Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Roger A. Kanable, conservation agronomist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Natural Resources Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

According to Nebraska Agriculture Statistics, about 23 percent of the total land acreage in Sheridan County is used as cropland. The largest acreage is used for dryland winter wheat and fallow. The rest is used mainly for irrigated field beans and corn. About 20 percent of the cropland is irrigated. The potential of soils in the county for increased production of food is good. Soils that are in land capability classes I through IV are suited to dryland or irrigated crops.

Management for Dryland Crops

Good management practices for dryland crops are those that reduce the rate of runoff and the risk of water erosion and soil blowing, conserve soil moisture, and improve tilth. Most of the soils are suitable for crops. In many areas, however, erosion is a severe hazard and should be controlled by suitable conservation practices.

Level terraces, contour farming, grassed waterways, and a conservation tillage system help to control water erosion. Keeping crop residue on the surface or growing a protective plant cover helps to prevent sealing and crusting of the soil during and after heavy rains. The moisture supply is increased in winter because the stubble catches drifting snow.

Soil blowing is a hazard on nearly all of the tillable soils, especially during periods of below average rainfall. A conservation tillage system and wind stripcropping help to control soil blowing. Planting row crops on the more productive soils and planting hay, pasture plants, or close-growing crops, such as small

grain and alfalfa, on the steeper, more erodible soils help to control soil blowing and water erosion. In many areas only the proper use of the land can reduce the hazard of erosion.

An insufficient amount of rainfall is the main limitation affecting dryland crops in Sheridan County. A cropping system that conserves moisture and controls water erosion and soil blowing is needed. A cropping system is the sequence of crops grown on a field and the management needed to conserve soil and water. It should preserve tilth and fertility, maintain a protective plant cover, and control weeds, insects, and disease on soils used for dryland crops. The cropping system selected should be the one best suited to the soil. For example, a conservation tillage system that maintains 1,500 pounds per acre of small grain residue on the surface to protect the soil from water erosion and soil blowing is needed on Satanta fine sandy loam, 6 to 11 percent slopes. On Alliance loam, 0 to 1 percent slopes, however, 1,000 pounds of small grain residue protect the soil from erosion.

Preparing a seedbed helps to control weeds and provide a favorable growing medium for plants. If tillage is excessive, however, the granular structure in the surface breaks down and tilth deteriorates. Tillage should be kept at a minimum. Various methods are used to reduce tillage in the county. Examples of methods that are well suited to all of the common crops are a fallow system in which weeds are controlled by the use of herbicides rather than by tillage; a system in which the soil is tilled with disks or chisels, which keeps tillage at a minimum and keeps crop residue on the surface; and a stubble mulching system in which crop residue from winter wheat remains on the surface after the soil is tilled. Grass seed can be drilled into a cover of stubble without further seedbed preparation.

Additional nutrients are needed in some of the soils used for dryland crops. The kind and amount of fertilizer to be applied to the soils should be based on the results of soil tests and on the content of moisture in the soil at the time of application. If the subsoil is dry and the amount of rainfall is low, fertilizer should be applied at a slightly lower rate than that needed when the soil is moist. On all of the soils that are used for nonlegume crops, nitrogen fertilizer is beneficial. Phosphorus and zinc are commonly needed on the more eroded soils and in areas that are cut for terraces, diversions, or land leveling. The amount of fertilizer needed on soils used for dryland crops is smaller than the amount needed on soils used for irrigated crops because the plant population is lower. All plant nutrients should be applied in a manner to prevent contamination of surface water and ground water.

On the soils assigned to capability subclass IIe, such as Alliance loam, 1 to 3 percent slopes, the best management includes a cover of crop residue, wind stripcropping, applications of fertilizer or feedlot manure, selection of suitable crop varieties, and a planned crop rotation. On the soils assigned to capability subclass IIIe, such as Alliance loam, 3 to 6 percent slopes, the best management includes a cover of crop residue throughout the winter, wind stripcropping, terracing, and a conservation tillage system that leaves, per acre, about 3,000 pounds of corn or sorghum residue or 1,500 pounds of small grain residue on the surface after the crops are planted. If the slope is more than 10 percent, grasses and legumes are needed in the cropping sequence to help control water erosion. The conversion of cropland to pasture or hayland is an economic alternative on the soils assigned to land capability class IV.

Some of the soils in Sheridan County, such as Lodgepole soils, are subject to ponding. The crops selected for planting should be those that can grow in a wet soil.

Some of the soils, such as Beckton silt loam, 0 to 2 percent slopes, are saline or sodic and thus are unsuitable for many climatically adapted plants. Saline or sodic (alkali) conditions affect the kind and production of crops and forage plants. Crops and forage plants that have a good degree of salt tolerance can be grown. Barley and winter wheat are more tolerant than field beans or corn. Such forage species as tall wheatgrass and birdsfoot trefoil are more tolerant than alfalfa or orchardgrass. Applications of feedlot manure and commercial fertilizer, particularly phosphorus, help to overcome the low fertility of these soils. Gypsum and sulfur can be applied on a trial basis, but results in the field are commonly disappointing.

Applications of herbicide are effective in controlling weeds. The kind and amount applied, however, should be carefully controlled. The application rate should be determined by the colloidal clay and humus fraction of the soil, which is responsible for most of the chemical activity in the soil. Applications of a large amount of herbicide result in crop damage on sandy soils, which have a low content of colloidal clay, and on soils that have a moderately low or low content of organic matter. Applying herbicides according to the kind of soil can lessen the danger of crop damage. All herbicides should be applied in a manner that minimizes the risk of contamination to surface and ground water.

Management for Irrigated Crops

About 20 percent of the cropland in Sheridan County is irrigated. Corn and dry, edible beans are the principal irrigated crops. A smaller acreage is used for alfalfa hay, wheat, and sugar beets. Corn, beans, and sugar beets can be irrigated by the furrow or sprinkler method. Alfalfa can be irrigated by the border, contour ditch, corrugation, or sprinkler method. Wheat, which generally is grown in rotation with beans or corn, is irrigated by sprinkler systems. The irrigation water is drawn by wells or canals.

The management needed in irrigated areas includes selecting a proper cropping sequence; land leveling, which provides a proper grade for the even distribution of irrigation water; applying measures that conserve moisture and control water erosion; and ensuring that the rate at which water is applied does not exceed the intake rate of the soil.

The cropping sequence on soils that are well suited to irrigation is dominated by row crops. A crop rotation that includes different row crops, small grains, and alfalfa or grass helps to control the diseases and insects that are common if the same crop is grown year after year.

A gently sloping soil, such as Keith loam, 3 to 6 percent slopes, is subject to water erosion in areas where it is irrigated by furrows that run down the slope. Contour bench leveling or a combination of contour furrows and parallel terraces helps to control water erosion in these areas. In areas where a sprinkler system is used, terracing, contour farming, grassed waterways, and a conservation tillage system, which keeps crop residue on the surface, help to control water erosion and conserve water.

If an adequate amount of water is available, sprinklers are most effective on moderately coarse textured and coarse textured soils and can be used on the more sloping and nearly level soils. The sprinklers are either the center-pivot type, which revolves around a central point, or are sets of sprinklers installed at various locations in the field. The water can be applied at a rate that does not exceed the intake rate of the soil and thus result in excessive runoff. Because the water can be carefully controlled, sprinklers are effective in helping to establish new pastures on the moderately steep soils. In summer, however, much of the water is lost through evaporation. Keeping crop residue on the surface increases the intake rate and decreases the evaporation rate. Wind drift can result in an uneven distribution of water in some areas.

Soil holds only a limited amount of water. The loams in Sheridan County, for example, hold about 2 inches of available water per foot of soil depth. Thus, a soil that is 4 feet deep and is planted to a crop that has roots extending to that depth can hold about 8 inches of water available for that crop. Irrigation should begin when about half of the available water has been used by the crop. Applying the water at regular intervals helps to keep the soil moist throughout at all times. The interval varies according to the crop and the time of year.

A tailwater recovery pit at the end of a field that is furrow irrigated helps to trap runoff of excess irrigation tailwater. This water can then be pumped to the upper end of the field and used again. These pits increase the efficiency of the irrigation system and conserve the supply of underground water.

All of the soils in Nebraska are assigned to irrigation design groups, which are described in the Nebraska Irrigation Guide *(5)*. Arabic numerals indicate the irrigation design groups to which the soils are assigned.

Assistance in planning and designing an irrigation system is available through the local office of the Natural Resources Conservation Service or the county agricultural agent. Estimates of the cost of equipment can be obtained from dealers and manufacturers of irrigation equipment.

Managing Pasture and Hayland

Areas that are used for hay or pasture should be managed for maximum forage production. A rotation system that results in a uniform distribution of grazing is needed. Many forage plants are a good source of minerals, vitamins, protein, and other nutrients. A well managed pasture can provide a balanced ration throughout the growing season. Adding plant nutrients to the soil helps to obtain maximum production. The kinds and amounts of fertilizer should be determined by soil tests. If pastures are irrigated, a high level of management is needed.

A mixture of grasses and legumes can be grown in rotation with grain crops on many soils. The grasses and legumes improve tilth, increase the organic matter content, and help to control erosion. They are ideal as part of a conservation cropping system.

The most commonly grown grasses in areas of irrigated pasture in Sheridan County are smooth brome and orchardgrass. Other grasses and legumes that are adapted to irrigation in the county are intermediate wheatgrass, meadow brome, and creeping foxtail. Legumes that may have potential for forage production are birdsfoot trefoil and cicer milkvetch. Under a high level of management, irrigated pastures in the county can produce 750 to 900 pounds of forage per acre.

Grasses that have potential for forage production in areas of dryland pasture are intermediate wheatgrass,

pubescent wheatgrass, and western wheatgrass. Smooth brome grows well on the lower, wetter soils.

Grasses and legumes grown on both irrigated and dryland pasture and hayland require additional plant nutrients for maximum forage production. The kinds and amounts of fertilizer should be determined by soil tests.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial

drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 and IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units," in the yields table, and in the Interpretive Groups that follow the tables at the back of the survey.

Rangeland

Kenneth L. Hladek, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Rangeland makes up about 70 percent of the agricultural land in Sheridan County. The largest acreages are in the Valent, Valent-Wildhorse, and Valent-Els, calcareous-Hoffland soil associations in about the southern half of the county (fig. 16). Larger ranching operations typically are dominant in these associations. The eastern part of the Sandhills area has predominantly dry valleys in contrast to wet valleys in the central and southwestern parts of the Sandhills.

Farms and ranches in the northern part of the county tend to be smaller and more diversified, with cash-grain and livestock operations more common. Rangeland throughout the county is used primarily for grazing by livestock and supports the production of native hay.

The raising of livestock, mainly cow and calf herds, is the most important agricultural enterprise in the county. The calves are sold in the fall as feeders. The range is generally grazed from late spring to early fall. The livestock spend the fall grazing the regrowth on native meadows or crop residue. At the end of the year many producers hold livestock on winter pastures near the ranch headquarters. Livestock are fed alfalfa, native hay, or both during the winter and early spring. The rangeland forage is often also supplemented with protein in fall and winter.

Some of the rangeland in the county is producing well below its forage potential because of past continuous heavy grazing. This is particularly true where stocking rates are tied to the amount of crop residue available for grazing in the fall. Poor grazing distribution, the encroachment of brush on uplands, and increased amounts of leafy spurge also contribute to a reduced production of forage on rangeland in the county.

This section can aid ranchers and conservationists in planning the management of rangeland in the county. It defines range sites, shows how range condition is evaluated, and describes planned grazing systems and other practices used in managing range and hayland for sustained forage production in the county.

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 and vegetation and water.

Table 8 shows, for each soil that supports rangeland vegetation suitable for grazing, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. 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 does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the

Figure 16.—A typical area of rangeland in the Valent association.

amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The main objective of range management is to maintain or improve the range to excellent condition. Proper range management is most important for the conservation of the soil, water, and plant resources in the county. The productivity of the range can be increased by such practices as proper grazing use, planned grazing systems, range seeding, and brush control. Proper management practices improve yields of desirable forage plants for grazing, reduce soil losses, and increase the potential for livestock production. They control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the

optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains sufficient cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. It is the first and most important step of successful range management. Proper grazing use increases the vigor and reproduction potential of desirable plants, allows the accumulation of litter and mulch necessary to control erosion, and increases forage production. Proper grazing use on rangeland is the removal of half of the current year's growth, by weight, when the site is grazed throughout the growing season.

Proper grazing use generally is determined by the degree to which a key species is grazed in a key grazing area. The factors that influence proper grazing use include the stocking rate, distribution of livestock, and kind and class of livestock.

Stocking rates.—The stocking rate is the number of animals grazing in a particular pasture. To attain proper grazing use, stocking rates are calculated on the basis of animal units (AU) and animal unit months (AUM). An animal unit is generally considered to be one mature cow of about 1,000 pounds and a calf as old as 4 months of age, or their equivalent. An animal unit month is the amount of forage or feed necessary to sustain an animal unit for 1 month. Range sites and range condition are used to determine animal unit months for each pasture. Suggested initial stocking rates can then be calculated for individual pastures. The animal unit months for each range site in excellent condition are given for each soil in the "Detailed Soil Map Units" section of this survey. AUM values are lower for range sites in less than excellent condition.

Suggested initial stocking rates for rangeland are relatively easy to calculate for any given soil or range site. For example, Valent fine sand, rolling, which is in the Sands range site, has a suggested initial stocking rate of 0.7 AUM per acre when the site is in excellent condition. A 640-acre pasture in excellent condition would then be able to carry 0.7 x 640, or 448 animal units, for 1 month. If the pasture is to be grazed for 5 months, the suggested initial stocking rate would be 448 animal unit months divided by 5 months, or 90 animal units. Suggested initial stocking rates are based on the condition of the present plant community and the average annual forage production each range site is capable of producing. This production may be high or low for any given year. Because of the weather conditions, forage production may vary. Stocking rates are intended to be a starting point and should be changed as forage production or management systems change.

Distribution of Livestock.—The cattle need to be distributed throughout a pasture if proper range use is to be uniform. Livestock tend to graze in areas near water, roads, or trails and in areas of gentle relief. Distant corners of the pasture, steep terrain, and areas away from water are often only lightly grazed. Poor grazing distribution may be caused by too few watering places, or by having salt, shade, supplemental feed, and water in one location or in a poor location. Continued concentration of livestock causes severe use in localized parts of a pasture. As a result, some areas are subject to erosion. Uniform distribution is best achieved by careful placement of fences, salt, and water and by planned grazing systems.

Fences help to distribute livestock and provide more uniform grazing of forage if placed at correct locations. They also divide pastures for grazing systems and can be used to exclude livestock from blowouts and reseeded areas. Cross fences should be built to follow natural land features and range site boundaries where possible. More importantly, they should be planned so that all pastures have similar potential stocking rates. Efficiency in forage use should be considered along with convenience in operations when pasture size is determined. Generally, the smaller the pasture, the more efficient the use of forage by livestock.

Properly locating salt and minerals is one of the easiest and most economical methods of encouraging uniform use of forage in a pasture. Salt and minerals should be located away from water. Cattle do not need to drink immediately after consuming salt or minerals. They can be easily moved to areas of the pasture that are undergrazed and can be moved periodically during the grazing season so that a uniform distribution of grazing is achieved. In areas of the Valent soils, moving these locations each time the livestock are permitted to graze the pasture lessens the hazard of blowouts resulting from concentrations of livestock.

Properly locating watering facilities can result in the distribution of grazing. In the Valent association, water is often obtained from wells that use windmills for pumping. Dugouts can be used on the wetter range sites, and stock-water dams are in the heavier textured soil associations in the county. Watering facilities should be spaced at varying distances, depending on topography. If distances to water are

excessive, cattle tend to graze close to the water sources repeatedly rather than moving out to graze the pasture uniformly. For example, in areas of rough or hilly terrain, cattle should not have to travel more than half a mile to water. In the more level areas, the greatest distance to water should be about a mile.

Kind and Class of Livestock. —Management of rangeland depends on the kind and class of livestock. Cattle, sheep, and horses have different grazing habits and nutritional needs that affect the way range can best be managed for proper grazing use.

Cattle are the principal livestock raised in Sheridan County and are well suited to grazing the dominant range sites. Grazing habits also differ among classes of cattle. Yearlings tend to travel more within a pasture than cow-calf pairs. They also graze the steeper slopes and use a pasture more uniformly than cows with calves. Yearlings tend to trail along fence lines, however, which sometimes results in erosion. Cow-calf pairs generally graze more on the gentler slopes and stay closer to watering facilities than yearlings. As a result, grazing distribution may be more of a problem on pastures stocked with cow-calf pairs than on pastures stocked with yearlings. Horses and sheep are raised in the county but are few in number.

The general management techniques outlined in this section and in the "Detailed Soil Map Units" section apply mainly to cattle production. In areas where a different kind of livestock grazes the site, adjustments in management may be needed.

Range Condition

Range condition for any range site is the present state of the vegetation compared to its potential, or climax, vegetation. Climax vegetation is a stable plant community that represents the highest point of plant succession. It is the most productive combination of forage plants on rangeland and represents the highest potential in kind and amount of vegetation for a given range site. It maintains itself and changes little as long as the climate and soil remain stable and grazing is at a proper level.

The purpose of determining the range condition is to provide an approximate measure of the overall health of the plant community. More importantly, it provides a basis for predicting the degree of improvement possible under different kinds of management. Four range condition classes express the degree to which the composition of the present plant community has departed from that of the climax vegetation—excellent, good, fair, and poor.

All food that green plants use for maintenance, growth, and reproduction is manufactured in their leaves. Excessive removal of plant leaves during the growing season drastically affects the growth of both roots and shoots. Livestock graze selectively, removing more leaves from some plants than from others. This selective grazing varies according to the season of use and the kind and class of livestock. Various plants respond to continuous heavy grazing in different ways. Some decrease in abundance, some increase, and others not originally present may invade. Plant responses to grazing are used to classify range condition.

Decreaser species on a range site are those present in the original plant community that decrease in abundance if grazed closely and continuously during the growing season. *Increaser plants* are those in the original plant community that normally increase, up to a point, in abundance under continuous heavy grazing. They increase as the decreaser plants cover less of the site. *Invader plants* are not part of the original plant community. They begin growing in an area after the decreasers and increasers have been weakened or eliminated.

Once range condition is determined, it is important to know whether it is improving or deteriorating. This change or trend in range condition is helpful in planning adjustments in grazing use and management. Important factors affecting this trend are plant vigor, composition change, and reproduction of both the desirable and undesirable plant species.

The goal of range management should be an excellent range condition. The highest forage yields are obtained, on a sustained basis, when the range is in excellent condition and the trend is up. Under these circumstances, soil blowing and water erosion are kept at an acceptable level without artificial aids. Plants make optimum use of precipitation on rangeland in this condition. At the end of each map unit description under the heading "Detailed Soil Map Units," the soil or soils in that unit are assigned to appropriate range sites according to the kind and amount of vegetation that can be expected when the site is in excellent condition.

Deferred Grazing

Deferred grazing is the resting of grazing land for a prescribed period of time. The need for deferment is based on the range condition and range trend. To be beneficial, deferment should be for a minimum of 3 consecutive months and coincide with the critical growth periods of the key forage plants. These periods vary with grass species. Maximum benefit from deferment coincides with the food-storage period. For warm-season native grasses, this period occurs in late summer, from late July to early October. In some areas a short deferment of 3 months is all that is

needed, while in other areas two complete growing seasons of continuous rest may be needed before there is improvement. Generally, some grazing during the year is more beneficial than a complete yearlong deferment. Deferred pastures may be grazed after heavy frost in fall or early in spring, before the initiation of growth of the warm-season grasses. During periods of winter grazing, protein supplements should be made available to cattle to meet their nutritional needs.

Deferred grazing allows plants a rest period during critical times in their growth cycle. This period allows grasses to build vigor and to produce a mulch at the surface, thus improving water infiltration. This mulch also reduces the hazard of erosion. Deferred grazing encourages natural grass reseeding by allowing desirable species to set seed and spread vegetatively.

