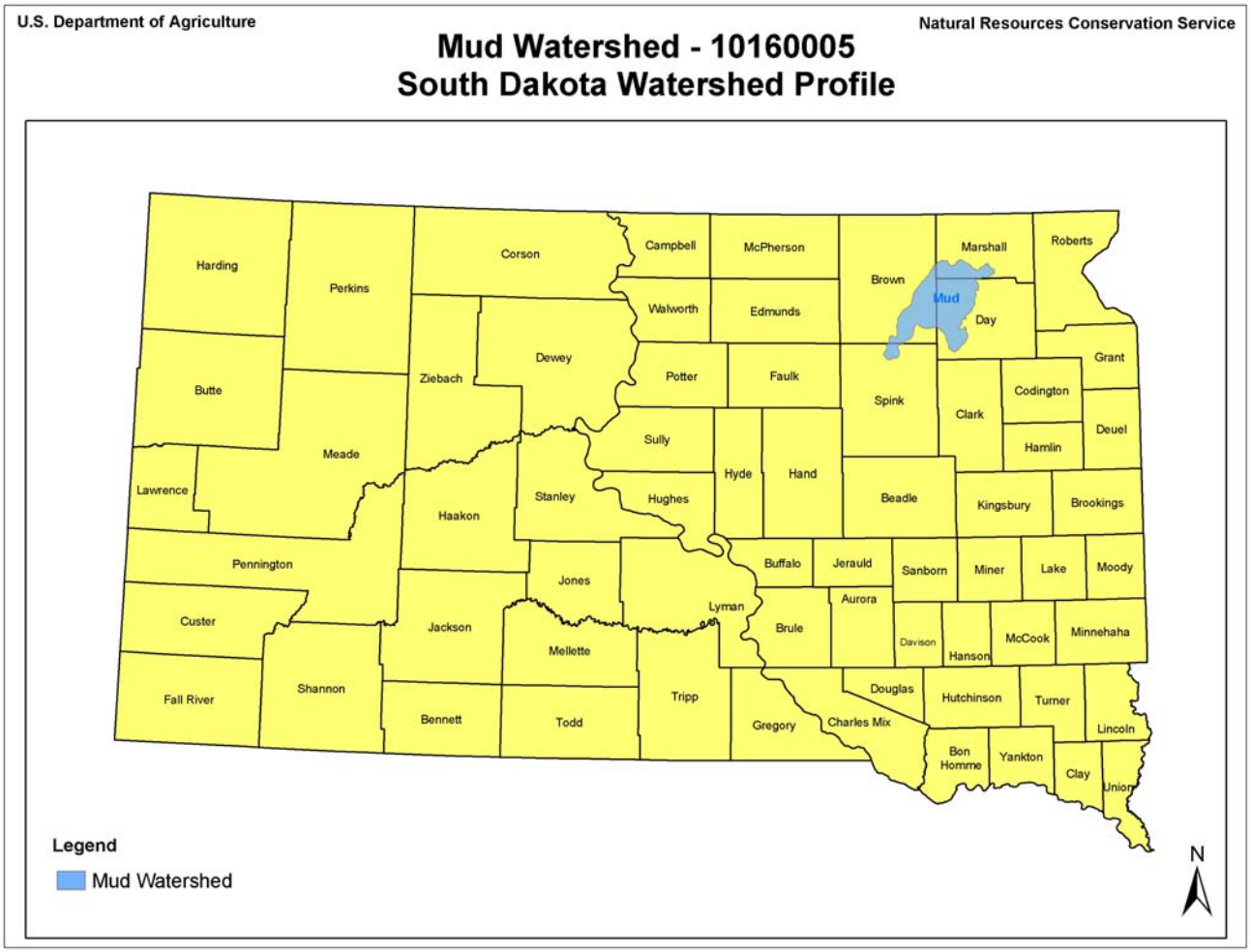
South Dakota

MUD - 10160005
8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service **July 2009**

SOUTH DAKOTA
Rapid Watershed Assessment



JULY 2009

Produced by:
United States Department of Agriculture
Natural Resources Conservation Service
200 Fourth Street SW
Huron, South Dakota 57350

South Dakota

MUD
8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service (NRCS) **May 2008**

South Dakota

MUD - 10160005
8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service **July 2009**

Mud Watershed
South Dakota (SD)

Rapid Watershed Assessment Project

Sponsored by:

SD Association of Conservation Districts

SD Department of Environment and Natural Resources

SD Department of Agriculture

SD Department of Game, Fish, and Parks

Brown Conservation District

Day Conservation District

Marshall Conservation District

Spink Conservation District

South Dakota

MUD - 10160005
8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service **July 2009**

Executive Summary

A Rapid Watershed Assessment (RWA) document compiles existing resource information and data within a watershed and is used to assist conservation districts, landowners, and other community organizations and stakeholders to identify where conservation investments are best utilized and set resource conservation goals. The RWA contains summaries of resource concerns and opportunities that are useful for a number of resource conservation activities. Local landowners and organizations can use the RWA as a basis to prioritize resource concerns and estimate the technical and financial resources required to achieve their resource conservation goals within the watershed. The assessment provides information that can be used to develop conservation district annual and long-range plans, or establish a foundation for more detailed watershed, area wide, or site-specific natural resource planning and the development of implementation plans.

A RWA provides sufficient information to help facilitate making some key resource management decisions. The RWA:

- Provides a quick and inexpensive source of information on which to base decisions about conservation priorities, allocation of resources, funding for implementation, and how to report outcomes/results.
- Supplies enough detail to identify conservation activities that can be implemented without waiting on further watershed-level studies or analyses.
- Provides a preliminary source of information for standard environmental evaluations.
- Identifies if there is a need for further detailed analysis or watershed studies.
- Determines if there are infrastructure needs.
- Addresses multiple concerns and objectives of landowners and communities.
- Enhances established local, state, and federal partnerships.
- Enables landowners and communities to decide on the best mix of Natural Resources Conservation Service (NRCS) programs and other funding sources to meet their resource concerns/needs.
- Evaluates availability of conservation program tools (cost-share, easements, and technical assistance).

The RWAs consist of two parts: the watershed profile which provides the physical, biological, and sociological characterization of the watershed resources; and the watershed assessment which defines the identified resource concerns and evaluates the effectiveness, the extent, and the associated costs of the conservation practices that address the identified resource concerns.

The RWAs are developed based on the first six steps of the NRCS conservation resource planning process on a watershed scale. The information is general in nature and is not sufficiently detailed to be used in lieu of an area wide or watershed plan when the identified resource concerns require specific information, for example, flood prevention or control. However, the information does provide a solid starting point for local stakeholders to use should they decide to proceed with a more detailed area wide or watershed planning effort or the development of a watershed implementation plan using existing NRCS conservation programs.

South Dakota

MUD - 10160005
8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service (NRCS) **July 2009**

Rapid Watershed Assessment Contents
Part I Watershed Profile

South Dakota

MUD - 10160005
8-DIGIT HYDROLOGIC UNIT PROFILE

USDA Natural Resources Conservation Service (NRCS) **July 2009**

I. WATERSHED PROFILE

1.0 PURPOSE

The watershed resource profile compiles the most recent, readily-available data which provides a physical, biological, and sociological characterization of watershed resources. The profile inventories the current resource health and condition of the soil, water, plants, animals, and social resources of a watershed and identifies the known resource concerns. The watershed profile also provides a brief overview of the social and economic composition of the watershed.

The profile summary of the resource conditions, concerns, and opportunities is useful for a number of conservation activities. Local landowners and organizations can use the information to prioritize resource concerns and estimate the technical and financial resources required to achieve resource conservation goals within the watershed. The information can be used to develop conservation district annual and long-range plans, establish a foundation for a more detailed watershed, area wide, or site-specific natural resource plan, or the development of an implementation plan.

2.0 INTRODUCTION

The Mud Watershed 8-Digit Hydrologic Unit Code (HUC) subbasin is located in four counties of northeastern SD. The watershed has 418,400 acres in Brown, Day, Marshall, and Spink Counties. The watershed lies in the heart of the Prairie Pothole Region of the Northern Great Plains. This region provides important habitats for migratory waterfowl and other wildlife, supporting more than 50 percent of North America's migratory waterfowl population

The dominant land use is cultivated cropland, approximately 332,900 acres or 80 percent of the watershed. Corn, small grains, soybeans, and sunflowers are the primary crops grown. Alfalfa and grass hay are also produced and included in some crop rotations. Rangeland and pastureland account for 44,500 acres or 10 percent of the watershed. Beef cattle production is the primary use on pasture and rangeland. Growing cash crops and hay, raising beef cattle, and dairying are the main agricultural enterprises. Agricultural production is a vital part of the local economic base.

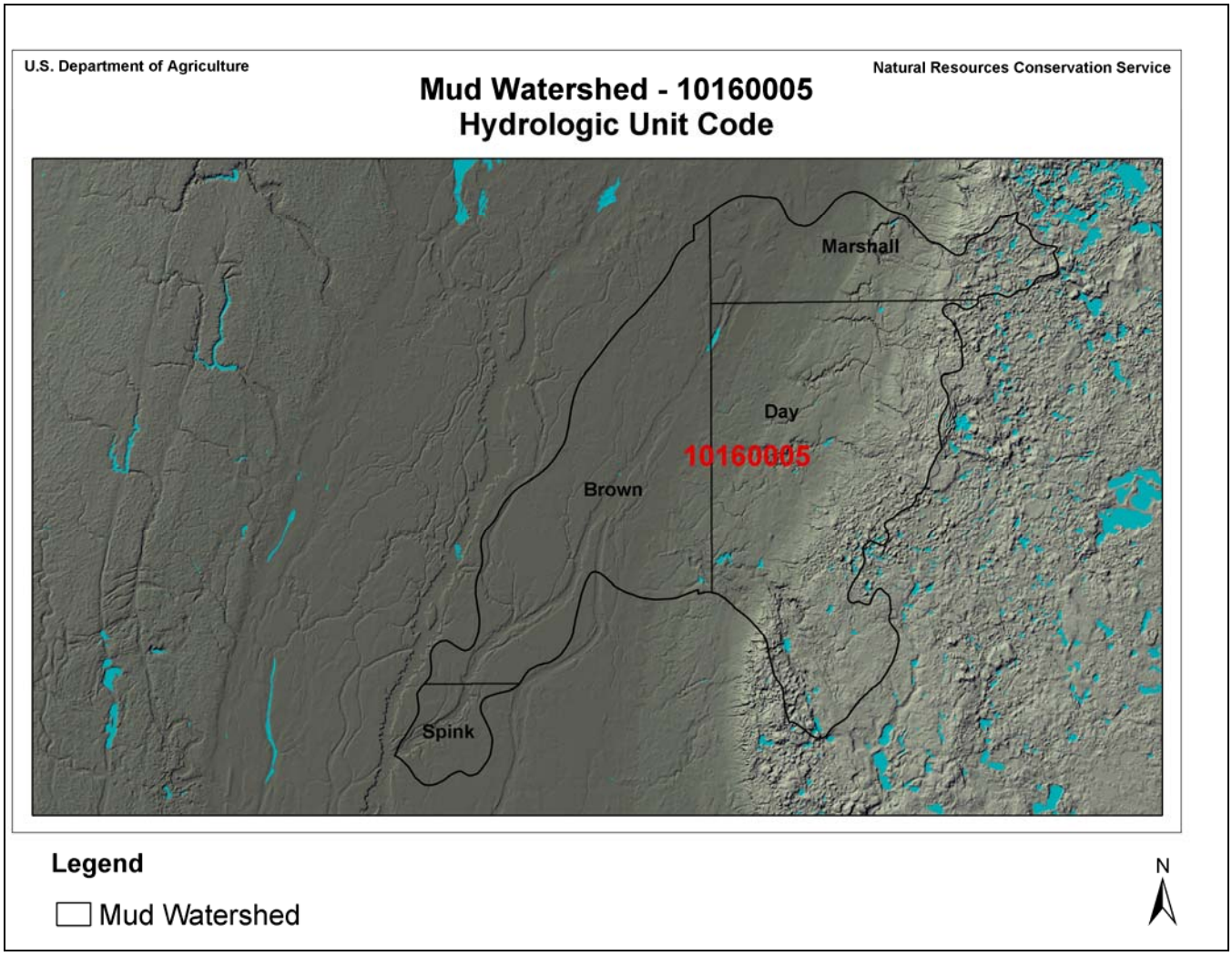
Conservation assistance is provided by four NRCS service centers, one field support office, and four conservation districts.

3.0 PHYSICAL DESCRIPTION

The physical description of the Mud subbasin provides a general description of the watershed location, geology, topography, precipitation, and climatic ranges.

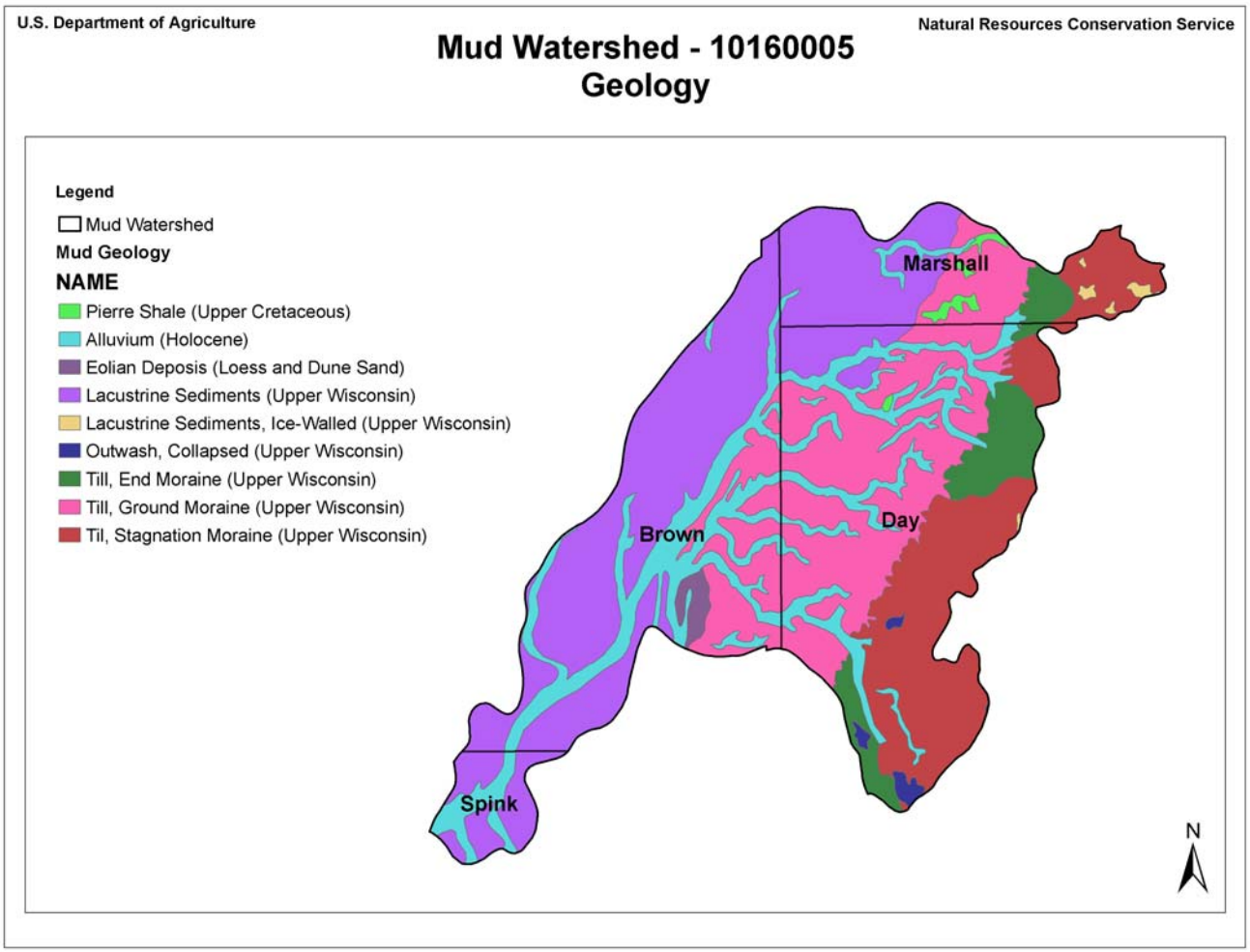
3.1 HYDROLOGIC UNIT CODE (HUC)[1]

A HU is part of a multi-level watershed mapping classification system. The HU boundaries are defined by hydrographic and topographic criteria used to delineate areas of land that contribute surface water runoff to a designated outlet point, such as a lake or stream segment. The United States Geological Survey (USGS) designates HU drainage areas as subwatersheds (including smaller drainages) numbered with 12-digit HUCs, nested within watersheds (10-digit HUCs). Watersheds are combined into larger drainage areas called subbasins (8 digits), basins (6 digits), and subregions (4 digits), which make up the large regional drainage basins (2 digits).



