	0.49
Steel	1,604	0.76	218	1.04	151	1.89	32	3.24	1	1.40
Concrete	222	0.11	29	0.14	15	0.18	2	0.20	0	0.08
Precast	412	0.20	41	0.20	35	0.44	10	0.99	0	0.18
RM	169	0.08	15	0.07	11	0.14	2	0.25	0	0.02
URM	13,714	6.50	2721	13.01	1,623	20.38	408	41.73	67	76.74
MH	22,337	10.59	5760	27.54	4,253	53.39	408	41.74	19	21.10
Total	210,979		20,919		7,966		977		88	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	54	0	0	52
Schools	841	0	0	841
EOCs	24	0	0	24
PoliceStations	157	0	0	157
FireStations	122	0	0	122

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	1,429	0	0	1,429	1,429
	Bridges	5,122	0	0	5,122	5,122
	Tunnels	0	0	0	0	0
Railways	Segments	1,176	0	0	1,176	1,176
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	20	0	0	20	20
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	152	0	0	152	152
	Runways	175	0	0	175	175

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	7	0	0	7	7
Waste Water	341	0	0	341	341
Natural Gas	1	0	0	1	1
Oil Systems	0	0	0	0	0
Electrical Power	12	0	0	12	12
Communication	134	0	0	134	134

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	169,028	2037	509
Waste Water	101,417	1611	403
Natural Gas	67,611	1722	430
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	290,245	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 8 ignitions that will burn about 0.04 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 5 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 63.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates (420 households to be displaced due to the earthquake. Of these, 105 people (out of a total population of 754,844 will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	5	1	0	0
	Industrial	2	0	0	0
	Other-Residential	95	13	1	2
	Single Family	84	11	1	2
	Total	**188**	**26**	**2**	**4**
2 PM	Commercial	117	18	2	3
	Commuting	0	0	0	0
	Educational	24	4	0	1
	Hotels	1	0	0	0
	Industrial	15	2	0	0
	Other-Residential	18	3	0	0
	Single Family	17	2	0	0
	Total	**192**	**29**	**3**	**5**
5 PM	Commercial	95	14	1	2
	Commuting	0	0	0	0
	Educational	2	0	0	0
	Hotels	2	0	0	0
	Industrial	9	1	0	0
	Other-Residential	36	5	0	1
	Single Family	33	5	0	1
	Total	**177**	**26**	**3**	**4**

Economic Loss

The total economic loss estimated for the earthquake is 918.16 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 432.76 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 57 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Loses							
	Wage	0.00	3.12	30.44	0.56	1.10	35.23
	Capital-Related	0.00	1.33	24.34	0.33	0.32	26.33
	Rental	5.30	10.40	13.12	0.13	0.37	29.32
	Relocation	0.57	0.32	0.93	0.02	0.15	1.98
	Subtotal	**5.87**	**15.18**	**68.83**	**1.05**	**1.94**	**92.86**
Capital Stock Loses							
	Structural	24.71	16.53	21.45	2.31	4.37	69.37
	Non_Structural	94.43	50.36	40.04	5.18	8.31	198.31
	Content	30.43	10.98	20.73	3.28	4.64	70.06
	Inventory	0.00	0.00	0.96	0.92	0.27	2.15
	Subtotal	**149.57**	**77.87**	**83.19**	**11.69**	**17.58**	**339.89**
	Total	**155.44**	**93.05**	**152.01**	**12.74**	**19.52**	**432.76**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	40,007.65	$0.00	0.00
	Bridges	2,373.66	$1.12	0.05
	Tunnels	0.00	$0.00	0.00
	Subtotal	**42381.30**	**1.10**	
Railways	Segments	2,136.22	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**2136.20**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	19.40	$1.17	6.03
	Subtotal	**19.40**	**1.20**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	737.28	$44.34	6.01
	Runways	4,840.71	$0.00	0.00
	Subtotal	**5578.00**	**44.30**	
	Total	**50114.90**	**46.60**	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	207.50	$3.10	1.49
	Distribution Line	3,380.60	$9.17	0.27
	Subtotal	**3,588.02**	**$12.27**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	20,212.40	$387.33	1.92
	Distribution Line	2,028.30	$7.25	0.36
	Subtotal	**22,240.77**	**$394.58**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	1.00	$0.01	0.68
	Distribution Line	1,352.20	$7.75	0.57
	Subtotal	**1,353.19**	**$7.76**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	1,174.80	$23.92	2.04
	Subtotal	**1,174.80**	**$23.92**	
Communication	Facilities	11.90	$0.24	2.02
	Subtotal	**11.93**	**$0.24**	
	Total	**28,368.71**	**$438.76**	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

	LOSS	Total	%
First Year			
	Employment Impact	873	0.43
	Income Impact	(1)	-0.01
Second Year			
	Employment Impact	256	0.13
	Income Impact	(9)	-0.13
Third Year			
	Employment Impact	6	0.00
	Income Impact	(12)	-0.18
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(13)	-0.18
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(13)	-0.18
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(13)	-0.18

Appendix A: County Listing for the Region

Aurora,SD

Beadle,SD

Bennett,SD

Bon Homme,SD

Brookings,SD

Brown,SD

Brule,SD

Buffalo,SD

Butte,SD

Campbell,SD

Charles Mix,SD

Clark,SD

Clay,SD

Codington,SD

Corson,SD

Custer,SD

Davison,SD

Day,SD

Deuel,SD

Dewey,SD

Douglas,SD

Edmunds,SD

Fall River,SD

Faulk,SD

Grant,SD

Gregory,SD

Haakon,SD

Hamlin,SD

Hand,SD

Hanson,SD

Harding,SD

Hughes,SD

Hutchinson,SD

Hyde,SD

Jackson,SD

Jerauld,SD

Jones,SD

Kingsbury,SD

Lake,SD

Lawrence,SD

Lincoln,SD

Lyman,SD

McCook,SD

McPherson,SD

Marshall,SD

Meade,SD

Mellette,SD

Miner,SD

Minnehaha,SD

Moody,SD

Pennington,SD

Perkins,SD

Potter,SD

Roberts,SD

Sanborn,SD

Shannon,SD

Spink,SD

Stanley,SD

Sully,SD

Todd,SD

Tripp,SD

Turner,SD

Union,SD

Walworth,SD

Yankton,SD

Ziebach,SD

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
South Dakota					
	Aurora	3,058	129	14	143
	Beadle	17,023	723	177	900
	Bennett	3,574	82	25	107
	Bon Homme	7,260	293	62	356
	Brookings	28,220	1,141	224	1,366
	Brown	35,460	1,519	370	1,890
	Brule	5,364	223	48	271
	Buffalo	2,032	36	13	49
	Butte	9,094	285	85	371
	Campbell	1,782	66	15	81
	Charles Mix	9,350	305	80	386
	Clark	4,143	164	50	214
	Clay	13,537	545	64	609
	Codington	25,897	1,022	230	1,253
	Corson	4,181	94	14	108
	Custer	7,275	325	41	366
	Davison	18,741	757	164	922
	Day	6,267	350	68	419
	Deuel	4,498	202	58	260
	Dewey	5,972	135	60	195
	Douglas	3,458	108	15	124
	Edmunds	4,367	183	32	215
	Fall River	7,453	293	56	349
	Faulk	2,640	99	16	115
	Grant	7,847	319	60	379
	Gregory	4,792	171	65	236
	Haakon	2,196	82	34	117
	Hamlin	5,540	270	49	320
	Hand	3,741	186	34	220
	Hanson	3,139	123	13	137
	Harding	1,353	54	13	68
	Hughes	16,481	688	204	893
	Hutchinson	8,075	300	52	353
	Hyde	1,671	63	18	82
	Jackson	2,930	74	16	91
	Jerauld	2,295	111	16	128
	Jones	1,193	43	15	59
	Kingsbury	5,815	267	34	302
	Lake	11,276	539	76	616
	Lawrence	21,802	914	231	1,146
	Lincoln	24,131	1,039	184	1,223
	Lyman	3,895	135	36	172
	McCook	5,832	257	34	291
	McPherson	2,904	107	45	153

	Marshall	4,576	235	47	283
	Meade	24,253	925	156	1,081
	Mellette	2,083	55	11	66
	Miner	2,884	120	21	141
	Minnehaha	148,281	6,471	1,970	8,442
	Moody	6,595	276	42	318
	Pennington	88,565	3,529	1,152	4,682
	Perkins	3,363	123	34	157
	Potter	2,693	133	67	200
	Roberts	10,016	409	94	504
	Sanborn	2,675	111	13	124
	Shannon	12,466	197	104	302
	Spink	7,454	330	49	380
	Stanley	2,772	109	26	135
	Sully	1,556	76	16	92
	Todd	9,050	177	43	221
	Tripp	6,430	233	60	293
	Turner	8,849	398	49	448
	Union	12,584	593	217	811
	Walworth	5,974	254	62	316
	Yankton	21,652	889	325	1,215
	Ziebach	2,519	51	7	59
Total State		**754,844**	**30,515**	**7,775**	**38,325**
Total Region		**754,844**	**30,515**	**7,775**	**38,325**

Appendix 3H. Critical Facilities in Flood and Wildfire Zones

Table 3Ha – Critical Facilities in the DFIRM 1% Annual Chance Floodplain

Critical Facilities	Count
Airport	1
Army National Guard	3
Board of Regents	12
Communication	14
Department of Environment & Natural Resources	1
Department of Agriculture	2
Department of Health	1
Department of Human Services	2
Department of Labor	1
Department of Public Safety	1
Department of Revenue	1
Department of Social Services	1
Department of Transportation	1
EMS	7
Fire	11
HAZMAT	7
Natural Gas Facility	6
Office of the Attorney General	1
Police	1
Power	5
Private School	2
Public School	18
State Fuel Sites	2
Waste Water Facility	48
Water Facility	1
Total	**150**

Table 3Hb – Critical Facilities in the DFIRM 0.2% Annual Chance Floodplain

Critical Facilities	Count
Board of Regents	9
Department of Revenue	1
Department of Public Safety	1
Department of Labor	1
Department of Corrections	3
Police	4
Department of Environment & Natural Resources	1
Bureau of Info & Telecomm	2
Board of Eng & Arch Examiners	1
Department of Social Services	1
Communication	4
Substation	2
Department of Transportation	2
Hospital	2
Waste Water Facility	5
State Fuel Sites	1
Public School	9
Power	3
Natural Gas Facility	4
HAZMAT	6
Fire	8
EMS	6
Total	**76**

Table 3Hc – Critical Facilities in Areas Protected by Levees

Critical Facilities	Count
Depart of Tourism & State Development	1
Airport	1
Army National Guard	1
Depart of Military & Vet Affairs	1
Department of Health	1
EMS	5
HAZMAT	12
Higher Education	1
Natural Gas Facility	1
Private School	4
Public School	7
Fire	4
Communication	2
Total	**41**

Table 3Hd – Critical Facilities in the HAZUS 1% Annual Chance Floodplain

Critical Facilities	Count
Hospital	1
Airport	1
Communication	4
EMS	1
Fire	4
HAZMAT	4
Police	2
Public School	13
Water Facility	1
Waste Water Facility	31
Natural Gas Facility	3
Total	**65**