Where severe overgrazing has eliminated the native grasses, reseeding the range to adapted native grasses is the best method of native range restoration. Reseeding of native range, excluding old cropland fields, should be done only after careful evaluation.

Planned Grazing Systems

Planned grazing systems are an effective method of achieving higher forage production and livestock performance while controlling the hazard of erosion. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years. Each pasture is rested sometime during the growing season. All livestock are removed from the pasture being rested. The pastures are grazed in a different sequence each year. Where the same pasture is not grazed at the same time each year, the plants are not close-cropped by livestock at the same stage of development every year, plant vigor and forage production are increased, and the plant community and range condition are improved. Planned grazing systems permit maximum and uniform use of forage and maintain rangeland productivity over a period of years.

Planned grazing systems maintain or speed up improvement in plant cover and result in the proper use of forage. They increase grazing efficiency by uniformly using all parts of the pasture. The rest periods built into a planned grazing system improve plant vigor, vegetative reproduction, and forage quality, thus increasing forage production. Planned grazing systems also help to buffer the adverse effects of drought and other climatic changes.

To be effective, planned grazing systems should be flexible and tailored to meet the needs of an individual rancher. Fences, watering facilities, range condition, range trend, range sites, kinds or classes of grazing animals, and economic factors are all important considerations in determining the best suited system for a particular operation. Grazing systems are dynamic and over a period of time should be modified to reflect improved plant vigor and forage production or changes in management needs.

The use of a planned grazing system, in time, can result in an increase in stocking rates because of improved plant production and quality. Planned grazing systems are also effective in controlling blowouts and may help to control parasites and disease among cattle.

Range Seeding

In some areas range management practices alone cannot restore a satisfactory cover of native vegetation. Old cultivated fields, "go-back" areas, and abandoned farmsteads should be restored by range seeding. Range seeding may also be required in severely overused areas where the vegetation has deteriorated to the point that it cannot respond to management practices.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, adapted species of native grasses are selected, correct seeding practices are employed, and careful management is used after seeding. Range seeding is most successful when the seedbed is firm and has a mulch cover. A firm seedbed helps to ensure good soil-to-seed contact, which is essential for seedling development. The cover of mulch helps keep the soil moist, lowers the surface soil temperature, and reduces the hazard of erosion. A mulch cover can be provided by a temporary crop, such as grain sorghum.

Grass should be seeded directly into the cover crop stubble the following fall, winter, or spring. Avoiding tillage helps to ensure a firm seedbed. On soils that have a coarser textured surface layer that is subject to soil blowing, preparing the seedbed and planting the seed in strips over a period of several years or with a range interseeder can minimize the hazard of soil blowing.

Seeding mixtures should be of adapted native grasses that are present when the site is in excellent range condition. Consequently, appropriate grass mixtures vary according to soils and range sites. Use of a grass drill with depth bands assures proper placement of seeds at a uniform depth in the soil. On soils in the Sands and Choppy Sands range sites and on other soils where tillage for seedbed preparation would result in a severe hazard of soil blowing, a range interseeder should be used. Interseeders place the seed in the center of a shallow furrow without

disturbing the vegetation or the soil between the furrows and thus without increasing the hazard of erosion.

Generally, newly seeded areas should not be fully grazed until after the grass is established. Establishment may take from 2 to 4 years, depending on the grass species, the range site, the method of planting, and the weather. Initial grazing of newly seeded areas should be light. Limited early spring, late fall, or winter grazing may be desirable for weed control until the grass has become established. Proper grazing use and a planned grazing system can keep the range productive after the establishment period.

Additional information about appropriate grass mixtures, grassland drills, and planting dates for range seeding can be obtained from the Natural Resources Conservation Service or Natural Resources District offices.

Control of Blowouts

Blowouts occur on sandy soils, mainly in areas of the Valent association where the vegetation has been disturbed. Many blowouts in the sandhills result from the livestock trailing associated with continuous heavy grazing. The larger blowouts generally start at watering facilities because livestock generally concentrate near water. The smaller blowouts often form along trails or fence lines. Drought increases the chance of blowout formation.

When blowouts are not stabilized, they are likely to enlarge. The wind blows sand onto bordering areas and covers the vegetation. The result is an ever-enlarging area that is subject to severe soil blowing.

Many blowouts can be stabilized in 4 to 5 years by controlling grazing through a planned grazing system. Locating salting facilities and mineral supplements away from blowouts discourages the concentration of livestock in these areas. A planned grazing system is the most effective way to control blowouts.

When a planned grazing system is not feasible, reseeding may be necessary. Reseeding, however, may not be economically feasible. If blowouts are reseeded, steep banks around the edges may need to be shaped to a stable slope. A rapidly growing cover crop should be planted in the spring. An adapted native grass mixture is then drilled into the undisturbed stubble left from the crop. This residue helps to protect the surface soil from the wind, lowers the surface soil temperature, and helps to ensure a good, firm seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and anchored into the sand after seeding. Mulching helps to control the damage from blowing sand while the grasses become established. Once seeded, blowout areas should be fenced to exclude livestock until a desirable stand is obtained. Proper grazing use and a planned grazing system help to prevent reactivation of stabilized blowouts after the grasses are established.

Managing Native Hayland

A fairly sizable acreage of rangeland in Sheridan County is used for the production of native hay. Some hay is cut on soils that have a high water table. They are associated with the Subirrigated range site in the Beckton-Lute and Valent-Els, calcareous-Hoffland associations. In some areas hay is harvested on upland sites that are generally used for grazing. These hayfields are mainly in the Sandy Lowland, Sandy, or Sands range sites.

Production from wet meadows can be maintained or improved by proper management. In order to maintain strong plant vigor and high-quality forage plants, timely mowing is needed. If possible, grasses should be mowed from the boot stage to the emergence of seed heads. Mowing during this period permits adequate regrowth and carbohydrate storage in the plant roots before the first frost. A mowing height of no less than 3 inches helps to maintain high plant vigor and promotes rapid regrowth.

Meadows should not be grazed or hayed when the soil is wet or the water table is within a depth of 6 inches. Grazing or using heavy machinery during these periods results in the formation of small bogs, ruts, and mounds that cause mowing difficulty in later years. Meadows can be grazed without damage after the ground is frozen, but livestock need to be removed before the ground thaws and the soil becomes wet.

When hay is cut on the drier upland sites, it should be harvested only every other year. The year following cutting, harvesting should be deferred during the growing season and the hay should be used for fall or winter grazing if necessary. This management method allows the warm-season grasses to regain vigor and suppresses cool-season grasses and weeds. As on the wetter sites, the best time for mowing is just before the dominant grasses reach boot stage. Regulating mowing allows the desirable grasses to remain vigorous and healthy. Early mowing allows enough time for adequate plant regrowth. The regrowth also helps to hold snow on the surface in the winter and increase the supply of soil moisture.

Ranchers and livestock producers can obtain technical assistance in range and hayland management or improvement programs from the local offices of the Natural Resources Conservation Service or Natural Resources District.

Brush Control

Small soapweed, western snowberry, juniper, and smooth sumac are the main brush species in Sheridan County. Although not a major range problem at the present time, these plants encroach on the continuously heavily grazed range and reduce forage production and carrying capacity for livestock.

Yucca can generally be controlled by winter grazing. Feeding a cottonseed cake supplement in yucca-infested areas encourages cattle to browse the yucca. Winter grazing causes yucca to lose vigor. Some plants are broken off below the root crown when livestock feed in these areas. Applications of approved herbicides have limited effectiveness.

Western snowberry, smooth sumac, and juniper are invading prairie uplands in fairly large numbers in soil associations that are adjacent to the steep canyon areas. Western snowberry and smooth sumac can be best controlled by applications of approved herbicides. Treatment of western snowberry may need to be repeated during several consecutive years for complete control. Herbicide recommendations are available from the county extension agent or the local office of the Natural Resources Conservation Service.

Juniper is best controlled by cutting the trees at ground level by hand or with earthmoving equipment in areas where the slopes and topography are suitable. Follow-up treatment is not necessary if no green branches remain. Approved herbicides are effective in controlling eastern redcedar. Deferment of pastures after treatment helps to restore plant vigor and the quality of forage.

Recommendations can be obtained from the local office of the Natural Resources Conservation Service.

Native Woodland

Gary Kuhn, forester, Natural Resources Conservation Service, and Doak Nickerson, district forester, Nebraska Forest Service, helped prepare this section.

Ponderosa pine, which is representative of the Rocky Mountain forest type, is on the slopes and in the canyons of the Pine Ridge area in Sheridan County. About 85 percent, or 175,000 acres, of the forest land in the Pine Ridge area is under nonindustrial private ownership. The rest, or 20,000 acres, is owned by the Bureau of Land Management and the State of Nebraska. The Pine Ridge is a crescent-shaped geologic fault that extends from east to west across Sheridan, Dawes, and Sioux Counties. The topography of this area ranges from steep slopes and canyons to flat and gently rolling surrounding tablelands. The average annual precipitation ranges from 12 to 14 inches in Sioux County and from 16 to 18 inches in Sheridan County.

Before European settlement, the forest land in Sheridan County was more savannahlike because of natural fires or fires caused by the native inhabitants. Native grasses were dominant, but old growth stands of ponderosa pine were in scattered areas. Isolated, dense pockets of pine may have been on protected, north-facing slopes. Hardwood forests were only on the drainage bottoms. Quaking aspen was much more prevalent because of the fires. After European settlement, the fires were eliminated. Consequently, ponderosa pine forests began to expand and quaking aspen disappeared, resulting in the forest of today.

The timber industry harvesting began in the late 1800's. Sawtimber was cut into ties for the railroad lines that were expanding into the region. From the 1960's through the 1980's, most of the sawtimber was cut into rough dimension lumber for local markets.

Timber harvesting activities in the county have greatly increased today. Timber companies based in South Dakota buy and harvest timber from the Pine Ridge area for local, regional, and national markets. Products include rough dimension lumber, landscape ties, pulp chips, fuelwood, and slabs. A new woodburning energy boiler at Chadron State College utilizes sawmill residue and possibly logging residue from timber harvesting and thinning operations.

The forest land in Sheridan County contains some of the most productive sites for growing timber in the Pine Ridge area because of the higher rainfall and greater abundance of deep soils on the north aspects. Because the topography in the county is gentler than that in other parts of the Pine Ridge area, operating logging equipment is easier. Many areas, however, are practically inaccessible because of the steep, heavily dissected slopes. The cost of logging and the potential for soil erosion are greatly increased in these areas. Most logging roads have been poorly designed in the past. Excessive water erosion has caused many roads to turn into gullies. Establishing water bars and seeding roadbeds to grass can aid in stabilizing these areas.

Much of the pine forest in Sheridan County is unmanaged. Measures that improve timber stands, such as precommercial or commercial thinning, have not been applied. As a result, most of the pine stands are overstocked and the trees are not growing at their full potential. The current average annual growth is estimated at 25 cubic feet per acre. Through management, the average annual growth could possibly be increased to 40 cubic feet per acre. Ponderosa pine responds well to thinning if the stand is less than 80 years old. The average annual growth

can be doubled through thinning. For example, trees taking 12 years to produce 1 inch of diameter growth before thinning take only 6 years to produce 1 inch of diameter growth after thinning. The best pine sites are in areas on north aspects and on the bottom of draws, where the soils are deeper and more moisture is available for tree growth.

The ponderosa pine timber type is unique because it offers opportunities for the growth of both timber and grass on the same site. Unmanaged pine stands shade out desirable forage, resulting in limited livestock grazing potential. Timber management, however, allows sunlight onto the forest floor, increasing forage production (fig. 17). Studies of Black Hills pine stands have shown that forage production more than doubles after thinning. A good rule of thumb for tree spacing when a pine stand is thinned is that the average tree diameter plus 6 equals the average spacing in feet (D+6). If increased forage for livestock grazing is a primary objective, tree spacing can be greater (i.e., D+8 rather than D+6 spacing). For example, if the average diameter of 10 pine trees at d.b.h. (diameter at breast height) is determined to be 8 inches, a spacing of 14 feet (D+6) would result in the best timber growth. If forage production is important, however, a spacing of 16 feet (D+8) would be better.

The trees that remain after a stand is thinned should be the best trees of the stand. They have a fuller crown, appear more vigorous, and generally have a larger diameter than the trees to be removed, which are weaker, are deformed or suppressed, and have a smaller diameter.

Forest fire is a serious threat to the unmanaged pine forests in the county. Because of the lack of management, forest fuels have built up to dangerously high levels. Also, the threat of crown fires is serious because of overstocked stands with no air space between crowns. The major forest fires in the Pine Ridge area, such as the Ft. Robinson and Belmont fires of 1989, indicate that fire is a serious threat. Timber management can make these forests more fireproof than they are at present.

Forest pests generally are not a major problem in the county. Western gall rust is pronounced in some stands. The best treatment for this rust is the removal of infected trees during thinning or harvesting. Bark beetle damage has been insignificant. Ips beetles have killed pockets of weaker pine, but no Dendroctonus beetle outbreaks have occurred. Drought cycles and overstocked, stressed pine stands could allow the entry of these beetles. Dendroctonus beetles pose a more serious threat because they can attack and kill the larger, mature pine trees, resulting in an extreme fire hazard.

The hardwood riparian forests on private land in Sheridan County are generally in poor condition. This condition is primarily the result of excessive overgrazing by livestock, whereby all understory shrubs and the capacity for hardwood tree reproduction is destroyed. The areas of hardwoods along drainageways are used as calving and feeding sites in the spring and are also overgrazed during the green-up periods of cool-season grasses in spring and fall. These areas are vital to wildlife and water quality. Livestock grazing should be controlled if the areas are to recover.

A forest stewardship program in Nebraska can address the proper management of ponderosa pine and hardwood riparian forests. Multiple benefits can result from timber and livestock grazing management.

Woodland Suitability Groups

To assist in planning the management of woodland in Sheridan County, soils have been grouped into four woodland suitability groups, which are shown in table 9 and described in the text. Each group is made up of soils that produce similar kinds and amounts of wood crops and that require similar management.

For management purposes, soil depth (the effective rooting depth to bedrock or an impenetrable layer), slope position (distance up the slope as a percentage of total slope length), slope class, and aspect are used to determine the potential productivity. In growth studies conducted in the Black Hills of South Dakota, the Forest Service has found that these variables are important in determining the site index of ponderosa pine.

Table 9 lists the potential productivity of the soils in each woodland suitability group and rates the hazards and limitations that affect management.

The site index shown in table 9 indicates productivity. It expresses the average height of the taller trees in a stand at a specified age. In table 9, the site index is the height, in feet, of ponderosa pine at 100 years of age.

The increments of periodic annual growth shown in table 9 are expressed in cubic feet for stands at 80 years of age. These yields are based on Forest Service studies on managed, even-aged stands of ponderosa pine in the Black Hills. In a managed stand where ponderosa pine is 80 years old and the soil has a site index of 70, the merchantable volume of wood products added each year would be about 65 cubic feet per acre. The conversion factors at the bottom of table 9 indicate that this amounts to about seven-tenths of a cord, or 390 board feet per acre per year. This is approximately double the increase in volume

Figure 17.—Thinning stands of pines allows more room for the remaining trees to grow and also increases forage production.

for the same period for a stand of the same age on a soil that has a site index of 55.

Woodland Suitability Group 1

Only the Ponderosa soils on north and east aspects are in this group. The moist phase of the Ponderosa soils occurs in Sheridan County because of the higher average annual precipitation, which is about 17 inches. The Ponderosa soils are mainly on the lower half of the total slope length. Slopes range from 3 to 60 percent. The soils are very deep. They have an effective rooting depth of well over 40 inches. The site index for ponderosa pine ranges from 70 to 80. Ponderosa pine grows better on these soils than on soils in the other groups. Timber management opportunities also are better in this group. The hazard of erosion and equipment limitations are severe where slopes are more than 30 percent. The native understory vegetation includes ponderosa pine, Oregongrape, skunkbush sumac, chokecherry, golden currant, Rocky Mountain maple, western snowberry, green ash, and horizontal juniper.

Woodland Suitability Group 2

The Canyon and Tassel soils on north and east aspects are in this group. They are on side slopes and ridgetops. Slopes range from 3 to 70 percent. These soils are mainly on the upper half of the total slope length. The major limiting factor affecting tree growth is soil depth. The effective rooting depth is less than 20 inches. The site index for ponderosa pine ranges from 50 to 59. Overstocked stands of ponderosa pine are common. Timber stand improvement activities, such as thinning, can increase the vigor and growth rates of the better trees, reduce the hazard of fire, and increase understory forage production. The hazard of

erosion and equipment limitations are severe where slopes are more than 30 percent. The native understory vegetation includes ponderosa pine, Oregongrape, skunkbush sumac, golden currant, western snowberry, Rocky Mountain maple, Rocky Mountain juniper, chokecherry, and horizontal juniper. The percentage of cool- and warm-season grasses is higher in open areas.

Woodland Suitability Group 3

The Ponderosa soils on the south and west aspects are in this group. They are on broad ridgetops and side slopes. Slopes range from 0 to 60 percent. The major limitation affecting tree growth is soil moisture because of the drier site conditions characteristic of south- and west-facing exposures. The productivity for trees is low or moderate. The site index for ponderosa pine ranges from 40 to 49. The potential for timber management is low because of scattered open stands of pine. Areas of this group are ideal for livestock grazing because the soils are deep and grasses are dominant in the understory. These areas are also well suited to wildlife habitat and recreational uses.

Woodland Suitability Group 4

The Canyon and Tassel soils on the south- and west-facing slopes are in this group. Slopes range from 0 to 70 percent. Soil depth is less than 20 inches. Because of the shallow soils and hot, dry site conditions, tree growth and the potential for timber management are extremely low. The site index for ponderosa pine is less than 40. Only scattered pine trees of low quality grow on these soils. The vegetation is dominantly a mixture of cool- and warm-season grasses. These soils are better suited to livestock grazing, wildlife habitat, and watershed protection than to timber.

Windbreaks and Environmental Plantings

Gary Kuhn, forester, Natural Resources Conservation Service, and Doak Nickerson, district forester, Nebraska Forest Service, helped prepare this section.

Sheridan County has a strong history of tree planting. When the area was being settled in the 1880's, one of the original tree planters was Jules Sandoz, a pioneer who had a great appreciation of trees. Hackberry, cottonwood, ash, fruit trees, and shrubs that he planted remain today as a living monument at his original homestead on the Niobrara River. His legacy still thrives on the farms and ranches in the county.

Sheridan County has some of the best windbreaks in the Nebraska Panhandle. These plantings are mainly classified as farmstead and livestock windbreaks. Most of these windbreaks are 3 to 5 rows wide with a combination of species, including eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash, plum, chokecherry, and caragana, all of which complement each other in multirow windbreaks.

Many of these good belts were planted in the 1950's and 1960's and, if managed correctly, will provide many more years of protection. Because the belts had good weed and grass control during the first 3 to 5 years of establishment, they have continuity with very few gaps. Also, these belts have shown very satisfactory growth rates for the precipitation zone. Active replanting that complemented good maintenance took place.

Some of the older belts from 30 to 50 years old are in poor condition. For example, windbreaks primarily made up of Siberian elm are in poor vigor, are overcrowded, do not have an evergreen or shrub component, and have big gaps. Most of the older belts are plagued by two critical problems. The belts have become sodbound from the encroachment of cool-season grasses, such as smooth brome or western wheatgrass. These grasses generally are adjacent to windbreaks near road ditches or are in areas of rangeland or pasture. They can quickly invade windbreaks and severely compete for moisture and nutrients. These sodbound belts are presently declining. The other critical problem is livestock grazing. Because fences are in total disrepair or are absent altogether, livestock have been allowed to graze in these belts, heavily in some places. The results are belts that have a pronounced "browse line," the complete absence of regeneration of trees and shrubs, and severe soil compaction because of trampling. Also, the invasion of cool-season grasses was increased because of the grazing disturbance within the windbreak.