3.2 GEOLOGY[2]

Precambrian metamorphic and igneous rock formations of granite, gneiss, limestone, sandstone, and shale underlie the entire watershed. Late Cretaceous sedimentary rocks of marine origin directly overlie the Precambrian bedrock. The surface geology of the watershed was formed by a series of Pleistocene glacial events. Glacial drift, the debris deposited by moving ice and glacial streams, determined the geologic features of the watershed. A sequence of glacial sediments (glacial till) was deposited directly from the ice as the glaciers advanced and retreated. The glacial till is generally an unconsolidated heterogeneous mixture of clay, silt, sand, gravel, and boulders ranging widely in size and shape. Thin sand and gravel layers occur erratically within and between the till layers. Glacial melt water streams formed localized, stratified deposits of well sorted clays, sands, and gravels (glacial outwash) as the glaciers receded. The glacial till commonly ranges between 100 and 300 feet thick, but may be in excess of 1,000 feet thick in some areas of the watershed. The upper 20 to 150 feet of the glacial till has been altered by weathering to gray smectitic clays.

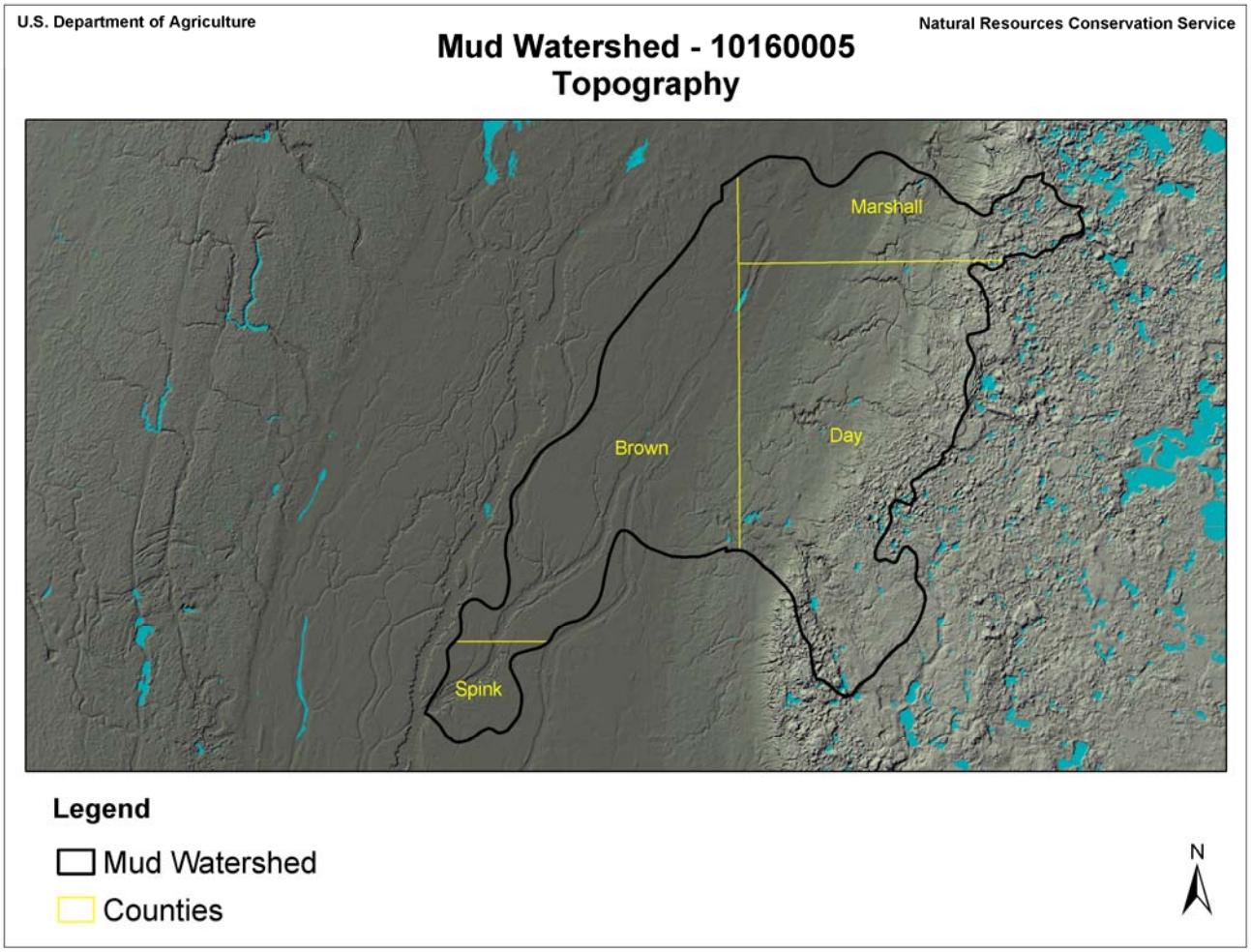


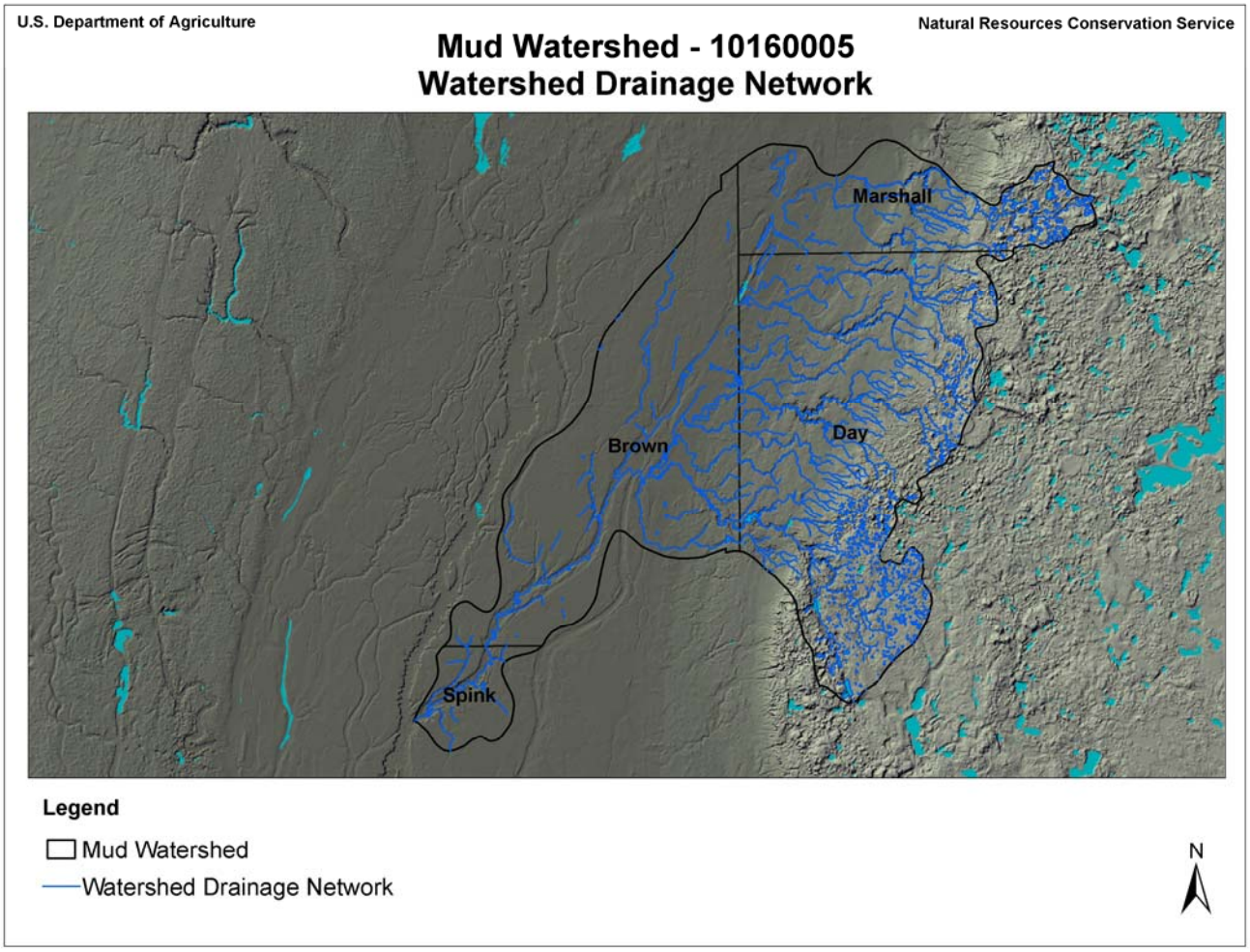
3.3 TOPOGRAPHY[1]

The Mud Watershed is located in the Great Plains Physiographic Province and lies within two distinct physical divisions; the Coteau des Prairies and the James River Lowland, which includes a part of the Lake Dakota plain subsection. The major landforms of the watershed are of two general types: lake plain and glacial uplands. Topographic relief varies from the flat nearly level lake plain to the undulating hills of the glacial uplands

The lake plain is the former bed of an extensive, shallow, but short-lived glacial lake. Lake Dakota was over 100 miles long and 27 miles across; it extended from southern Spink County, in SD, to approximately 15 to 20 miles north of the ND/SD State line. The lake plain does not have a well developed natural drainage system and water tables are high year round

The glacial uplands lie east and north of the lake plain. They consist of deposits of glacial till that form smoothly rolling hills. The relief is dominantly undulating to hilly. The uplands are characterized by many potholes or closed basins and have a poorly defined drainage pattern.





3.4 CLIMATE

The climate of the Mud Watershed is semi-humid and continental, characterized by large seasonal fluctuations in temperature, long winters, warm summers with moderate to high relative humidity, and frequent high winds. Storms are generally of moderate intensity and short duration; localized convective, high intensity storms of short duration are common. Recurring periods of drought and near-drought conditions are common. Less frequently, periods of short duration yield higher than normal amounts of precipitation. Warm to hot summer months give way to cold winters. On the average, between 70 and 80 percent of the annual precipitation occurs from April through September, the growing season for most of the crops raised in the area, with the largest amount generally occurring in June. The average growing season ranges from 115 days to 130 days with the last killing frost in mid-May and the first killing frost in mid-September. Many freeze-thaw events occur in the fall and early spring.

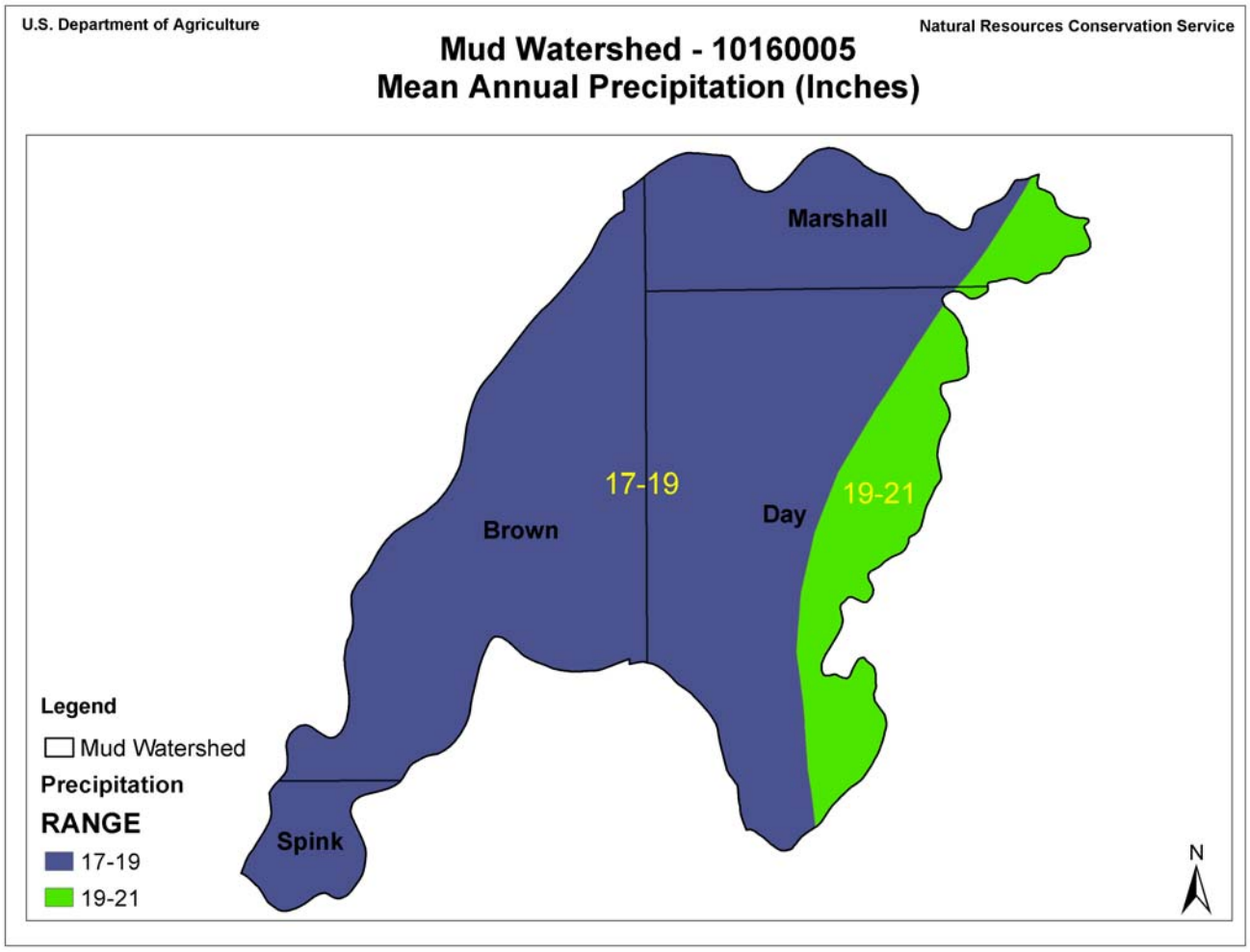
It is estimated that more than 75 percent of the annual runoff occurs during the four-month period of March through June. The high runoff in March and April is usually from snowmelt while the runoff in May and June is from rainfall. Heavy runoff during the summer months is caused by brief, intense

thunderstorms. Annual runoff can vary widely from year to year; the average annual runoff totals 1.25 inches. Most of the tributaries will show periods of low or no flow almost every year during the fall and winter months.

The historical data records for average temperature, wind speed, and relative humidity data used to represent the watershed are from the Aberdeen, SD, municipal airport and the Andover, SD weather service reporting station.