Table 3He – DFIRM and HAZUS Total Flooded Critical Facilities

Critical Facilities	Count
Airport	2
Army National Guard	3
Board of Regents	12
Communication	18
Department of Environment & Natural Resources	1
Department of Agriculture	2
Department of Health	1
Department of Human Services	2
Department of Labor	1
Department of Public Safety	1
Department of Revenue	1
Department of Social Services	1
Department of Transportation	1
EMS	8
Fire	15
HAZMAT	11
Hospital	1
Natural Gas Facility	9
Office of the Attorney General	1
Police	3
Power	5
Private School	2
Public School	31
State Fuel Sites	2
Waste Water Facility	79
Water Facility	2
Total	**215**

Table 3Hf – Critical Facilities in the High & Moderate Fire Risk Zones

Critical Facilities	Count
Airport	2
Army National Guard	3
Board of Regents	3
Bureau of Administration	3
Bureau of Info & Telecomm	2
Communication	16
Department of Environment & Natural Resources	1
Depart of Game, Fish & Parks	3
Depart of Tourism & State Development	2
Department of Agriculture	1
Department of Corrections	4
Department of Education	2
Department of Health	5
Department of Labor	6
Department of Legislative Audit	1
Department of Public Safety	5
Department of Revenue	3
Department of Social Services	12
Department of Transportation	10
Division of Criminal Investigation	1
EMS	60
Fire	89
HAZMAT	16
Higher Education	1
Hospital	12
Natural Gas Facility	15
Office of the Attorney General	2
Police	40
Power	3
Private School	11
Public School	93
Public Utility Commission	1
SD Building Authority	1
SD Retirement	1
State Fuel Sites	15
Substation	10
Waste Water Facility	26
Total	**481**

State Facilities in Hazard Zones by State Agency

1% Annual Chance DFIRM

Agency	Count
DDN	3
DOA	1
DOH	2
DSS	1
Educational Facility	1
Energy/electric	1
GFP	3
Total	**12**

0.2% Annual Chance DFIRM

Agency	Count
BOA	4
DDN	6
DENR	2
DOC	2
DOH	2
DRR	1
DSS	2
GFP	4
Storage stockpile	1
Unknown	1
Total	**25**

Area Protected by Levee DFIRM

Agency	Count
DDN	2
DOC	1
DOH	1
TSD	1
Total	**5**

1% Annual Chance HAZUS

Agency	Count
DDN	5
DOH	2
DSS	2
Educational Facility	1
Total	**10**

1% Annual Chance HAZUS and DFIRM

Agency	Count
DDN	8
DOA	1
DOH	4
DSS	3
Educational Facility	2
Energy/electric	1
GFP	3
Total	**22**

WUI High and Moderate Fire Risk

Agency	Count
BOA	7
DDN	34
DOA	1
DOC	3
DOH	10
DPS	5
DRR	2
DSS	14
Educational Facility	6
Electric Power	1
GFP	11
Natural Gas Pipe	1
Office Building	1
TSD	3
Unknown	1
Total	**100**

Appendix 4A

NFIP Participating Communities

Federal Emergency Management Agency
Community Status Book Report
SOUTH DAKOTA
Communities Participating in the National Flood Program

CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date	Tribal
460007#	ABERDEEN, CITY OF	BROWN COUNTY	10/05/73	06/01/78	09/29/10	06/01/78	No
460153#	ALEXANDRIA, CITY OF	HANSON COUNTY	06/27/75	09/02/09	09/02/09	01/19/10	No
460096	ALPENA, CITY OF	JERAULD COUNTY	09/26/75		(NSFHA)	06/08/98	No
460234	ARMOUR, CITY OF	DOUGLAS COUNTY	08/06/76	10/01/86	10/01/86(L)	10/01/86	No
461207	ARTAS, CITY OF	CAMPBELL COUNTY			(NSFHA)	06/08/98	No
460097#	ARTESIAN, TOWN OF	SANBORN COUNTY	08/08/75	07/22/10	(NSFHA)	02/11/85	No
460077#	ASHTON, CITY OF	SPINK COUNTY	12/06/74	10/19/10	(NSFHA)	12/12/12	No
460293#	AURORA COUNTY *	AURORA COUNTY		11/19/03	11/19/03	02/02/09	No
460051#	AURORA, CITY OF	BROOKINGS COUNTY		07/16/08	07/16/08	07/16/08	No
460154	AVON, CITY OF	BON HOMME COUNTY	10/29/76		(NSFHA)	06/08/98	No
460058#	BALTIC, TOWN OF	MINNEHAHA COUNTY	12/06/74	11/19/80	09/02/09	11/19/80	No
460251#	BEADLE COUNTY *	BEADLE COUNTY	01/10/78	10/01/97	06/02/09	10/01/97	No
460012#	BELLE FOURCHE, CITY OF	BUTTE COUNTY	11/02/73	06/01/77	01/06/12	06/01/77	No
460156#	BIG STONE CITY, CITY OF	GRANT COUNTY	11/12/76	07/01/98	11/04/09(M)	07/01/98	No
460039#	BLUNT, CITY OF	HUGHES COUNTY	10/10/75	05/15/80	05/17/04	05/15/80	No
460252	BON HOMME COUNTY *	BON HOMME COUNTY			(NSFHA)	06/08/98	No
460089#	BOX ELDER, CITY OF	PENNINGTON COUNTY	10/25/74	05/15/80	06/03/13	05/15/80	No
460296#	BRANDON,CITY OF	MINNEHAHA COUNTY	11/19/76	07/10/79	09/02/09	07/10/79	No
460158#	BRIDGEWATER, CITY OF	MCCOOK COUNTY	11/19/76	06/18/13	(NSFHA)	07/11/11	No
460101#	BRISTOL, CITY OF	DAY COUNTY	06/03/77	12/06/01	(NSFHA)	04/25/97	No
460159	BRITTON, CITY OF	MARSHALL COUNTY			(NSFHA)	06/08/98	No
460253#	BROOKINGS COUNTY*	BROOKINGS COUNTY	12/20/77	01/01/87	07/16/08(M)	01/01/87	No
460004#	BROOKINGS, CITY OF	BROOKINGS COUNTY	03/22/74	10/17/78	07/16/08	10/17/78	No
460006#	BROWN COUNTY *	BROWN COUNTY	12/20/74	09/30/88	09/29/10	09/30/88	No
460005#	BRUCE, TOWN OF	BROOKINGS COUNTY	09/13/74	02/05/80	07/16/08(M)	02/05/80	No
460284	BRULE COUNTY *	BRULE COUNTY			(NSFHA)	06/08/98	No
460255	BUFFALO COUNTY *	BUFFALO COUNTY			(NSFHA)	06/08/98	No
460161	BURKE, CITY OF	GREGORY COUNTY			(NSFHA)	06/08/98	No
460236#	BUTTE COUNTY*	BUTTE COUNTY	12/20/77	01/06/12	01/06/12	01/06/12	No
460256	CAMPBELL COUNTY *	CAMPBELL COUNTY			(NSFHA)	06/08/98	No
460162#	CANISTOTA,CITY OF	MCCOOK COUNTY	08/13/76	06/18/13	(NSFHA)	04/25/97	No
460102	CANOVA, CITY OF	MINER COUNTY	05/20/77		(NSFHA)	04/25/97	No
460047#	CANTON, CITY OF	LINCOLN COUNTY	08/16/74	09/04/85	04/02/08(M)	09/04/85	No
460035	CASTLEWOOD, CITY OF	HAMLIN COUNTY	05/17/74	04/15/86	04/15/86(M)	04/15/86	No
461212#	CAVOUR, TOWN OF	BEADLE COUNTY		06/02/09	06/02/09(M)	06/08/98	No
460163	CENTERVILLE, CITY OF	TURNER COUNTY	08/13/76		(NSFHA)	06/08/98	No
461200#	CENTRAL CITY, TOWN OF	LAWRENCE COUNTY		04/17/12	04/17/12(M)	09/24/12	No
460164	CHAMBERLAIN, CITY OF	BRULE COUNTY	06/25/76		(NSFHA)	07/15/85	No
460104	CHANCELLOR, TOWN OF	TURNER COUNTY			(NSFHA)	06/08/98	No
460257#	CHARLES MIX COUNTY *	CHARLES MIX COUNTY	01/10/78	07/01/98	06/02/04	07/01/98	No
461209	CHELSEA, TOWN OF	FAULK COUNTY			(NSFHA)	06/08/98	No
461203#	CHEYENNE RIVER INDIAN RESERVATION DEWEY	DEWEY COUNTY/ZIEBACH COUNTY		05/03/04	05/03/04	06/08/98	Yes
460105#	CLAREMONT, TOWN OF	BROWN COUNTY	04/25/75	09/30/88	(NSFHA)	03/05/10	No
	NSFHA COMMUNITY.						
460258	CLARK COUNTY *	CLARK COUNTY			(NSFHA)	06/08/98	No
460013	CLARK, CITY OF	CLARK COUNTY	03/12/76	07/01/98	07/01/98(L)	07/01/98	No
460259#	CLAY COUNTY*	CLAY COUNTY	10/18/77	08/05/10	08/05/10(L)	04/01/87	No
460260#	CODINGTON COUNTY*	CODINGTON COUNTY	01/24/78	02/01/86	01/16/09	02/01/86	No
460106#	COLMAN, CITY OF	MOODY COUNTY	07/11/75	08/19/08	(NSFHA)	02/11/85	No
460084	COLOME, CITY OF	TRIPP COUNTY	05/10/74	05/01/86	05/01/86(L)	05/01/86	No
460166#	COLTON, CITY OF	MINNEHAHA COUNTY	08/13/76	09/02/09	(NSFHA)	06/08/98	No