Within the past ten years many windbreaks have been planted in Sheridan County. These belts are showing excellent survival and growth, which can be attributed primarily to an effective weed control program provided by the Upper Niobrara-White Natural Resource District. This program started about ten years ago and has increased dramatically because of the demands of farmers and ranchers.

In Sheridan County, however, the effort to establish field windbreaks can be accelerated. Field windbreaks can protect livestock and farmsteads. Establishing field windbreaks is a conservation concept that has not been considered. Properly located field windbreaks can help to control wind erosion, protect such crops as winter wheat from winter kill, trap and hold snow to

increase the soil moisture content for crop use, and provide additional wildlife habitat. In designing field windbreaks, modern designs need to be used. Specifically, these designs require no more than 2 rows, or 3 rows if wildlife habitat is an objective. One or two rows can be planted on the field borders. To protect winter wheat these windbreaks should be established on the north and west borders. Very little land is taken out of production, and farming systems would not have to change within the field. Excellent tree and shrub species for use in these windbreaks include eastern redcedar, Rocky Mountain juniper, ponderosa pine, caragana, skunkbush sumac, honeylocust, and green ash. Once field borders are established and providing good protection, landowners may be more willing to plant a system of field windbreaks.

In figure 18, the arrow indicates the wind direction, and the percentages indicate the wind reduction at distances (H) behind the windbreak. "H" is the height of the barrier. For example, a one-row planting of eastern redcedar that averages 25 feet tall reduces wind velocity by about 50 percent at 250 feet (10H), and some reduction of the wind would extend to as much as 500 feet (20H). Crop and soil protection, crop production, and snow accumulation are enhanced in this zone of wind reduction. Generally, the protected area extends 10 to 12 times the height of the windbreak on the leeward side and 3 to 5 times on the windward side. Beneficial microclimate changes, such as increased soil moisture, soil temperature, air temperature during the day, and relative humidity, occur within the protected area. Wind speed and evaporation are decreased. The overall result is an increase in crop yields in the protected area.

Another concern is the need for renovation in the older windbreaks (30 to 50 years old). Many of the older Siberian elm windbreaks could be easily renovated by plantings of supplemental conifers on the upwind or downwind side. In many areas where the landowner does not want to lose the marginal protection provided by Siberian elm windbreaks, renovation is taking place. Eventually, the dead and dying Siberian elm windbreaks can be removed as the supplemental conifer plantings mature. These supplemental plantings outside the existing belts have more application than a conifer component within the existing belts because of competition from deciduous trees and limited rainfall.

Eliminating brome or wheatgrass is needed in many of the windbreaks in order to release the trees. Applying postemergent herbicides would be the most practical method of weed control since tillage would be difficult because of tight spacings and branches. Also, installing or repairing fences helps to control livestock grazing. The exclusion of livestock would eliminate the further destruction of low-level density and reproduction of trees and shrubs.

Thinning and row removal and replacement are other renovation methods that can be used. Thinning is used only in situations where a belt is overstocked and tree removal would create more growing space for the remaining trees. Most of the belts in Sheridan County date from the 1930's onward and have satisfactory tree spacing. The removal and replacement of the tree rows are renovation alternatives when additional space for supplemental plantings is limited. Entire rows are removed and are replaced by new plantings. A good rule to follow when using this method is "for every two rows removed, only one row is replanted." This allows ample room for the new plantings and also for weed control.

Site preparation is the most important factor to consider before new windbreaks are established. The information in table 10, along with the 6 footnotes below the table, can aid in selecting the proper site preparation method. Site preparation stores moisture and controls weeds before the trees or shrubs are planted. It is extremely important in arid climates, such as that in Sheridan County. For example, if a windbreak is to be planted in a level area of cropland on a sandy soil, site preparation would involve sowing a cover crop in late summer if the soil is bare during the winter and planting directly into the soil or the cover crop without destroying the existing crop residue. Footnotes 2 and 3 in table 10 would also apply.

A commitment of 3 to 5 years of weed and grass control is needed for new windbreak plantings. Weeds can be controlled by mechanical methods, by chemical methods, or by the use of synthetic weed barriers. Windbreak design features are influenced by the weed control method that is used.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely

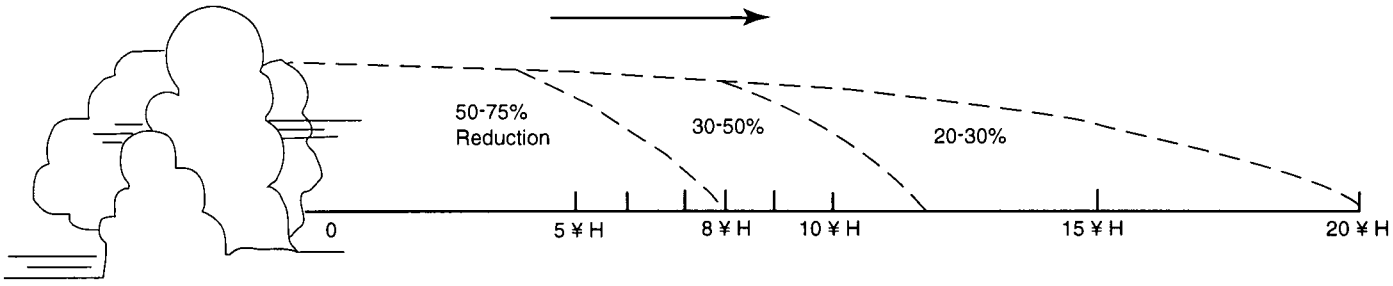

Figure 18.—Zones of wind reduction on the leeward side of a windbreak.

spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 11 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 11 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or of the Cooperative Extension Service or from a commercial nursery.

Recreation

Gerald E. Jasmer, wildlife biologist, Natural Resources Conservation Service, helped prepare this section.

A good diversity of quality recreational activities is available in Sheridan County. Opportunities for picnicking, hiking, swimming, hunting, fishing, camping, and golfing are plentiful.

Because of the many natural, scenic, and historical sites in the county, sightseeing can be particularly enjoyable *(3)*. Several roadside historical markers point out the rich history of the area. One marker concerns the author Mari Sandoz. Miss Sandoz is probably best known for her book, "Old Jules," an historical account of her father's experiences in Sheridan County from 1884 through 1928. The Mari Sandoz State Historical Marker is 20 miles south of Gordon along Nebraska Highway 27, near the Sandoz orchard and the Mari Sandoz grave site. Roadside picnic and playground facilities are also available at the marker.

A marker entitled "Opening the Sandhills" is east of Gordon. This marker describes the early years of ranching in the Sandhills, described as an area that "would not support cattle" and considered "dangerous for humans."

A third historical marker is in the southern part of the county along Nebraska Highway 2. This marker describes the potash plants that were near Antioch. Potash is important for the manufacture of fertilizer and was derived from the alkaline lakes in the area. For a time during World War One, Antioch was the leading potash center in the United States.

Additional unmarked historic sites include the Old Spotted Tail Agency, Camp Sheridan, the Sawyer Trail, and Fort Nendell.

Three State-owned areas provide significant recreational opportunities. Walgren Lake State Recreation Area is made up of a 50-acre lake and about 80 adjacent acres southeast of Hay Springs. Fishing, picnicking, hiking, hunting, camping, and unsupervised swimming are available. Facilities at Walgren Lake include a picnic shelter, boat dock, restrooms, and playground equipment.

Smith Lake State Wildlife Management Area is about 20 miles south of Rushville. Although managed primarily for wildlife, this 641-acre sandhill lake area has campsites, restrooms, and a scenic backdrop for picnickers. Hiking, fishing, hunting, and unsupervised swimming are also available.

Metcalf State Wildlife Management Area, which is more than 2,400 acres, is the largest public recreation area in the county. It is on the Pine Ridge escarpment about 12 miles north of Hay Springs. It is an area of fairly rough ponderosa pine forest that is ideal for hiking and big game hunting.

The 1988 Nebraska State Comprehensive Outdoor Recreation Plan (recreation reference A) lists 165 acres of municipal recreational facilities in Sheridan County. Nine-hole golf courses are at Rushville, Gordon, and Hay Springs. These communities also

maintain playgrounds, picnic areas, and swimming pools. Campsites are available in Gordon.

Hunting for big game, small game, and waterfowl are popular recreational activities in Sheridan County. Small game includes both birds and mammals. Sharp-tailed grouse, ringnecked pheasant, cottontail rabbit, coyote, raccoon, and fox squirrel are the major small game species subject to harvest. Mourning dove are throughout the county and are hunted in early fall. Big game species that are hunted in the county are white-tailed deer, mule deer, pronghorn antelope, and wild turkey. Waterfowl includes numerous species of ducks and geese. Early hunting for waterfowl can be quite successful. Hunting for waterfowl ends in late fall when marshes and lakes in the county become covered by ice. Selected springs, streams, and the Niobrara River (locally known as the Running Water) can provide opportunities for hunting waterfowl into the winter. Hunting occurs during regular seasons in public areas that are open to hunting and on private lands with permission of the landowner.

Fishing is one of the most popular recreational activities in Nebraska. Walgren Lake and Smith Lake provide the only public fishing in Sheridan County. Smith Lake was renovated in 1987 and should provide good fishing for the next decade or more. Largemouth bass, bluegill, yellow perch, walleye, and tiger musky were stocked. Walgren Lake has these five species, as well as black crappie. Some privately owned lakes in the county contain largemouth bass and bluegill or occasionally northern pike and yellow perch. Limited trout fishing occurs in a few streams on private land. Brown trout of catchable size are regularly stocked in Pine, Larabee, and White Clay Creeks and occasionally in Deer Creek. Permission must be obtained from the landowner before fishing on private land.

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 12, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 12 can be supplemented by other information in the survey, for example, interpretations for septic tank absorption fields in table 15 and interpretations for dwellings without basements and for local roads and streets in table 14.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones, absorbs rainfall readily but remains firm, and is not dusty when dry. Steep slopes can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is firm after rains and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or gravel should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Technical assistance in improving habitat for fish and wildlife and in designing recreational facilities is available at the local field office of the Natural Resources Conservation Service in Rushville.

Wildlife Habitat

Gerald E. Jasmer, wildlife biologist, Natural Resources Conservation Service, helped prepare this section.

Sheridan County has a wide variety of habitat for openland, wetland, woodland, and rangeland wildlife species.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the availability of natural water sources and the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water.

In table 13, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the degree of management needed for each habitat element.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, and dry, edible beans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass, smooth brome, crested wheatgrass, clovers, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are switchgrass, goldenrod, western wheatgrass, sunflower, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are hackberry, cottonwood, willow, green ash, boxelder, Russian-olive, and honeylocust.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, blue spruce, eastern redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of fruit producing shrubs that are suitable for planting on soils rated *good* are American plum, skunkbush sumac, chokecherry, silver buffaloberry, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, prairie cordgrass, rushes, sedges, cattails, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if

the shallow water areas are to be developed. Examples of shallow water areas are marshes, shallow dugouts, ditches, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, shrubs, herbs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife that are attracted to these areas include ring-necked pheasant, mourning dove, meadowlark, killdeer, badger, and skunk.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous woody plants and associated shrubs, grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, deer, porcupine, squirrel, raccoon, songbirds, and woodpeckers.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shorebirds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include pronghorn antelope, mule deer, coyote, prairie dog, bull snake, upland plover, sharp-tailed grouse, and greater prairie chicken.

The two major land resource areas in Sheridan County are the Mixed Sandy and Silty Tableland and the Nebraska Sandhills. These areas often have different potential for wildlife habitat. In these major land resource areas, 16 soil associations have been identified. Many of these associations can be grouped according to the wildlife habitat and wildlife species they support. Each soil association and its relation to wildlife are discussed in the following paragraphs.

The Valent association is almost entirely rangeland that is used for grazing. The good-quality rangeland habitat in this association is chiefly made up of native grasses and forbs and scattered woody plants. Sharp-tailed grouse, coyote, mule deer, jackrabbits, small rodents, meadowlark, horned lark, and occasional pronghorn antelope are typical wildlife species in this association.

The Valent-Wildhorse and Valent-Tryon-Ipage associations are also used for grazing. However, the broad, lush valleys are often cut for hay. Good-quality rangeland and wetland habitat are abundant. The wet meadows are important habitat for grouse and also support many species of mice, voles, and other small rodents. Many of the shallow lakes are alkaline and support large numbers of brine shrimp and brine flies, which in turn support large numbers of waterfowl and shorebirds. Mink and muskrat are common on wetlands vegetated by cattails, bulrush, and reeds.

The Tuthill-Keya, Satanta-Canyon-Busher, Oglala-Alliance-Canyon, and Thirtynine-Kadoka-Epping associations support a mixture of agricultural uses. Rangeland, pasture, hayland, and cropland are common land uses. The primary crops are winter wheat, alfalfa, and some irrigated corn. These associations provide habitat for a variety of openland wildlife, such as pheasant, cottontail rabbit, and mourning dove. Water areas, shrubs, and undisturbed nesting areas are limitations affecting wildlife habitat.

The Keith, gravelly substratum-Bridget-Johnstown association also supports a mixture of agricultural uses. Much of this association, however, is used for the production of irrigated corn. This area provides abundant openland wildlife habitat, particularly for pheasants. Irrigation canals and their adjacent grassy borders provide some of the habitat elements that are limited in the other associations.

The Orpha-Calamus-Rock outcrop association is the only association in the Niobrara River valley. It is on bottom land and side slopes. This association provides a diversity of habitat types that support a rich mixture of wildlife. Shallow water areas, flowing streams, wetlands, shrubs, hardwoods, coniferous trees, and wild herbaceous plants are in the valley. The most common plant species in the area are chokecherry, American plum, indigobush, wild grape, snowberry, cottonwood, willow, ponderosa pine, Rocky Mountain juniper, skunkbush sumac, and poison ivy. Waterfowl, herons, shorebirds, mink, raccoon, coyote, bobcat, wild turkey, snakes, songbirds, white-tailed deer, mule deer, cottontail rabbit, great horned owl, and small rodents are the most common wildlife species.

The Tassel-Ponderosa-Rock outcrop association makes up the area commonly known as the Pine Ridge. As its name implies, ponderosa pine is common in this area. Other common plants include Rocky Mountain juniper, skunkbush sumac, small soapweed, chokecherry, and blue grama. These plants provide good habitat for woodland wildlife. Wild turkeys, mule deer, porcupine, bobcat, turkey vultures, woodpeckers, fox squirrel, and coyote are typical woodland species in areas of this association. Elk disappeared from this area around the turn of the century. Recently, elk from Wyoming and South Dakota have reestablished themselves in this area.

Engineering

This section provides information for planning land uses related to urban development and to water

management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 14 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope,

and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 15 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 15 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 15 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is

disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of groundwater pollution. Ease of excavation and revegetation should be considered.

The ratings in table 15 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 16 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 16, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil),

the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 17 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to

bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 21.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

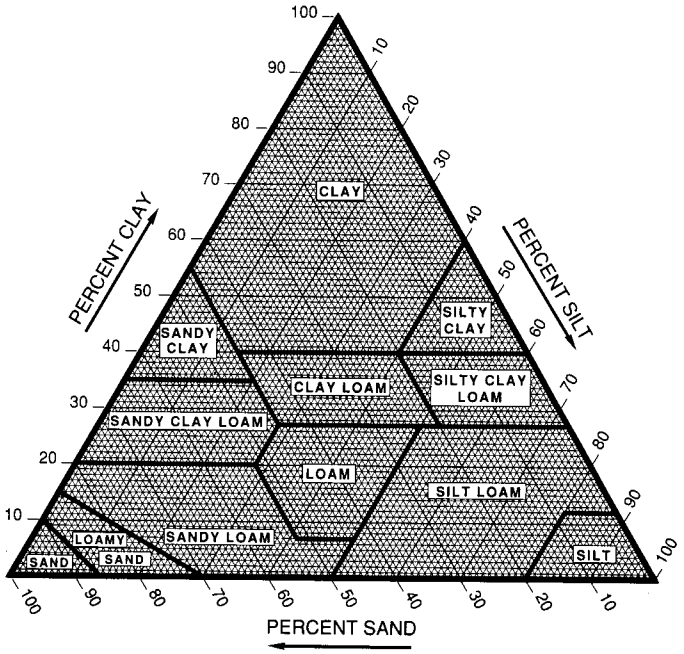

Figure 19.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 18 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 19). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 21.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 19 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For

many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 19, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to

the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 20 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 20 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information about flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 20 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 20.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or

lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 21 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Moisture density—T 99 (AASHTO), D 698 (ASTM); Specific gravity—T 100 (AASHTO), D 854 (ASTM); California bearing ratio—T 193 (AASHTO), D 1883 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(4)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 22 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(6)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(4)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alliance Series

The Alliance series consists of deep, well drained, moderately permeable soils on uplands. They formed in loess and the underlying calcareous sandstone. Slopes range from 0 to 6 percent.

Alliance soils are commonly adjacent to Canyon, Duroc, Keith, and Rosebud soils. Canyon, Keith, and Rosebud soils are in landscape positions similar to those of the Alliance soils. Canyon soils are shallow to calcareous sandstone. Duroc soils have a mollic epipedon more than 20 inches thick and are lower on the landscape than the Alliance soils. Keith soils do not have calcareous sandstone within a depth of 60 inches. Rosebud soils have sandstone at a depth of 20 to 40 inches.

Typical pedon of Alliance loam, 1 to 3 percent slopes, 800 feet south and 900 feet east of the northwest corner of sec. 29, T. 30 N., R. 46 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; abrupt smooth boundary.

Bt1—8 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; very dark brown (10YR 2/2 moist) coatings on ped faces; moderate coarse prismatic structure parting to moderate coarse subangular blocky; hard, firm; neutral; clear smooth boundary.

Bt2—13 to 18 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; very dark grayish brown (10YR 3/2 moist) coatings on ped faces; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; neutral; clear smooth boundary.

BC—18 to 23 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C—23 to 49 inches; light gray (10YR 7/2) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few fine sandstone fragments; violent effervescence; slightly alkaline; clear smooth boundary.

Cr—49 to 60 inches; white (10YR 8/2), calcareous sandstone, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum and the depth to free carbonates range from 16 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam. The Bt horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes loam, clay loam, and silt loam. The Bt horizon ranges from 25 to 35 percent clay. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is typically very fine sandy loam, but the range includes loam, fine sandy loam, and silt loam. Fine-grained sandstone is at a depth of 40 to 60 inches.

Almeria Series

The Almeria series consists of very deep, very poorly drained, rapidly permeable soils on bottom land. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Almeria soils are commonly adjacent to Bolent and Calamus soils. Bolent soils are somewhat poorly drained, and Calamus soils are moderately well drained. The adjacent soils are higher on the landscape than the Almeria soils.

Typical pedon of Almeria loamy fine sand, channeled, 0 to 2 percent slopes, 800 feet north and 1,250 feet east of the southwest corner of sec. 28, T. 30 N., R. 44 W.

A—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; few medium distinct dark yellowish brown (10YR 4/4 moist) mottles; weak medium granular structure; soft, very friable; common thin dark strata of loam; slight effervescence; moderately alkaline; clear smooth boundary.

C1—8 to 18 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; common fine distinct yellowish brown (10YR 5/4 moist) mottles; single grain; loose; slight effervescence; moderately alkaline; gradual smooth boundary.

C2—18 to 60 inches; light gray (10YR 7/2) stratified sand and loamy very fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; 12 percent gravel, by volume; slight effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 15 inches.

The A horizon has value of 3 to 6 (2 to 5 moist) and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes fine sandy loam and fine sand. The C horizon has value of 3 to 8 (2 to 7 moist) and chroma of 1 to 3. It is dominantly sand or fine sand stratified with finer and coarser textured material. The content of gravel in the C horizon is 2 to 15 percent, by volume.