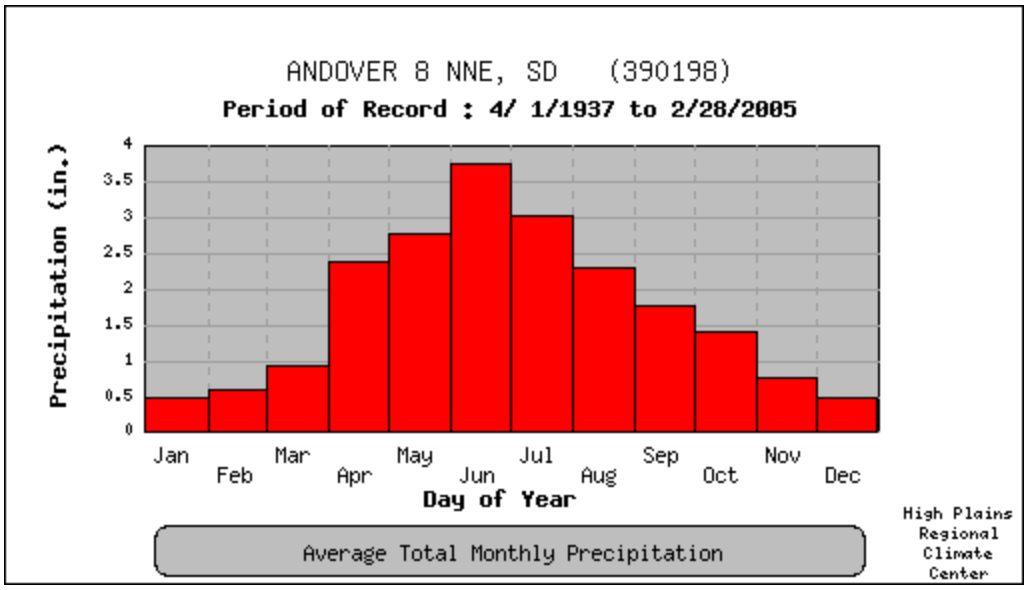
3.4.1 Precipitation[3]

The average annual precipitation for the watershed area is 20 inches per year measured at the U.S. Weather Bureau Station at Andover, SD.



3.4.1a Precipitation Distribution Graph

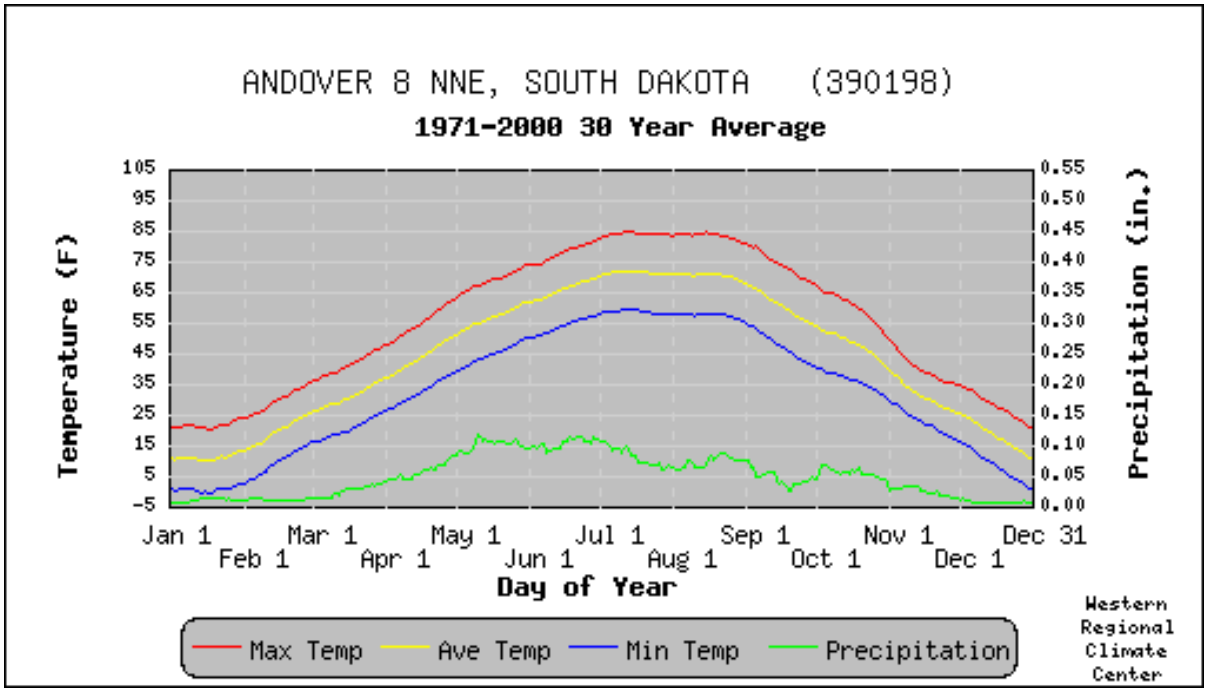
Period of Record - Monthly Average Total Precipitation



- Average precipitation recorded for the month.

3.4.2 Average Monthly Temperature[4]

Temperatures vary considerably throughout the year. The average winter temperature is 19 degrees F and the average summer temperature is 72 degrees F. Extreme temperatures for the year often range from below zero in the winter to an occasional 100 plus degree summer day.

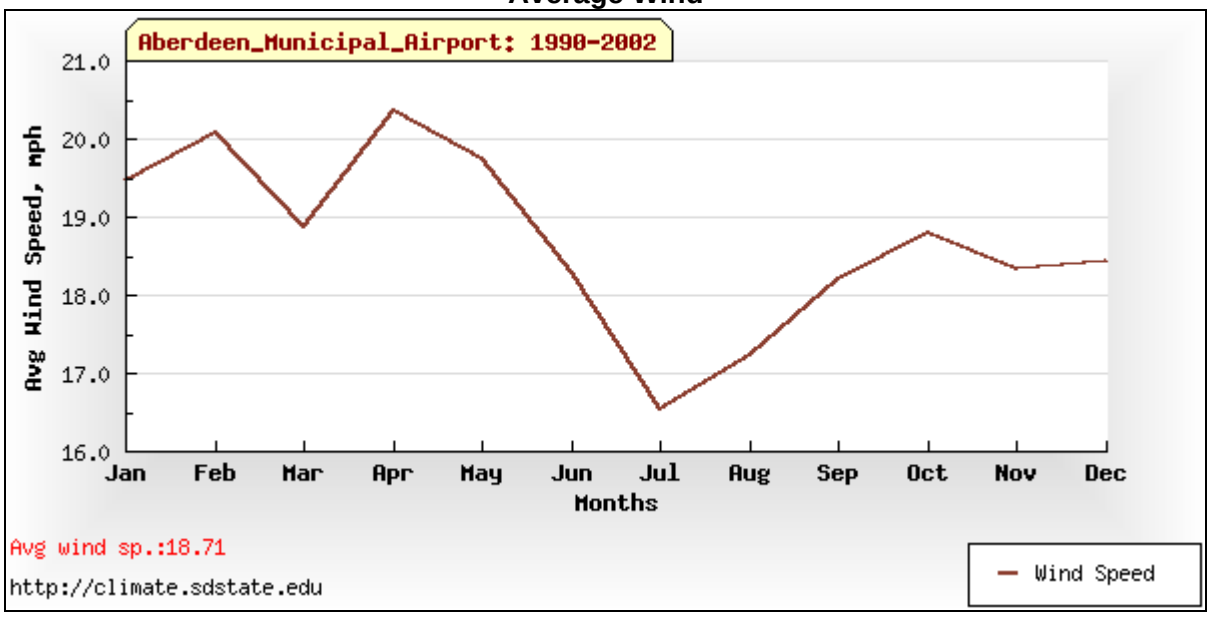


Data is smoothed using a 29 day running average.

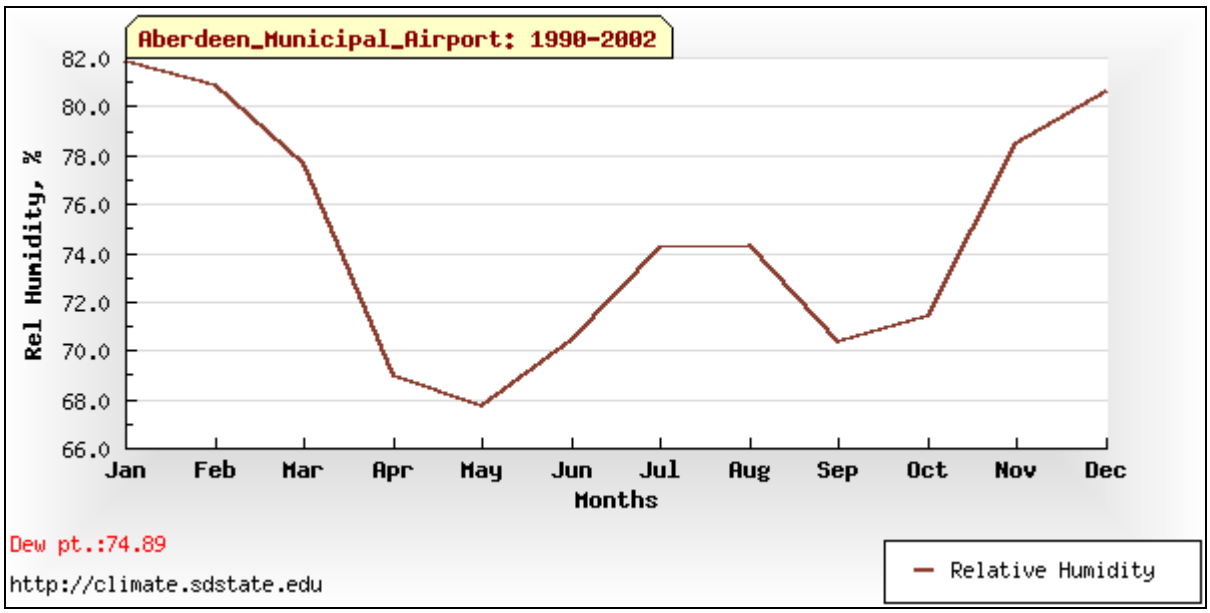
- Max. Temp. is the average of all daily maximum temperatures recorded for the day of the year between the years 1971 and 2000.
- Ave. Temp. is the average of all daily average temperatures recorded for the day of the year between the years 1971 and 2000.
- Min. Temp. is the average of all daily minimum temperatures recorded for the day of the year between the years 1971 and 2000.
- Precipitation is the average of all daily total precipitation recorded for the day of the year between the years 1971 and 2000.

3.4.3 Average Monthly Wind Speed[4]

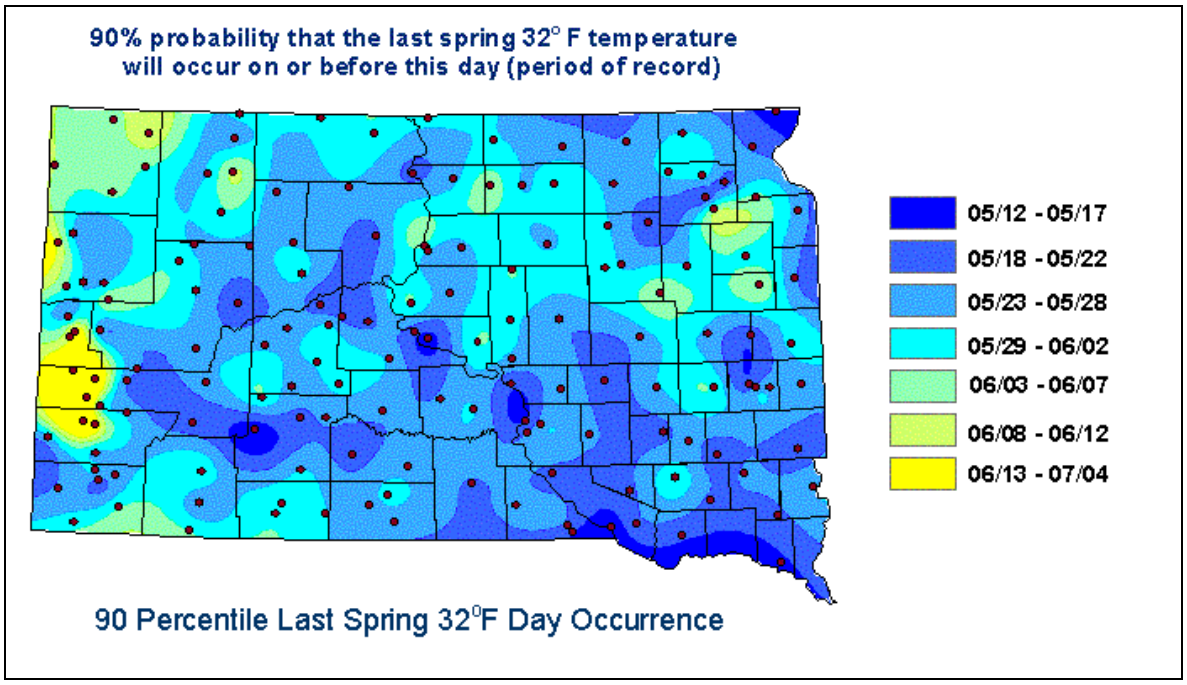
Average Wind



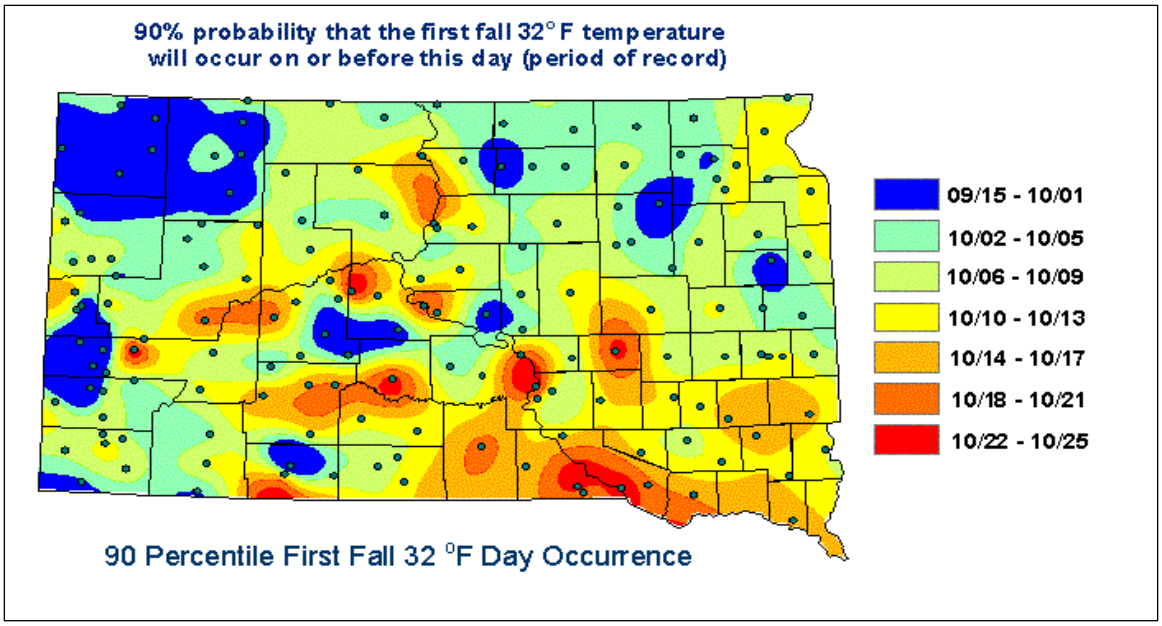
3.4.4 Average Monthly Relative Humidity[4]



3.4.5 Last Spring Freeze[4]



3.4.6 First Fall Freeze[4]



3.4.7 Climate Summary[5]

Overall monthly climatic summary of temperature and precipitation averages for the watershed.

ANDOVER, SD (390198)
Period of Record Monthly Climate Summary
Period of Record: 4/1/1937 to 2/28/2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	21.5	27.5	39.4	56.8	69.0	77.8	84.9	84.3	73.7	61.8	41.6	28.1	55.5
Average Min. Temperature (F)	0.0	6.5	18.2	32.6	43.7	53.6	58.9	57.5	47.2	35.9	21.1	8.2	31.9
Average Total Precipitation (in.)	0.46	0.56	0.93	2.37	2.74	3.75	3.02	2.24	1.78	1.40	0.69	0.49	20.42
Average Total SnowFall (in.)	5.8	6.9	6.7	4.4	0.2	0.0	0.0	0.0	0.1	0.8	5.2	5.3	35.4
Average Snow Depth (in.)	5	6	3	0	0	0	0	0	0	0	1	3	2

Percent of possible observations for period of record:
Maximum Temperature: 52.9 percent;
Minimum Temperature: 52.7 percent;
Precipitation: 55.5 percent;
Snowfall: 55.1 percent;
Snow Depth: 53.7 percent.