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460008#	COLUMBIA, CITY OF	BROWN COUNTY	12/06/74	07/17/78	09/29/10	04/07/94	No
460078#	CONDE, CITY OF	SPINK COUNTY	12/20/74	10/19/10	10/19/10(M)	09/21/11	No
460071#	CORONA, TOWN OF	ROBERTS COUNTY	02/21/75	03/04/87	07/20/09(M)	03/04/87	No
460237#	CORSON COUNTY*	CORSON COUNTY		05/17/04	05/17/04	06/08/98	No
	There are no unincorporated areas in the County.						
460107	CRESBARD, TOWN OF	FAULK COUNTY	07/18/75	07/01/98	07/01/98(L)	07/01/98	No
460018#	CUSTER COUNTY*	CUSTER COUNTY	10/18/77	09/29/86	01/06/12	09/29/86	No
460019#	CUSTER, CITY OF	CUSTER COUNTY	05/24/74	01/02/81	01/06/12	01/02/81	No
460108	DALLAS, TOWN OF	GREGORY COUNTY	04/25/75		(NSFHA)	03/18/86	No
465466#	DANTE, TOWN OF	CHARLES MIX COUNTY		06/02/04	06/02/04	01/30/13	No
460086#	DAVIS, TOWN OF	TURNER COUNTY	05/02/75	03/18/86	07/02/08(M)	03/18/86	No
460020#	DAVISON COUNTY*	DAVISON COUNTY	05/20/77	04/01/87	09/29/10	04/01/87	No
460261#	DAY COUNTY *	DAY COUNTY		12/06/01	12/06/01	06/08/98	No
460168	DE SMET, CITY OF	KINGSBURY COUNTY	07/11/75		(NSFHA)	04/25/97	No
460045#	DEADWOOD, CITY OF	LAWRENCE COUNTY	07/11/75	04/16/90	04/17/12	02/03/82	No
460059#	DELL RAPIDS, CITY OF	MINNEHAHA COUNTY	05/02/75	08/15/80	09/02/09	08/15/80	No
460025	DELMONT, TOWN OF	DOUGLAS COUNTY	08/08/75	08/05/86	08/05/86(M)	08/05/86	No
460262	DEUEL COUNTY *	DEUEL COUNTY			(NSFHA)	06/08/98	No
460023	DEWEY COUNTY*	DEWEY COUNTY			(NSFHA)	06/08/98	No
460079#	DOLAND, TOWN OF	SPINK COUNTY	02/07/75	10/19/10	10/19/10(M)	11/12/85	No
460169	DUPREE, CITY OF	ZIEBACH COUNTY	04/25/75	07/01/98	07/01/98(L)	07/01/98	No
460170	EAGLE BUTTE, TOWN OF	DEWEY COUNTY	11/12/76	07/01/98	07/01/98(L)	07/01/98	No
460026#	EDGEMONT, CITY OF	FALL RIVER COUNTY	08/02/74	12/16/80	12/18/07	12/16/80	No
460264	EDMUNDS COUNTY *	EDMUNDS COUNTY			(NSFHA)	06/08/98	No
460061#	EGAN, TOWN OF	MOODY COUNTY	03/01/74	01/22/80	08/19/08(M)	01/22/80	No
460172#	ELKTON, CITY OF	BROOKINGS COUNTY	08/22/75	07/16/08	(NSFHA)	04/25/97	No
460036#	ESTELLINE, CITY OF	HAMLIN COUNTY	05/10/74	01/22/80	01/22/80(M)	01/22/80	No
460111#	ETHAN, CITY OF	DAVISON COUNTY		09/29/10	(NSFHA)	03/08/89	No
460173	EUREKA, CITY OF	MCPHERSON COUNTY	07/16/76	10/01/86	10/01/86(L)	10/01/86	No
460238#	FALL RIVER COUNTY*	FALL RIVER COUNTY	11/01/77	12/18/07	12/18/07	12/27/07	No
460265	FAULK COUNTY *	FAULK COUNTY			(NSFHA)	06/08/98	No
460175	FAULKTON, CITY OF	FAULK COUNTY	02/21/75	08/05/86	08/05/86(M)	08/05/86	No
460062#	FLANDREAU, CITY OF	MOODY COUNTY	09/26/75	01/16/81	08/19/08	01/16/81	No
460306#	FLORENCE, TOWN OF	CODINGTON COUNTY		01/16/09	01/16/09(M)	02/24/10	No
465419#	FORT PIERRE, CITY OF	STANLEY COUNTY		01/12/73	05/17/04	01/12/73	No
460009#	FREDERICK, TOWN OF	BROWN COUNTY	11/22/74	03/01/78	03/18/08	03/01/78	No
460177#	GARRETSON, CITY OF	MINNEHAHA COUNTY	09/26/75	09/02/09	(NSFHA)	01/30/84	No
460112	GARY, TOWN OF	DEUEL COUNTY	06/27/75	07/01/98	07/01/98(L)	07/01/98	No
460205#	GAYVILLE, TOWN OF	YANKTON COUNTY		07/06/10	(NSFHA)	04/13/10	No
	NON-FLOODPRONE COMMUNITY						
460299	GETTYSBURG, CITY OF	POTTER COUNTY			(NSFHA)	06/08/98	No
460266#	GRANT COUNTY*	GRANT COUNTY	12/20/77	02/01/87	11/04/09	02/01/87	No
460267	GREGORY COUNTY *	GREGORY COUNTY			(NSFHA)	06/08/98	No
460178	GREGORY, CITY OF	GREGORY COUNTY	08/22/75		(NSFHA)	12/09/85	No
461201#	GRENVILLE, TOWN OF	DAY COUNTY		12/06/01	12/06/01	06/08/98	No
460179#	GROTON, CITY OF	BROWN COUNTY	07/11/75	03/01/78	03/18/08	03/01/78	No
460268	HAAKON COUNTY *	HAAKON COUNTY			(NSFHA)	06/08/98	No
460034#	HAMLIN COUNTY*	HAMLIN COUNTY		05/15/86	05/15/86(M)	05/15/86	No
460269	HAND COUNTY *	HAND COUNTY			(NSFHA)	06/08/98	No
460270#	HANSON COUNTY *	HANSON COUNTY	08/16/77	07/01/98	09/02/09	07/01/98	No
460114#	HARRISBURG, TOWN OF	LINCOLN COUNTY		04/02/08	04/02/08	06/08/98	No

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460180#	HARTFORD, CITY OF	MINNEHAHA COUNTY	07/16/76	09/05/79	09/02/09(M)	04/25/97	No
	The initial FIRM date for the City of Hartford is 09/05/1979. A request has been made to the MSC to update the initial FIRM date field. This note will remain in the CSB until that update occurs.						
460294#	HECLA, CITY OF	BROWN COUNTY		09/30/88	(NSFHA)	09/03/86	No
460230#	HERMOSA, TOWN OF	CUSTER COUNTY	01/21/77	09/29/86	01/06/12	08/01/06	No
	Annexed areas on Custer County FIRM panel 460018 0085 B dated 03/02/1998. Current flood zones for Hermosa are Zones A and C.						
460181	HERREID, CITY OF	CAMPBELL COUNTY	07/11/75	07/01/98	07/01/98(L)	07/01/98	No
460182	HIGHMORE, CITY OF	HYDE COUNTY	07/11/75		(NSFHA)	01/30/84	No
460116#	HILL CITY, CITY OF	PENNINGTON COUNTY	04/23/76	11/18/81	06/03/13	11/18/81	No
460117	HOSMER, CITY OF	EDMUNDS COUNTY	10/29/76		(NSFHA)	04/25/97	No
460027#	HOT SPRINGS, CITY OF	FALL RIVER COUNTY		03/17/02	12/18/07	06/30/76	No
460183#	HOWARD, CITY OF	MINER COUNTY	07/11/75	08/19/85	08/19/85(M)	08/19/85	No
460271#	HUGHES COUNTY *	HUGHES COUNTY	01/10/78	07/01/98	05/17/04	07/01/98	No
460118#	HUMBOLDT, TOWN OF	MINNEHAHA COUNTY	09/05/75	09/02/09	09/02/09(M)	06/08/98	No
460003#	HURON,CITY OF	BEADLE COUNTY	06/28/74	07/16/87	06/02/09	07/16/87	No
460041#	HUTCHINSON COUNTY*	HUTCHINSON COUNTY	06/03/77	04/01/87	09/02/09	04/01/87	No
460272	HYDE COUNTY *	HYDE COUNTY			(NSFHA)	06/08/98	No
460184#	IPSWICH, CITY OF	EDMUNDS COUNTY	11/05/76	12/18/85	12/18/85(M)	12/18/85	No
460120#	IRENE, TOWN OF	TURNER COUNTY/CLAY COUNTY/YANKTON COUNTY		07/06/10	07/06/10(M)	10/31/11	No
460121#	IROQUOIS, CITY OF	KINGSBURY COUNTY/BEADLE COUNTY	07/18/75	10/15/85	10/15/85(M)	10/15/85	No
460122	ISABEL, CITY OF	DEWEY COUNTY			(NSFHA)	06/08/98	No
460240	JACKSON COUNTY*	JACKSON COUNTY			(NSFHA)	06/08/98	No
460273	JERAULD COUNTY*	JERAULD COUNTY			(NSFHA)	06/08/98	No
460185	KADOKA, CITY OF	JACKSON COUNTY	07/16/76		07/16/76	10/09/07(E)	No
460050	KENNEBEC, TOWN OF	LYMAN COUNTY	01/17/75	08/05/86	08/05/86(M)	08/05/86	No
460231#	KEYSTONE, TOWN OF	PENNINGTON COUNTY	01/07/77	03/04/80	06/03/13	03/04/80	No
460275#	KINGSBURY COUNTY*	KINGSBURY COUNTY		09/18/87	(All Zone D)	09/18/87	No
460187#	LAKE ANDES, CITY OF	CHARLES MIX COUNTY	02/07/75	06/02/04	(NSFHA)	12/09/85	No
460276#	LAKE COUNTY *	LAKE COUNTY	06/07/77	08/05/86	09/02/09	08/05/86	No
460124	LAKE NORDEN, CITY OF	HAMLIN COUNTY	09/19/75		(NSFHA)	04/05/11	No
	This community is NSFHA.						
460189	LAKE PRESTON, CITY OF	KINGSBURY COUNTY	07/18/75		(NSFHA)	01/30/84	No
460125	LANGFORD, TOWN OF	MARSHALL COUNTY	06/27/75		(NSFHA)	04/25/97	No
460094#	LAWRENCE COUNTY *	LAWRENCE COUNTY	06/17/77	05/17/90	04/17/12	05/17/90	No
460190#	LEAD, CITY OF	LAWRENCE COUNTY	02/07/75	04/17/12	04/17/12(M)	04/17/12	No
460068	LEBANON, TOWN OF	POTTER COUNTY	01/03/75		(NSFHA)	07/15/85	No
460192#	LENNOX, CITY OF	LINCOLN COUNTY	09/26/75	04/02/08	(NSFHA)	06/08/98	No
460206#	LESTERVILLE, TOWN OF	YANKTON COUNTY		07/06/10	(NSFHA)	04/22/11	No
460277#	LINCOLN COUNTY*	LINCOLN COUNTY	10/25/77	10/01/86	04/02/08	10/01/86	No
460278	LYMAN COUNTY *	LYMAN COUNTY				06/08/98	No
460044#	MADISON, CITY OF	LAKE COUNTY	08/02/74	07/05/82	09/02/09	07/05/82	No
460197	MARION, CITY OF	TURNER COUNTY	07/02/76		(NSFHA)	06/08/98	No
460279	MARSHALL COUNTY *	MARSHALL COUNTY			(NSFHA)	06/08/98	No
460280#	MCCOOK COUNTY *	MCCOOK COUNTY		06/18/13	06/18/13	06/08/98	No
460195#	MCINTOSH, CITY OF	CORSON COUNTY	09/19/75	05/17/04	(NSFHA)	06/08/98	No
460054#	MEADE COUNTY *	MEADE COUNTY		08/01/78	09/16/11	08/01/78	No