Bankard Series

The Bankard series consists of very deep, somewhat excessively drained, rapidly permeable soils on bottom land. These soils formed in stratified, sandy alluvium (fig. 20). Slopes range from 0 to 2 percent.

Bankard soils are commonly adjacent to Bridget and Satanta soils. The adjacent soils are higher on the landscape than the Bankard soils. They have less sand and more silt in the control section and are not stratified.

Typical pedon of Bankard loamy fine sand, channeled, 0 to 2 percent slopes, 100 feet south and 1,000 feet west of the northeast corner of sec. 8, T. 30 N., R. 46 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak moderate subangular blocky structure; soft, very friable; thin strata of fine sandy loam; slightly alkaline; clear wavy boundary.

C1—7 to 30 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; thin strata of gravelly coarse sand; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; light gray (10YR 7/2) loamy very fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; thin strata of gravelly coarse sand; slight effervescence; moderately alkaline.

The depth to free carbonates is less than 10 inches.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 to 4. It is dominantly loamy fine sand, but the range includes fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is sand, fine sand, loamy sand, loamy fine sand, and loamy very fine sand. Strata of finer and coarser textured material are throughout the profile.

Beckton Series

The Beckton series consists of very deep, moderately well drained, slowly permeable soils on alluvial fans and low stream terraces. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Beckton soils are commonly adjacent to Lute soils, which are somewhat poorly drained and are slightly lower on the landscape than the Beckton soils.

Typical pedon of Beckton silt loam, 0 to 2 percent slopes, 450 feet west and 600 feet south of the northeast corner of sec. 31, T. 33 N., R. 45 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt wavy boundary.

E—5 to 8 inches; light gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to weak fine subangular blocky; soft, very friable; neutral; abrupt wavy boundary.

Btn—8 to 18 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium columnar structure parting to moderate fine subangular blocky; slightly hard, firm; common thin clay films on faces of peds; 29 percent exchangeable sodium; slightly alkaline; clear wavy boundary.

BCn—18 to 35 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; soft, very friable; 47 percent exchangeable sodium; threads of finely crystalline gypsum; violent effervescence; strongly alkaline; gradual wavy boundary.

Cn—35 to 50 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; violent effervescence; 58 percent exchangeable sodium; very strongly alkaline; gradual wavy boundary.

C—50 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; violent effervescence; 26 percent exchangeable sodium; very strongly alkaline.

The thickness of the solum ranges from 22 to 40 inches, and the depth to free carbonates ranges from 10 to 24 inches. The percentage of exchangeable sodium is more than 15 throughout the solum.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes fine sandy loam and loam. The E horizon, if it occurs, has value of 5 or 6 (3 to 5 moist). It is dominantly silt loam, but the range includes loam and fine sandy loam. The Btn horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes clay loam and silty clay in which the content of clay ranges from 35 to 45 percent. The C horizon has hue of 2.5Y or 10YR, value of 5 to 8 (4 to 6 moist), and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam, silty clay loam, clay loam, sandy clay loam, and silty clay.

Bolent Series

The Bolent series consists of very deep, somewhat poorly drained, rapidly permeable soils on bottom land along the Niobrara River and its tributaries. These soils formed in recent sandy alluvium. Slopes range from 0 to 2 percent.

Bolent soils are commonly adjacent to Almeria, Calamus, and Las Animas soils. Almeria soils are very

poorly drained and are slightly lower on the landscape than the Bolent soils. Calamus soils are moderately well drained and are higher on the landscape than the Bolent soils. Las Animas soils contain more silt and clay in the control section than the Bolent soils and are in similar landscape positions.

Typical pedon of Bolent loamy fine sand, 0 to 2 percent slopes, 2,400 feet south and 1,500 feet west of the northeast corner of sec. 22, T. 30 N., R. 44 W.

A—0 to 7 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; 2 percent gravel, by volume; violent effervescence; moderately alkaline; abrupt smooth boundary.

C1—7 to 19 inches; light gray (10YR 7/2) fine sand stratified with thin layers of grayish brown (10YR 5/2) loamy fine sand, grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) moist; single grain; loose; 2 percent gravel, by volume; violent effervescence; moderately alkaline; clear smooth boundary.

C2—19 to 26 inches; stratified white (10YR 8/2) and light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; violent effervescence; moderately alkaline; clear smooth boundary.

C3—26 to 57 inches; white (10YR 8/2) fine sand stratified with layers of light gray (10YR 7/2) loamy very fine sand, light brownish gray (10YR 6/2) and grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/2 moist) mottles; single grain; loose; slightly alkaline; abrupt smooth boundary.

C4—57 to 60 inches; white (10YR 8/1) fine sand, light gray (10YR 6/1) moist; single grain; loose; slightly alkaline.

Some pedons contain as much as 5 percent gravel, by volume.

The A horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes fine sandy loam and fine sand. Some pedons have an AC horizon. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 1 to 3. It is dominantly fine sand, but the range includes loamy fine sand, loamy sand, and sand. The C horizon has brownish or reddish mottles and is typically stratified with lenses of lighter and darker material that is finer textured.

Bridget Series

The Bridget series consists of very deep, well drained, moderately permeable soils on foot slopes, stream terraces, and alluvial fans. These soils formed in loamy colluvial and alluvial sediments. Slopes range from 0 to 3 percent.

Bridget soils are commonly adjacent to Duroc, Oglala, Ponderosa, and Thirtynine soils. Duroc soils have a mollic epipedon that is more than 20 inches thick. They are slightly lower on the landscape than the Bridget soils. Oglala soils have soft, calcareous sandstone below a depth of 40 inches and are higher on the landscape than the Bridget soils. Ponderosa soils are coarse-loamy and are higher on the landscape than the Bridget soils. Thirtynine soils have an argillic horizon and are higher on the landscape than the Bridget soils.

Typical pedon of Bridget loam, 0 to 1 percent slopes, 2,450 feet north and 750 feet west of the southeast corner of sec. 6, T. 30 N., R. 46 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—6 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; neutral; gradual smooth boundary.

AC—9 to 15 inches; light brownish gray (10YR 6/2) loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; strong effervescence; slightly alkaline; gradual smooth boundary.

C1—15 to 48 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure parting to weak fine subangular blocky; soft, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—48 to 60 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam or very fine sandy loam, but the range includes silt loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma

of 2 or 3. It is dominantly loam, but the range includes silt loam and very fine sandy loam.

Bufton Series

The Bufton series consists of very deep, well drained, moderately slowly permeable soils on uplands, foot slopes, and stream terraces. They formed in residuum weathered from silty shale or in colluvial and alluvial sediments weathered from shale. Slopes range from 0 to 20 percent.

Bufton soils are commonly adjacent to Enning, Mitchell, Orella, and Thirtynine soils. The adjacent soils are on landscape positions similar to those of the Bufton soils. Enning and Orella soils are shallow to bedrock. Mitchell and Thirtynine soils formed in material weathered from siltstone. Mitchell soils have less clay in the control section than the Bufton soils. Thirtynine soils have a mollic epipedon.

Typical pedon of Bufton silty clay loam, in an area of Bufton-Orella complex, 3 to 9 percent slopes; 300 feet east and 2,550 feet south of the northwest corner of sec. 16, T. 34 N., R. 46 W.

A—0 to 5 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable; neutral; clear wavy boundary.

Bw1—5 to 10 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate fine blocky; hard, firm; strong effervescence; moderately alkaline; clear wavy boundary.

Bw2—10 to 18 inches; light gray (10YR 7/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium blocky; hard, firm; strong effervescence; moderately alkaline; clear wavy boundary.

Bk—18 to 23 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to weak medium blocky; hard, firm; few threadlike accumulations of carbonates; violent effervescence; moderately alkaline; clear wavy boundary.

C—23 to 60 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable; 3 percent, by volume, shale channers; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 13 to 41 inches, and the depth to free carbonates ranges from 0 to 6 inches. Chalcedony fragments are commonly on the surface and throughout the profile.

The A horizon has value of 4 to 6 (3 or 4 moist). Horizons that have value of less than 3.5 moist are less than 7 inches thick. The A horizon is dominantly silty clay loam, but the range includes clay loam or silt loam. The Bw horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 to 4. It is silty clay loam, silty clay, or clay loam in which the content of clay ranges from 35 to 45 percent. The Bk horizon has hue of 2.5Y or 10YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is silty clay loam, clay loam, or silty clay. The C horizon has colors similar to those of the Bk horizon. It is dominantly silty clay loam, but the range includes silt loam to silty clay. Silty shale is below a depth of 60 inches.

Busher Series

The Busher series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in material weathered from calcareous sandstone. Slopes range from 0 to 30 percent.

Busher soils are commonly adjacent to Jayem, Oglala, Satanta, Tassel, and Tuthill soils. The adjacent soils are in landscape positions similar to those of the Busher soils. Jayem soils do not have sandstone within a depth of 60 inches. Oglala soils are coarse-silty. Satanta and Tuthill soils have more clay in the control section than the Busher soils and have bedrock below a depth of 60 inches. Tassel soils have calcareous sandstone within a depth of 20 inches.

Typical pedon of Busher fine sandy loam, in an area of Busher-Tassel complex, 6 to 30 percent slopes; 1,900 feet north and 300 feet west of the southeast corner of sec. 31, T. 27 N., R. 46 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly alkaline; clear smooth boundary.

A2—5 to 10 inches; dark brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slightly alkaline; clear smooth boundary.

Bw—10 to 18 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to weak medium and coarse subangular blocky; soft, very friable; slightly alkaline; clear smooth boundary.

C1—18 to 30 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive;

soft, very friable; slight effervescence; moderately alkaline; abrupt smooth boundary.
C2—30 to 44 inches; white (10YR 8/2) loamy very fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; violent effervescence; moderately alkaline; clear smooth boundary.
Cr—44 to 60 inches; white (10YR 8/2), calcareous sandstone, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum ranges from 15 to 40 inches, and the depth to free carbonates ranges from 15 to 36 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loamy very fine sand and very fine sandy loam. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loamy very fine sand. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3. It is dominantly fine sandy loam and loamy very fine sand, but the range includes very fine sandy loam. Calcareous sandstone is at a depth of 40 to 60 inches.

Calamus Series

The Calamus series consists of very deep, moderately well drained, rapidly permeable soils on bottom land along the Niobrara River and its tributaries. These soils formed in sandy alluvium. Slopes range from 0 to 2 percent.

Calamus soils are commonly adjacent to Almeria, Bolent, Las Animas, and Munjor soils. Almeria soils are very poorly drained and are lower on the landscape than the Calamus soils. Bolent and Las Animas soils are somewhat poorly drained and are lower on the landscape than the Calamus soils. Munjor soils are well drained, are coarse-loamy in the control section, and are in landscape positions similar to those of the Calamus soils.

Typical pedon of Calamus loamy fine sand, 0 to 2 percent slopes, 2,500 feet north and 1,100 feet west of the southeast corner of sec. 28, T. 30 N., R. 44 W.

A—0 to 9 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.
AC—9 to 18 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose; neutral; gradual smooth boundary.
C1—18 to 37 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; slightly alkaline; clear smooth boundary.
C2—37 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; strong medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; thin strata of fine sandy loam and loamy fine sand; slightly alkaline.

Typically, this soil does not have free carbonates. The depth to mottles is 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It is dominantly fine sand, but the range includes loamy sand to coarse sand. Strata of coarser textured material are common in the C horizon. The content of gravel is as much as 15 percent, by volume.

Canyon Series

The Canyon series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from calcareous sandstone. Slopes range from 3 to 30 percent.

Canyon soils are commonly adjacent to Alliance, Oglala, Rosebud, and Satanta soils. The adjacent soils have a mollic epipedon and are more than 20 inches deep to calcareous sandstone. Satanta soils do not have sandstone within a depth of 60 inches. These soils are lower on the landscape than the Canyon soils.

Typical pedon of Canyon loam, in an area of Oglala-Canyon complex, 11 to 30 percent slopes, 1,100 feet east and 350 feet south of the northwest corner of sec. 12, T. 32 N., R. 44 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slightly alkaline; clear smooth boundary.
AC—5 to 10 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; 2 percent, by volume, sandstone pebbles; violent effervescence; moderately alkaline; clear wavy boundary.
C—10 to 14 inches; light gray (10YR 7/2) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; 10 percent, by volume, sandstone pebbles; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—14 to 60 inches; white (10YR 8/2), calcareous sandstone, light gray (10YR 7/2) moist; violent effervescence.

The depth to free carbonates ranges from 0 to 6 inches. The depth to bedrock ranges from 6 to 20 inches. The content of clay in the control section ranges from 12 to 25 percent.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes fine sandy loam and very fine sandy loam. The AC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam and fine sandy loam. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam and gravelly loam.

Crowther Series

The Crowther series consists of very deep, poorly drained and very poorly drained soils in sandhill valleys. Permeability is moderate in the solum and rapid in the underlying material. These soils formed in calcareous loamy and sandy alluvium. Slopes range from 0 to 1 percent.

Crowther soils are commonly adjacent to Els, Hoffland, Ipage, Marlake, and Wildhorse soils. Els, Ipage, and Wildhorse soils are slightly higher on the landscape than the Crowther soils and have a sandy control section. Els and Wildhorse soils are somewhat poorly drained. Ipage soils are moderately well drained. Hoffland soils have a sandy control section and are in landscape positions similar to those of the Crowther soils. Marlake soils have a sandy control section and are lower on the landscape than the Crowther soils. They have water on the surface for most of the growing season.

Typical pedon of Crowther loam, 0 to 1 percent slopes, 2,400 feet south and 1,900 feet east of the northwest corner of sec. 10, T. 24 N., R. 44 W.

O—1 inch to 0; partly decomposed grass litter; violent effervescence.

Ak1—0 to 3 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; 25 percent calcium carbonates; violent effervescence; moderately alkaline; abrupt smooth boundary.

Ak2—3 to 6 inches; light gray (10YR 6/1) and gray (10YR 5/1), crushed clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; 31 percent calcium carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

Ak3—6 to 8 inches; light gray (10YR 6/1) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; 39 percent calcium carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

Ak4—8 to 18 inches; light gray (10YR 6/1) loam, very dark gray (10YR 3/1) moist; few fine faint dark yellowish brown (10YR 4/4 moist) mottles; weak coarse subangular blocky structure parting to weak fine granular; slightly hard, friable; 33 percent calcium carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

ACk—18 to 28 inches; light gray (10YR 7/1) sandy clay loam, dark grayish brown (10YR 4/2) moist; few fine faint dark yellowish brown (10YR 4/4 moist) mottles; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; 25 percent calcium carbonates; violent effervescence; moderately alkaline; clear wavy boundary.

2C1—28 to 40 inches; light gray (2.5Y 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; common medium prominent dark yellowish brown (10YR 4/4 moist) mottles; single grain; loose; slightly alkaline; clear wavy boundary.

2C2—40 to 60 inches; light gray (2.5Y 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; common medium distinct dark yellowish brown (10YR 3/4 moist) and yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slightly alkaline.

The thickness of the solum ranges from 20 to 35 inches, and the thickness of the mollic epipedon ranges from 7 to 20 inches. Free carbonates are at the surface and throughout the solum. The content of calcium carbonate ranges from 15 to 40 percent throughout the solum.

The Ak horizon has value of 4 to 6 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam and clay loam, but the range includes silt loam and fine sandy loam. The 2C horizon has hue of 10YR to 5Y, value of 5 to 8 (4 to 6 moist), and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy fine sand, loamy sand, and sand.

Dailey Series

The Dailey series consists of very deep, somewhat excessively drained, rapidly permeable soils on uplands and in sandhill valleys. These soils formed in eolian sand. Slopes range from 0 to 9 percent.

Dailey soils are commonly adjacent to Els, Ipage, Jayem, Tuthill, and Valent soils. Els soils are somewhat

poorly drained and do not have a mollic epipedon. Ipage soils are moderately well drained, do not have a mollic epipedon, and are lower on the landscape than the Dailey soils. Jayem and Tuthill soils contain more clay in the subsoil than the Dailey soils, are well drained, and are in similar landscape positions. Valent soils do not have a mollic epipedon and are higher on the landscape than the Dailey soils.

Typical pedon of Dailey loamy fine sand, 0 to 3 percent slopes, 250 feet west and 2,150 feet south of the northeast corner of sec. 7, T. 26 N., R. 41 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; neutral; abrupt smooth boundary.

A2—9 to 15 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; clear smooth boundary.

AC—15 to 26 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; weak medium prismatic structure; soft, very friable; neutral; clear smooth boundary.

C1—26 to 42 inches; light yellowish brown (10YR 6/4) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral; clear wavy boundary.

C2—42 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grain; loose; slightly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. In some pedons carbonates are below a depth of 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is dominantly fine sand, but the range includes loamy fine sand or loamy sand.

Duroc Series

The Duroc series consists of very deep, well drained, moderately permeable soils on toe slopes and in swales on uplands. These soils formed in local loamy alluvial and colluvial sediments and loess. Slopes range from 0 to 3 percent.

Duroc soils are commonly adjacent to Alliance, Bridget, Keith, and Rosebud soils. Alliance, Keith, and Rosebud soils have an argillic horizon, have a mollic epipedon less than 20 inches thick, and are higher on the landscape than the Duroc soils. Bridget soils have less clay in the control section than the Duroc soils and are higher on the landscape.

Typical pedon of Duroc loam, 1 to 3 percent slopes, 500 feet south and 500 feet east of the northwest corner of sec. 35, T. 32 N., R. 45 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

A1—6 to 24 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

A2—24 to 32 inches; light brownish gray (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; slightly alkaline; clear smooth boundary.

C—32 to 60 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 50 inches. The depth to free carbonates ranges from 10 to 36 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam and very fine sandy loam.

Els Series

The Els series consists of very deep, somewhat poorly drained, rapidly permeable soils in sandhill valleys. They formed in eolian sand and sandy alluvium. Slopes range from 0 to 2 percent.

Els soils are commonly adjacent to Crowther, Hoffland, Ipage, Tryon, Valentine, and Wildhorse soils. Crowther, Hoffland, and Tryon soils are poorly drained and very poorly drained and are lower on the landscape than the Els soils. Ipage and Valentine soils are better drained than the Els soils and are higher on the landscape. Wildhorse soils are very strongly alkaline and are in landscape positions similar to those of the Els soils.

Typical pedon of Els fine sand, calcareous, 0 to 2 percent slopes, 1,650 feet west and 1,500 feet north of the southeast corner of sec. 31, T. 26 N., R. 41 W.

A—0 to 7 inches; gray (10YR 5/1) fine sand, very dark

grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slight effervescence; moderately alkaline; clear wavy boundary.

AC—7 to 13 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; few medium faint dark brown (10YR 3/3 moist) mottles; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slight effervescence; moderately alkaline; clear wavy boundary.

C—13 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; slight effervescence; slightly alkaline.

The depth to free carbonates ranges from 0 to 15 inches.

The A horizon has value of 4 or 5 (3 moist) and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy fine sand. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 7 moist), and chroma of 2 or 3. It is fine sand, sand, or loamy sand. In some pedons the C horizon has thin, dark layers of loamy fine sand or fine sand.

Elsmere Series

The Elsmere series consists of very deep, somewhat poorly drained, rapidly permeable soils in sandhill valleys. They formed in eolian sand and sandy alluvium. Slopes range from 0 to 2 percent.

Elsmere soils are commonly adjacent to Dailey, Els, Ipage, Tryon, Valent, and Valentine soils. Dailey, Ipage, Valent, and Valentine soils are better drained than the Elsmere soils and are higher on the landscape. Els soils do not have a mollic epipedon and are in landscape positions similar to those of the Elsmere soils. Ipage, Valent, and Valentine soils also do not have a mollic epipedon. Tryon soils do not have a mollic epipedon, are poorly drained and very poorly drained, and are lower on the landscape than the Elsmere soils.