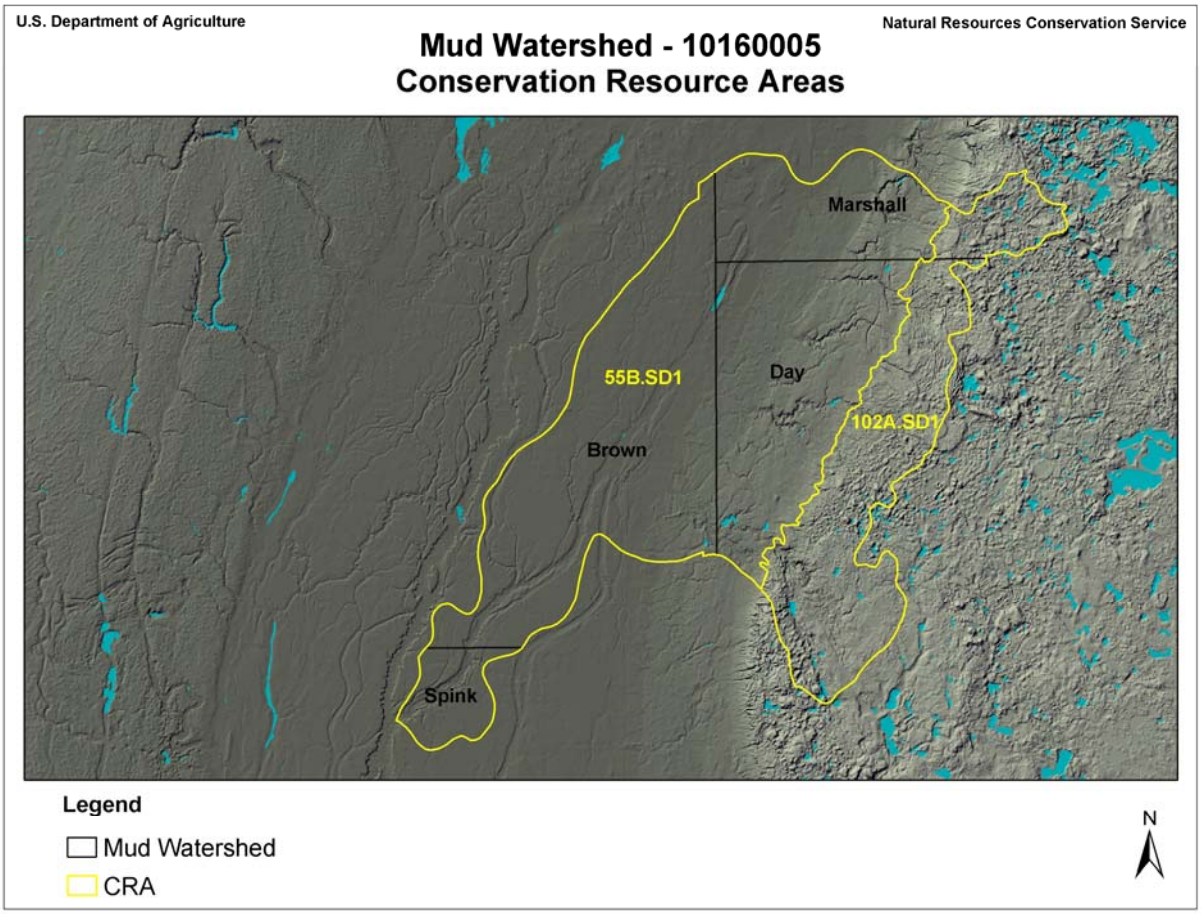
Check Station Metadata or Metadata graphics for more detail about data completeness.

4.0 RESOURCE INVENTORY

The resource inventory provides a general summary of the existing conditions of the natural resources in the watershed that are related to the soil, water, animals, plants, air, and humans (SWAPA+H). The resource descriptions provide general information on land use, land capability, soils and productivity, and prime farmland.

4.1 MAJOR LAND RESOURCE AREAS (MLRA) AND COMMON RESOURCE AREA (CRA)[1]

The MLRA's are a part of a USDA classification system that defines land as a resource for farming, ranching, forestry, engineering, recreation, and other uses. The MLRA is a broad-based geographic area characterized by a uniform pattern of soils, elevation, topography, climate, water resources, potential natural vegetation, and land uses. Large MLRAs may be further subdivided to create smaller more homogeneous resource areas. The CRAs are the basic unit of an MLRA, a subdivision based on significant geographic differences in climate, water resources, or land use and resource concerns where resource problems or treatment needs are similar. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a CRA. In SD, the MLRA and CRA boundaries coincide.

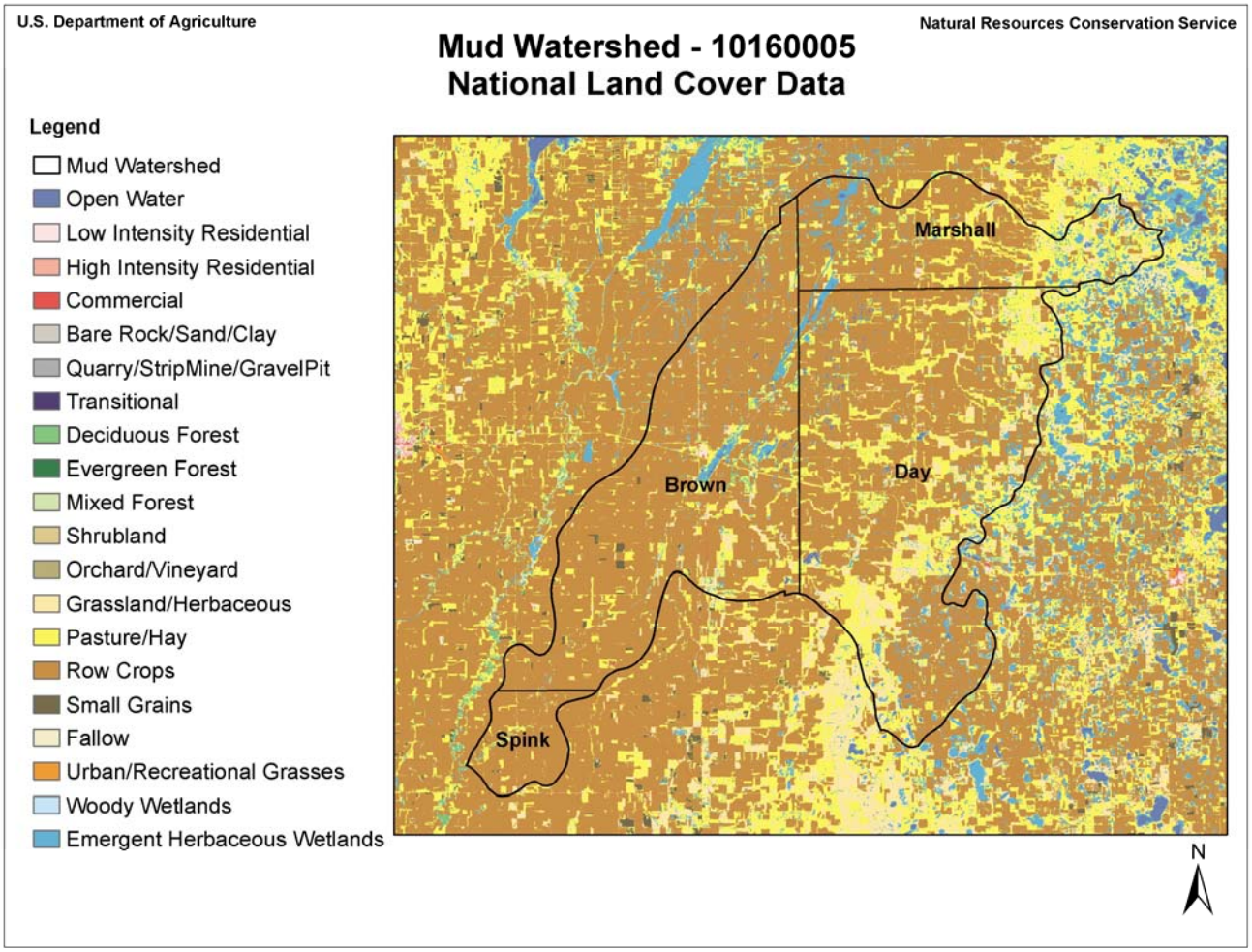


4.1.1 Common Resource Area Descriptions

Symbol	Name	Brief Description
55B.SD1	Central Dark Brown Glaciated Plains	Most of this area is in cropland with the major crops being small grain and sunflowers. The more sloping soils are used for livestock grazing. This area is nearly level to rolling till plains. Moderately steep and steep slopes are adjacent to the major streams. Most of the soils are deep, well-drained, and medium textured with a frigid temperature regime and mixed mineralogy.
102A.SD1	Rolling Till Prairie	Gently sloping to steep, loamy glacial till soils with scattered sandy outwash soils and silty alluvial flood plains soils. This area is part of the Prairie Pothole region of the upper Midwest. Predominantly cropped to corn and soybeans with increasing hayland and pasture and small grains in the western part. Resource concerns are water and wind erosion, nutrient management and water quality.

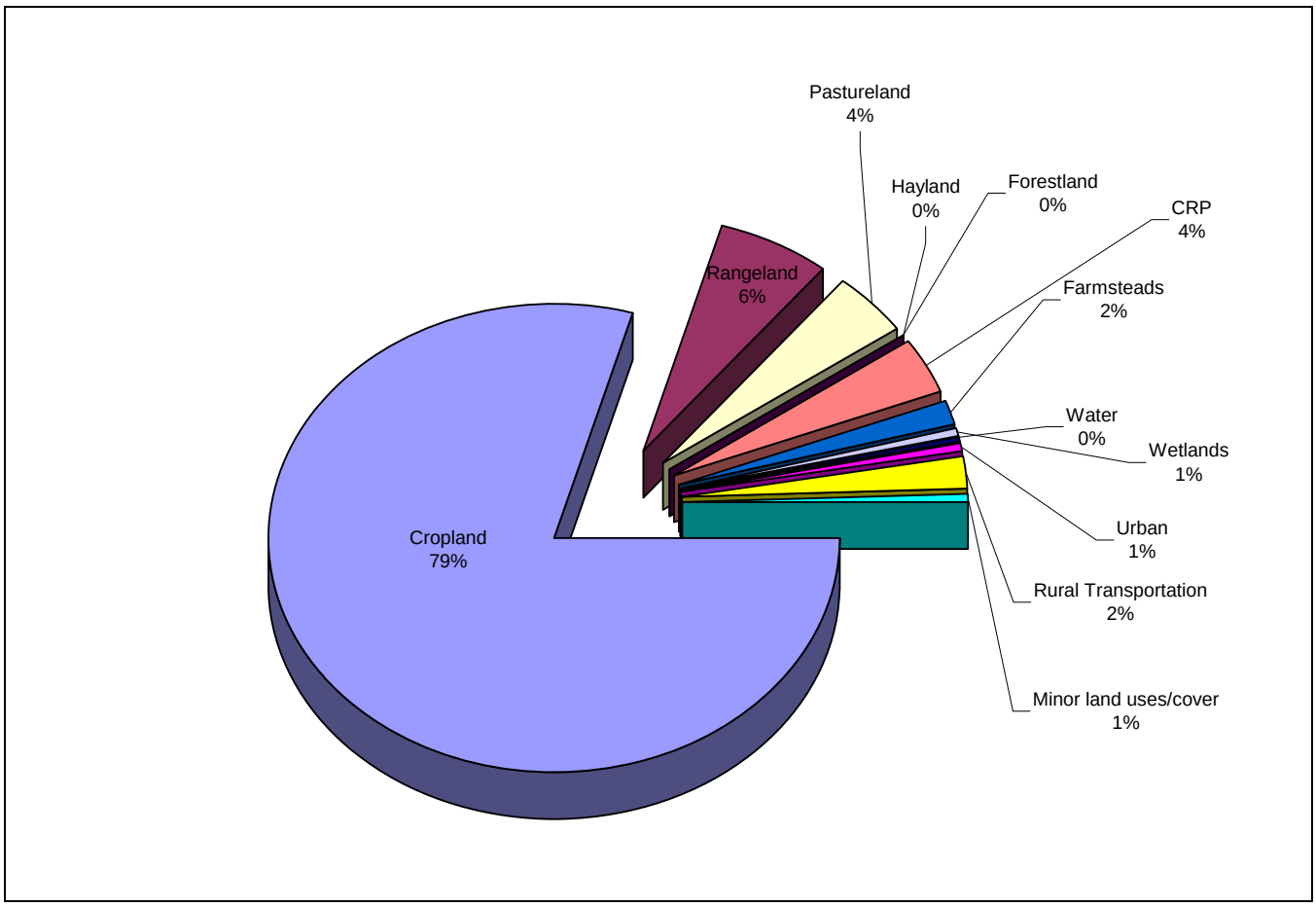
4.2 LAND COVER AND LAND USE DISTRIBUTION[6]

The National Resources Inventory (NRI) uses the term land cover/use to identify the categories that account for all the surface area in the U. S. Land cover describes the different types of vegetation or other kind of material that covers the land surface. Land use is defined as the purpose of human activity on the land, it is usually, but not always, related to land cover.



4.2.1 Land Cover and Land Use Summary

Land Use Cover 1997 NRI	Acres	Percent
Cropland	332,900	80
Rangeland	25,700	6
Pastureland	18,800	4
Hayland	0	0
Forestland	0	0
CRP	16,200	4
Farmsteads	7,000	2
Wetlands	2,600	1
Water	700	0
Urban	3,400	1
Rural Transportation	8,300	2
Minor land uses/cover	2,800	1
Total	**418,400**	**100**



Primary Land Uses [NRI-97]

Cropland - A land cover/use category that includes areas used for the production of adapted crops for harvest. Two subcategories of cropland are recognized: cultivated and noncultivated. Cultivated cropland consists land in row crops or close-grown crops and other cultivated cropland, for example, hayland or pastureland that is in a rotation with row or close-grown crops. Noncultivated cropland includes permanent hayland and horticultural cropland.

Pastureland –A land use category managed primarily for the production of introduced or native forage plants for livestock grazing. Pastureland may consist of one species in a pure stand, a grass mixture, or a grass-legume mixture. Management consists of cultural treatments; fertilization, weed control, reseeding or renovation, and controlled grazing. For NRI, this includes land that has a vegetative cover of grasses, legumes, and/or forbs, regardless of whether or not it is being grazed by livestock.)

Hayland - A subcategory of cropland managed for the production of forage crops that are machine harvested. These crops may be grasses, legumes, or a combination. Hayland also includes land in set-aside or other short-term agricultural programs. [NRI-97]

Rangeland - A land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. This would include areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities of low forbs and shrubs, such as mesquite, chaparral, mountain shrub, and pinyon-juniper, are also included as rangeland. [NRI-97]

Urban and built-up –Land that is used for residential, industrial, commercial, and institutional land; construction sites; public administrative sites; railroad yards; cemeteries; airports; golf courses; sanitary landfills; sewage treatment plants; water control structures and spillways; small parks (less than 10 acres) within urban and built-up areas; and transportation facilities if they are surrounded by urban areas. This also includs tracts of less than 10 acres that do not meet the above definition but are completely surrounded by urban and built-up land. Two size categories are recognized in the NRI: (i) areas 0.25 to 10 acres, and (ii) areas greater than 10 acres. [NRI-97]

Minor land cover/use includes farmsteads, farm structures, field windbreaks, barren land, and marshland.

Federal land - A land ownership category designating land that is owned by the federal government. It does not include Trust lands administered by the Bureau of Indian Affairs. No data is collected for any year that land is in this ownership category.