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460199#	MENNO, CITY OF	HUTCHINSON COUNTY	09/19/75	11/15/85	09/02/09(M)	11/15/85	No
460032	MIDLAND, CITY OF	HAAKON COUNTY	09/13/74	08/05/86	08/05/86(M)	08/05/86	No
460200#	MILBANK, CITY OF	GRANT COUNTY	08/13/76	11/04/09	11/04/09	12/09/85	No
460201#	MILLER, CITY OF	HAND COUNTY	04/25/75	10/15/85	10/15/85(M)	10/15/85	No
460283	MINER COUNTY *	MINER COUNTY			(NSFHA)	06/08/98	No
460057#	MINNEHAHA COUNTY *	MINNEHAHA COUNTY	05/24/77	09/05/79	11/16/11	09/05/79	No
460091#	MISSION HILL, TOWN OF	YANKTON COUNTY	12/13/74	06/18/80	07/06/10	06/18/80	No
460202	MISSION, CITY OF	TODD COUNTY	06/27/75	08/05/86	08/05/86(M)	08/05/86	No
460021#	MITCHELL, CITY OF	DAVISON COUNTY	03/22/74	02/01/79	09/29/10	02/01/79	No
461210	MONROE, TOWN OF	TURNER COUNTY			(NSFHA)	06/08/98	No
460052#	MONTROSE, CITY OF	MCCOOK COUNTY	12/13/74	08/05/86	06/18/13	08/05/86	No
460235#	MOODY COUNTY *	MOODY COUNTY	04/15/77	09/04/85	08/19/08(M)	09/04/85	No
460022#	MOUNT VERNON, CITY OF	DAVISON COUNTY		09/20/06	09/29/10	06/11/76	No
460092#	NEW UNDERWOOD, CITY OF	PENNINGTON COUNTY	01/28/77	05/15/80	06/03/13	05/15/80	No
460087#	NORTH SIOUX CITY, CITY OF	UNION COUNTY	11/16/73	12/01/77	02/23/01	12/01/77	No
460129	OLDHAM, TOWN OF	KINGSBURY COUNTY	10/29/76		(NSFHA)	06/08/98	No
460210	ONIDA, CITY OF	SULLY COUNTY	07/11/75		(NSFHA)	12/23/85	No
461202	ORIENT, TOWN OF	FAULK COUNTY			(NSFHA)	06/08/98	No
460211	PARKER, CITY OF	TURNER COUNTY	06/27/75		(NSFHA)	06/08/98	No
460042#	PARKSTON, CITY OF	HUTCHINSON COUNTY	06/14/74	11/15/85	09/02/09	11/15/85	No
460064#	PENNINGTON COUNTY *	PENNINGTON COUNTY	12/27/74	12/01/81	06/03/13	12/01/81	No
460033	PHILIP, CITY OF	HAAKON COUNTY	06/07/74	03/01/87	03/01/87(L)	03/01/87	No
465468#	PICKSTOWN, TOWN OF	CHARLES MIX COUNTY		06/02/04	06/02/04	03/27/12	No
461198#	PIEDMONT, CITY OF	MEADE COUNTY		09/16/11	09/16/11	09/16/11	No
460040#	PIERRE, CITY OF	HUGHES COUNTY	06/07/74	06/04/80	05/17/04	06/04/80	No
460001#	PLANKINTON, CITY OF	AURORA COUNTY	06/07/74	08/05/86	11/19/03	08/05/86	No
460212#	PLATTE, CITY OF	CHARLES MIX COUNTY		06/02/04	(NSFHA)	06/08/98	No
460132	POLLOCK, CITY OF	CAMPBELL COUNTY	06/27/75		(NSFHA)	06/08/98	No
460285	POTTER COUNTY *	POTTER COUNTY				12/10/98(E)	No
460297	PRESHO, CITY OF	LYMAN COUNTY	07/19/77		(NSFHA)	04/25/97	No
465420#	RAPID CITY, CITY OF	PENNINGTON COUNTY		09/14/73	06/03/13	09/14/73	No
461205	RAYMOND, CITY OF	CLARK COUNTY			(NSFHA)	06/08/98	No
460081#	REDFIELD, CITY OF	SPINK COUNTY	08/02/74	11/15/85	10/19/10(M)	11/15/85	No
460031#	REVILLO, TOWN OF	GRANT COUNTY	09/19/75	10/01/86	11/04/09(M)	10/01/86	No
460286#	ROBERTS COUNTY*	ROBERTS COUNTY	09/12/78	10/01/86	07/20/09(M)	10/01/86	No
460136	ROSCOE, TOWN OF	EDMUNDS COUNTY	11/12/76		(NSFHA)	06/08/98	No
461211#	ROSHOLT, CITY OF	ROBERTS COUNTY			(NSFHA)	06/08/98	No
460053#	SALEM, CITY OF	MCCOOK COUNTY	08/13/76	05/01/86	06/18/13(M)	05/01/86	No
460074#	SANBORN COUNTY *	SANBORN COUNTY	10/18/77	11/15/85	01/06/12	11/15/85	No
460213	SCOTLAND, CITY OF	BON HOMME COUNTY	09/05/75		(NSFHA)	01/30/84	No
461206	SENECA, TOWN OF	FAULK COUNTY			(NSFHA)	06/08/98	No
460098#	SINAI, TOWN OF	BROOKINGS COUNTY	06/27/75	07/16/08	07/16/08	07/16/08	No
460060#	SIOUX FALLS, CITY OF	LINCOLN COUNTY/MINNEHAHA COUNTY	06/28/74	01/17/79	11/16/11	01/17/79	No
460072#	SISSETON, CITY OF	ROBERTS COUNTY	06/28/74	05/01/86	07/20/09(M)	05/01/86	No
460046#	SPEARFISH, CITY OF	LAWRENCE COUNTY	03/29/74	09/02/81	04/17/12	09/02/81	No
460140#	SPENCER, TOWN OF	MCCOOK COUNTY	11/12/76	06/18/13	(NSFHA)	06/08/98	No
460076#	SPINK COUNTY *	SPINK COUNTY	01/10/78	08/05/86	10/19/10	08/05/86	No
460216	SPRINGFIELD, CITY OF	BON HOMME COUNTY	08/06/76		(NSFHA)	06/08/98	No
461219#	STANDING ROCK INDIAN RESERVATION	CORSON COUNTY		05/17/04	05/17/04	05/04/98	Yes
460287#	STANLEY COUNTY *	STANLEY COUNTY		05/17/04	05/17/04	06/08/98	No

Federal Emergency Management Agency
Community Status Book Report
SOUTH DAKOTA
Communities Participating in the National Flood Program

CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Reg-Emer Date	Tribal
460065#	STRATFORD, TOWN OF	BROWN COUNTY		03/18/08	(NSFHA)	03/08/10	No
460055#	STURGIS, CITY OF	MEADE COUNTY	11/16/73	06/01/77	09/16/11	06/01/77	No
460288	SULLY COUNTY *	SULLY COUNTY			(NSFHA)	06/08/98	No
460316#	SUMMERSET, CITY OF	MEADE COUNTY		09/16/11	(NSFHA)	10/12/10(E)	No
460141#	SUMMIT, TOWN OF	ROBERTS COUNTY	07/18/75	07/20/09	(NSFHA)	05/11/11	No
460142	TABOR, TOWN OF	BON HOMME COUNTY	06/25/76		(NSFHA)	04/25/97	No
460143#	TEA, TOWN OF	LINCOLN COUNTY	09/19/75	04/02/08	04/02/08	04/25/97	No
460063#	TRENT, TOWN OF	MOODY COUNTY	12/06/74	06/04/80	08/19/08	06/04/80	No
460289	TRIPP COUNTY *	TRIPP COUNTY			(NSFHA)	04/25/97	No
460145#	TULARE, TOWN OF	SPINK COUNTY	07/25/75	10/19/10	10/19/10(M)	11/01/12	No
460290	TURNER COUNTY *	TURNER COUNTY			(NSFHA)	06/08/98	No
461208#	TWIN BROOKS, CITY OF	GRANT COUNTY		11/04/09	(NSFHA)	06/08/98	No
460220	TYNDALL, CITY OF	BON HOMME COUNTY	08/06/76		(NSFHA)	04/25/97	No
460242	UNION COUNTY*	UNION COUNTY	05/10/77	02/01/87	02/23/01	02/01/87	No
460244#	UTICA, TOWN OF	YANKTON COUNTY		07/06/10	07/06/10(M)	03/13/12	No
460221#	VALLEY SPRINGS, CITY OF	MINNEHAHA COUNTY	09/26/75	07/16/80	09/02/09	07/16/80	No
460146	VEBLEN, TOWN OF	MARSHALL COUNTY	04/25/75	05/01/86	05/01/86(L)	05/01/86	No
460015#	VERMILLION, CITY OF	CLAY COUNTY	03/22/74	08/05/10	(NSFHA)	01/30/84	No
460223#	VOLGA, CITY OF	BROOKINGS COUNTY	10/08/76	07/16/08	07/16/08	09/22/11	No
460224#	WAGNER, CITY OF	CHARLES MIX COUNTY	08/13/76	06/02/04	06/02/04	03/12/09	No
460232#	WAKONDA, TOWN OF NSFHA	CLAY COUNTY	11/12/76	08/05/10	(NSFHA)	04/08/10	No
460291	WALWORTH COUNTY *	WALWORTH COUNTY			(NSFHA)	06/08/98	No
460298#	WARNER, CITY OF	BROWN COUNTY	04/22/80	03/18/08	09/29/10(M)	06/08/98	No
460016#	WATERTOWN, CITY OF	CODINGTON COUNTY	06/28/74	07/04/89	01/16/09	07/04/89	No
460226#	WAUBAY, CITY OF	DAY COUNTY	07/23/76	12/06/01	12/06/01	04/25/97	No
460227#	WEBSTER, CITY OF	DAY COUNTY	12/24/76	12/06/01	12/06/01	04/25/97	No
460043	WESSINGTON SPRINGS, CITY OF	JERAULD COUNTY	10/18/74		(NSFHA)	01/30/84	No
460011#	WESTPORT, TOWN OF	BROWN COUNTY	03/06/79	08/05/86	03/18/08	08/05/86	No
460228#	WHITEWOOD, CITY OF	LAWRENCE COUNTY	08/13/76	04/17/12	(NSFHA)	11/30/83	No
460014#	WILLOW LAKE, TOWN OF	CLARK COUNTY	05/20/77	07/01/98	07/01/98(L)	07/01/98	No
460303	WINNER, CITY OF	TRIPP COUNTY			(NSFHA)	06/08/98	No
460075#	WOONSOCKET, CITY OF	SANBORN COUNTY	06/14/74	11/15/85	01/06/12	11/15/85	No
460151#	WORTHING, TOWN OF	LINCOLN COUNTY	08/22/75	04/02/08	(NSFHA)	04/25/97	No
460088#	YANKTON COUNTY*	YANKTON COUNTY	08/16/77	10/01/86	07/06/10	10/01/86	No
461204#	YANKTON SIOUX TRIBE	CHARLES MIX COUNTY		06/02/04	06/02/04	06/08/98	Yes
460093#	YANKTON, CITY OF	YANKTON COUNTY	03/22/74	08/15/80	07/06/10	08/15/80	No
460292	ZIEBACH COUNTY *	ZIEBACH COUNTY			(NSFHA)	06/08/98	No

Summary:

Total In Flood Program	228
Total In Emergency Program	3
Total In the Regular Program	225
Total In Regular Program with No Special Flood Hazard	87
Total In Regular Program But Minimally Flood Prone	51

Federal Emergency Management Agency
Community Status Book Report
SOUTH DAKOTA
Communities Not in the National Flood Program

CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Sanction Date	Tribal
461214#	ANDOVER, TOWN OF	DAY COUNTY		12/06/01	12/06/01	12/06/02	No
460305#	BATESLAND, TOWN OF	SHANNON COUNTY	05/13/80		05/13/80	05/13/81	No
460099	BISON, TOWN OF	PERKINS COUNTY	11/05/76		11/05/76	11/05/77	No
460247#	BUFFALO GAP, TOWN OF	CUSTER COUNTY	11/05/76	01/06/12	01/06/12	11/05/77	No
460037	BUFFALO, TOWN OF	HARDING COUNTY	11/05/76		11/05/76	11/05/77	No
461215#	BUTLER, TOWN OF	DAY COUNTY		12/06/01	12/06/01	12/06/02	No
460248#	FAIRBURN, TOWN OF	CUSTER COUNTY		01/06/12	01/06/12	01/06/13	No
460048#	FAIRVIEW, TOWN OF	LINCOLN COUNTY		04/02/08	04/02/08	04/02/09	No
460174#	FAITH, CITY OF	MEADE COUNTY		09/16/11	09/16/11	09/16/12	No
460002#	FRANKFORT, CITY OF	SPINK COUNTY		10/19/10	10/19/10	10/19/11	No
460312#	FRUITDALE, TOWN OF	BUTTE COUNTY		01/06/12	01/06/12	01/06/13	No
460310#	FULTON, CITY OF	HANSON COUNTY		09/02/09	09/02/09	09/02/10	No
460049#	HUDSON, TOWN OF	LINCOLN COUNTY	11/22/74	12/18/85	04/02/08	04/03/08(S)	No
460010#	KRANZBURG, TOWN OF	CODINGTON COUNTY		01/16/09	01/16/09	01/16/10	No
461216#	LILY, TOWN OF	DAY COUNTY		12/06/01	12/06/01	12/06/02	No
460209#	NEWELL, CITY OF	BUTTE COUNTY	07/18/75	01/06/12	01/06/12	07/18/76	No
460245#	NISLAND, CITY OF	BUTTE COUNTY	02/04/77	01/06/12	01/06/12	02/04/78	No
460080#	NORTHVILLE, TOWN OF	SPINK COUNTY	12/13/74	10/19/10	10/19/10	12/13/75	No
460217#	OLIVET, TOWN OF	HUTCHINSON COUNTY		09/02/09	09/02/09	09/02/10	No
460131#	PIERPONT, TOWN OF	DAY COUNTY		12/06/01	12/06/01	12/06/02	No
460315#	QUINN, TOWN OF	PENNINGTON COUNTY		06/03/13	06/03/13	06/03/14	No
460137#	ROSLYN, TOWN OF	DAY COUNTY	04/25/75	12/06/01	12/06/01	04/25/76	No
460214	SELBY, CITY OF	WALWORTH COUNTY	07/25/75		11/07/78	07/25/76	No
460188#	SOUTH SHORE, TOWN OF	CODINGTON COUNTY		01/16/09	01/16/09	01/16/10	No
460138	ST. FRANCIS, TOWN OF	TODD COUNTY	09/19/75		09/19/75	09/19/76	No
460139	ST. LAWRENCE, TOWN OF	HAND COUNTY	07/18/75		07/18/75	07/18/76	No
461199#	VERDON, TOWN OF	BROWN COUNTY		09/30/88	03/18/08	09/30/89	No
460215#	VOLIN, TOWN OF	YANKTON COUNTY		07/06/10	07/06/10	07/06/11	No
460225#	WALL, TOWN OF	PENNINGTON COUNTY		06/03/13	06/03/13	06/03/14	No
460250#	WASTA, TOWN OF	PENNINGTON COUNTY	12/24/76	06/03/13	06/03/13	12/24/77	No
460147#	WESSINGTON, TOWN OF	BEADLE COUNTY	08/22/75	06/02/09	06/02/09	08/22/76	No
460073#	WHITE ROCK, TOWN OF	ROBERTS COUNTY		07/20/09	07/20/09	07/20/10	No
460148#	WHITE, TOWN OF	BROOKINGS COUNTY	04/30/76	07/16/08	07/16/08	04/30/77	No
460150#	WOLSEY, TOWN OF	BEADLE COUNTY	08/13/76	06/02/09	06/02/09	08/13/77	No

Summary:

Total Not in Flood Program	34
Total Suspended from Emergency Program	0
Total Suspended from Regular Program	1
Total Withdrawn Communities Not In Program	0
Total Not In Program With Hazard Area Identified	34
Total Not In Program With Hazard Area Identified < 1 Year	2

Federal Emergency Management Agency
Community Status Book Report
SOUTH DAKOTA
Communities Not in the National Flood Program

CID	Community Name	County	Init FHBM Identified	Init FIRM Identified	Curr Eff Map Date	Sanction Date	Tribal

Legend:

(E)	Indicates Entry In Emergency Program
NSFHA	No Special Flood Hazard Area - All Zone C
(>)	Date of Current Effective Map is after the Date of This Report
N/A	Not Applicable At This Time
(S)	Suspended Community
(W)	Withdrawn Community
(M)	No Elevation Determined - All Zone A, C and X
(L)	Original FIRM by Letter - All Zone A, C and X

Appendix 4B

Local Plan Roll Up

	Flooding	Severe Winter Storms	Tornadoes	Wildfires	Landslide and Mudflow	Earthquake	Drought	Extreme Heat	Extreme Cold	Dam Failure	Levee Failure	Flash Flooding	Spring Snow Melt	Ice storm	Ice Jam	Hail	Windstorm	Lightning Strikes	Severe Thunderstorms	Summer Storm (Hail, Lightning, High Winds, Torna	Wildland/Interface Fire	Urban Fire	Agriculture Contamination / Illness in Livestock	Natural Caused mass evacuation	Subsidence/Expansive Soils	Straight Line Wind
Aurora	x	x		x																x						
Beadle	M	H	H	H		L	M	M	M					H	M	H	H	M	x							
Bennett	M	H	H	H		M	H					X								H						
Bon Homme	x	x		x																x						
Brookings	H	H				L	L													M						
Brown	H	H	M	M	L	L	x	H		x					M	H	H	M	x	x					x	
Brule	x	x		x																						
Buffalo	x	x		x																						
Butte	x	x	x	x	x	x	x			x		x							x							x
Campbell	M	H	M	L					H			M				L										x
Charles Mix	x	x	x	x																		x				
Clark	M	H	M	M			H										M				M					
Clay	L	H																		M						
Codington	x	x	x	x			x	x	x	x			x	x		x	x	x	x			x				
Corson	x	x	x	x												x	x	x	x			x				
Custer		x			x	x	x					x								x	x					
Davison	x	x		x																x						
Day	H	H		M			M			L										H		M				
Deuel	M	H	M	L		L	H													H						
Dewey	x	x	x	x												x	x	x	x			x				
Douglas	x	x		x																x						
Edmunds	M	M	H	M		L	M	M	M					H	M	H	M	M	x							
Fall River	x		x	x			x							x		x	x	x	x			x				
Faulk	x	x	x	x			x							x		x	x	x	x		x					
Grant	x	x	x	x			x							x		x		x	x		x					
Gregory	x	x		x																x						
Haakon	H	H	M	H			H			M						M	H									
Hamlin	H	H		M			M													H		M				
Hand	x	x		x			x													x						
Hanson	x	x		x																x						
Harding	x	x		x			x													x						
Hughes	x	x	x	x	x		x			x							x									
Hutchinson	x	x		x																x						
Hyde	L	H	M	M			M									H	H									
Jackson	M	H	M	H	L	L	H			L						H	H			x					L	
Jerauld	x	x	x	x			x										x					x				
Jones	x	x		x		x	x										x									
Kingsbury	x	x	x	x			x							x		x	x	x	x		x					

	Flooding	Severe Winter Storms	Tornadoes	Wildfires	Landslide and Mudflow	Earthquake	Drought	Extreme Heat	Extreme Cold	Dam Failure	Levee Failure	Flash Flooding	Spring Snow Melt	Ice storm	Ice Jam	Hail	Windstorm	Lightning Strikes	Severe Thunderstorms	Summer Storm (Hail, Lightning, High Winds, Torna	Wildland/Interface Fire	Urban Fire	Agriculture Contamination / Illness in Livestock	Natural Caused mass evacuation	Subsidence/Expansive Soils	Straight Line Wind
Lake	x	x	x	x			x							x			x									
Lawrence		x	x		x	x	x					x							x		x	x				
Lincoln	x	x	x																	x						
Lyman	x	x	x	x			x															x				
Marshall	x	x	x	x			x							x			x				x					
McCook	H	H	M						M			L				L	H		L							
Mcpherson	x	x	x	x			x							x			x				x					
Meade	x	x	x	x	x	x	x			x		x							x	x	x		x			
Mellette	L	H	M	M			H			L		L		M		H		H	H							H
Miner	x	x	x	x			x							x			x				x	x				
Minnehaha	x	x	x																	x						
Moody	x	x		x			x			x										x		x				
Pennington	M	H	M	H	M	L	M			L		H				M	M					H				
Perkins	M	H	L	H	L	L	H			L				H					H							
Potter	H	H		M			M			L										H		M				
Roberts	H	H		M			M													H		M				
Sanborn	x	x		x																x						
Shannon	x	x	x	x			x							x		x	x	x	x			x				
Spink	M	H	H	M	M	M	M							H					H	x						
Standing Rock/Sioux	H	H		H	x		M			M										H		L				
Stanley	x	x	x	x	x		x			x							x									
Sully	M	H	M	M			H									H	H									
Todd	x	x	x	x			x			x												x				
Tripp	x	x		x																x						
Turner	H	H	M						M			L				L	H		L							
Union	L	x		L												x				x						
Walworth	x	x	x	x	x		x	x	x			x				x		x								x
Yankton	x	x		x																x						
Ziebach	M	H	M						M			M				L	H		L							
Rosebud Sioux Tribe	x	x	x	x			x										x					x				
	10	24	4	7	0	0	8	1	1	0	0	1	0	4	0	7	9	1	3	7	0	1	0	0	0	1
	12	1	13	11	2	2	10	2	5	2	0	2	0	1	3	2	3	3	0	2	1	4	0	0	0	0
	4	0	1	3	3	8	1	0	0	6	0	3	0	0	0	4	0	0	3	0	0	1	0	0	1	0
	40	42	25	38	8	5	26	2	2	8	0	6	1	10	0	10	16	9	14	21	9	13	1	0	1	3
	66	**67**	**43**	**59**	**13**	**15**	**45**	**5**	**8**	**16**	**0**	**12**	**1**	**15**	**3**	**23**	**28**	**13**	**20**	**30**	**10**	**19**	**1**	**0**	**2**	**4**

	Man-Made Hazards	Agricultural pests and Diseases	Infectious Diseases / Epidemic	Transportation Incidents	Motor Vehicle Transportation Incidents	Aviation Incident	Railway Incident	Ground Transportation Incident	Hazardous Materials Incidents	Structural Fires	Technological Hazards	Societal Hazards	Civil Disturbances	Terrorism	Nuclear Incident	Utility Mishap	Bio-Terrorism	Communication Failure	Power Failure	Explosion	Seasonal Population Shift	Acquifer/Water Supply Contamination	Communications Isolation	Hostage / Violence	Fuel Shortage	Structural Failure	Natural Gas Failure	Sewer Failure	National Security Emergency	Shortage of critical materials	Mass Casualty Incident
Aurora																															
Beadle																															
Bennett																															
Bon Homme																															
Brookings											x			x																	
Brown																															
Brule																															
Buffalo																															
Butte			x			x			x				x	x			x							x							x
Campbell			L																												
Charles Mix																															
Clark						L	M	x	M	M				L	L	L	L														M
Clay														L					H												
Codington																															
Corson				x					x					x																	
Custer									x					x																	
Davison																															
Day									M				L	L															L	L	M
Deuel																															
Dewey				x					x					x																	
Douglas																															
Edmunds																															
Fall River				x					x				x	x	x																
Faulk						x	x		x	x			x	x	x	x	x														x
Grant						x	x		x	x			x	x	x	x	x														x
Gregory																															
Haakon			M						H					L																	
Hamlin									M				L	L															L	L	L
Hand						x		x	x					x																	
Hanson																															
Harding		x																													
Hughes			x						x					x																	
Hutchinson																															
Hyde			M						M					L																	
Jackson			L						M					M																	
Jerauld								x	x				x	x																	
Jones			x						x					x																	
Kingsbury				x	x	x	x		x	x			x	x	x	x	x														x