Typical pedon of Elsmere loamy fine sand, 0 to 2 percent slopes, 1,150 feet west and 500 feet north of the southeast corner of sec. 9, T. 27 N., R. 43 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly alkaline; abrupt smooth boundary.

A—6 to 11 inches; very dark grayish brown (10YR 3/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slightly alkaline; clear smooth boundary.

AC—11 to 17 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine granular; soft, very friable; slightly alkaline; clear smooth boundary.

C1—17 to 35 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; few fine distinct yellowish brown (10YR 5/4 moist) mottles; single grain; loose; slightly alkaline; clear wavy boundary.

C2—35 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; few medium distinct yellowish brown (10YR 5/4 moist) mottles; single grain; loose; slightly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. Carbonates are not typically in the solum, but some pedons are calcareous in the surface layer.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes loamy sand and fine sand. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly fine sand, but the range includes loamy fine sand, loamy sand, and sand.

Enning Series

The Enning series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in silty, calcareous material weathered from interbedded chalk and shale (fig. 21). Slopes range from 6 to 40 percent.

Enning soils are commonly adjacent to Epping, Manvel, Minnequa, Mitchell, and Thirtynine soils. Epping, Mitchell, and Thirtynine soils formed in material weathered from siltstone and are higher on the landscape than the Enning soils. Minnequa soils have interbedded chalk and shale at a depth of 20 to 40 inches and are lower on the landscape than the Enning soils. Manvel soils are more than 60 inches thick over bedrock and formed in colluvial and alluvial sediments on foot slopes.

Typical pedon of Enning silty clay loam, in an area of Enning-Minnequa complex, 6 to 20 percent slopes; 1,600 feet south and 85 feet west of the northeast corner of sec. 28, T. 35 N., R. 46 W.

A—0 to 3 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure;

slightly hard, friable; 3 percent calcium carbonates; violent effervescence; moderately alkaline; clear wavy boundary.

AC—3 to 7 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; 11 percent calcium carbonates; violent effervescence; moderately alkaline; clear wavy boundary.

C—7 to 18 inches; light gray (10YR 7/2) silty clay loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; 32 percent calcium carbonates; 3 percent, by volume, chalk and shale channers; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—18 to 60 inches; white (10YR 8/1), interbedded chalk and shale.

The depth to interbedded chalk and shale ranges from 10 to 20 inches.

The A horizon has value of 5 to 7 (3 or 4 moist) and chroma of 2 to 4. It is dominantly silty clay loam, but the range includes silt loam. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is dominantly silty clay loam, but the range includes silt loam.

Epping Series

The Epping series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in loamy sediment weathered from siltstone. Slopes range from 3 to 60 percent.

Epping soils are commonly adjacent to Bridget, Mitchell, and Thirtynine soils. The adjacent soils do not have bedrock within a depth of 60 inches. They are lower on the landscape than the Epping soils. Bridget soils have a mollic epipedon. Thirtynine soils have a mollic epipedon and an argillic horizon.

Typical pedon of Epping very fine sandy loam, in an area of Mitchell-Epping complex, 9 to 30 percent slopes; 950 feet west and 600 feet north of the southeast corner of sec. 34, T. 35 N., R. 45 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slightly alkaline; clear wavy boundary.

AC—3 to 6 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; soft, very friable; 5 percent, by volume, small siltstone channers; strong effervescence; slightly alkaline; clear wavy boundary.

C—6 to 15 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; 10 percent, by volume, small siltstone channers; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—15 to 60 inches; very pale brown (10YR 8/3) siltstone, very pale brown (10YR 7/3) moist; violent effervescence.

The depth to siltstone ranges from 10 to 20 inches. The depth to carbonates ranges from 0 to 6 inches.

The A horizon has value of 5 to 7 (3 or 4 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes silt loam and loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam or silt loam.

Gannett Series

The Gannett series consists of very deep, poorly drained and very poorly drained soils in sandhill valleys. Permeability is moderately rapid in the solum and rapid in the underlying material. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 1 percent.

Gannett soils are commonly adjacent to Els, Elsmere, Ipage, Marlake, and Tryon soils. Els and Elsmere soils have more sand in the solum than the Gannett soils, are somewhat poorly drained, and are slightly higher on the landscape. Ipage soils have more sand in the solum than the Gannett soils, are moderately well drained, and are higher on the landscape. Marlake soils have more sand and less silt in the control section than the Gannett soils and are lower on the landscape. They have water on the surface for most of the growing season. Tryon soils do not have a mollic epipedon, have more sand and less silt in the control section than the Gannett soils, and are in similar landscape positions.

Typical pedon of Gannett loam, 0 to 1 percent slopes, 2,100 feet north and 900 feet west of the southeast corner of sec. 20, T. 28 N., R. 41 W.

O—2 inches to 0; partly decomposed organic matter.

A1—0 to 16 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable; neutral; clear smooth boundary.

A2—16 to 23 inches; very dark gray (10YR 3/1) loam,

black (10YR 2/1) moist; moderate medium subangular blocky structure; slightly hard, friable; neutral; abrupt smooth boundary.

C—23 to 60 inches; light gray (10YR 7/1) fine sand, gray (10YR 5/1) moist; few medium prominent light yellowish brown (2.5Y 6/4 moist) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 16 to 24 inches. It commonly is the same as the thickness of the mollic epipedon.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam and sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy sand and sand.

Hoffland Series

The Hoffland series consists of very deep, poorly drained and very poorly drained, rapidly permeable soils in sandhill valleys (fig. 22). These soils formed in sandy alluvium. Slopes range from 0 to 1 percent.

Hoffland soils are commonly adjacent to Crowther, Els, Ipage, Marlake, and Wildhorse soils. Crowther soils are coarse-loamy over sandy or sandy-skeletal and are in landscape positions similar to those of the Hoffland soils. Els and Wildhorse soils are sandy and somewhat poorly drained and are higher on the landscape than the Hoffland soils. Wildhorse soils also are very strongly alkaline. Ipage soils are moderately well drained and are higher on the landscape than the Hoffland soils. Marlake soils are lower on the landscape than the Hoffland soils and have water on the surface for most of the growing season.

Typical pedon of Hoffland fine sandy loam, in an area of Wildhorse-Hoffland complex, 0 to 3 percent slopes; 1,900 feet west and 450 feet north of the southeast corner of sec. 3, T. 24 N., R. 44 W.

O—1 inch to 0; partly decomposed organic matter; strong effervescence.

Ak1—0 to 4 inches; gray (10YR 5/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; 23 percent calcium carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

Ak2—4 to 7 inches; gray (10YR 6/1 and 5/1) crushed fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable; 33 percent calcium carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

Ak3—7 to 11 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak very fine granular; slightly hard, very friable; 18 percent calcium carbonates; violent effervescence; moderately alkaline; clear smooth boundary.

C1—11 to 31 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; common fine and medium distinct dark yellowish brown (10YR 4/4 moist) mottles; single grain; loose; moderately alkaline; clear wavy boundary.

C2—31 to 41 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; common fine and medium distinct yellowish brown (10YR 5/4 moist) mottles; single grain; loose; slightly alkaline; clear wavy boundary.

C3—41 to 60 inches; light gray (10YR 7/1) fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; stratified with dark grayish brown (2.5Y 4/2) fine sandy loam; slightly alkaline.

The thickness of the solum ranges from 7 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 10 inches. Free carbonates are generally at the surface and throughout the solum.

The upper part of the Ak horizon has value of 4 to 6 (2 or 3 moist) and chroma of 1 or 2. The lower part has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. The Ak horizon is dominantly fine sandy loam, but the range includes loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 8 (2 to 6 moist), and chroma of 1 to 3. It is dominantly fine sand, but the range includes loamy fine sand and sand that has thin strata of fine sandy loam.

Ipage Series

The Ipage series consists of very deep, moderately well drained, rapidly permeable soils in sandhill valleys. These soils formed in eolian sand. Slopes range from 0 to 3 percent.

Ipage soils are commonly adjacent to Crowther, Els, Hoffland, Valent, Valentine, and Wildhorse soils. Crowther and Hoffland soils are poorly drained and very poorly drained and are lower on the landscape than the Ipage soils. Els and Wildhorse soils are somewhat poorly drained and are lower on the landscape than the Ipage soils. Wildhorse soils also are very strongly alkaline. Valent and Valentine soils are excessively drained and are higher on the landscape than the Ipage soils.

Typical pedon of Ipage fine sand, 0 to 3 percent

slopes, 2,100 feet east and 1,600 feet north of the southwest corner of sec. 5, T. 27 N., R. 44 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; loose; neutral; clear smooth boundary.

AC—5 to 11 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C1—11 to 35 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C2—35 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; few fine distinct yellowish brown (10YR 5/4 moist) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 3 to 18 inches. The depth to free carbonates is typically more than 60 inches but ranges from 20 to 60 inches.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It is dominantly fine sand, but the range includes sand, loamy sand, and loamy fine sand. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 or 3. It is dominantly fine sand, but the range includes sand and loamy sand.

Jayem Series

The Jayem series consists of very deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy and sandy eolian material weathered from sandstone (fig. 23). Slopes range from 0 to 9 percent.

Jayem soils are commonly adjacent to Busher, Dailey, Satanta, Tuthill, and Vetal soils. Busher soils have soft, calcareous sandstone at a depth of 40 to 60 inches. Dailey soils have more sand throughout the profile than the Jayem soils. Busher and Dailey soils are in landscape positions similar to those of the Jayem soils. Satanta and Tuthill soils have more clay in the subsoil than the Jayem soils and are in similar landscape positions. Tuthill soils also have fine sand at a depth of 40 to 60 inches. Vetal soils have a mollic epipedon more than 20 inches thick and are lower on the landscape than the Jayem soils.

Typical pedon of Jayem fine sandy loam, 3 to 6 percent slopes, 1,800 feet west and 2,300 feet north of the southeast corner of sec. 3, T. 32 N., R. 41 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—7 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable; neutral; clear wavy boundary.

Bw—11 to 24 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; slightly alkaline; clear wavy boundary.

C—24 to 60 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; slightly alkaline.

The thickness of the solum ranges from 18 to 36 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. Carbonates are typically below a depth of 40 inches.

The A horizon has hue of 2.5Y or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loamy fine sand. The Bw horizon has hue of 2.5Y to 7.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam. The C horizon has hue of 2.5Y to 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly fine sandy loam, loamy very fine sand, or very fine sandy loam, but the range includes loamy fine sand, loamy sand, and sand below a depth of 40 inches.

Johnstown Series

The Johnstown series consists of very deep, well drained soils on uplands. Permeability is moderate in the solum and rapid and very rapid in the underlying material. These soils formed in loess and loamy sediment deposited over gravelly sand. Slopes range from 0 to 1 percent.

Johnstown soils are adjacent to Bridget; Keith, gravelly substratum; and Satanta soils. Bridget soils do not have an argillic horizon and are in landscape positions similar to those of the Johnstown soils. Keith, gravelly substratum, soils have a mollic epipedon that is less than 20 inches thick and are in landscape positions similar to those of the Johnstown soils. Satanta soils have more sand in the control section than the Johnstown soils and are higher on the landscape.

Typical pedon of Johnstown loam, 0 to 1 percent slopes, 250 feet west and 1,900 feet south of the northeast corner of sec. 18, T. 29 N., R. 45 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2)

loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—7 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse subangular structure parting to weak medium and fine subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

Bt—11 to 18 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; neutral; clear smooth boundary.

Btb1—18 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, firm; neutral; clear smooth boundary.

Btb2—30 to 34 inches; pale brown (10YR 6/3) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; slightly alkaline; clear smooth boundary.

BCb—34 to 37 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C—37 to 43 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

2C—43 to 60 inches; light gray (10YR 7/2) gravelly coarse sand, pale brown (10YR 6/3) moist; single grain; loose; 29 percent gravel, by volume; strong effervescence; slightly alkaline.

The thickness of the solum ranges from 36 to 55 inches. The depth to carbonates ranges from 30 to more than 60 inches. The thickness of the mollic epipedon ranges from 20 to 44 inches. The depth to the 2C horizon ranges from 40 to 60 inches. The depth to the buried soil ranges from 14 to 36 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is dominantly loam, but the range includes fine sandy loam, silt loam, and clay loam. The Bt horizon has value of 4 or 5 (3 moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes clay loam. The Btb horizon has hue of 10YR or 2.5Y, value of 3 to 6 (2 to 5 moist), and chroma of 1 to 4. It is dominantly silty clay loam, but the range includes clay loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly loam, but the range includes silt loam, very fine sandy loam, or silty clay loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is dominantly gravelly coarse sand, but the range includes coarse sand, sand, fine sand, or loamy sand.

Kadoka Series

The Kadoka series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in silty material weathered from siltstone. Slopes range from 0 to 9 percent.

Kadoka soils are commonly adjacent to Bufton, Epping, Orella, and Thirtynine soils. Bufton and Thirtynine soils are very deep and are in landscape positions similar to those of the Kadoka soils. Epping and Orella soils are shallow over bedrock and are higher on the landscape than the Kadoka soils.

Typical pedon of Kadoka silt loam, 6 to 9 percent slopes, 850 feet east and 1,600 feet south of the northwest corner of sec. 20, T. 35 N., R. 45 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; neutral; abrupt smooth boundary.

Bt—7 to 15 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable; neutral; clear wavy boundary.

Bw—15 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slightly alkaline; clear wavy boundary.

Bk—20 to 27 inches; very pale brown (10YR 8/3) silt loam, very pale brown (10YR 7/3) moist; weak medium subangular blocky structure; slightly hard, friable; secondary calcium carbonates on ped faces; 5 percent, by volume, siltstone channers; violent effervescence; moderately alkaline; gradual wavy boundary.

C—27 to 32 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; 10 percent, by volume, siltstone channers; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—32 to 60 inches; very pale brown (10YR 8/4) bedded siltstone; violent effervescence.

The thickness of the solum ranges from 15 to 27 inches. The depth to carbonates ranges from 12 to 25 inches. The thickness of the mollic epipedon ranges from 8 to 16 inches. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist). It is

dominantly silt loam, but the range includes loam or silty clay loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 to 4. It is dominantly silty clay loam, but the range includes silt loam and loam. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 to 4. It is dominantly silt loam, but the range includes loam.

Keith Series

The Keith series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 6 percent.

Keith soils are commonly adjacent to Alliance, Bridget, Johnstown, and Satanta soils. Alliance soils have soft, calcareous sandstone at a depth of 40 to 60 inches and are in landscape positions similar to those of the Keith soils. Bridget soils do not have an argillic horizon and are lower on the landscape than the Keith soils. Johnstown soils have a mollic epipedon more than 20 inches thick and are in landscape positions similar to those of the Keith soils. Satanta soils are fine-loamy and are in landscape positions similar to those of the Keith soils.

Typical pedon of Keith loam, 1 to 3 percent slopes, 1,950 feet south and 2,100 feet west of the northeast corner of sec. 18, T. 29 N., R. 46 W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; neutral; clear smooth boundary.

Bt1—9 to 17 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—17 to 23 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; thin patchy clay films on faces of peds; clay films on faces of peds; neutral; abrupt smooth boundary.

Bk—23 to 28 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; accumulations of calcium carbonate in cracks and very small concretions; violent effervescence; moderately alkaline; clear smooth boundary.

C1—28 to 45 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; calcium carbonate accumulations; violent effervescence; slightly alkaline; gradual smooth boundary.

C2—45 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; slightly alkaline.

The thickness of the solum ranges from 15 to 42 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to free carbonates ranges from 15 to 38 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam and silty clay loam. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam, loam, and clay loam. The content of clay in this horizon ranges from 25 to 35 percent. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam. A gravelly substratum that has white or pale brown, calcareous gravelly coarse sand, coarse sand, or sand is at a depth of 40 to 60 inches.

Keya Series

The Keya series consists of very deep, well drained, moderately permeable soils in upland swales. These soils formed in local loamy alluvium. Slopes range from 0 to 2 percent.

Keya soils are commonly adjacent to Busher, Jayem, Satanta, Tuthill, and Vetal soils. Busher, Jayem, Satanta, and Tuthill soils have a mollic epipedon less than 20 inches thick and are higher on the landscape than the Keya soils. Busher soils also have soft, calcareous sandstone at a depth of 40 to 60 inches. Busher and Jayem soils are coarse-loamy. Vetal soils are coarse-loamy and are in landscape positions similar to those of the Keya soils.

Typical pedon of Keya loam, 0 to 2 percent slopes, 1,000 feet east and 800 feet north of the southwest corner of sec. 30, T. 31 N., R. 44 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—6 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak moderate fine and medium granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

Bt1—17 to 35 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2)

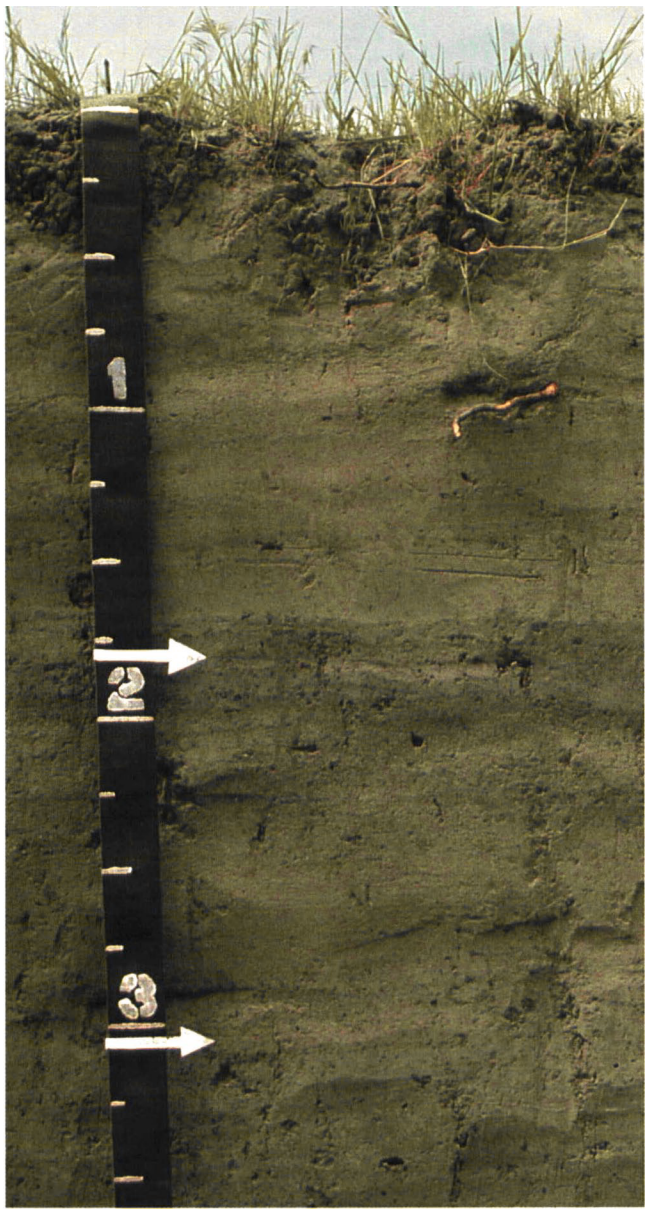

Figure 20.—Typical profile of Bankard loamy fine sand. The arrows indicate areas of stratification. Depth is marked in feet.