Rural transportation land consists of all highways, roads, railroads, and associated right-of-ways outside urban and built-up areas*;* also includes private roads to farmsteads or ranch headquarters, logging roads, and other private roads (field lanes are not included).

Conservation Reserve Program - (CRP) land is highly erodible or other environmentally sensitive acreage normally devoted to crop production which is converted to long-term vegetative cover.

4.2.2 Land Capability Class (LCC)[1]

Land capability classification (LCC) is a system of grouping soils primarily on the basis of their ability to produce common cultivated crops and pasture plants without the deterioration of the soil resource over a long period of time. The LCC reflects the physical and chemical properties, along with the topographic relief of a soil. The LCC can be used as a guide for land management decisions based on the capability or limitations of the soil.

Land Capability Class (1997 NRI Estimate)	**Acres**	**Percent**
I - slight limitations	14,200	3
II - moderate limitations	239,200	57
III - severe limitations	76,600	18
IV - very severe limitations	36,700	9
V - no erosion hazard, but other limitations	7,200	2
VI - very severe limitations, unsuited for cultivation, limited to pasture, range, forest	29,300	7
VII - very severe limitations, unsuited for cultivation, limited to grazing, forest, wildlife	0	0
VIII – misc. areas have limitations, limited to recreation, wildlife, and water supply	2,600	1
Other Acres Not Determined – includes water, rock outcrop, nonsoil areas	12,500	3
Total Acres	418,300	100

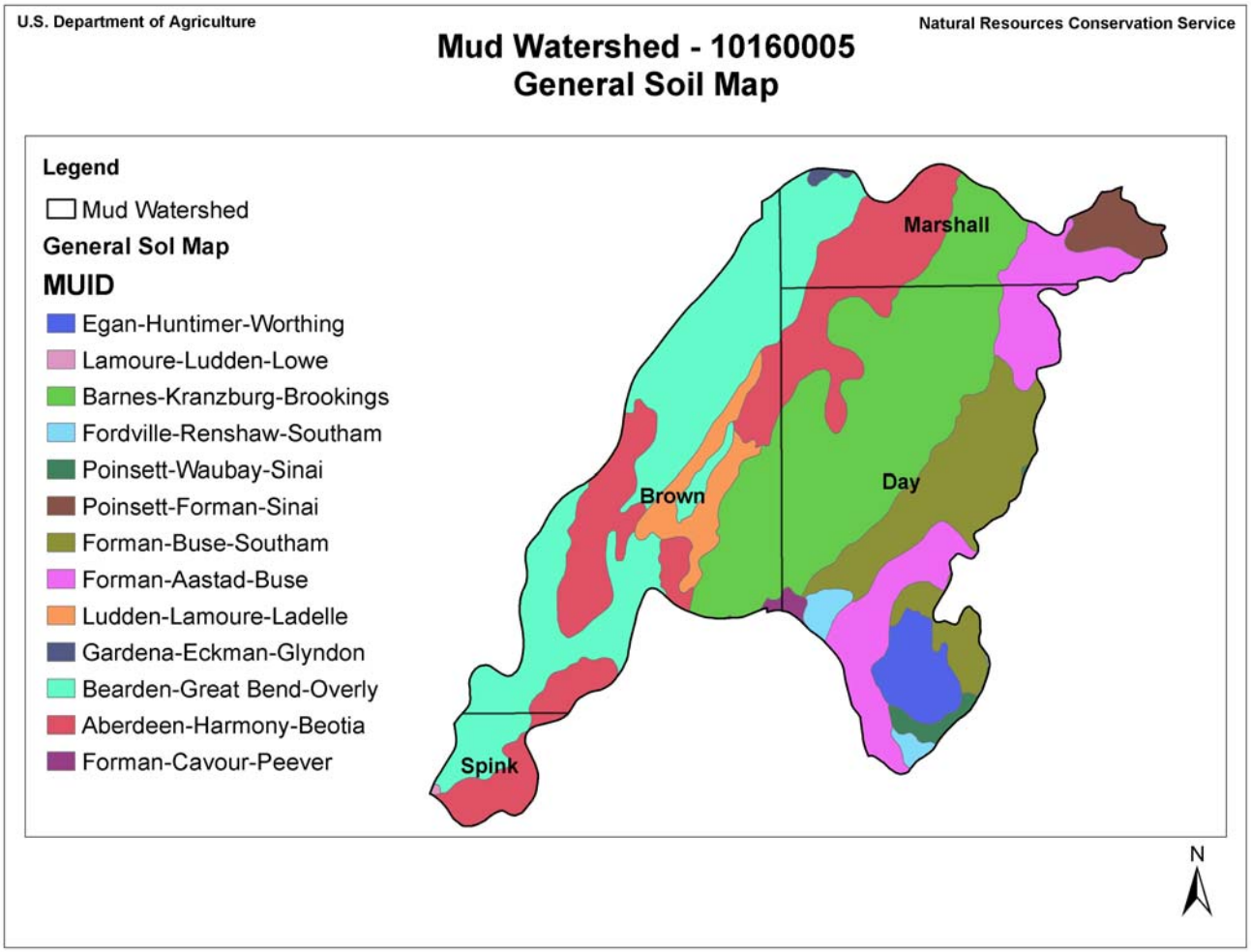
4.2.3 Prime Farmland[1]

Prime farmland, as defined by the USDA, is land that has the best combination of physical and chemical characteristics for food, feed, forage, fiber, and oilseed crop production. It must also be available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Prime farmland soils are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Prime Farmland 1997 NRI	**Acres**	**Percent**
Total Acres Prime Farmland	242,670	58
Other Acres	175,730	42

4.3 GENERAL SOILS

Most of the soils in the watershed were formed in the exposed glacial materials which were eroded, transported, and deposited by the repeated movement of ice across the region. The formation of soils is influenced not only by geologic forces but also topographic relief. Factors such as drainage, runoff, erosion, plant cover, and soil temperature cause soils to develop with certain characteristics and qualities.



4.3.1 General Soil Descriptions

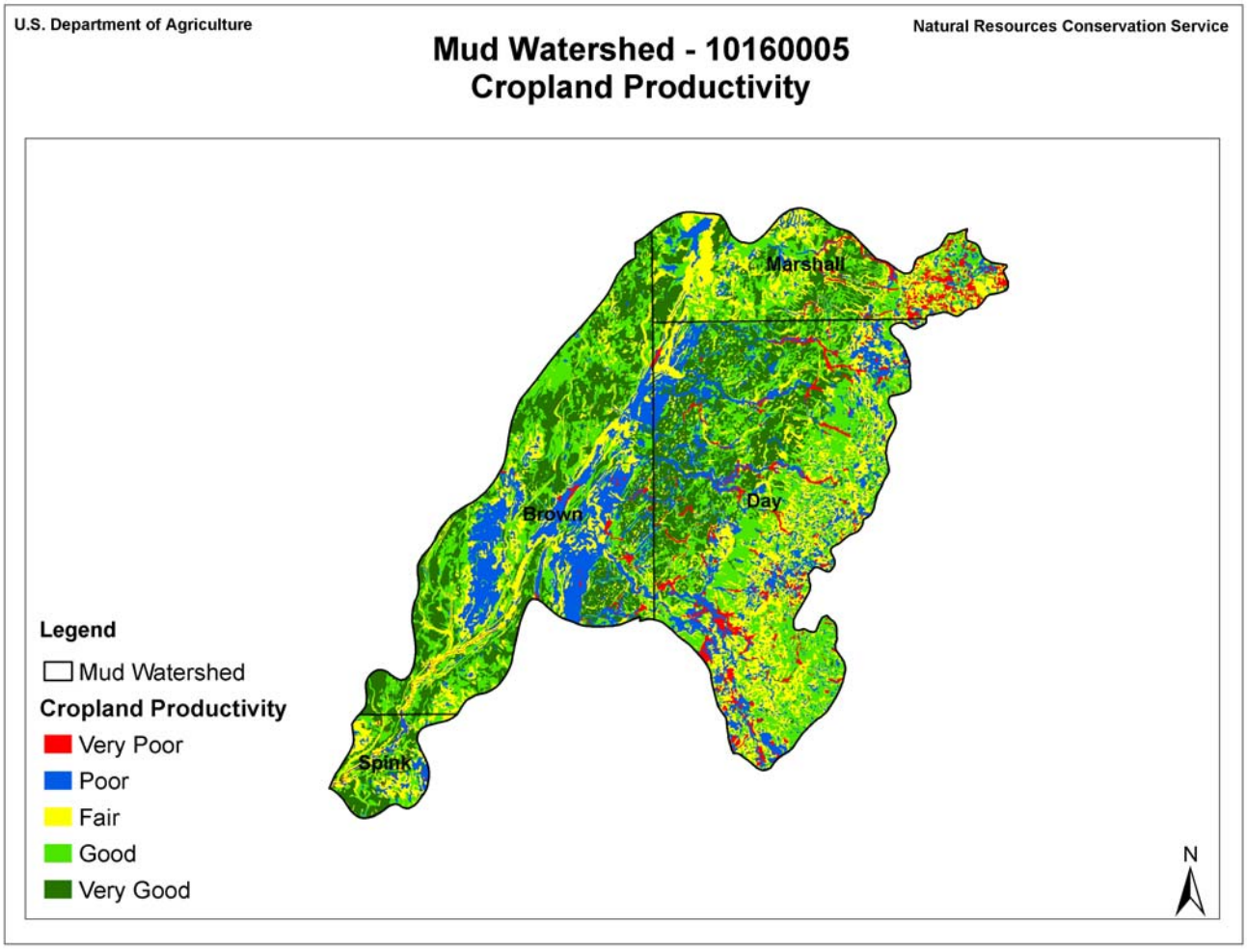
Soils in the watershed have been placed into 13 broad groups or associations that are geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit. Each soil association has a distinctive pattern of soils, relief, drainage, and natural landscape. The dominant soils within the watershed are loamy and silty soils formed in glacial till on the uplands, loamy soils over sand and gravel on the outwash plains, and clayey and silty soils formed in alluvium on the floodplains and low terraces.

More detailed information on individual soils is available in the published county soil survey reports or from the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov). The accompanying map is of a general nature and is not intended for any type of intensive planning and management.

SD119	Egan-Huntimer-Worthing	Deep, well-drained to very poorly drained, nearly level to gently sloping, loamy and clayey soils on ice walled lake plains and depressions.
SD125	Lamoure-Ludden-Lowe	Deep, somewhat poorly drained to very poorly drained, level and nearly level, silty, loamy, and clayey soils formed in alluvium on floodplains and low terraces.
SD126	Barnes-Kranzburg-Brookings	Deep, well-drained, strongly sloping to level, loamy and silty soils on glacial till plains.
SD128	Fordville-Renshaw-Southam	Somewhat excessively drained to very poorly drained, level to moderately steep, loamy soils over gravelly material, and silty soils over clayey material on outwash plains and terraces.
SD130	Poinsett-Waubay-Sinai	Deep, well-drained, and moderately well-drained, level to gently sloping, silty, and clayey soils on ice-walled lake plains.
SD131	Poinsett-Forman-Sinai	Deep, well-drained, level to moderately steep, silty, loamy, and clayey soils on glacial till plains.
SD134	Forman-Buse-Southam	Deep, well-drained, and very poorly drained level to moderately steep, loamy, and silty soils on glacial till plains.
SD135	Forman-Aastad-Buse	Deep, well-drained, and moderately well-drained, nearly level to steep, loamy soils on glacial till plains and moraines.
SD139	Ludden-Lamoure-Ladelle	Deep, very poorly drained to moderately well-drained, level to nearly level, clayey and silty soils formed in alluvium on flood plains and low terraces.
SD144	Gardena-Eckman-Glyndon	Deep, well-drained to somewhat poorly drained, level to strongly sloping, silty and loamy soils on glacial lake plains and till plains.
SD145	Bearden-Great Bend-Overly	Deep, well to somewhat poorly drained, level to very gently sloping silty soils on glacial lake plains.
SD146	Aberdeen-Harmony-Beotia	Deep, Well and moderately well-drained, level to gently sloping loamy and clayey soils on glacial lake plains.
SD148	Forman-Cavour-Peever	Deep, well-drained and moderately well-drained, level to moderately sloping, loamy and clayey soils on glacial till plains.

4.4 CROPLAND PRODUCTIVITY[1]

Cropland Productivity Index (CPI) is a rating assigned to each soil map unit to rate the soil for cropland production. The rating is based on a scale of 1 to 100, with 100 being the most productive map unit in the county. The CPI assigned to each map unit is based on the physical and chemical properties of each soil type in the map unit. Properties such as slope, organic matter levels, topsoil thickness, soil texture, available water capacity, pH, and salinity levels will directly affect the productivity level of each soil type. The experience of soil scientists and university researchers is used to develop the ratings.



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Cropland Productivity Index			Descriptions
1-25	Very Poor	Red	Soils with >15 percent slopes; soils with claypan, bedrock or gravels near the surface; high salinity soils
26-50	Poor	Blue	Soils with 9-15 percent slopes; soils with claypan, bedrock, or gravels within 20 inches of the surface
51-75	Fair	Yellow	Soils with 6-9 percent slopes; soils with claypan, bedrock, or gravels at 20 to 40 inches of the surface
76-89	Good	Light Green	Soils with 2-6 percent slopes
90-100	Very Good	Dark Green	Silty or loamy soils with high soil organic matter levels

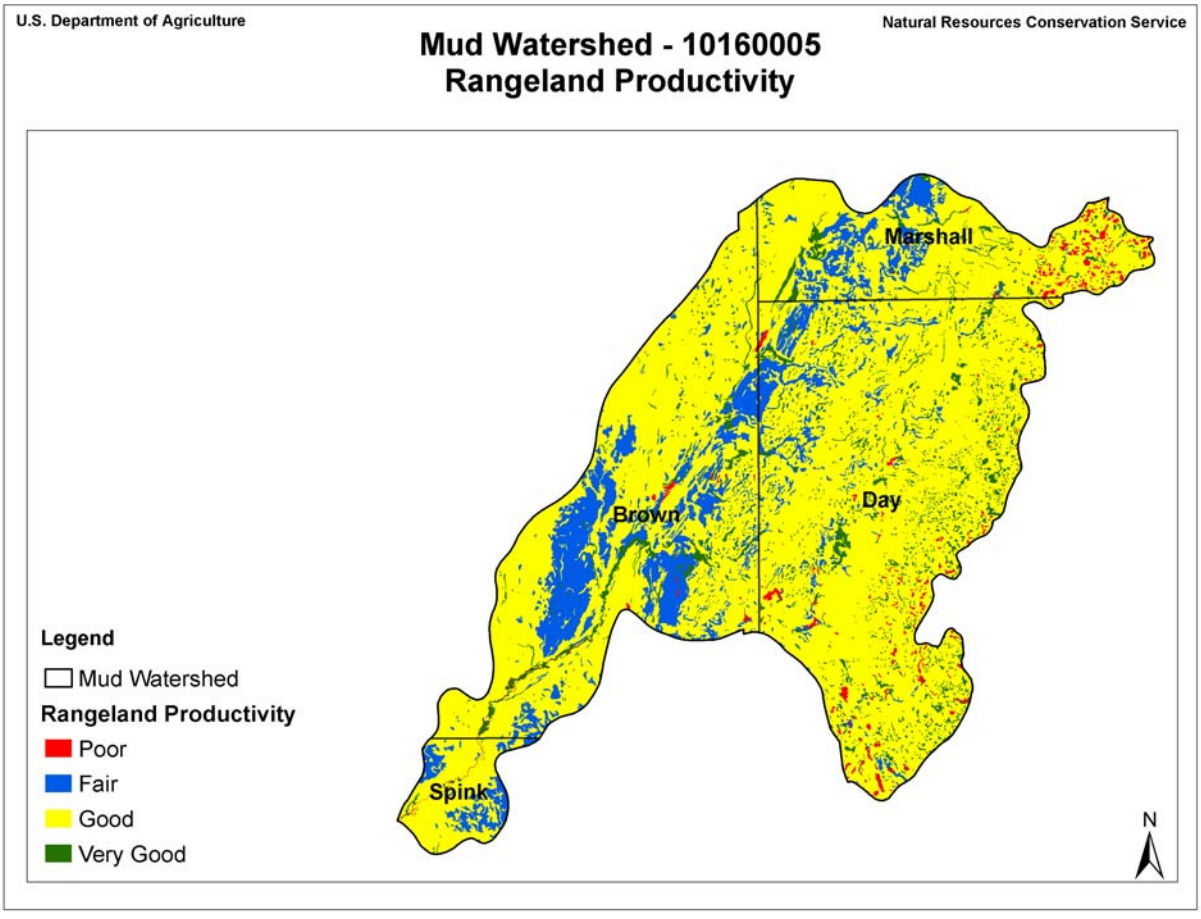
4.5 RANGELAND PRODUCTION (NORMAL YEAR)[1]

Rangeland has a native vegetation of grasses, grasslike plants, forbs, and shrubs. In many areas, introduced forage species are also managed as rangeland. The vegetation is suitable for grazing and browsing by animals. Rangeland includes natural grasslands, savannahs, many wetlands and deserts, tundra, and certain shrub and forb communities.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils, vegetation, and water.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It is expressed in pounds per acre of air-dry vegetation for normal years.