	Man-Made Hazards	Agricultural pests and Diseases	Infectious Diseases / Epidemic	Transportation Incidents	Motor Vehicle Transportation Incidents	Aviation Incident	Railway Incident	Ground Transportation Incident	Hazardous Materials Incidents	Structural Fires	Technological Hazards	Societal Hazards	Civil Disturbances	Terrorism	Nuclear Incident	Utility Mishap	Bio-Terrorism	Communication Failure	Power Failure	Explosion	Seasonal Population Shift	Acquifer/Water Supply Contamination	Communications Isolation	Hostage / Violence	Fuel Shortage	Structural Failure	Natural Gas Failure	Sewer Failure	National Security Emergency	Shortage of critical materials	Mass Casualty Incident
Lake						x	x		x	x			x	x	x	x	x														x
Lawrence			x	x		x			x				x	x		x		x													x
Lincoln																															
Lyman								x	x				x	x																	
Marshall						x	x		x	x			x	x	x	x	x														x
McCook			M						M	M																					
Mcpherson						x			x	x			x	x	x	x	x														x
Meade			x	x		x			x		x		x	x		x								x						x	x
Mellette		M				L		H	M	H								x	x												
Miner						x		x	x	x			x	x	x	x	x														x
Minnehaha																															
Moody									x				x	x																x	x
Pennington		H/M				L			H					L				M	L/H		H									L	
Perkins			M	L					L				L	L			L		H	L			M	M	L		L	L			L
Potter									M				L	L															L	L	M
Roberts									M				L	L															L	L	M
Sanborn																															
Shannon				x					x				x	x	x																
Spink			H	L		x		x	M				M	M		M	M	H	M	H				H	M		L				H
Standing Rock/Sioux			L	L					L																					L	
Stanley			x						x					x																	
Sully			L						M								L														
Todd		x			x				x									x	x												
Tripp																															
Turner			M						M	M																					
Union														x					x												
Walworth			x						x	x																					
Yankton																															
Ziebach																															
Rosebud Sioux Tribe					x				x				x	x																	
	0	0	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	1	2	1	1	0	0	1	0	0	0	0	0	0	1
	0	1	5	0	0	0	1	0	12	3	0	0	1	2	0	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	4
	0	0	4	3	0	3	0	0	2	0	0	0	5	10	1	1	3	0	0	1	0	0	0	0	1	0	2	1	4	6	2
	0	2	7	7	3	12	5	6	25	8	2	0	16	25	9	9	8	3	3	0	0	0	0	2	0	0	0	0	0	2	11
	0	**3**	**17**	**10**	**3**	**15**	**6**	**7**	**41**	**12**	**2**	**0**	**22**	**37**	**10**	**11**	**12**	**5**	**6**	**2**	**1**	**0**	**1**	**4**	**2**	**0**	**2**	**1**	**4**	**8**	**18**

Local Capabilities Identified by County	Comprehensive Plan	Zoning / Planning Commission	Building Code	Capital Improvement Plans	Outdoor / Indoor Warning System / Proactive Weather Program	NOAA Weather Radio	Designated Storm Shelters	Weather Spotters	Monitor Drought Situation	Public Awareness Campaigns / CERT / Citizen Corp	Tree-trimming from power lines	Equipment for winter storm response	Pre-Planning for Winter Operations	continual maintenance of infrastructure (electrical, lift stations, sewer, drain)	Emergency Power	Regular dam and culvert inspections and maintenance	Response plan in case of dam failure	Stored Sandbags for flood fighting operations	NFIP / Strict development regulation in flood hazard zones/ Floodplain Management Program	Regular training for Emergency Responders	Public safety programs for public and children	Mutual Aid Agreements with other fire departments	Catalogue and Track Hazardous Materials	Equipment to respond to Hazardous Materials Incidents
Aurora	x				x		x	x		x		x	x	x		x		x	x	x	x	x		
Beadle	x	x	x																					
Bennett					x		x		x	x			x		x						x			
Bon Homme	x				x		x	x		x		x			x	x	x		x	x	x	x		
Brookings	x		x	x							x								x					
Brown																			x					
Brule					x		x	x		x		x	x		x	x	x		x	x	x	x		
Buffalo					x		x	x		x		x	x			x			x	x	x	x		
Butte					x	x	x	x					x	x	x		x			x			x	
Campbell		x	x		x	x													x			x		
Charles Mix					x		x	x		x		x		x		x			x	x	x	x		x
Clark					x									x		x				x				x
Clay			x											x		x			x	x				
Codington	x	x	x	x	x			x		x									x					
Corson					x									x		x				x				
Custer	x	x	x		x	x	x			x		x	x						x	x				
Davison			x		x	x	x	x		x		x	x		x	x	x	x	x	x	x	x		
Day		x	x																x				x	
Deuel	x		x																x	x				
Dewey					x									x						x				
Douglas					x		x	x		x		x	x			x	x	x	x	x	x	x		
Edmunds					x	x	x	x		x									x					
Fall River			x		x					x									x	x				
Faulk					x									x						x				x
Grant					x									x					x	x				
Gregory					x		x	x		x		x	x		x	x		x	x	x	x			
Haakon		x																	x					
Hamlin		x	x																x				x	
Hand					x	x	x												x	x			x	
Hanson					x		x	x		x		x			x	x		x	x	x	x	x		
Harding	x	x			x												x							
Hughes	x	x													x									
Hutchinson			x		x		x	x		x		x			x	x	x	x	x	x	x			
Hyde		x	x		x		x	x		x										x				
Jackson																				x				
Jerauld					x			x		x		x				x			x	x	x	x	x	x
Jones	x	x			x			x		x		x				x		x		x	x	x	x	x

Local Capabilities Identified by County	Fire bans and public water restrictions during dry periods	Increased security, communication, and educational outreach to prevent terrorism	Stormwater master plan	"Storm Ready"	Regular road maintenance and repair	Emergency Operations Center / Incident Command System Interface	Local Emergency Operations Plans	Digital Infrastructure Mapping	911 Addressing	Hazard Mitigation Interagency Team / Local Emergency Planning Committee	Regional Terrorism Response Plan	Flood Damage Prevention Ordinance	HAZUS	State Hazard Mitigation Plan	Elevation Certificates/Ordinance	Drainage Ordinance	Radio Station Weather Announcements	NIMS Compliant	Fire Mitigation Plan	Contingency Plans	SD Electric Cooperatives Mutual Aid Plan	Equipment to handle fire/wildfire	Emergency exercises to test emergency response plans	CWPP	GIS Data and Mapping
Aurora												x									x	x			
Beadle							x					x	x	x		x									
Bennett	x					x																			
Bon Homme																					x	x			
Brookings			x																						
Brown																									
Brule																					x	x			
Buffalo																					x	x			
Butte							x			x								x					x	x	
Campbell	x																								
Charles Mix																						x			
Clark	x	x																							
Clay	x						x																		
Codington												x													
Corson	x																								
Custer	x					x											x		x					x	x
Davison	x			x						x						x					x	x			x
Day							x																		
Deuel						x	x	x	x	x															
Dewey	x																								
Douglas										x											x	x			
Edmunds	x																					x			
Fall River	x									x	x														
Faulk	x	x					x																		
Grant	x	x																							
Gregory										x											x	x			
Haakon							x			x															
Hamlin							x																		
Hand				x			x																x		
Hanson																					x	x			
Harding																						x		x	
Hughes							x								x										
Hutchinson										x						x					x	x			
Hyde							x			x															x
Jackson							x			x		x			x	x				x	x	x			
Jerauld	x									x															
Jones	x	x																							

Local Capabilities Identified by County	Comprehensive Plan	Zoning / Planning Commission	Building Code	Capital Improvement Plans	Outdoor / Indoor Warning System / Proactive Weather Program	NOAA Weather Radio	Designated Storm Shelters	Weather Spotters	Monitor Drought Situation	Public Awareness Campaigns / CERT / Citizen Corp	Tree-trimming from power lines	Equipment for winter storm response	Pre-Planning for Winter Operations	continual maintenance of infrastructure (electrical, lift stations, sewer, drain)	Emergency Power	Regular dam and culvert inspections and maintenance	Response plan in case of dam failure	Stored Sandbags for flood fighting operations	NFIP / Strict development regulation in flood hazard zones/ Floodplain Management Program	Regular training for Emergency Responders	Public safety programs for public and children	Mutual Aid Agreements with other fire departments	Catalogue and Track Hazardous Materials	Equipment to respond to Hazardous Materials Incidents	Fire bans and public water restrictions during dry periods	Increased security, communication, and educational outreach to prevent terrorism	Stormwater master plan	"Storm Ready"	Regular road maintenance and repair	Emergency Operations Center / Incident Command System Interface	Local Emergency Operations Plans	Digital Infrastructure Mapping	911 Addressing	Hazard Mitigation Interagency Team / Local Emergency Planning Committee	Regional Terrorism Response Plan	Flood Damage Prevention Ordinance	HAZUS	State Hazard Mitigation Plan	Elevation Certificates/Ordinance	Drainage Ordinance	Radio Station Weather Announcements	NIMS Compliant	Fire Mitigation Plan	Contingency Plans	SD Electric Cooperatives Mutual Aid Plan	Equipment to handle fire/wildfire	Emergency exercises to test emergency response plans	CWPP	GIS Data and Mapping
Kingsbury					x									x	x									x	x						x																		
Lake	x	x	x		x	x									x							x		x						x																x	x		x
Lawrence					x															x																							x			x		x	
Lincoln			x		x		x					x	x		x	x			x	x				x																						x			
Lyman					x		x	x		x		x				x				x	x	x			x									x												x			
McCook		x	x									x							x	x		x			x						x															x			
Mcpherson					x									x						x				x	x	x																							
Marshall					x									x		x				x				x	x						x																		
Meade	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x		x	x		x	x		x	x			x	x	x	x	x	x								x	x	x					
Mellette																															x																		
Miner					x									x						x			x	x	x						x																		
Minnehaha			x		x		x					x	x		x	x			x	x				x																						x			
Moody		x	x																x																														
Pennington																			x												x					x												x	
Perkins																				x		x									x			x															
Potter	x	x	x																x				x								x																		
Roberts	x	x	x																x				x								x																		
Sanborn					x		x	x		x		x	x			x		x	x	x	x	x												x											x	x			
Shannon														x											x																								
Spink	x	x	x	x	x		x												x	x			x	x				x						x															
Standing Rock/Sioux		x	x		x												x		x									x			x																		x
Stanley	x	x													x																x								x										
Sully		x																	x												x			x															
Todd																														x																			
Tripp			x		x		x	x		x		x	x		x	x	x	x	x	x	x	x			x									x											x	x			
Turner	x		x										x						x						x						x															x			
Union			x																x						x																								
Walworth																																																	
Yankton			x		x		x	x		x					x	x	x	x	x	x	x	x																							x	x			
Ziebach			x										x						x		x	x			x						x															x			
Rosebud Sioux Tribe					x			x		x		x			x	x			x	x	x	x	x	x	x	x			x																				
total # of counties	17	21	28	3	43	8	24	22	2	24	1	21	16	15	18	24	11	10	43	40	19	21	12	14	27	7	1	4	2	6	27	2	2	18	1	5	1	1	3	4	1	2	3	2	13	24	3	5	5

County	Presidential Declarations Info	Pres Dec Total Damage	Pres Dec PA Costs	Pres Dec Damage to Rural Electrics	Total Exposure Value	Total Exposure Value in Hazard Area	Estimated Potential Losses to Vulnerable Structures (RECs)
Aurora	1984-2008: Severe Storms, Flooding, Tornadoes, Severe Winter Storm	276,346,345.00	72,222.00	1,002,498			
Beadle							51,505,000
Bon Homme	1984-2008: Severe Storms, Flooding, Tornadoes, Severe Winter Storm	267,290,006	69,221	259,618			
Brown					366,861,690		18,692,486
Brule	1995-2008: Winter Storm, Flooding, Severe Storms, Tornadoes	185,823,500	145,334		140,560,762*		
Buffalo	1969-2008: Flooding, Severe Storms, Tornadoes, Winter Storm	202,871,803	119,650	73,628	3,598,188*		
Butte	2004-2009: winter storm, flooding, severe storm	993,635.60		3,374,059			