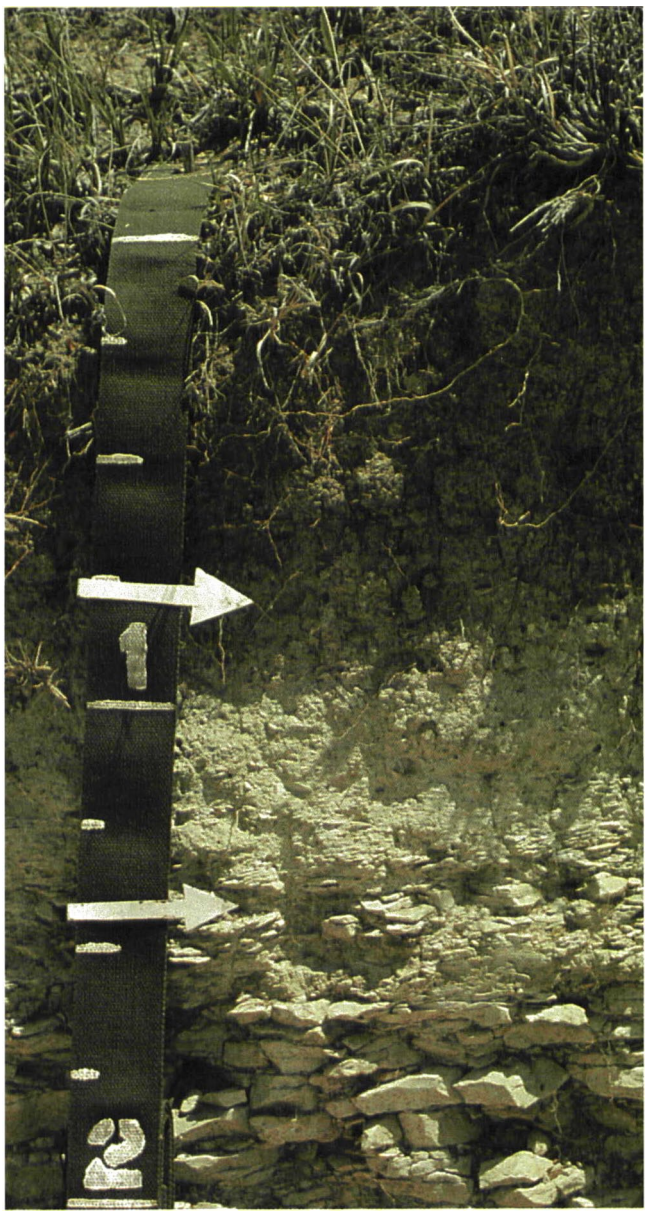

Figure 21.—Typical profile of Enning silty clay loam. The upper arrow indicates the bottom of the surface layer, and the lower arrow indicates the soil contact with the chalky shale. Depth is marked in feet.

Figure 22.—Typical profile of Hoffland fine sandy loam. This poorly drained and very poorly drained, calcareous soil is in sandhill valleys.

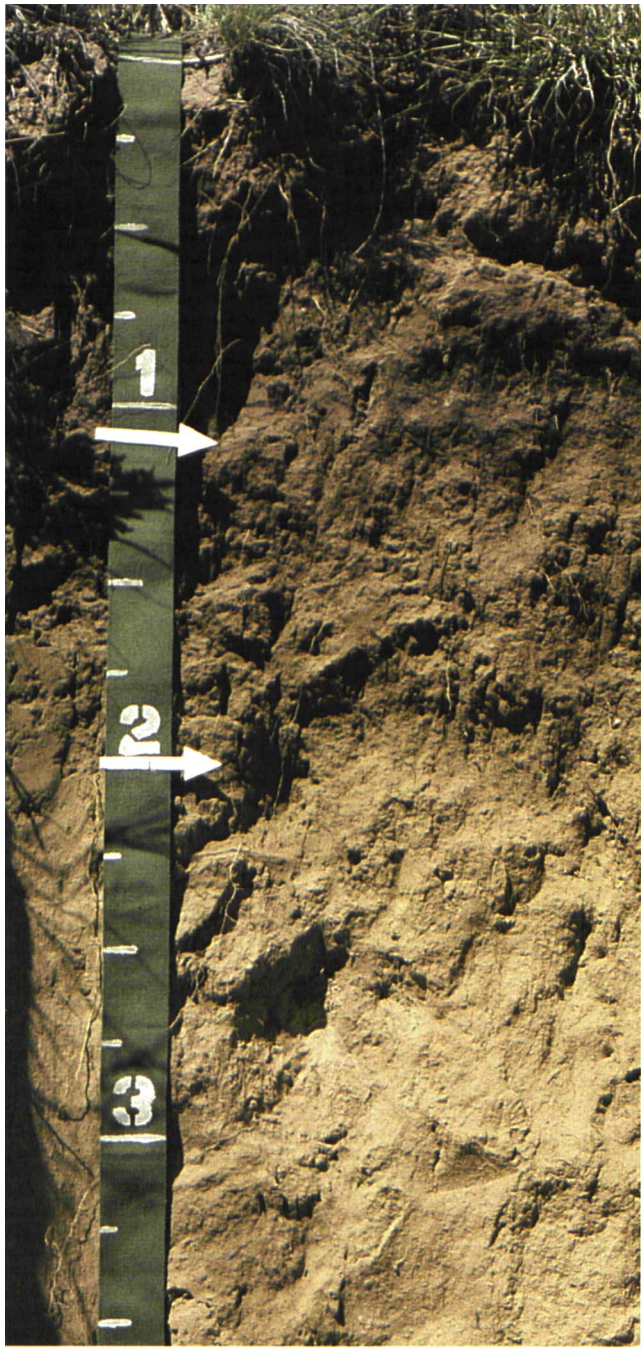

Figure 23.—Typical profile of Jayem fine sandy loam. The upper arrow indicates the lower boundary of the surface soil. The lower arrow indicates the lower boundary of the subsoil. Depth is marked in feet.

Figure 24.—Typical profile of Tuthill fine sandy loam. The upper arrow indicates the lower boundary of the surface soil. The lower arrow indicates the lower boundary of the subsoil. Depth is marked in feet.

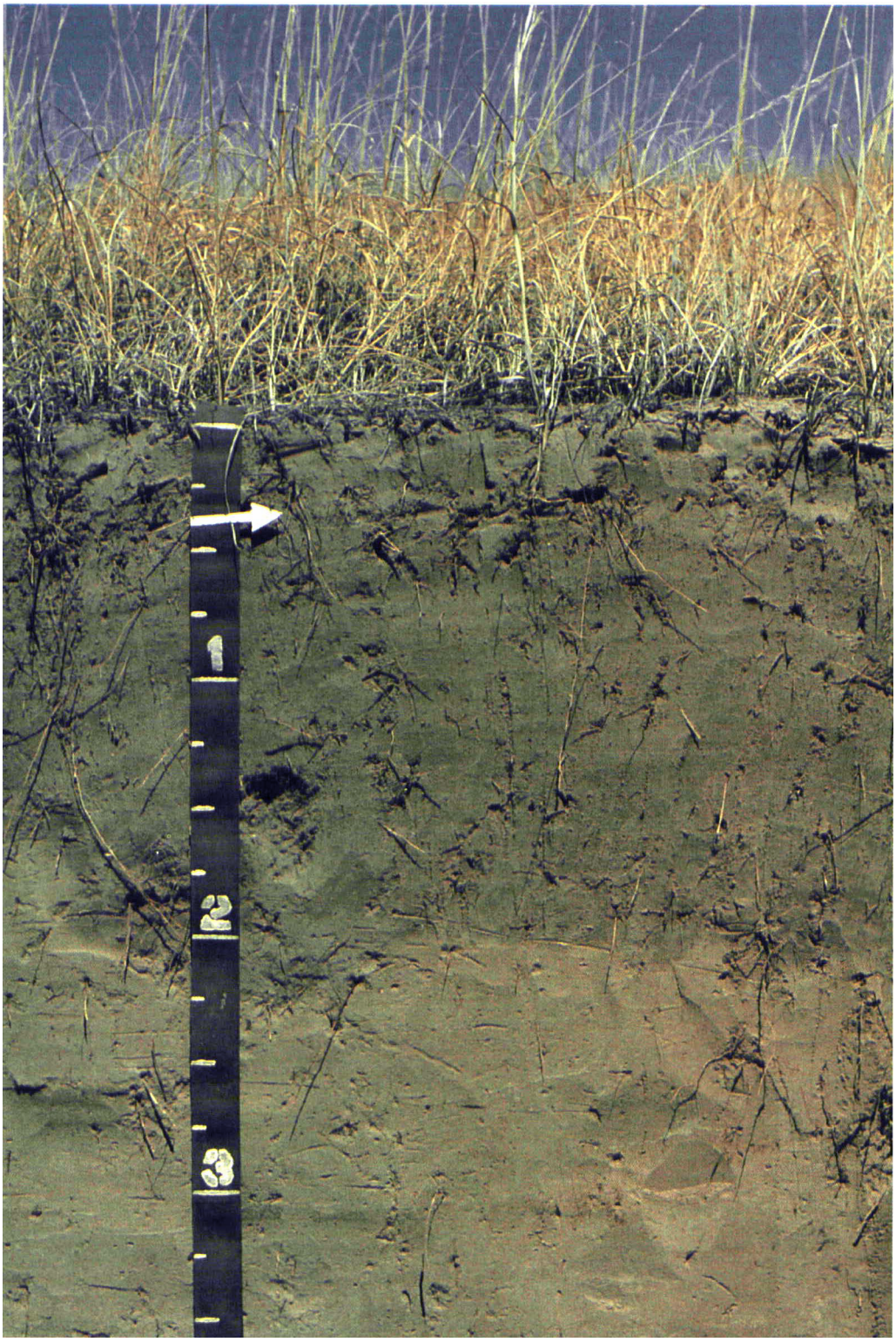

Figure 25.—Typical profile of Valent fine sand. The arrow indicates the lower boundary of the surface soil. Depth is marked in feet.

moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm; neutral; clear smooth boundary.

Bt2—35 to 40 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong coarse prismatic structure parting to strong medium subangular blocky; hard, firm; neutral; clear wavy boundary.

BC—40 to 49 inches; pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.

C—49 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 58 inches. The thickness of the mollic epipedon ranges from 20 to 45 inches. It extends into the Bt horizon. The depth to free carbonates ranges from 30 to more than 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam. The Bt horizon has value of 4 or 5 (2 to 4 moist) and chroma of 2 or 3. It is dominantly clay loam, but the range includes loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes clay loam and fine sandy loam. In some pedons loamy fine sand and fine sand are below a depth of 40 inches.

Las Animas Series

The Las Animas series consists of very deep, somewhat poorly drained, moderately rapidly permeable soils on bottom land. These soils formed in stratified, calcareous loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Las Animas soils are commonly adjacent to Bolent and Calamus soils. The adjacent soils have more sand throughout the profile than the Las Animas soils. Bolent soils are in landscape positions similar to those of the Las Animas soils. Calamus soils are moderately well drained and are higher on the landscape than the Las Animas soils.

Typical pedon of Las Animas loam, 0 to 2 percent slopes, 1,300 feet west and 800 feet north of the southeast corner of sec. 10, T. 30 N., R. 43 W.

A—0 to 5 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak medium and coarse granular structure; soft, very friable; slight effervescence; slightly alkaline; abrupt smooth boundary.

Cg1—5 to 27 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; common medium prominent yellowish brown (10YR 5/4 moist) mottles; massive; soft, very friable; thin strata of loamy very fine sand; strong effervescence; slightly alkaline; clear smooth boundary.

Cg2—27 to 60 inches; light gray (10YR 7/2) fine sand stratified with very fine sandy loam, grayish brown (10YR 5/2) moist; common medium prominent strong brown (7.5YR 5/6 moist) mottles; single grain; loose; strong effervescence; slightly alkaline.

The depth to free carbonates ranges from 0 to 10 inches.

The A horizon has hue of 5Y to 7.5YR, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. It is dominantly loam, but the range includes very fine sandy loam and fine sandy loam. The C horizon has hue of 5Y to 7.5YR, value of 5 to 7 (5 or 6 moist), and chroma of 2 or 3. The upper part of the C horizon is dominantly very fine sandy loam, but the range includes loam and fine sandy loam stratified with loamy very fine sand. The lower part is dominantly fine sand that has strata of calcareous loam and very fine sandy loam, but the range includes stratified sand and loamy fine sand.

Lodgepole Series

The Lodgepole series consists of very deep, somewhat poorly drained, very slowly permeable soils in depressions on uplands. These soils formed in loess and loamy sediment. Slopes range from 0 to 1 percent.

Lodgepole soils are commonly adjacent to Alliance, Duroc, Keith, and Satanta soils. The adjacent soils have less clay in the control section than the Lodgepole soils and are higher on the landscape.

Typical pedon of Lodgepole silt loam, 0 to 1 percent slopes, 200 feet west and 2,700 feet south of the northeast corner of sec. 10, T. 31 N., R. 46 W.

A—0 to 5 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

Bt1—5 to 16 inches; dark gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to strong medium subangular blocky; very hard, very firm; thin patchy clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—16 to 32 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; black (10YR 2/1 moist) coatings on peds; few fine faint yellowish brown (10YR 5/4 moist) mottles; moderate medium prismatic structure parting to strong medium subangular blocky; very hard, very firm; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

BC—32 to 40 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; few fine faint yellowish brown (10YR 5/4 moist) mottles; moderate medium subangular blocky structure; slightly hard, friable; slight effervescence; neutral; clear smooth boundary.

C1—40 to 46 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; slightly alkaline; clear smooth boundary.

C2—46 to 60 inches; very pale brown (2.5Y 8/2) fine sandy loam, brown (2.5Y 6/4) moist; massive; soft, very friable; strong effervescence; slightly alkaline.

The thickness of the mollic epipedon ranges from 20 to 41 inches, and the depth to free carbonates ranges from 30 to more than 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The Bt horizon has value of 3 to 5 (2 to 4 moist) and chroma of 0 to 2. It is dominantly silty clay, but the range includes clay and silty clay loam. The content of clay ranges from 35 to 40 percent. The C horizon has hue of 2.5Y or 10YR, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is dominantly loam, but the range includes silt loam or very fine sandy loam. Fine sandy loam, sandy loam, loamy fine sand, or loamy sand is common below a depth of 40 inches.

Lute Series

The Lute series consists of very deep, somewhat poorly drained soils on alluvial fans and low stream terraces. These soils formed in loamy alluvium. Permeability is slow in the subsoil and moderately rapid in the underlying material. Slopes range from 0 to 2 percent.

Lute soils are commonly adjacent to Beckton soils, which are moderately well drained and are slightly higher on the landscape than the Lute soils.

Typical pedon of Lute loam, 0 to 2 percent slopes, 1,000 feet south and 1,000 feet west of the northeast corner of sec. 30, T. 33 N., R. 45 W.

A—0 to 6 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slightly alkaline; abrupt smooth boundary.

E—6 to 7 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak fine granular structure; soft, friable; slightly alkaline; clear wavy boundary.

Btn1—7 to 13 inches; gray (10YR 5/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate medium columnar structure parting to moderate fine and medium subangular blocky; hard, firm; thin patchy clay films on faces of peds; violent effervescence; moderately alkaline; clear smooth boundary.

Btn2—13 to 18 inches; gray (10YR 5/1) sandy clay loam, dark grayish brown (10YR 4/2) moist; few fine faint dark brown (10YR 4/3 moist) mottles; moderate fine subangular blocky structure; hard, firm; thin patchy clay films on faces of peds; violent effervescence; strongly alkaline; clear wavy boundary.

BCn—18 to 24 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; common medium faint yellowish brown (10YR 5/4 moist) mottles; weak medium subangular blocky structure; soft, very friable; violent effervescence; strongly alkaline; clear wavy boundary.

C—24 to 60 inches; light gray (10YR 7/2) very fine sandy loam stratified with loamy fine sand and loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 26 inches. The depth to free carbonates ranges from 0 to 10 inches. The percentage of exchangeable sodium is more than 15 in the natric horizon.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam and loamy fine sand. The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes fine sandy loam and loamy fine sand. The Btn horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 to 3. It is dominantly sandy clay loam, but the range includes loam and fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes fine sandy loam and loamy fine sand.

Manvel Series

The Manvel series consists of very deep, well drained, moderately slowly permeable soils on foot

slopes and alluvial fans. These soils formed in calcareous colluvial and alluvial sediments derived from interbedded chalk and shale. Slopes range from 2 to 6 percent.

Manvel soils are commonly adjacent to Bufton, Enning, and Minnequa soils. The adjacent soils are higher on the landscape than the Manvel soils. Bufton soils have more clay than the Manvel soils. Enning soils have chalk and shale at a depth of 10 to 20 inches. Minnequa soils have chalk and shale at a depth of 20 to 40 inches.

Typical pedon of Manvel silty clay loam, 2 to 6 percent slopes, 1,600 feet east and 2,500 feet north of the southwest corner of sec. 26, T. 35 N., R. 46 W.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; 21 percent calcium carbonate; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—5 to 11 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure; slightly hard, friable; 2 percent, by volume, chalk and shale channers; 31 percent calcium carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C1—11 to 50 inches; light gray (2.5Y 7/2) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, firm; 2 percent, by volume, chalk and shale channers; 29 percent calcium carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2—50 to 60 inches; pale yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; hard, firm; 2 percent, by volume, chalk and shale channers; 31 percent calcium carbonate; strong effervescence; moderately alkaline.

Chalk and shale channers range from 0 to 10 percent throughout the profile. Calcium carbonate equivalent ranges from 15 to 40 percent.

The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. It is dominantly silty clay loam, but the range includes silt loam and loam. The C horizon has hue of 5Y to 7.5YR, value of 6 to 8 (4 or 5 moist), and chroma of 2 to 4. It is dominantly silty clay loam, but the range includes silt loam.

Marlake Series

The Marlake series consists of very deep, very poorly drained, rapidly permeable soils in depressions in sandhill valleys. These soils formed in eolian and alluvial sand. Slopes range from 0 to 1 percent.

Marlake soils are commonly adjacent to Crowther, Els, Gannett, Hoffland, and Tryon soils. Crowther and Gannett soils are coarse-loamy in the upper part of the control section and have a mollic epipedon. These soils are higher on the landscape than the Marlake soils. Els soils are higher on the landscape than the Marlake soils and are somewhat poorly drained. Hoffland and Tryon soils are higher on the landscape than the Marlake soils. Hoffland soils have a calcic horizon. Tryon soils are not stratified in the upper part of the control section.

Typical pedon of Marlake fine sandy loam, 0 to 1 percent slopes, 1,000 feet south and 2,000 feet west of the northeast corner of sec. 3, T. 25 N., R. 44 W.

O—2 inches to 0; partly decomposed plant litter.

A—0 to 7 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; slight effervescence; slightly alkaline; clear wavy boundary.

AC—7 to 14 inches; grayish brown (10YR 5/2) loamy fine sand stratified with very dark gray (10YR 3/1) fine sandy loam and light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

C—14 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand stratified and mixed with gray (10YR 5/1) fine sandy loam and light gray (10YR 7/1) fine sand, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/4 moist) mottles in the upper part; single grain; soft, very friable; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 0 to 15 inches. The thickness of the mollic colors ranges from 6 to 10 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loamy fine sand. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is dominantly loamy fine sand, but the range includes fine sand and sand. Strata of finer textured material are common in the C horizon.

McCook Series

The McCook series consists of very deep, well drained, moderately permeable soils on bottom land. These soils formed in stratified, calcareous, loamy alluvium. Slopes range from 0 to 2 percent.

McCook soils are commonly adjacent to Beckton, Keith, and Munjor soils. Beckton soils have a high content of exchangeable sodium and are moderately well drained. These soils are in landscape positions similar to those of the McCook soils. Keith soils are not stratified and have an argillic horizon. These soils are higher on the landscape than the McCook soils. Munjor soils are coarse-loamy in the control section and are in landscape positions similar to those of the McCook soils.

Typical pedon of McCook loam, 0 to 2 percent slopes, 250 feet east and 2,100 feet south of the northwest corner of sec. 29, T. 34 N., R. 42 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure parting to weak medium granular; slightly hard, friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A—6 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium granular; slightly hard, friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—12 to 20 inches; stratified light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to weak coarse and medium granular; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

Ab—20 to 33 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine granular; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C—33 to 45 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable; strong effervescence; slightly alkaline; gradual smooth boundary.

Ab —45 to 60 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; violent effervescence; slightly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to free carbonates is dominantly less than 10 inches, and most pedons are calcareous at or near the surface.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam or fine sandy loam. The AC and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam or very fine sandy loam. Buried soils and dark loamy strata are common in the C horizon.