Yield and production values are represented as a single value for the map unit. They are calculated based on a weighted average.



Rangeland Normal Year Production			Descriptions
1-1700 lbs/Ac	Poor	Red	Low rainfall areas or shallow soils
1701-2600 lbs/Ac	Fair	Blue	Areas that are high in sodium or salts or shallow to bedrock or gravel
2601-4500 lbs/Ac	Good	Yellow	Areas where there is no additional moisture and the soil properties do not influence the grasses
4501-9000 lbs/Ac	Very Good	Light Green	Low lying areas that receive additional moisture

5.0 RESOURCE CONCERNS

Resource concerns or problems are issues related to the environment that impact the health, productivity, or condition of natural resources in a watershed. The most common resource concerns are associated with the SWAPA+H.

5.1 SUMMARY OF RESOURCE CONCERNS[1]

Specific resource concerns have been identified for each major land use at the state level. The following table is a summary of state level concerns. The resource concerns specific to the watershed have been identified and evaluated by land use in the watershed assessments.

SWAPA + H Concerns	Specific Resource Concerns/Issue	Pasture/Hay	Cropland	Rangeland	Forest	Wildlife
Soil Erosion	Streambank	X	X	X	X	X
	Sheet and Rill		X			
	Wind		X			
	Ephemeral Gully		X			
	Classic Gully		X			
Soil Condition	Organic Matter		X			
	Excess Nitrogen		X			
	Excess Phosphorous		X			
	Compaction		X			
	Soil Salinity		X			
	Rangeland Site Stability		X			
Water Quantity	Inefficient Water Use on Irrigated Lands		X			
Water Quality	Harmful levels of Pesticides in Ground Water		X			
	Harmful levels of Pesticides in Surface Water		X			
	Nutrients and Organics in Ground Water		X			
	Nutrients and Organics in Surface Water		X			
	Suspended Sediment in Surface Water	X	X	X	X	X
Plant Suitability	Plants Not Adapted to Site	X				
Plant Condition	Productivity Health and Vigor	X		X	X	
	Forage Quality and Palatability	X		X	X	
	Noxious and Invasive Plants	X		X		X
Domestic Animals	Inadequate Feed and Forage Quantities and Quality	X		X	X	
	Inadequate Stock Water	X		X	X	
Fish and Wildlife	Species of Concern	X	X	X	X	X
	Inadequate Cover and Shelter	X	X	X	X	X

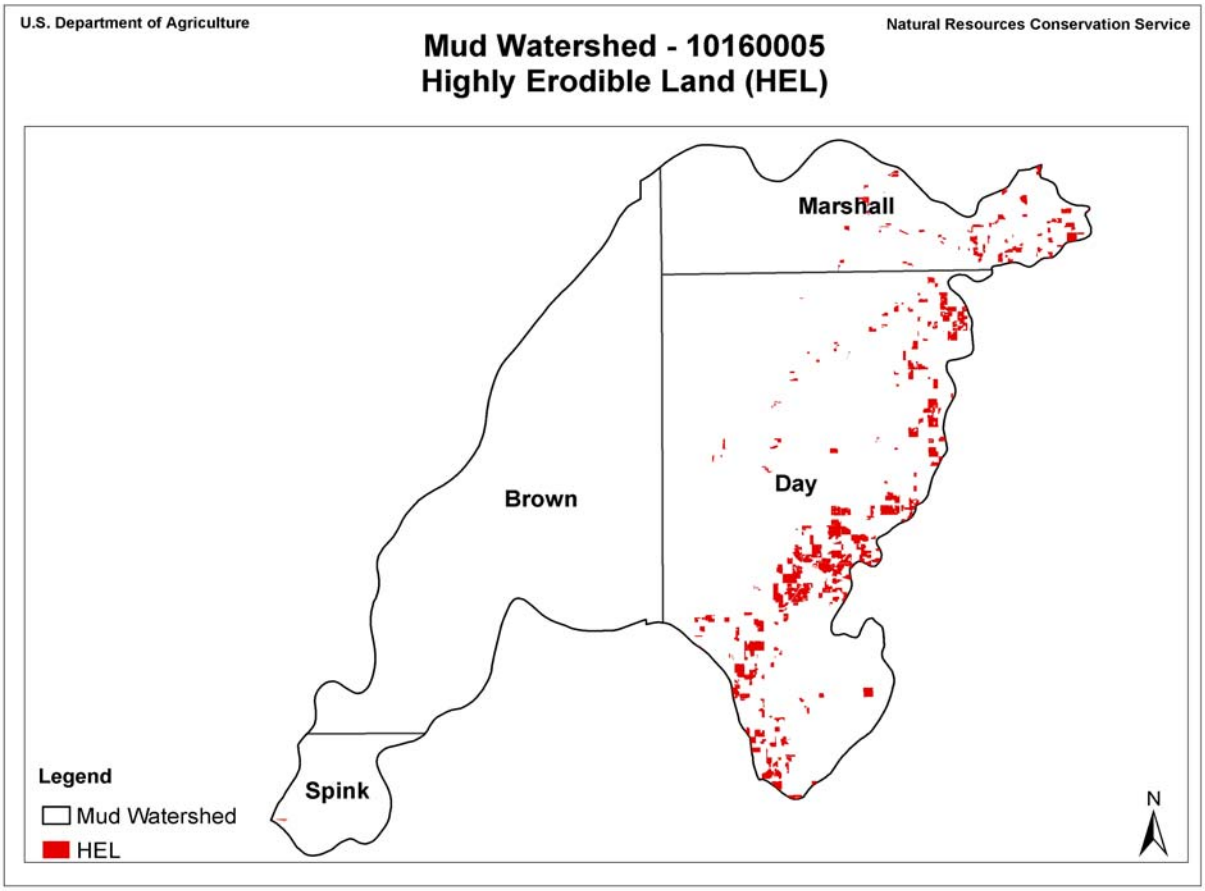
5.2 SOIL EROSION - WIND AND WATER[1]

Soil erosion is defined as the detachment and movement of topsoil, or soil material from the upper part of the soil profile, through the action of wind or running water, especially as a result of changes associated with human activity related to agricultural practices. Soil erosion from water includes rill, gully, and sheet.

Soil loss wind and water (cultivated cropland, hayland, pastureland and CRP).	Erosion	Average Annual Erosion Rate (T/Ac/Yr)	Acres	Total (T/Yr)
	Wind (WEQ)	2.04	367,900	750,500
	Water (USLE)	1.41	367,900	518,700

5.3 HIGHLY ERODIBLE LAND (HEL)

The basis for identifying highly erodible land (HEL) is the erodibility index (EI) of a soil map unit. The "EI" of a soil is determined by dividing the potential erodibility for each soil by the soil loss tolerance (T) value established for the soil as of January 1, 1990. The "T" value represents the maximum annual rate of soil erosion that can take place without causing a decline in long-term productivity. A soil map unit with an "EI" of eight or more is a highly erodible soil map unit. Refer to the National Food Security Act Manual (NFSAM), for further guidance.



5.4 WATER RESOURCE CONSIDERATIONS

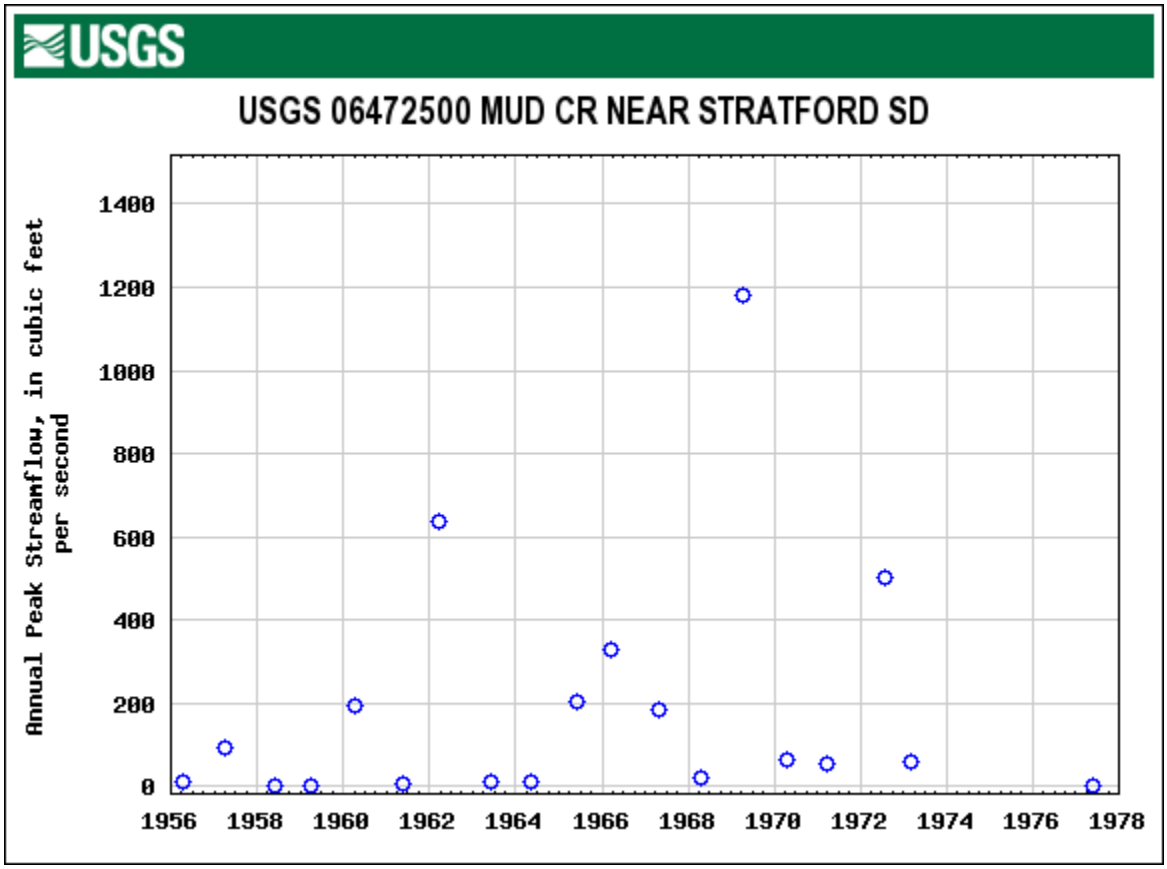
5.4.1 Water Resources Table[1]

The NRI data collected for streams and water bodies within the watershed.

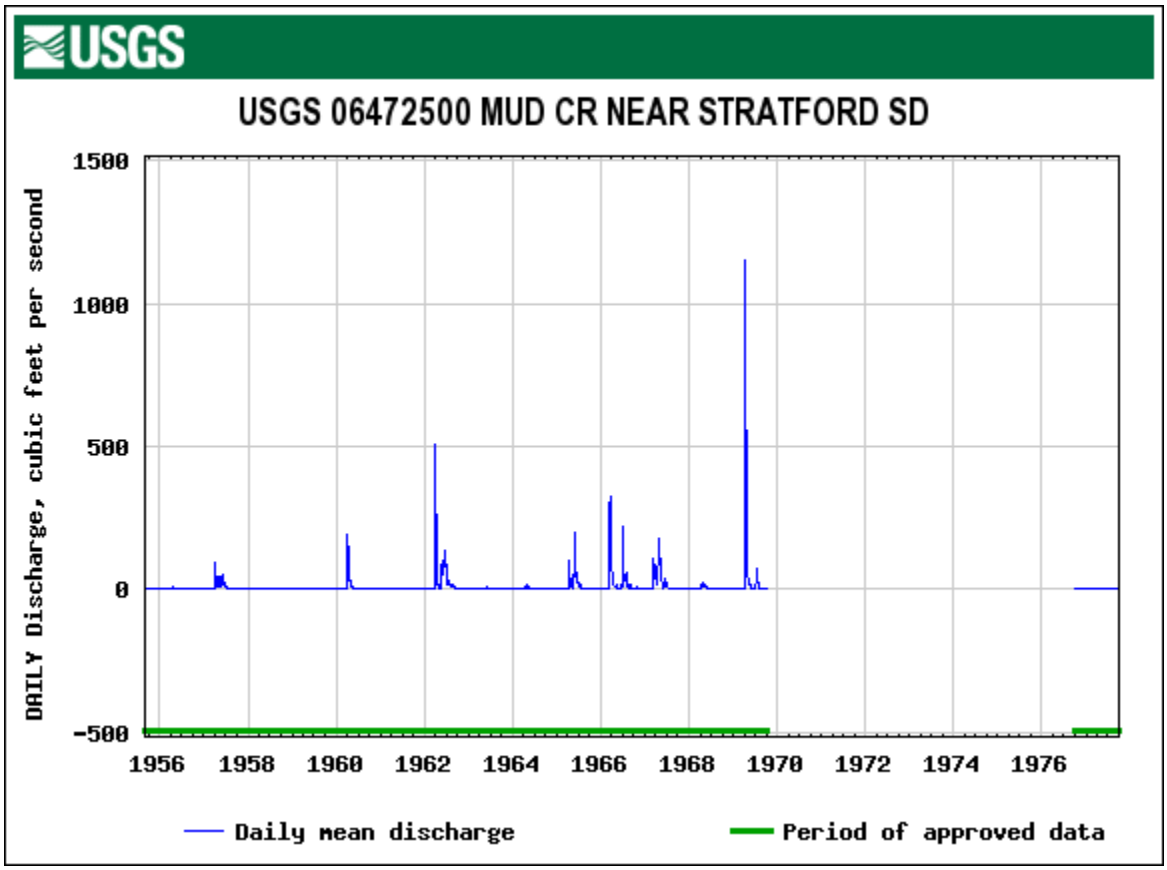
Water Resources 1997 NRI	Acres	Percent
Streams <660' wide and water bodies <40 Ac	100	0.0
Streams >660' wide and water bodies >40 Ac	600	0.1

5.4.2 Peak Stream Flow[6]

The USGS collected peak stream flow data from a gage station located on Mud Creek near Stratford, SD. The site is located near the southwest boundary of the watershed and has a drainage area of 674 square miles. This station collected peak stream flow data from 1956 through 1978 and daily discharge data from1956 to 1970.



5.4.3 Daily Discharge[6]



5.4.4 Groundwater[1]

Several major and minor aquifers of varying depths and water quality are utilized for domestic and agricultural purposes. Shallow aquifers tend to be smaller and usually have higher quality water but are also more vulnerable to leaching of nutrients, pesticides, organic waste, and pathogens. Recharge of shallow aquifers occurs primarily from infiltration of precipitation but also from wetlands, lakes, and streams. Deep aquifers occur between confining layers of impermeable bedrock. The quality of this water is often variable but usually of lower quality than that of shallow aquifers. As a result of the confining layers protecting these aquifers and the depth at which they occur, they are less susceptible to leaching and other surface activities and impacts. Important aquifers within this watershed are:

There are five major aquifers in the watershed; three are glacial drift aquifers and two bedrock aquifer:

Glacial drift includes all rock material transported by glacier ice even though subsequently affected by wind or water. It can be divided into till and outwash. The till is unstratified and unsorted drift deposited by ice without subsequent movement by wind or water. Generally, till is composed of a heterogeneous mixture of clay, silt, and sand that contain lesser amounts of rock fragments ranging in size from gravel to huge boulders. Because of the large clay

content, the till has low permeability and usually is a poor source of water. However, till locally contains small sand lenses that may yield as much as five gallons per minute.