County	Presidential Declarations Info	Pres Dec Total Damage	Pres Dec PA Costs	Pres Dec Damage to Rural Electrics	Total Exposure Value	Total Exposure Value in Hazard Area	Estimated Potential Losses to Vulnerable Structures (RECs)
Campbell							
Charles Mix					979,208,000*****		
Codington	1969-2011: Flooding, Severe Storms, Tornadoes, Winter Storm	281,640,839	78,017,203.04		1,235,662,306	163,949,836**	3,436,200
Davison	1984-2007: severe storms, flooding, tornadoes, winter storm	267,290,006	341,094	3,218,744		74,044,985 (Land and Improvement Value located in Flood Hazard Zones)	
Douglas	1986-2008:Severe Storms, Flooding, Tornado, Winter Storm	242,437,444	86,837	513,000			

County	Presidential Declarations Info	Pres Dec Total Damage	Pres Dec PA Costs	Pres Dec Damage to Rural Electrics	Total Exposure Value	Total Exposure Value in Hazard Area	Estimated Potential Losses to Vulnerable Structures (RECs)
Edmunds					96,341,729		
Gregory	1993-2008: Severe Storms, Tornadoes, Winter Storm, Flooding	273,408,650	392,436				
Haakon	1995-2008: Winter Storm, Flooding, Severe Storms, High Winds - Estimated Damage (Some damage unknown)	5,322,764			146,783,000		
Hanson	1969-2008: Flooding, Severe Storms, Tornadoes, Winter Storm	307,779,879	260,455	1,951,130			
Harding							
Hughes							
Hutchinson	1969-2008: Flooding, Severe Storms, Tornadoes, Winter Storm	279,834,448	504,172	1,686,000			

County	Presidential Declarations Info	Pres Dec Total Damage	Pres Dec PA Costs	Pres Dec Damage to Rural Electrics	Total Exposure Value	Total Exposure Value in Hazard Area	Estimated Potential Losses to Vulnerable Structures (RECs)
Hyde	1995-2011: flooding, winter storm, severe weather, high winds, severe storm, winter storm	21,569,859			104,891,000		
Jackson					189,889,880		
Jerauld							
Lake							
Lawrence					114,999,377****		
Lincoln	1960-2010: Flooding, tornadoes, severe storms, winter storms	213,179,640			4,059,264,827		
Lyman							
McCook							
Mellette					79,000,000		
Minnehaha	1960-2010: Flooding, tornadoes, severe storms, winter storms	174,208,072			11,609,473,010		

County	Presidential Declarations Info	Pres Dec Total Damage	Pres Dec PA Costs	Pres Dec Damage to Rural Electrics	Total Exposure Value	Total Exposure Value in Hazard Area	Estimated Potential Losses to Vulnerable Structures (RECs)
Moody							
Pennington					5,606,639		
Sanborn	1993-2010: Severe Storms, Flooding, Tornadoes, Winter Storm	273,408,650	1,654,617	708,956	50,077,084		
Standing Rock/Sioux							
Stanley							
Sully					114,641,000		
Tripp	1986-2008 - Severe Storms, Flooding, Winter Storms, Tornadoes	200,130,639	662,188				
Turner							
Walworth							
Yankton	1984-2007: severe storms, flooding, tornadoes, winter storm	229,049,163	118,716	100,284	936,703,138		
Ziebach							

County	Flood Potential Losses Info	Flood Potential Losses	Flood Crop Potential Losses Info	Flood Crop Potential Losses	Flood Average Annualized Losses	Winter Storm Potential Losses	Winter Storm Average Annualized Losses	Winter Storm Potential Crop Losses Info	Winter Storm Potential Crop Losses
Aurora	Total Amount of Land and Improvement Values for Plankinton	2,606,571	2000-2008	15,551				2000-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	$1,063,398
Beadle									
Bon Homme	Total Amount of Land and Improvement Values for Avon, Springfield, Tabor, and Tyndall	10,594,484	2000-2008	9,283				2000-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	153,043
Brown									
Brule	Total Amount of Land, Residential, and Non-Residential Losses for Chamberlain and Pukwana	2,610,247	2000-2008	13,162		140,560,762		2000-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	$2,867,930
Buffalo	Total Amount of Land and Improvement Values for Fort Thompson and Gann Valley	267,042				3,598,188		200-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	1,169,509
Butte									

County	Flood Potential Losses Info	Flood Potential Losses	Flood Crop Potential Losses Info	Flood Crop Potential Losses	Flood Average Annualized Losses	Winter Storm Potential Losses	Winter Storm Average Annualized Losses	Winter Storm Potential Crop Losses Info	Winter Storm Potential Crop Losses
Campbell	Includes income and total building loss from flood in Campbell County based on HAZUS	8,910,000							
Charles Mix									
Codington	Based off of HAZUS run in 2008 SHMP. Amount includes building damage, contents damage, and income loss	93,040,000							
Davison	Total Residential and Commercial Land and Building Values for Mitchell and Mount Vernon	4,803,465	2000-2008	14,269				2000-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	365,553
Douglas	Total Assessed Land and Improvement Values for Armour and Delmont	2,084,412	2000-2008	33,777				2000-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	513,676

County	Flood Potential Losses Info	Flood Potential Losses	Flood Crop Potential Losses Info	Flood Crop Potential Losses	Flood Average Annualized Losses	Winter Storm Potential Losses	Winter Storm Average Annualized Losses	Winter Storm Potential Crop Losses Info	Winter Storm Potential Crop Losses
Edmunds									
Gregory	Total Assessed Land and Improvement Values for Bonesteel and Gregory	593,690							
Haakon	HAZUS-MH	12,150,000				146,783,000	98,073.45***		
Hanson	Total Assessed and Improvement Values for Bloom Creek, James River, Johnson Creek, Lake Hanson, Pierre Creek, Plum Creek, Rock Creek, Twelvemile Creek, Wolf Creek	27,518,510	2000-2008	62,847				2000-2008 - Total Amount of Losses from Freeze/Frost and Cold Winter	1,240,916
Harding							128,996.60***		
Hughes	HAZUS MH - includes Captial Stock Losses and Income Losses	8,698,000							
Hutchinson	Total Land and Improvement Value for both urban (Freeman, Menno, Olivet, Parkston) and rural areas	21,919,495	2000-2008	930,958				Total Crop Losses from 2000-2008 from cold winter and freeze/frost	649,332

County	Flood Potential Losses Info	Flood Potential Losses	Flood Crop Potential Losses Info	Flood Crop Potential Losses	Flood Average Annualized Losses	Winter Storm Potential Losses	Winter Storm Average Annualized Losses	Winter Storm Potential Crop Losses Info	Winter Storm Potential Crop Losses
Hyde	HAZUS MH	720,000				104,891,000	12,777.27***		
Jackson	Includes total building damage and total contents damage from HAZUS	1,425,000				189,889,880			
Jerauld	Total Building Stock Exposure created by HAZUS for Alpena, Lane, Wessington Springs	11,791,000							
Lake	Total Building Value in Lake County	802,854,000							
Lawrence	Total Valuation of property in the floodplain	15,441,051							
Lincoln	HAZUS MH - includes building damage loss and contents damage loss	14,101,000	Total Crop Losses from 2000-2009 from flooding	297,269	50,000***		470,937.50***	Total Crop Losses from 2000-2009 from cold winter and freeze/frost	17,374
Lyman	HAZUS MH building damage and transportation system exposure	1,338,355							
McCook	Total building related economic loss estimate from HAZUS	6,220,000							
Mellette	Total economic loss from HAZUS	2,330,000							
Minnehaha	HAZUS MH - includes building damage loss and contents damage loss	414,885,000	Total Crop Losses from 2000-2009 from flooding	16,297	4,238,647.05***		505,000***	Total Crop Losses from 2000-2009 from cold winter and freeze/frost	106,289

County	Flood Potential Losses Info	Flood Potential Losses	Flood Crop Potential Losses Info	Flood Crop Potential Losses	Flood Average Annualized Losses	Winter Storm Potential Losses	Winter Storm Average Annualized Losses	Winter Storm Potential Crop Losses Info	Winter Storm Potential Crop Losses
Moody	HAZUS MH - includes economic loss estimated from flooding and total building related losses	11,920,000							
Pennington	HAZUS MH	568,761							
Sanborn	Assesed value of property located in the floodplain	14,082,224				50,077,084			
Standing Rock/Sioux	Estimated Economic Losses to Buildings during a 100 year event from HAZUS	4,991,000							
Stanley	HAZUS MH - includes Captial Stock Losses and Income Losses	26,296,000							
Sully	HAZUS-MH	1,040,000				114,641,000	12,777.27***		
Tripp	Total Land and Improvement Value for Colome, New Witten, and Winner	6,783,581	2000-2004	528				Total Crop Loss from 2000-2008 from freeze/frost and cold winter	1,516,477
Turner	Building related economic loss estimate from HAZUS	6,220,000							
Walworth	HAZUS MH includes contents loss, income loss, and building loss	6,121,000				narrative description on page 66			
Yankton	HAZUS MH includes assessed land and improvement values for both urban and rural areas	146,043,939	Total Crop Loss due to flooding from 2000-2008	484,297		936,703,138		Total Crop Loss from 2000-2008 from freeze/frost and cold winter	27,510
Ziebach	Building Related Economic Loss Estimate from HAZUS	2,160,000							

County	Summer Storm Potential Losses	Summer Storm Potential Crop Losses Info	Summer Storm Potential Crop Losses	Summer Storm Average Annualized Losses	Lightning Strike Potential Losses	Tornado Potential Losses Info	Tornado Potential Losses	Tornado Average Annualized Losses	Tornado Average Annualized Crop Losses
Aurora		2000-2008 - Total Amount of Losses from Hail and High Wind	$1,040,912						
Beadle									
Bon Homme		2000-2008 - Total Amount of Losses from Hail and High Wind	1,702,221						
Brown									
Brule	140,560,762	2000-2008 - Total Amount of Losses from Hail and High Wind	$417,916						
Buffalo	3,598,188	2000-2008 - Total Amount of Losses from Hail and High Wind	671,424						
Butte									

County	Summer Storm Potential Losses	Summer Storm Potential Crop Losses Info	Summer Storm Potential Crop Losses	Summer Storm Average Annualized Losses	Lightning Strike Potential Losses	Tornado Potential Losses Info	Tornado Potential Losses	Tornado Average Annualized Losses	Tornado Average Annualized Crop Losses
Campbell									
Charles Mix									
Codington						Based off of HAZUS run in 2008 SHMP. Total includes annualized losses from 1950-2006	332,236		
Davison		2000-2008 - Total Amount of Losses from Hail and High Wind	460,494						
Douglas		2000-2008 - Total Amount of Losses from Hail and High Wind	383,766						

County	Summer Storm Potential Losses	Summer Storm Potential Crop Losses Info	Summer Storm Potential Crop Losses	Summer Storm Average Annualized Losses	Lightning Strike Potential Losses	Tornado Potential Losses Info	Tornado Potential Losses	Tornado Average Annualized Losses	Tornado Average Annualized Crop Losses
Edmunds									
Gregory									
Haakon							146,783,000	135,201.50***	
Hanson		2000-2008 - Total Amount of Losses from Hail and High Wind	992,816						
Harding				13,360***					
Hughes									
Hutchinson		2000-2008 - Total Amount of Losses from Hail and High Wind	1,410,159						