Minnequa Series

The Minnequa series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in silty, calcareous material weathered from interbedded chalk and shale. Slopes range from 6 to 20 percent.

Minnequa soils are commonly adjacent to Bufton, Enning, and Manvel soils. Bufton soils contain more clay in the control section than the Minnequa soils and are higher on the landscape. Enning soils have interbedded chalk and shale at a depth of 10 to 20 inches and are higher on the landscape than the Minnequa soils. Manvel soils have 15 to 40 percent calcium carbonate in the control section and are lower on the landscape than the Minnequa soils.

Typical pedon of Minnequa silty clay loam, in an area of Enning-Minnequa complex, 6 to 20 percent slopes; 1,700 feet south and 800 feet west of the northeast corner of sec. 28, T. 35 N., R. 46 W.

A—0 to 4 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, friable; 12 percent calcium carbonate equivalent; violent effervescence; moderately alkaline; clear wavy boundary.

AC—4 to 10 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; 12 percent calcium carbonate equivalent; violent effervescence; moderately alkaline; clear wavy boundary.

C1—10 to 22 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable; 17 percent calcium carbonate equivalent; violent effervescence; moderately alkaline; clear wavy boundary.

C2—22 to 33 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, very friable; 25 percent calcium carbonate equivalent; 3 percent, by volume, channers; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—33 to 60 inches; white (2.5Y 8/2), interbedded chalk and shale; violent effervescence.

The depth to free carbonates ranges from 0 to 3 inches. The calcium carbonate equivalent ranges from 10 to 39 percent in the control section.

The A horizon has hue of 5Y to 7.5YR, value of 5 to 8 (3 to 7 moist), and chroma of 1 to 3. It is dominantly silty clay loam, but the range includes silt loam and loam. The C horizon has hue of 5Y to 7.5YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4. It is dominantly silty clay loam and silt loam, but the range includes loam. The depth to the Cr horizon ranges from 20 to 40 inches.

Mitchell Series

The Mitchell series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous loamy sediment weathered from siltstone. Slopes range from 9 to 30 percent.

Mitchell soils are commonly adjacent to Bridget, Epping, and Thirtynine soils. Bridget soils have a mollic epipedon and are on foot slopes, alluvial fans, and stream terraces. Epping soils are shallow over siltstone and are higher on the landscape than the Mitchell soils. Thirtynine soils have a mollic epipedon and an argillic horizon. These soils are in landscape positions similar to those of the Mitchell soils.

Typical pedon of Mitchell very fine sandy loam, in an area of Mitchell-Epping complex, 9 to 30 percent slopes; 1,050 feet west and 800 feet north of the southeast corner of sec. 34, T. 35 N., R. 45 W.

A—0 to 4 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium platy structure parting to weak fine granular; soft, very friable; slight effervescence; slightly alkaline; clear wavy boundary.

AC—4 to 9 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak fine granular; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

C—9 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; 2 percent, by volume, siltstone channers; slightly hard, very friable; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 10 inches.

The A horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam, silt loam, and fine sandy loam. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam and silt loam.

Munjor Series

The Munjor series consists of very deep, well drained, moderately rapidly permeable soils on bottom land. These soils formed in calcareous, stratified loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Munjor soils are commonly adjacent to Bridget, Oglala, and Ponderosa soils. Bridget and Oglala soils are coarse-silty and are higher on the landscape than the Munjor soils. Ponderosa soils are not stratified and have carbonates below a depth of 15 inches. These soils are higher on the landscape than the Munjor soils.

Typical pedon of Munjor fine sandy loam, 0 to 2 percent slopes, 2,300 feet east and 2,200 feet north of the southwest corner of sec. 16, T. 34 N., R. 44 W.

A—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

C1—6 to 23 inches; brown (10YR 5/3) loamy very fine sand, dark brown (10YR 4/3) moist; thin strata of pale brown (10YR 6/3) fine sandy loam; massive; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C2—23 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; thin strata of very pale brown (10YR 7/3) loamy very fine sand; massive; soft, very friable; slight effervescence in some layers, noncalcareous in others; moderately alkaline.

Typically, these soils are calcareous throughout, but they are leached for a few inches in some pedons.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It commonly has value darker than 5.5 dry and 3.5 moist but is less than 7 inches thick. It is dominantly fine sandy loam, but the range includes loam, sandy loam, and loamy fine sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam, sandy loam, and loamy very fine sand. In some pedons the C horizon has thin strata of loam, very fine sandy loam, fine sandy loam, loamy fine sand, loamy very fine sand, or fine sand.

Niobrara Series

The Niobrara series consists of shallow, excessively drained, rapidly permeable soils on breaks and canyons of the Niobrara River and its tributaries. These soils formed in sandy material weathered from sandstone. Slopes range from 9 to 30 percent.

Niobrara soils are commonly adjacent to Dailey, Jayem, Orpha, Valent, and Valentine soils. The adjacent soils are very deep. Jayem soils are coarse-loamy. Orpha soils are lower on the landscape than the Niobrara soils. Dailey, Jayem, Valent, and Valentine soils are higher on the landscape than the Niobrara soils.

Typical pedon of Niobrara loamy fine sand, in an area of Orpha-Niobrara complex, 9 to 30 percent slopes; 1,200 feet north and 2,550 feet east of the southwest corner of sec. 33, T. 31 N., R. 43 W.

A—0 to 4 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; 2 percent, by volume, sandstone gravel; slight effervescence; slightly alkaline; clear smooth boundary.

C—4 to 13 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; 5 percent, by volume, sandstone gravel; strong effervescence; moderately alkaline; abrupt wavy boundary.

Cr—13 to 60 inches; white (10YR 9/2), calcareous sandstone, light gray (10YR 7/2) moist; violent effervescence.

The depth to carbonates ranges from 0 to 6 inches. The depth to sandstone ranges from 10 to 20 inches.

The A horizon has value of 4 to 6 (2 to 5 moist) and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes fine sandy loam and fine sand. Some pedons have an AC horizon. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 or 3. It is dominantly fine sand, but the range includes loamy fine sand, loamy sand, and sand.

Oglala Series

The Oglala series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from calcareous sandstone. Slopes range from 3 to 30 percent.

Oglala soils are commonly adjacent to Alliance, Canyon, and Rosebud soils. Alliance soils have more clay in the control section than the Oglala soils and are in similar landscape positions. Canyon soils are shallow over bedrock and do not have a mollic epipedon. These soils are in landscape positions similar to those of the Oglala soils. Rosebud soils have more clay in the control section than the Oglala soils and are moderately deep over bedrock. These soils are in similar landscape positions.

Typical pedon of Oglala loam, in an area of Oglala-Canyon complex, 11 to 30 percent slopes; 2,300 feet north and 400 feet west of the southeast corner of sec. 11, T. 32 N., R. 45 W.

A—0 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; slightly acid; clear wavy boundary.

AC—8 to 19 inches; grayish brown (10YR 5/2) silt loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

C1—19 to 24 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—24 to 58 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; massive; soft, very friable; 2 percent, by volume, sandstone gravel; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—58 to 60 inches; white (10YR 8/2), calcareous sandstone; violent effervescence.

The depth to carbonates ranges from 15 to 42 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to sandstone ranges from 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam and very fine sandy loam. The AC horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam, fine sandy loam, and loamy very fine sand.

Onita Series

The Onita series consists of very deep, moderately well drained, slowly permeable soils in upland swales. These soils formed in loamy and clayey sediments. Slopes range from 0 to 1 percent.

Onita soils are commonly adjacent to Bridget, Keya, and Satanta soils. The adjacent soils have less clay in the control section than the Onita soils. Bridget and

Satanta soils have a mollic epipedon less than 20 inches thick and are higher on the landscape than the Onita soils.

Typical pedon of Onita silty clay loam, 0 to 1 percent slopes, 2,500 feet east and 1,800 feet south of the northwest corner of sec. 9, T. 30 N., R. 45 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate fine and very fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

Bt1—8 to 18 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; slightly alkaline; clear smooth boundary.

Bt2—18 to 32 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium prismatic structure parting to coarse fine and medium subangular blocky; very hard, firm; slightly alkaline; clear smooth boundary.

Bk—32 to 51 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; fine threads of calcium carbonates; strong effervescence; moderately alkaline; clear smooth boundary.

C—51 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to carbonates ranges from 25 to 40 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silty clay loam, but the range includes silt loam or loam. The Bt horizon has value of 3 to 5 (2 to 4 moist) and chroma of 1 to 3. It is dominantly silty clay, but the range includes silty clay loam or clay loam. The Bk horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is dominantly silt loam, but the range includes silty clay loam or clay loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is dominantly silt loam, but the range includes silty clay loam or clay loam.

Orella Series

The Orella series consists of shallow, well drained, very slowly permeable soils on uplands. These soils formed in material weathered from shale. Slopes range from 3 to 30 percent.

Orella soils are commonly adjacent to Bufton, Enning, Minnequa, and Thirtynine soils. Bufton soils are very deep. Enning soils formed in material weathered from interbedded chalk and shale. Minnequa soils are moderately deep and formed in material weathered from interbedded chalk and shale. Thirtynine soils are very deep and formed in material weathered from siltstone.

Typical pedon of Orella silty clay loam, in an area of Bufton-Orella complex, 3 to 9 percent slopes; 800 feet west and 300 feet south of the northeast corner of sec. 35, T. 35 N., R. 46 W.

A—0 to 5 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; hard, firm; strong effervescence; slightly alkaline; clear wavy boundary.

AC—5 to 10 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; strong effervescence; slightly alkaline; clear wavy boundary.

C—10 to 16 inches; light gray (2.5Y 7/2) silty clay loam, light grayish brown (2.5Y 6/2) moist; weak coarse prismatic structure; hard, firm; 5 percent, by volume, shale and chalcedony channers; few fine accumulations of salts; percentage of exchangeable sodium—20; strong effervescence; slightly alkaline; clear wavy boundary.

Cr—16 to 60 inches; white (2.5Y 8/2), weathered silty shale.

The depth to carbonates ranges from 0 to 10 inches. The depth to shale ranges from 10 to 20 inches.

The A horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 to 4. It is dominantly silty clay loam, but the range includes silty clay or clay loam. The AC and C horizons have hue of 7.5YR to 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The control section is dominantly silty clay loam, but the range includes clay or clay loam. The percentage of exchangeable sodium ranges from 8 to 30 percent.

Orpha Series

The Orpha series consists of very deep, excessively drained, rapidly permeable soils on valley side slopes and foot slopes along the Niobrara River and its tributaries. These soils formed in sandy material weathered from sandstone. Slopes range from 3 to 45 percent.

Orpha soils are commonly adjacent to Calamus, Dailey, Jayem, Niobrara, and Valent soils. Calamus soils are stratified sand and are on bottom land. Dailey and Jayem soils are lower on the landscape than the Orpha soils. Valent and Niobrara soils are higher on the landscape. Niobrara soils are also shallow over sandstone. Dailey and Valent soils formed in eolian sand and do not have sandstone fragments. Jayem soils are coarse-loamy and formed in loamy and sandy eolian material.

Typical pedon of Orpha loamy fine sand, in an area of Orpha-Rock outcrop complex, 20 to 60 percent slopes; 100 feet east and 1,300 feet north of the southwest corner of sec. 9, T. 31 N., R. 41 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; slightly alkaline; clear smooth boundary.

AC—6 to 10 inches; light brownish gray (10YR 6/2) sand, brown (10YR 4/3) moist; single grain; loose; slightly alkaline; clear wavy boundary.

C1—10 to 32 inches; light gray (10YR 7/2) sand, brown (10YR 5/3) moist; single grain; loose; 2 percent, by volume, sandstone gravel; slightly alkaline; clear wavy boundary.

C2—32 to 48 inches; light gray (2.5Y 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; single grain; loose; 9 percent, by volume, sandstone gravel; slight effervescence; moderately alkaline; gradual wavy boundary.

C3—48 to 60 inches; light gray (2.5Y 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; single grain; loose; 12 percent, by volume, sandstone gravel; slight effervescence; moderately alkaline.

The depth to carbonates ranges from 30 to more than 60 inches. The content of sandstone gravel in the control section is less than 15 percent, by volume.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. Texture is loamy fine sand, loamy sand, fine sand, or sand. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 7 moist), and chroma of 2 to 4. It is dominantly sand, but the range includes loamy sand or fine sand.

Ponderosa Series

The Ponderosa series consists of very deep, well drained, moderately rapidly permeable soils on valley sides and foot slopes. These soils formed in sandy and loamy sediments weathered from calcareous sandstone. Slopes range from 3 to 60 percent.

Ponderosa soils are commonly adjacent to Bridget, Busher, Oglala, Tassel, and Vetal soils. Bridget soils are on stream terraces and foot slopes and are coarse-silty. Busher and Oglala soils are on side slopes of uplands and have calcareous sandstone at a depth of 40 to 60 inches. Tassel soils are on knolls, narrow ridgetops, and shoulders and are shallow over calcareous sandstone. Vetal soils are in upland valleys and swales and on toe slopes and have a mollic epipedon more than 20 inches thick.

Typical pedon of Ponderosa very fine sandy loam, in an area of Ponderosa-Tassel-Vetal complex, 6 to 30 percent slopes; 2,000 feet south and 300 feet west of the northeast corner of sec. 4, T. 33 N., R. 44 W.

A—0 to 12 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear wavy boundary.

AC—12 to 21 inches; pale brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; 2 percent, by volume, sandstone gravel; slightly alkaline; clear wavy boundary.

C1—21 to 27 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; 4 percent, by volume, sandstone gravel; slightly alkaline; gradual wavy boundary.

C2—27 to 60 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; single grain; soft, very friable; 7 percent, by volume, sandstone gravel; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 20 inches. In some pedons the dark surface layer is more than 20 inches thick, but the organic carbon is less than 0.6 percent. The depth to free carbonates ranges from 15 to more than 60 inches. The control section averages more than 35 percent very fine sand and 2 to 15 percent, by volume, sandstone gravel.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is very fine sandy loam or loamy very fine sand. The AC horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4. It is very fine sandy loam or loamy very fine sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is loamy very fine sand or very fine sandy loam.

Rosebud Series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from calcareous sandstone. Slopes range from 1 to 3 percent.

Rosebud soils are commonly adjacent to Alliance, Canyon, Duroc, Oglala, and Satanta soils. Alliance soils have sandstone at a depth of 40 to 60 inches and are in landscape positions similar to those of the Rosebud soils. Canyon soils do not have a mollic epipedon and have sandstone at a depth of 6 to 20 inches. These soils are higher on the landscape than the Rosebud soils. Duroc soils are very deep and have a mollic epipedon more than 20 inches thick. These soils are lower on the landscape than the Rosebud soils. Oglala soils do not have an argillic horizon and have sandstone at a depth of 40 to 60 inches. These soils are in landscape positions similar to those of the Rosebud soils. Satanta soils do not have sandstone within a depth of 60 inches and are in landscape positions similar to those of the Rosebud soils.

Typical pedon of Rosebud loam, 1 to 3 percent slopes, 1,900 feet east and 1,600 feet south of the northwest corner of sec. 20, T. 34 N., R. 42 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

Bt1—9 to 13 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; clay films on faces of peds; neutral; clear wavy boundary.

Bt2—13 to 17 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk—17 to 21 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; soft, very friable; 2 percent, by volume, sandstone gravel; soft masses of calcium carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C—21 to 32 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; soft, very friable; 10 percent, by volume, sandstone gravel; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—32 to 60 inches; white (10YR 8/2), calcareous sandstone; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 14 to 26 inches, and the depth to the Cr horizon ranges from 20 to 40 inches. The depth to free carbonates ranges from 10 to 25 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is dominantly clay loam, but the range includes loam. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3. It is dominantly loam, but the range includes sandy clay loam, sandy loam, and very fine sandy loam.

Satanta Series

The Satanta series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loamy eolian material. Slopes range from 0 to 15 percent.

Satanta soils are commonly adjacent to Busher, Dailey, Jayem, Keya, and Tuthill soils. Busher, Dailey, and Jayem soils have more sand in the control section than the Satanta soils and are in similar landscape positions. Busher soils have sandstone at a depth of 40 to 60 inches. Keya soils have a mollic epipedon more than 20 inches thick and are lower on the landscape than the Satanta soils. Tuthill soils have contrasting sandy material in the lower part of the profile and are in landscape positions similar to those of the Satanta soils.

Typical pedon of Satanta fine sandy loam, 0 to 3 percent slopes, 1,150 feet south and 150 feet east of the northwest corner of sec. 20, T. 26 N., R. 46 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure parting to weak very fine granular; slightly hard, very friable; neutral; abrupt smooth boundary.

A—9 to 14 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; clear smooth boundary.

Bt1—14 to 23 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure parting to moderate fine subangular blocky; hard, firm; clay films on faces of peds; neutral; clear smooth boundary.

Bt2—23 to 29 inches; pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, firm; clay films on faces of peds; neutral; clear smooth boundary.

Bk—29 to 35 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—35 to 46 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—46 to 60 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to free carbonates ranges from 15 to 36 inches. The content of gravel throughout is 0 to 10 percent, by volume.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam and very fine sandy loam. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly sandy clay loam, but the range includes loam or clay loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly very fine sandy loam and fine sandy loam, but the range includes loam. Below a depth of 40 inches the C horizon ranges from loam to loamy fine sand.

Tassel Series

The Tassel series consists of shallow, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy material weathered from calcareous sandstone. Slopes range from 9 to 70 percent.

Tassel soils are commonly adjacent to Busher and Ponderosa soils. Busher soils have a mollic epipedon and have sandstone at a depth of 40 to 60 inches. These soils are lower on the landscape than the Tassel soils. Ponderosa soils have a mollic epipedon, have sandstone below a depth of 60 inches, and are leached of carbonates to a depth of 15 inches or more. They are lower on the landscape than the Tassel soils.

Typical pedon of Tassel fine sandy loam, in an area of Busher-Tassel complex, 6 to 30 percent slopes; 1,000 feet south and 950 feet east of the northwest corner of sec. 8, T. 28 N., R. 46 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; slightly alkaline; clear smooth boundary.

C—3 to 10 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; 10 percent, by volume, sandstone gravel; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—10 to 60 inches; white (10YR 8/2), calcareous sandstone; violent effervescence.

The depth to free carbonates ranges from 0 to 3 inches. The depth to the Cr horizon ranges from 6 to 20 inches.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loamy fine sand. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam, very fine sandy loam, and loamy very fine sand.

Thirtynine Series

The Thirtynine series consists of very deep, well drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from siltstone. Slopes range from 1 to 9 percent.

Thirtynine soils are commonly adjacent to Bridget, Epping, McCook, and Mitchell soils. Bridget soils are lower on the landscape than the Thirtynine soils. Bridget and Mitchell soils have less clay in the control section than the Thirtynine soils. Epping soils are shallow over bedded siltstone and are higher on the landscape than the Thirtynine soils. McCook soils are on bottom land and are stratified. Mitchell soils are in landscape positions similar to those of the Thirtynine soils.

Typical pedon of Thirtynine loam, 6 to 9 percent slopes, 1,700 feet north and 300 feet east of the southwest corner of sec. 1, T. 34 N., R. 46 W.

A—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, friable; neutral; clear wavy boundary.

Bt1—8 to 13 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; thin clay films on faces of peds; neutral; clear wavy boundary.

Bt2—13 to 21 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate coarse prismatic structure parting to

moderate medium subangular blocky; hard, firm; thin patchy clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bk—21 to 25 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; soft, friable; few fine filaments of carbonates; violent effervescence; moderately alkaline; gradual wavy boundary.

C—25 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The depth to free carbonates ranges from 15 to 28 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. The Bt horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 to 4. It is dominantly silty clay loam, loam, or silt loam. The content of clay ranges from 20 to 35 percent. The C horizon has hue of 10YR or 7.5YR, value of 7 or 8 (5 or 6 moist), and chroma of 2 to 4. It is silt loam, loam, or very fine sandy loam.