Outwash and loess are considered stratified drift, most of which has been re-worked and deposited by wind or water. Outwash is material deposited by melt water that flowed on or away from the glacier; loess is material deposited by wind. Outwash consisting of sorted gravel, sand, and silt constitutes the most permeable glacial aquifers.

Aquifers in glacial drift:

Deep James, Middle James, and Elm.

Aquifers in bedrock:

As many as eight major bedrock aquifers underlie parts of the Mud Watershed; however, only the uppermost two are used as sources of water:

Dakota Formation and Pierre Shale.

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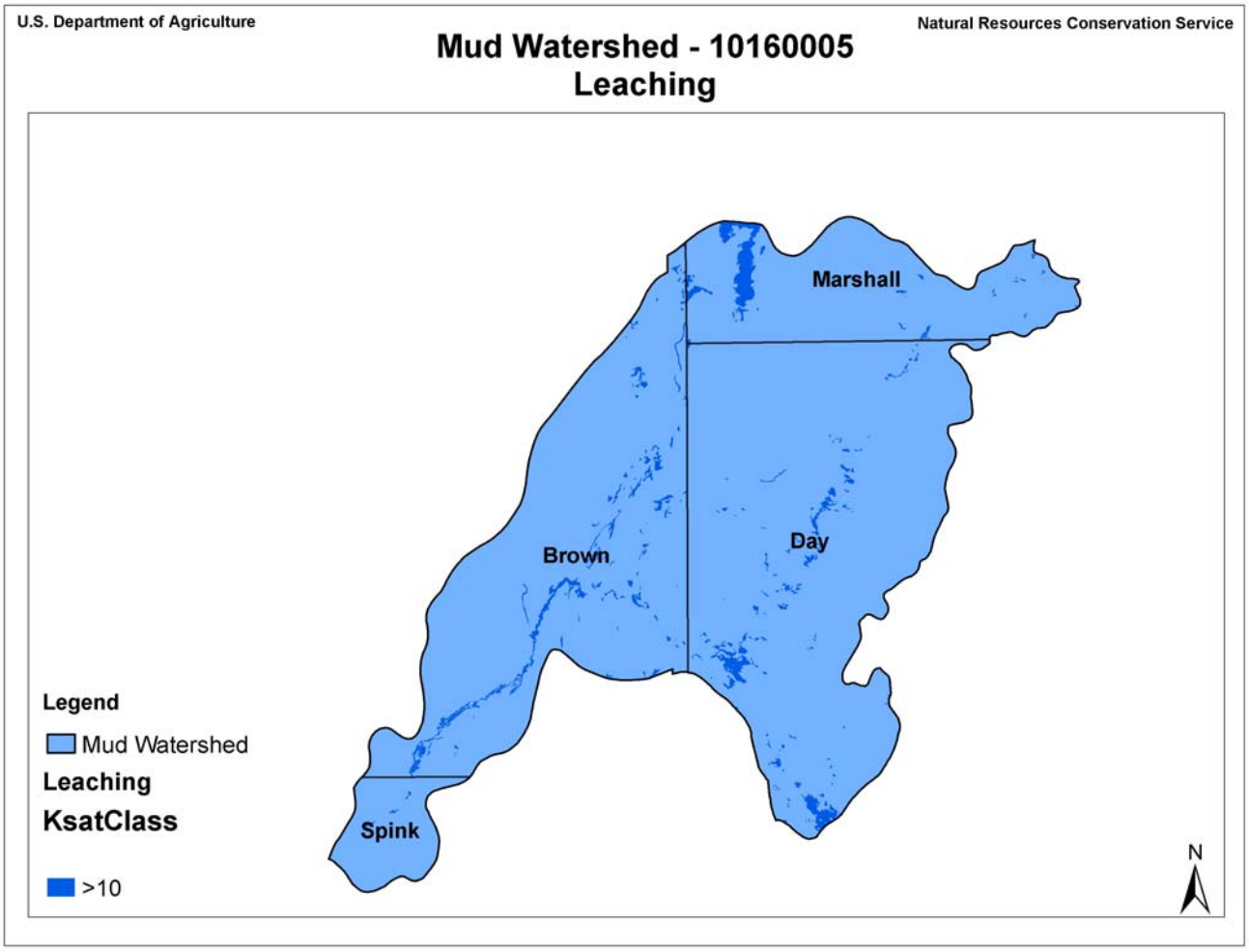
The NRCS makes groundwater leaching assessments based on a soils “saturated hydraulic conductivity” (Ksat). Ksat refers to the ease with which pores in a saturated soil transmit water and is expressed in terms of micrometers per second. Soil map units that have a Ksat value of 10 micrometers/second or greater and with <6 percent slope would be considered to have a “high leaching risk”.



5.4.5 Public Water Supply Systems[7]

Approximately 670 public water systems (PWS) currently exist in SD. The public water supply systems within this watershed rely on both surface and ground water sources. These systems meet the needs of rural and municipal households as well as industrial and agricultural needs. Protection and conservation of both surface and groundwater sources is critical.

Primary enforcement of the federal Safe Drinking Water Act (SDWA) began in 1983. The SD Drinking Water Program, part of the Department of Environment and Natural Resources (DENR), develops and enforces the SD Drinking Water Regulations (http://www.state.sd.us/denr/des/drinking/regs.htm) that apply to public water systems in the state. To see a list of drinking water contaminants that the Drinking Water Program regulates visit the Drinking Water Standards Web page at http://www.state.sd.us/denr/des/drinking/standard.htm. Plans and specifications reviews are part of the department's regulatory efforts to protect the state's surface and groundwater resources and public health. The areas of responsibility include design criteria development, technical assistance, and plan approvals for the Drinking Water, Groundwater Quality, Minerals and Mining, Surface Water and Waste Management Programs within the Division of Environmental Services.

5.4.6 Surface Waters - Designated Beneficial Uses[7]

Surface waters in SD are classified for one or more of the following beneficial uses:

(1) Domestic water supply waters;
(2) Cold water permanent fish life propagation waters;
(3) Cold water marginal fish life propagation waters;
(4) Warm water permanent fish life propagation waters;
(5) Warm water semipermanent fish life propagation waters;
(6) Warm water marginal fish life propagation waters;
(7) Immersion recreation waters;
(8) Limited contact recreation waters;
(9) Fish and wildlife propagation, recreation, and stock watering waters;
(10) Irrigation waters; and
(11) Commerce and industry waters.

All streams, in SD, are assigned the beneficial uses (9) and (10) unless otherwise stated. All lakes, in SD, are assigned the beneficial uses of (7), (8), and (9).

5.4.7 Total Maximum Daily Loads (TMDLs) 2008 Report[7]

Section 303(d) of the federal Clean Water Act requires that states develop TMDLs for water bodies that are impaired. The SD DENR is responsible for managing the monitoring of water bodies and development of TMDLs in SD. The TMDLs are calculations to determine the sum allowable load of a pollutant from all contributing point and nonpoint sources, that a waterbody can receive and still meet the applicable water quality standards. The TMDLs must be developed for water bodies that do not meet the water quality standards. The TMDLs developed by DENR are required to be approved by the Environmental Protection Agency (EPA) and to public notice the TMDL.

The following data was presented by the DENR in "THE 2008 SOUTH DAKOTA INTEGRATED REPORT FOR SURFACE WATER QUALITY ASSESSMENT." This information represents the current status of water quality for waters within Fort Randall Watershed.

Segment or Lake Name	Segment or Lake Location	Impairment	Status	Status Date	Initial Listing
Lakes					
Amsden Dam	Day County	TSI	Water impaired requires a TMDL	2008	2006
Pierpont Lake	Day County	NA	Some uses met but insufficient data to determine support of other uses.	2008	NA
Mud Creek		DO	Water impaired requires a TMDL	2008	2006

Impairments

DO -	Dissolved Oxygen, results from the photosynthetic and respiratory activities of the biota in the water body. DO is essential for aquatic life.
pH -	Acidity/Alkalinity the measure of the hydrogen ion concentration. pH can affect many chemical reactions in water.
TSI -	Carlson's (1977) Trophic State Indices (TSI), Carlson's TSI is a measure of productivity in a lake or reservoir. Typically Secchi depth, chlorophyll *a*, and phosphorus measurements are used to calculate a mean TSI value.
TSS -	Total Suspended Solids, the organic and inorganic material left on a standard glass fiber filter (0.45 micron) after a water sample is filtered through it. TSS can be used to measure the volume of solids in a water body. Too much suspended solids can be harmful to the biota in a stream.

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TMDL Project Status

Assessment Initiated -	Data for developing the TMDL is being collected.
Delist -	A water body has been removed from the TMDL list. Delisting may occur when a TMDL is approved by EPA, water quality standards are met, a water body was listed in error, additional state effluent controls address water quality problems, reservoirs have been breached and are no longer a viable water body, or data assessment methodologies have been modified.
Delist* -	Water quality standards have been met; however, a TMDL was completed because an assessment had already been initiated while the segment was previously listed.
Not Initiated -	Projects are proposed and waiting final funding to begin assessment.
Special Approvals -	A water body that had sufficient data to write a TMDL before the first 303(d) list was published.
TMDL in Public Notice -	During the public notice phase, a TMDL has been developed and is ready for public review and comment. Comments received are reviewed and considered before submitting a final TMDL to EPA for approval.
TMDL Public Noticed -	The public notice comment period has passed. Comments received are being reviewed and considered before submitting a final TMDL to EPA for approval.
TMDL Approved -	EPA has approved a TMDL as submitted by the state.
TMDL Not Required -	Water body is meeting its beneficial uses.

Watershed Projects, Plans, Studies, and Assessments

Mud Watershed Projects, Plans, Studies, and Assessments					
NRCS Watershed Projects			NRCS Watershed Plans, Studies, and Assessments		
Name	Status	Goals:	Name	Status	Goals
None	NA	NA	None	NA	NA
SD DENR Water Quality Projects or Conservation District Projects	Status	Results:			
Amsden Dam/ Lake Minnewasta	Complete	Complete TMDL			

5.4.8 Confined Animal Feeding Operations (CAFO)[8]

The SD DENR is the state agency responsible for regulating animal feeding operations. A CAFO is a lot or facility that stables or confines and feeds or maintains animals for a total of 45 days or more in any 12-month period and meets the criteria for either a large, medium, or small concentrated animal feeding operation. Concentrated Animal Feeding Operations are regulated by a general water pollution control permit. Producers must submit plans for manure management systems to DENR. These plans must meet DENR design requirements and be approved by a department engineer.

Livestock production is an important industry within the Mud watershed. Farms and ranches raise beef cattle, dairy cattle, hogs, and poultry.

CAFO Watershed Summary					
Animal/Operation Type	Cattle	Dairy	Swine	Poultry	Not Specified
Number of Permitted Farms	2	2	1	1	
- Number of Permitted Animals	11,000	1,805	12,156	3,000	
- Permitted Acres for Waste Management	3,435	2,960			1,114
Partially Permitted Farms	1				
- # of Animals Permitted	770	265	6,130		
- Total Animals	770	265	6,970		
- # of Acres					2,535
Approved Farms Not yet permitted	1				
- # of Animals	1,000				
- # of Acres	1,515				
Operations Under Review					
- # of Animals					
- # of Acres					
Other Acres Not Specified					790

Current as of May 2007

5.5 RESOURCES OF SPECIAL CONCERN

In support of federal actions proposed by the NRCS, the agency prepares programmatic, policy, legislative, and other Environmental Assessments (EA) or Environmental Impact Statements (EIS), as necessary, for environmental compliance with federal regulations. All conservation programs administered by the agency have a program level EA or EIS. Additionally, the NRCS policy requires that for all projects or conservation practices where the NRCS provides financial or technical assistance, a site-specific environmental evaluation (EE) of practice effects is completed to ensure the proposed action has been sufficiently analyzed in an existing NRCS environmental document.

The SD NRCS site-specific EE reviews and evaluates the proposed activity impacts with regard to the following federal laws, Executive Orders, regulations, or agency policy as applicable:

National Historic Preservation Act (1966), as amended, and implementing regulations found at 36 CFR Part 800;
Endangered Species Act (1973), as amended;
Fish and Wildlife Coordination Act (1943), as amended;
Executive Order 11988 (1987) - Floodplain Management;
Executive Order 13112 (1999) - Invasive Species;
Migratory Bird Treaty Act (1918), as amended, and Executive Order 13186 – Responsibility of Federal Agencies to Protect Migratory Birds;
The NRCS policy General Manual (GM), Title 190, Part 410.23 - Natural Areas;
Farmland Protection Policy Act and 7 CFR 658.5 regulations;
The NRCS policy GM, Title 190, Part 411.03(d) Riparian Areas;
Clean Water Act and Waters of the U.S. (1972);
Executive Order 11990 “Protection of Wetlands,” the Food Security Act of 1985, revised NRCS Wetland Technical Assistance Policy - 7 CFR Part 650 (1997);
Wild and Scenic Rivers Act – PL 90-542.

5.5.1 Endangered and Threatened Species[1]

Status of federally and state listed threatened and endangered species in the watershed.

Scientific Name	Common Name	Federal Status	State Status
Haliaeetus leucocephalus	Bald Eagle		Threatened
Fundulus diaphanus	Banded Killifish		Endangered
Lontra canadensis	Northern River Otter		Threatened
Charadius melodus	Piping Plover	Threatened	Threatened
Notropis topeka	Topeka Shiner	Endangered	
Grus americana	Whooping Crane	Endangered	Endangered

5.6 RESOURCE ACCOMPLISHMENTS

5.6.1 Performance Results Systems (PRS) Data

The PRS is an Integrated Accountability System (IAS) application that collects practice-based information for NRCS conservation programs. Currently, the PRS program is used by NRCS employees and partners to record performance data on conservation plans and practices that are planned and applied.