County	Summer Storm Potential Losses	Summer Storm Potential Crop Losses Info	Summer Storm Potential Crop Losses	Summer Storm Average Annualized Losses	Lightning Strike Potential Losses	Tornado Potential Losses Info	Tornado Potential Losses	Tornado Average Annualized Losses	Tornado Average Annualized Crop Losses
Hyde							104,891,000	1,602.08***	
Jackson	189,889,880						189,889,880		
Jerauld									
Lake									
Lawrence									
Lincoln		Total Crop Losses from 2000-2009 from hail and excess rain	9,462,363	153,840***				562,892.86***	
Lyman									
McCook								466,666	8,333
Mellette									
Minnehaha		Total Crop Losses from 2000-2009 from hail and excess rain	5,808,376	611,680***				216,839***	

County	Summer Storm Potential Losses	Summer Storm Potential Crop Losses Info	Summer Storm Potential Crop Losses	Summer Storm Average Annualized Losses	Lightning Strike Potential Losses	Tornado Potential Losses Info	Tornado Potential Losses	Tornado Average Annualized Losses	Tornado Average Annualized Crop Losses
Moody									
Pennington									
Sanborn	50,077,084								
Standing Rock/Sioux									
Stanley									
Sully							114,641,000	2,878.67***	
Tripp		Total Crop Losses due to hail and high wind from 2000-2008	848,285						
Turner								208,333	
Walworth					$30 million nationally. No damage reported in the county. (page 69)			8,333.33***	
Yankton	936,703,138	Total Crop Losses due to hail and high wind from 2000-2008	1,628,177						
Ziebach								14,841	1,190

County	High Wind Average Annualized Losses	High Wind Potential Losses	High Wind Potential Crop Losses Info	High Wind Potential Crop Losses	Wildfire Potential Losses Info	Wildfire Potential Losses	Wildfire Average Annualized Losses	Hail Potential Losses	Hail Average Annualized Losses	Hail Average Annualized Crop Losses
Aurora										
Beadle										
Bon Homme										
Brown										
Brule										
Buffalo										
Butte										

County	High Wind Average Annualized Losses	High Wind Potential Losses	High Wind Potential Crop Losses Info	High Wind Potential Crop Losses	Wildfire Potential Losses Info	Wildfire Potential Losses	Wildfire Average Annualized Losses	Hail Potential Losses	Hail Average Annualized Losses	Hail Average Annualized Crop Losses
Campbell										
Charles Mix										
Codington										
Davison										
Douglas										

County	High Wind Average Annualized Losses	High Wind Potential Losses	High Wind Potential Crop Losses Info	High Wind Potential Crop Losses	Wildfire Potential Losses Info	Wildfire Potential Losses	Wildfire Average Annualized Losses	Hail Potential Losses	Hail Average Annualized Losses	Hail Average Annualized Crop Losses
Edmunds										
Gregory					Based off of SHMP HAZUS run, estimated bldg replacement value for Gregory County	242,088,000				
Haakon	11,667.98***	146,783,000				146,783,000		146,783,000	17,263***	
Hanson										
Harding										
Hughes										
Hutchinson										

County	High Wind Average Annualized Losses	High Wind Potential Losses	High Wind Potential Crop Losses Info	High Wind Potential Crop Losses	Wildfire Potential Losses Info	Wildfire Potential Losses	Wildfire Average Annualized Losses	Hail Potential Losses	Hail Average Annualized Losses	Hail Average Annualized Crop Losses
Hyde	8,472***	104,891,000			City of Highmore (Moderate Risk Zone) building value	21,124,736	24,660	104,891,000	5,929***	
Jackson						189,889,880				
Jerauld										
Lake										
Lawrence										
Lincoln	189,062.50***		Total Crop Losses from 2000-2009 from Winds	35,856						
Lyman										
McCook									39,537	5,555
Mellette										
Minnehaha	194,062.50***		Total Crop Losses from 2000-2009 from Winds	190,565						

County	High Wind Average Annualized Losses	High Wind Potential Losses	High Wind Potential Crop Losses Info	High Wind Potential Crop Losses	Wildfire Potential Losses Info	Wildfire Potential Losses	Wildfire Average Annualized Losses	Hail Potential Losses	Hail Average Annualized Losses	Hail Average Annualized Crop Losses
Moody										
Pennington										
Sanborn										
Standing Rock/Sioux										
Stanley										
Sully	11,667.98***	114,641,000					263,850	114,641,000		
Tripp										
Turner	16,666								62,407	31,481
Walworth	7,500***				Value of parcels burned from 1999-2009 and "other" losses such as equipment	75,200		narrative on page 73.		
Yankton					Includes land, home, and other structure value for Lewis and Clark area	107,659,196				
Ziebach										

County	Landslide/Mud slide	Extreme Heat Potential Losses	Extreme Cold Potential Losses	Drought Potential Losses	Structure Fire Potential Losses	HazMat Average Annualized Losses	Ag Pests and Diseases Potential Losses	Comments
Aurora								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight.
Beadle								Table 4.18 on page 46 shows estimated potential dollar losses to vulnerable structures for Beadle County; however, only residential, commercial, and agricultural structures are tallied and there is no total value. Also missing is potential loss information by hazard. Obtaining Appendix G may give HAZUS information for flood.
Bon Homme								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are the most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight.
Brown								
Brule								Winter Storm - Rural areas of county are vulnerable to storms.
Buffalo								
Butte								

County	Landslide/Mud slide	Extreme Heat Potential Losses	Extreme Cold Potential Losses	Drought Potential Losses	Structure Fire Potential Losses	HazMat Average Annualized Losses	Ag Pests and Diseases Potential Losses	Comments
Campbell								For each hazard that is ranked there is a "Loss Estimate Range" in the Magnitude section. - Page 107. Extreme cold may cuase loss of wildlife and vegetation, kill livestock and other domestic animals. Economic loss may result from flooding due to burst pipes, large demands on energy resources, and diminished busniess activity. The potential for river flooding on the Missouri River is low and may not be a concern. Records show that no significant property or crop damage was a direct result from extreme cold temperatures. Page 61 includes Loss Estimate from winter storm, but narrative Page 63 includes Loss Estimate from lightning, but narrative Page 68 includes Loss Estimate from Hail but narrative Page 72 - Since 1950 there has been approx $200,000 in reported property damages and $90,000 in crop damage due to tornadoes in the County. Page 76- Since 1950 there has been approx $45,000 in reported personal damage and crop losses tied to straight line wind as reported by SHELDUS. Page 90 - wildfire - The assumption is usually made that there is 100% loss which is frequently not the case. The fires were predominately grassland so crop loss in only about 380 acres or 2%. This loss does include farm equipment and costs associated with the response.
Charles Mix								High Potential Loss facilities (dams) are located in the Appendix on Page 26.
Codington								
Davison								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are the most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight.
Douglas								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are the most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight.

County	Landslide/Mud slide	Extreme Heat Potential Losses	Extreme Cold Potential Losses	Drought Potential Losses	Structure Fire Potential Losses	HazMat Average Annualized Losses	Ag Pests and Diseases Potential Losses	Comments
Edmunds								Numbers are incomplete but will be updated in next plan. This is just the structures located in the County and does not include structures located in the municipalities.
Gregory								
Haakon								
Hanson								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are the most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight. Another area of potential vulnerability is along the Burlington Northern Santa Fe Railroad line.
Harding								
Hughes								
Hutchinson								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are the most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight.

County	Landslide/Mud slide	Extreme Heat Potential Losses	Extreme Cold Potential Losses	Drought Potential Losses	Structure Fire Potential Losses	HazMat Average Annualized Losses	Ag Pests and Diseases Potential Losses	Comments
Hyde						$35.00		
Jackson								
Jerauld								
Lake								
Lawrence								
Lincoln								
Lyman								
McCook								Narratives of potential losses located on pages 56, 65-66, 79, 84, 89, 92-94, 101, 104, 106, 110
Mellette								
Minnehaha								

County	Landslide/Mud slide	Extreme Heat Potential Losses	Extreme Cold Potential Losses	Drought Potential Losses	Structure Fire Potential Losses	HazMat Average Annualized Losses	Ag Pests and Diseases Potential Losses	Comments
Moody								
Pennington								
Sanborn								
Standing Rock/Sioux							91,225,000	Ag Pests and Diseases = total of crops and cattle sold
Stanley								
Sully						239.43		
Tripp								Wildfire - No formal analysis. Reasonable assumption that the rural areas of the county are the most vulnerable. Since most of these areas lack a significant population base and critical infrastructure, the loss potential is slight.
Turner								
Walworth		Estimated at billions to hundreds of billions nationally (page 57)	Loss of wildlife, vegetation, livestock and other domestic animals. Flooding due to pipe bursts, large demands on energy resources and diminished business activity (page 60)	Page 51 includes a table from 1970-2009 of farmer's income that could have the potential to be lossed given a drought.	It is estimated that total annual losses in the county are in the thousands of dollars (page 109)	narrative on page 114		
Yankton								
Ziebach								

* Total Exposure Value includes Owner-occupied property valuation and "Other" valuation - non owner occupied, commercial, and utility - within entire county.
** Value of structures in hazard area was estimated by determining the avg value per structure and multiplying that value by the number of properties or structures used with a corresponding land use.
*** Annualized Average Potential Losses taken by dividing the total property and crop damages from SHELDUS or NCDC by the total number of years (1959-2009)
**** Valuation of property at risk in the County, which includes both building and contents values for critical facilities
*****Includes Building Stock Exposure and Transportation System Dollar Exposure

Appendix 6A

Project Closeout Procedures

ATTACHMENT 9D

PROJECT CLOSEOUT PROCEDURES

1. Following the sub-grantee's final request for payment, the sub-grantee will request closeout of the project by letter, addressed to the SDHMO (See Attachment 9E).

2. Upon receipt of this letter from the sub-grantee, the SDHMO will prepare a reconciliation file for FEMA complete with copies of all relevant invoices, vouchers, receipts, bills of lading, sub-grantee checks and warrants, and grantee checks and warrants. The SDHMO will also include a Financial Reconciliation/Adjustment worksheet and a Mitigation Final Inspection Report.

3. The SDHMO will request in writing to FEMA a deobligation of any remaining grant funds. When the SDHMO has received written verification of this deobligation, the SDHMO will then pay the appropriate amount of administrative allowance to the sub-grantee and submit a copy of the administrative allowance warrant to FEMA.

4. FEMA will review accounting of eligible costs, supporting documentation, and the GAR's evaluation and recommendation. Any unused grant funds (project and administrative allowance) must be refunded to the grantee (see E3 above). FEMA will not pay more than the initial amount approved unless additional funds were requested and approved according to Cost Overrun Procedures.

5. As soon as the South Dakota Office of Emergency Management is notified that FEMA agrees with the information contained in the reconciliation file, the GAR will submit a letter to FEMA certifying that the project was completed in accordance with FEMA approvals; all required and allowable funds have been paid to the sub-grantee; all reported costs were incurred in the performance of eligible work; work was completed in compliance with the provisions of the FEMA-State Agreement; payments for the project were made in accordance with the existing requirements of Federal and State laws and regulations; no further requests for funding on this project will be made; and there are no pending bills.