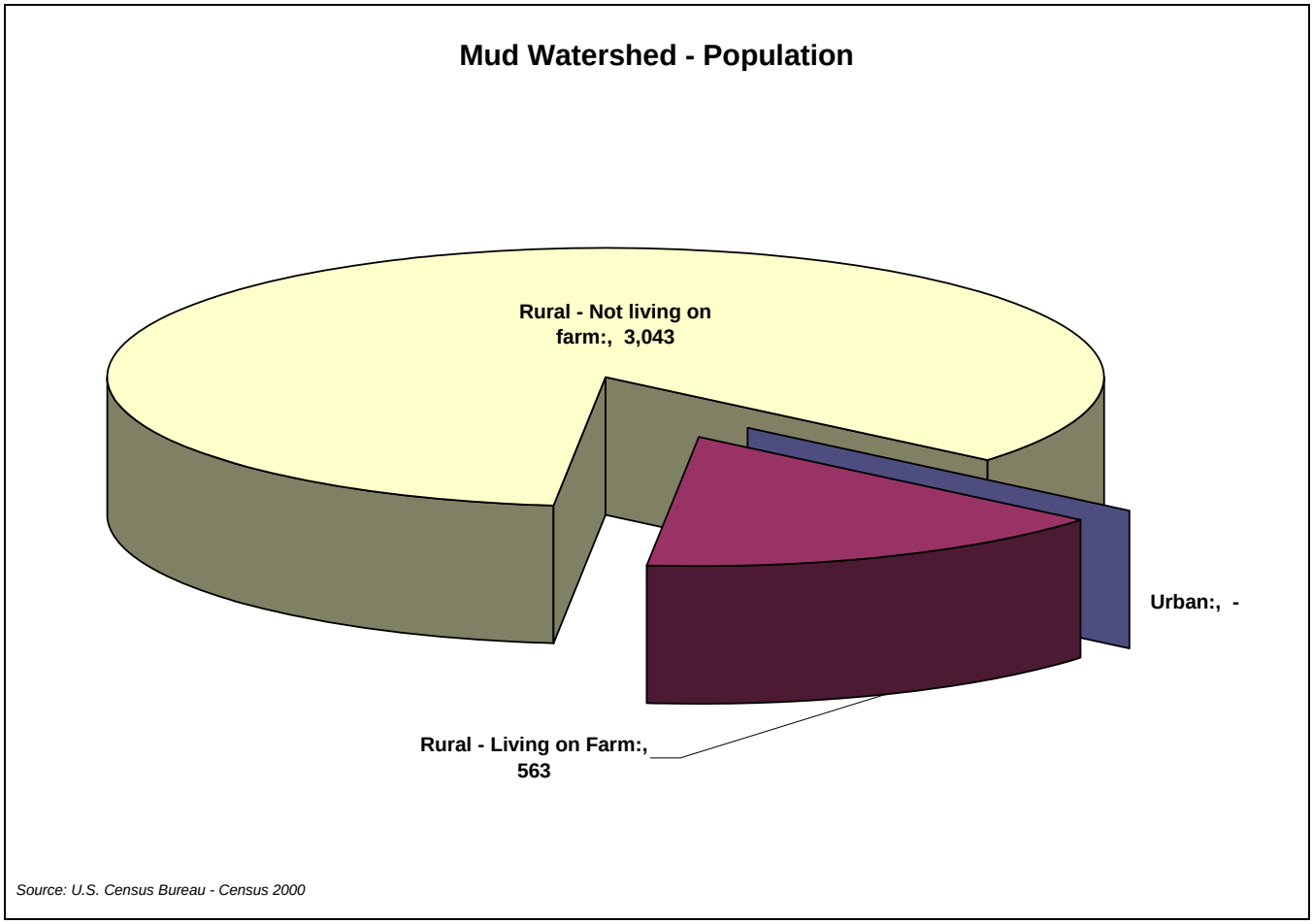
PRS Data	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Applied Conservation Treatment (Units/Acres)						
Access Control (472) (ac)	188	101	43	397	1,107	56
Brush Management (314) (ac)					91	
Comprehensive Nutrient Management Plan (100) (no)				1	1	
Conservation Cover (327) (ac)	183	152	2,821	3,198	753	2,872
Conservation Crop Rotation (328) (ac)	47	105	2,431	160	12,096	61
Critical Area Planting (342) (ac)				4	6	
Fence (382) (ft)			9,034	9,492	4,240	
Filter Strip (393) (ac)	6		30	89	69	
Forage Harvest Management (511) (ac)	188			60	7	263
Heavy Use Area Protection (561) (ac)					16	
Hedgerow Planting (422) (ft)		1,510				
Mulching (484) (ac)		9	7	18	10	9
Nutrient Management (590) (ac)	3			2,154	3,489	
Pest Management (595) (ac)	127	105	2,203	376	1,654	9
Pipeline (516) (ft)	7,974		6,014	3,397		
Pond (378) (no)	1			2		
Prescribed Grazing (528) (ac)		1,305	1,820	843	812	
Residue Management, No-Till/Strip Till/Direct Seed (329) (ac)			1,515		4,926	
Residue Management, Mulch Till (329B) (ac)			776		686	
Residue Management, No-Till/Strip Till(329A) (ac)			140		6,704	
Residue Management, Seasonal (344) (ac)	47	59	246			
Riparian Forest Buffer (391) (ac)	3		3	5	4	
Sediment Basin (350) (no)				1		
Soil Salinity Management (571) (ac)	55			21		
Salinity and Sodic Soil Management (610) (ac)			34	283	108	
Upland Wildlife Habitat Management (645) (ac)	21	202	790	49	551	
Waste Storage Facility (313) (no)				3		
Water Well (642) (no)	1	1				
Watering Facility (614) (no)	8	2			2	
Wetland Creation, Enhancement, and Restoration (658, 659, 657) (ac)	53		18	332	52	
Wetland Wildlife Habitat Management (644) (ac)		2				
Windbreak/Shelterbelts (380 and 650) (ft)	19,381	8,078	11,466	14,721	9,735	4,270

6.0 CENSUS AND SOCIAL DATA[9]

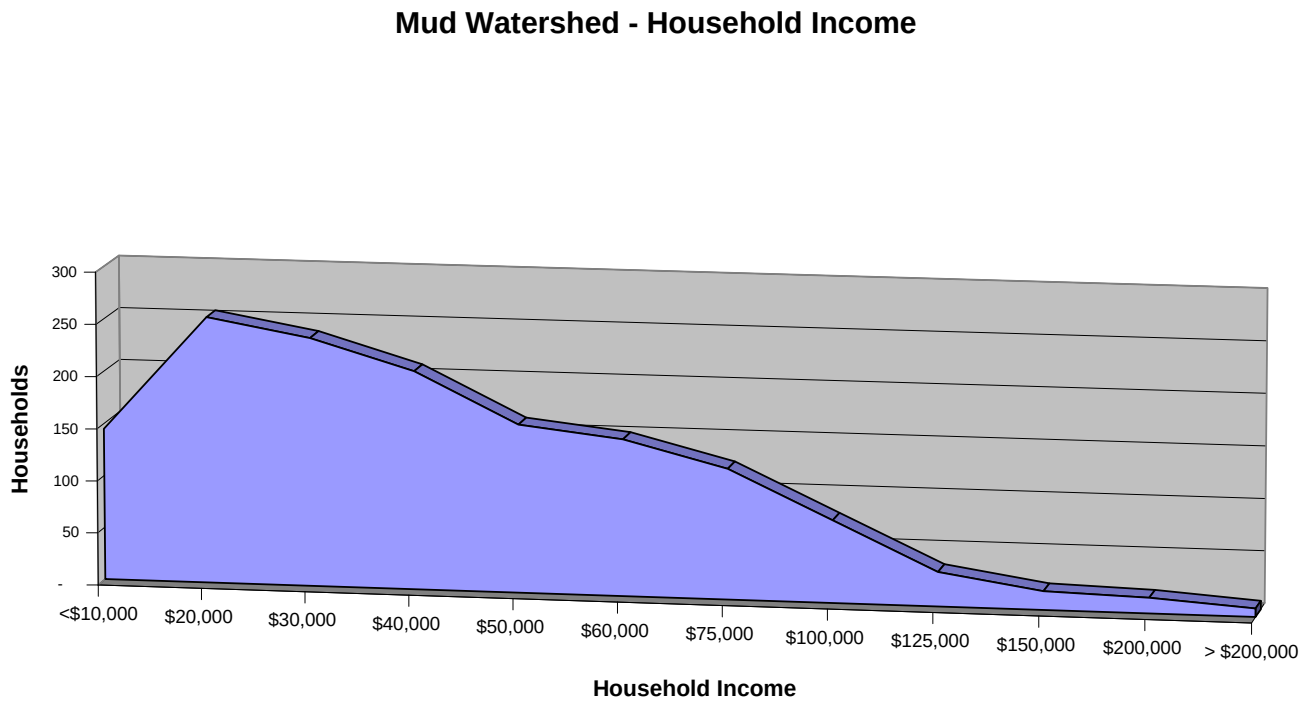
This section provides basic social data gathered through the 2002 Census

6.1 POPULATION CHART

Census data for the rural and urban population within the watershed.

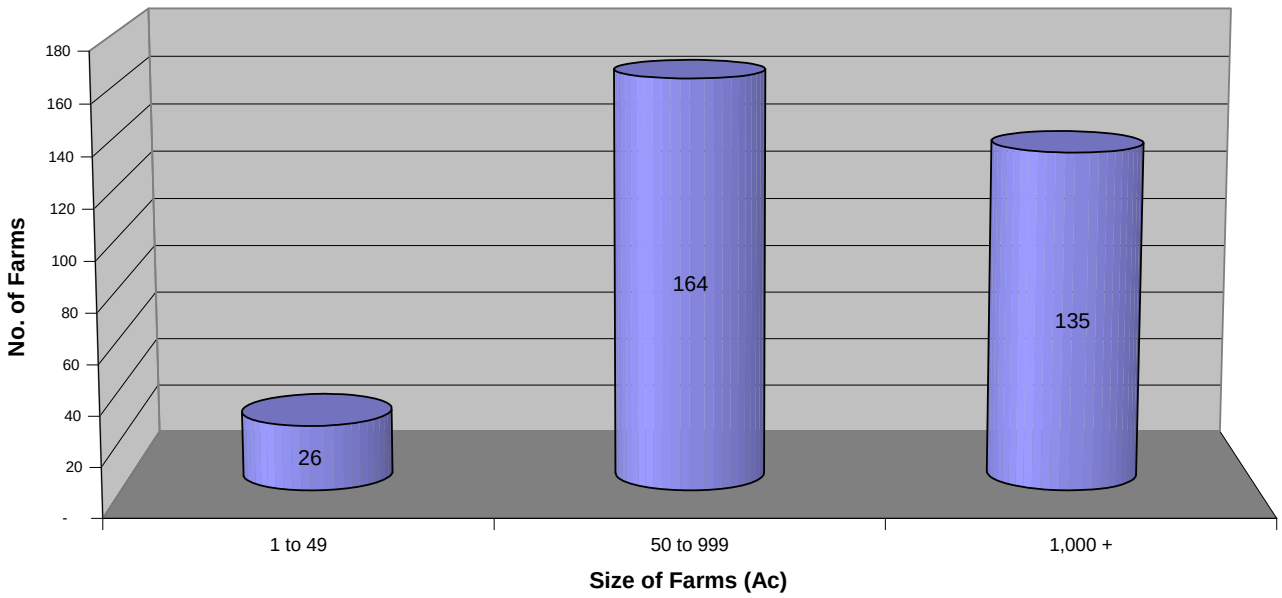


6.2 HOUSEHOLD INCOME



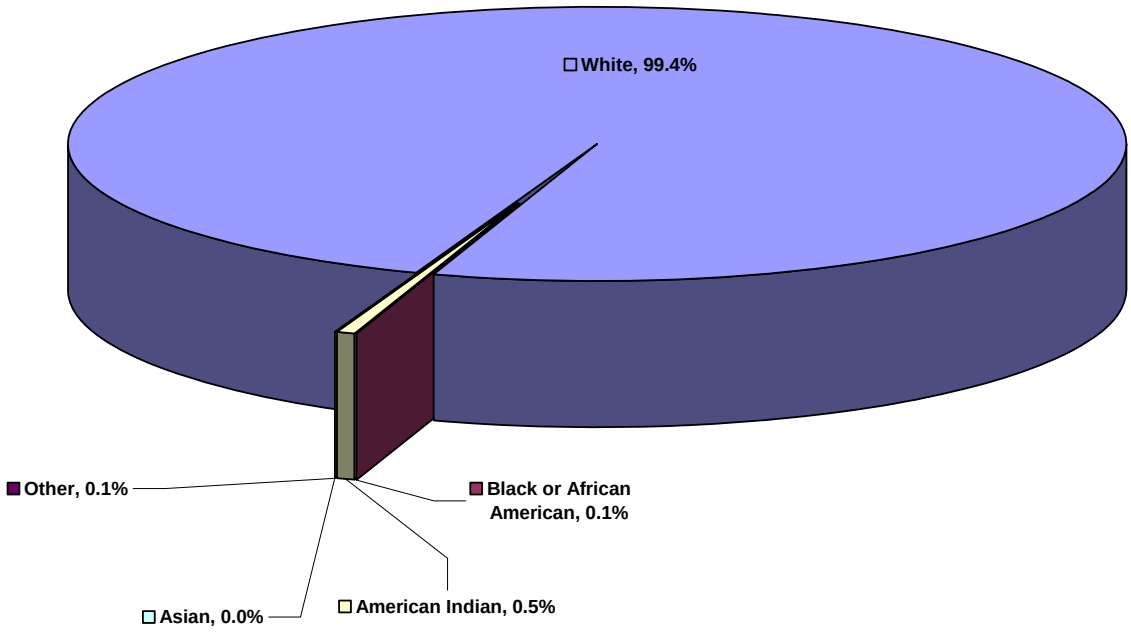
Source: U.S. Census Bureau - Census 2000

6.3 FARM SIZE



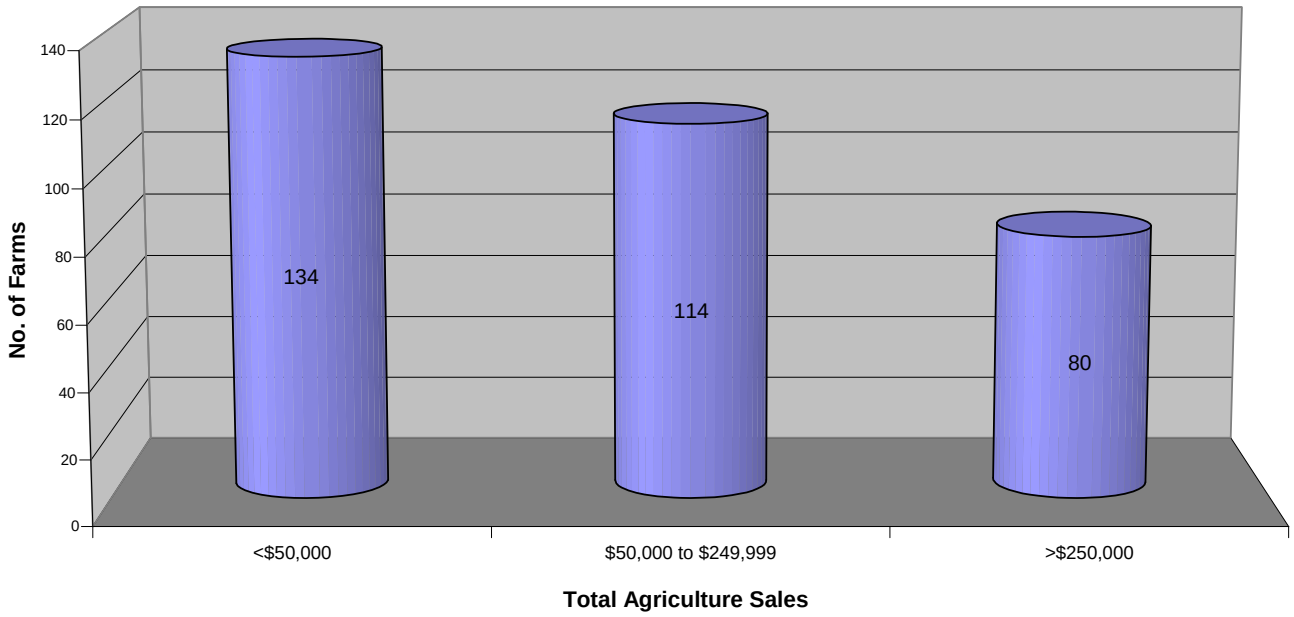
Source: 2002 Census of Agriculture

6.4 DEMOGRAPHICS



Source: U.S. Census Bureau - Census

6.5 TOTAL AGRICULTURAL SALES



Source: 2002 Census of Agriculture

7.0 REFERENCES/PREPARERS

7.1 LIST OF PREPARERS

This RWA was prepared by an interdisciplinary team composed of the following personnel:

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7.2 REFERENCES

[1] Natural Resources Conservation Service, 2002
[2] South Dakota Geological Survey, 2004
[3] Prism Group, 1990. South Dakota Annual Precipitation Data 1961-1990
[4] South Dakota State University, 2007. South Dakota Office of Climatology
[5] High Plains Regional Climate Center, 2007.
[6] United States Geological Survey (USGS) – Originator of National Land Cover Dataset (NLCD)
[7] South Dakota Department of Environment and Natural Resources (SD DENR)
[8] SD DENR – Surface Water Quality
[9] 2002 Agricultural Census. Adjusted by percent of HUC in the county or by percent of zip code in the HUC, depending on the level of data available.