Tryon Series

The Tryon series consists of very deep, poorly drained and very poorly drained, rapidly permeable soils in sandhill valleys. They formed in eolian sand and sandy alluvium. Slopes range from 0 to 1 percent.

Tryon soils are commonly adjacent to Els, Ipage, and Marlake soils. Els soils are somewhat poorly drained and are higher on the landscape than the Tryon soils. Ipage soils are moderately well drained and have more sand in the solum than the Tryon soils. These soils are higher on the landscape. Marlake soils are lower on the landscape than the Tryon soils and have water on the surface for most of the growing season.

Typical pedon of Tryon fine sandy loam, 0 to 1 percent slopes, 1,900 feet north and 750 feet west of the southeast corner of sec. 20, T. 28 N., R. 41 W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, black (10YR 2/1) moist; moderate fine granular structure; soft, very friable; moderately acid; gradual smooth boundary.

C1—6 to 15 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; slightly acid; gradual smooth boundary.

C2—15 to 25 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; many coarse and medium prominent yellowish brown (10YR 5/6 moist) mottles; single grain; soft, very friable; moderately acid; gradual smooth boundary.

C3—25 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; slightly acid.

Free carbonates, if they occur, are in the surface layer.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loamy fine sand, fine sand, and loam. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3. It is sand, fine sand, loamy sand, or loamy fine sand. In some pedons strata of dark fine sandy loam or loam are below a depth of 40 inches.

Tuthill Series

The Tuthill series consists of very deep, well drained soils on uplands. These soils formed in sandy and loamy material of mixed origin. Permeability is moderate in the subsoil and rapid in the underlying material (fig. 24). Slopes range from 0 to 11 percent.

Tuthill soils are commonly adjacent to Jayem, Keya, Satanta, and Vetal soils. Jayem soils have less silt and clay in the control section than the Tuthill soils and are in similar landscape positions. Keya and Vetal soils have a mollic epipedon more than 20 inches thick and are lower on the landscape than the Tuthill soils. Satanta soils do not have contrasting sandy material in the lower part of the profile and are in landscape positions similar to those of the Tuthill soils.

Typical pedon of Tuthill fine sandy loam, 3 to 6 percent slopes, 350 feet west and 900 feet north of the southeast corner of sec. 24, T. 32 W., R. 41 W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to moderate fine granular; soft, very friable; slightly alkaline; clear smooth boundary.

Bt1—9 to 14 inches; dark brown (10YR 4/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to moderate medium subangular blocky; hard, firm; thin patchy clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—14 to 21 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; strong coarse prismatic structure parting to moderate medium

subangular blocky; hard, firm; thin patchy clay films on faces of peds; neutral; clear wavy boundary.

2C1—21 to 24 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; neutral; gradual wavy boundary.

2C2—24 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grain; loose; neutral.

The depth to free carbonates ranges from 36 to more than 60 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to the contrasting 2C horizon ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly fine sandy loam or loamy fine sand. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is dominantly sandy clay loam, but the range includes fine sandy loam, clay loam, loam, and sandy loam in which the content of clay ranges from 18 to 27 percent. The 2C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It is fine sand, loamy sand, or loamy fine sand. In some pedons strata of loam or sandy loam are at a depth of 40 to 60 inches.

Valent Series

The Valent series consists of very deep, excessively drained, rapidly permeable soils in the sandhills. These soils formed in eolian sand (fig. 25). Slopes range from 0 to 60 percent.

Valent soils are commonly adjacent to Dailey, Els, Hoffland, Ipage, and Wildhorse soils. Dailey soils have a mollic epipedon and are lower on the landscape than the Valent soils. Els soils are somewhat poorly drained and are lower on the landscape than the Valent soils. Hoffland soils are poorly drained and very poorly drained and are lower on the landscape than the Valent soils. Ipage soils are moderately well drained and are lower on the landscape than the Valent soils. Wildhorse soils are very strongly alkaline and are lower on the landscape than the Valent soils.

Typical pedon of Valent fine sand, rolling, 1,600 feet north and 1,800 feet west of the southeast corner of sec. 10, T. 27 N., R. 44 W.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C—4 to 60 inches; pale brown (10YR 6/3) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; slightly alkaline.

Reaction is neutral or slightly alkaline throughout the profile.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2. It is dominantly fine sand, but the range includes loamy fine sand. Some pedons have an AC horizon. The C horizon has value of 5 to 7 (5 or 6 moist) and chroma of 2 to 4. It is dominantly fine sand, but the range includes loamy fine sand and sand.

Valentine Series

The Valentine series consists of very deep, excessively drained, rapidly permeable soils in the sandhills. These soils formed in eolian sand. Slopes range from 3 to 60 percent.

Valentine soils are commonly adjacent to Els, Ipage, and Tryon soils. The adjacent soils are lower on the landscape than the Valentine soils. Els soils are somewhat poorly drained, Ipage soils are moderately well drained, and Tryon soils are poorly drained and very poorly drained.

Typical pedon of Valentine fine sand, rolling, 2,000 feet north and 2,200 feet west of the southeast corner of sec. 27, T. 35 N., R. 41 W.

A—0 to 6 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; slightly acid; gradual wavy boundary.

C—6 to 60 inches; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; single grain; loose; neutral.

Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly fine sand, but the range includes loamy fine sand. The AC horizon, if it occurs, has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4. It is dominantly fine sand, but the range includes loamy fine sand.

Vetal Series

The Vetal series consists of very deep, well drained, moderately rapidly permeable soils on foot slopes and in upland swales. These soils formed in loamy and sandy alluvium and eolian sediments. Slopes range from 0 to 9 percent.

Vetal soils are commonly adjacent to Busher, Dailey, Jayem, Ponderosa, and Tuthill soils. The adjacent soils have a mollic epipedon less than 20 inches thick and are higher on the landscape than the Vetal soils. Busher soils have soft, calcareous sandstone at a depth of 40 to 60 inches. Dailey soils are sandy. Tuthill soils have more clay in the profile than the Vetal soils.

Typical pedon of Vetal fine sandy loam, 0 to 2 percent slopes, 150 feet east and 2,400 feet south of the northwest corner of sec. 8, T. 28 N., R. 46 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A1—7 to 17 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; neutral; clear smooth boundary.

A2—17 to 31 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; clear wavy boundary.

AC—31 to 43 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; neutral; clear wavy boundary.

C—43 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; 2 percent, by volume, sandstone gravel; strong effervescence; slightly alkaline.

The thickness of the solum and the mollic epipedon range from 24 to 50 inches. Free carbonates are below a depth of 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly fine sandy loam or loamy fine sand, but the range includes very fine sandy loam. The AC horizon has value of 4 or 5 (3 or 4 moist) and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes sandy loam, loam, and very fine sandy loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, sandy loam, or very fine sandy loam. Sand, fine sand, loamy sand, or loamy fine sand is common below a depth of 40 inches.

Wildhorse Series

The Wildhorse series consists of very deep, somewhat poorly drained, rapidly permeable soils in sandhill valleys. These soils formed in eolian sand and sandy alluvium. Slopes range from 0 to 3 percent.

Wildhorse soils are commonly adjacent to Crowther, Els, Hoffland, and Ipage, calcareous, soils. Crowther and Hoffland soils have a calcic horizon, are poorly drained and very poorly drained, and are lower on the landscape than the Wildhorse soils. Els soils are not affected by sodium and other salts and are in landscape positions similar to those of the Wildhorse soils. Ipage, calcareous, soils are better drained than the Wildhorse soils and are higher on the landscape.

Typical pedon of Wildhorse fine sand, 0 to 3 percent slopes, 1,650 feet west and 2,450 feet north of the southeast corner of sec. 28, T. 27 N., R. 44 W.

A—0 to 5 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; percentage of exchangeable sodium—48; sodium adsorption ratio 42; strong effervescence; very strongly alkaline; clear smooth boundary.

AC—5 to 10 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; percentage of exchangeable sodium—31; sodium adsorption ratio 17; violent effervescence; very strongly alkaline; clear smooth boundary.

C1—10 to 24 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; common medium prominent very dark grayish brown (2.5Y 3/2 moist) mottles; single grain; loose; percentage of exchangeable sodium—12; sodium adsorption ratio 4; violent effervescence; very strongly alkaline; gradual smooth boundary.

C2—24 to 42 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common medium prominent very dark grayish brown (2.5Y 3/2 moist) mottles; single grain; loose; percentage of exchangeable sodium—15; sodium adsorption ratio 9; strong effervescence; very strongly alkaline; clear smooth boundary.

C3—42 to 60 inches; light gray (10YR 6/1) fine sand, gray (10YR 5/1) moist; many coarse prominent olive gray (5Y 5/2 moist) mottles; single grain; loose; percentage of exchangeable sodium—8; sodium adsorption ratio 7; strongly alkaline.

The percentage of exchangeable sodium is more than 15 and the sodium adsorption ratio is more than 13 in half or more of the upper 20 inches of the profile.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy fine sand. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 1 or 2. It is dominantly fine sand, but the range includes sand and loamy fine sand. In some pedons the C horizon has strata of loamy fine sand and fine sandy loam.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Generally, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Climate

Climate has had an important effect on soil formation in Sheridan County by its direct effect on the parent material and its indirect effect on vegetation and micro-organisms.

The climatic factors that affect soil formation are rainfall, fluctuating temperatures, and wind. Runoff of rainwater removes, relocates, and sorts the soil material. The wind removes, sorts, and deposits the soil material. The extensive deposits of eolian sand in the county are examples of the importance of the wind as a soil-forming agent. Alternating periods of freezing and thawing and of wetting and drying speed the chemical and mechanical weathering processes and loosen and mix the soil material, thus improving the physical condition of the soil.

Micro-organisms in the soil are the most active at a defined temperature range. Thus, the rate at which organic matter is decomposed into humus varies with the climatic conditions. Changes in temperature and moisture activate the weathering of parent material, which results in chemical and physical changes in the soil.

Because the humidity in Sheridan County is generally low, the soil loses a fairly high amount of water through evaporation and transpiration. Thus, the soil has less decomposition of organic matter and chemical weathering.

Parent Material

Parent material is the weathered or partly weathered material in which a soil forms. It affects the chemical and mineralogical composition of the soil. The soils in Sheridan County formed in eolian sand, loess, material weathered from sandstone, siltstone, shale, and interbedded chalk and shale, and alluvium or colluvium.

Eolian sand is the most extensive parent material in the county and the dominant parent material in the sandhills. It is material that was deposited by the wind and consisting mainly of quartz and feldspar minerals. The thickness of the sand deposit ranges from 1 foot to several hundred feet. Except for a slightly darkened layer at the surface, soils formed in eolian sand show little horizon development. Dailey, Ipage, and Valent soils formed in eolian sand.

Loess is a major parent material of many of the soils north of the sandhills. This windblown material is believed to be the fine sediments blown out of ancient river and stream valleys. It is a brownish and yellowish deposit ranging in thickness from 1 to about 8 feet. Alliance and Keith soils formed in loess and generally have good horizon development.

Material weathered from sandstone is a major parent material of the soils north of the sandhills and through the Pine Ridge area. The soils formed in place or they formed in material that was locally reworked and transported by the wind. These deposits range in thickness from a few inches to several feet. Except for a slightly darkened surface layer, most of the soils that formed in this material have weakly developed horizons. Busher, Canyon, Oglala, and Ponderosa

soils formed in this material. Most of the material in Jayem soils also weathered from sandstone, but it has been locally reworked by the wind and possibly contains material from other sources.

Material weathered from siltstone, shale, and interbedded chalk and shale are common parent materials in the northwestern part of the county. The weathered material ranges from a few inches to several feet thick. Epping, Kadoka, Mitchell, and Thirtynine soils formed in material weathered from siltstone. Bufton soils formed in material weathered from shale and have a higher content of clay. Enning, Manvel, and Minnequa soils formed in material weathered from interbedded chalk and shale.

Alluvium is material that has been deposited by water. It consists of loamy and sandy material washed from the higher areas and deposited on bottom land along drainageways. The deposits range in thickness from a few feet to more than 20 feet. They are young and, except for the dark surface layer, generally do not have clearly defined horizons. Almeria, Beckton, Bolent, Lute, and McCook soils formed in alluvium. Beckton and Lute soils have a well developed subsoil.

Colluvium consists of material that has been moved downslope from the higher areas and accumulated at the base of slopes, along small streams, and in swales through the action of gravity, soil creep, and local wash. These deposits are generally less than 10 feet thick. Except for the dark surface layer, soils formed in this material have only weakly developed soil horizons. Duroc soils formed in this material.

In some areas of the county, soils formed in a mixture of different types of parent material or in areas where younger parent material was deposited over older parent material. Examples of soils formed in more than one type of parent material are Johnstown soils, which formed in loess and loamy sediments deposited over gravelly sands.

Plant and Animal Life

Plants, burrowing animals, micro-organisms, earthworms, and other living organisms affect soil formation. The soils in Sheridan County formed mainly under a mixture of short, mid, and tall grasses. Every year, the grasses grew and their fibrous roots penetrated the upper few feet of the soil. In time, a dark layer formed on the surface. This layer gradually thickened as more organic matter decayed into humus. Because of the additional humus, the soils developed a granular structure and good tilth. Plant roots bring nutrients to the surface. Calcium is particularly helpful in keeping the soils more porous. Organic acids form during the decomposition of organic material. In solution, these acids hasten the leaching process.

Micro-organisms act on the undecomposed organic matter and help change it into humus. Some bacteria take in nitrogen from the air. As they die, they release nitrogen available to plants. Other bacteria oxidize sulphur, which then becomes available to plants. The plants, in turn, complete the cycle by producing more organic matter. Other living organisms, such as algae, fungi, protozoa, and actinomycetes, affect the physical and chemical makeup of the soil. Larger animals, such as gophers and moles, and earthworms, millipedes, spiders, and other insects help in mixing the soil and in adding organic matter after they die.

Human activities have a major effect on soil formation. Because of cropping sequences, drainage systems, irrigation, and summer fallow, the relationships among soil, water, and erosion that existed for several thousand years have changed. Removing the grass cover has exposed the fertile surface layer to erosion. Drainage systems have increased chemical activity and weathering in the poorly drained soils. Irrigation and summer fallow have increased the moisture supply and the rates of chemical weathering and water movement.

Relief

Relief influences soil formation mainly through its effect on runoff, erosion, aeration, and drainage. The rate of runoff is more rapid on the steep and very steep soils than on the less sloping soils. Consequently, plant growth generally is less vigorous on the steeper soils, the surface absorbs less water, soil horizons are thinner and less distinct, the lime is not leached to so great a depth as it is in the less sloping soils, and, if all other factors are equal, the hazard of erosion is more severe on the steeper soils.

The nearly level and gently sloping soils on uplands in Sheridan County are characterized by stronger profile development and more distinct horizons than the steeper soils. They absorb more moisture, have less runoff, and water percolates deeper into the profile. Consequently, more leaching of lime, plant nutrients, and clay particles occurs in these soils, and well developed and distinct horizons form. The nearly level and gently sloping Alliance and Satanta soils have fairly well developed profiles.

On steep slopes where runoff is rapid and little moisture penetrates the soil, the rate of soil formation is slower than that in the soils on the gentler slopes. Erosion removes the surface soil almost as fast as it

forms. Lime and other elements are not leached to so great a depth as they are in the less sloping soils. Because the soils on ridges and hilltops are more exposed to air currents than the soils in the lower areas, they are more susceptible to the loss of moisture through evaporation. The steep Canyon and Tassel soils have little evidence of profile development other than a slightly darkened, thin surface layer.

In upland depressions, runoff is slow and the soils receive runoff from the higher areas. Because of the extra moisture, Lodgepole soils have a thick, dark surface layer and good horizon development.

The soils on bottom land have very little relief, but their position on the landscape has an influence on soil development in the young parent material. Some of these soils have a high water table, which affects decomposition of organic matter, soil temperature, and alkalinity. Other soils on bottom land are subject to flooding and to continuous deposition of sediments. All of these influences have an effect on the kind and amount of vegetation and on soil development. The well drained McCook and Munjor soils on bottom land are rarely flooded to frequently flooded. Hoffland and Wildhorse soils on bottom land are affected by alkalinity and a high water table.

The soils in the sandhills, such as Valent soils, are not affected as much by slope, runoff, and internal drainage as by erosion and the resistance of the sandy material to chemical weathering. These soils show little horizon development.

Time

Time is needed for relief, climate, and plant and animal life to change the parent material into a soil. If the parent material has been in place for only a short time, the soils are weakly developed. The degree of profile development depends on the intensity of the soil-forming factors. The distinctness of horizons in the soil profile commonly reflects the length of time that the geological material has been in place.

The time needed for a soil to form depends mainly on the kind of parent material and the climate. The resistance of the parent material to weathering partly determines the length of time that is needed for a soil to form. Generally, soils in warm, humid areas form more rapidly than soils in cool, dry areas.

The maturity of soils is related not only to time but also to the other four soil-forming factors. Soils that do not have a B horizon are commonly considered immature, and soils that have a well developed B horizon are considered mature. The maturity of a soil, however, depends on the interaction of all five soil-forming factors. Thus, the very steep Ponderosa soils, which do not have a B horizon, may be as mature as they can be on their particular slopes and under their particular climate.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for

significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed

waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and are less palatable to livestock.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single*

grain (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-87 at Hay Springs, Nebraska)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	35.3	10.2	22.8	61	-24	0	0.53	0.25	0.80	2	8.2
February----	40.8	15.2	28.0	67	-17	1	.66	.27	.99	2	9.2
March-------	47.2	21.2	34.2	76	-9	7	1.34	.54	2.01	4	11.7
April-------	59.1	31.3	45.2	84	7	53	2.45	1.35	3.42	5	7.1
May---------	69.9	41.8	55.9	90	23	215	3.30	1.71	4.68	6	.5
June--------	80.0	51.2	65.6	99	34	469	3.44	2.06	4.67	7	.1
July--------	88.0	57.4	72.7	104	43	701	3.12	1.87	4.25	5	.0
August------	86.7	55.6	71.2	101	40	654	1.78	.73	2.75	4	.0
September---	76.8	44.6	60.7	97	23	340	1.39	.40	2.26	3	.5
October-----	64.3	33.4	48.8	87	14	94	1.13	.40	1.73	3	2.5
November----	47.2	21.1	34.2	74	-5	4	.75	.35	1.13	2	8.0
December----	38.0	13.3	25.6	65	-18	0	.63	.23	.97	2	9.3
Yearly:											
Average---	61.1	33.0	47.1	---	---	---	---	---	---	---	---
Extreme---	110	-31	---	104	-25	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,537	20.52	15.79	23.42	45	57.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-87 at Hay Springs, Nebraska)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 9	May 20	May 30
2 years in 10 later than--	May 3	May 13	May 25
5 years in 10 later than--	Apr. 21	May 1	May 14
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 23	Sept. 17	Sept. 10
2 years in 10 earlier than--	Sept. 29	Sept. 22	Sept. 15
5 years in 10 earlier than--	Oct. 9	Oct. 1	Sept. 23

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-87 at Hay Springs, Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	146	128	114
8 years in 10	154	136	120
5 years in 10	170	152	132
2 years in 10	185	168	143
1 year in 10	193	176	150

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ac	Alliance loam, 0 to 1 percent slopes	1,630	0.1
AcB	Alliance loam, 1 to 3 percent slopes	16,160	1.0
AcC	Alliance loam, 3 to 6 percent slopes	17,710	1.1
An	Almeria loamy fine sand, channeled, 0 to 2 percent slopes	970	0.1
Bc	Bankard loamy fine sand, channeled, 0 to 2 percent slopes	340	*
Bd	Beckton silt loam, 0 to 2 percent slopes	16,210	1.0
Bf	Bolent loamy fine sand, 0 to 2 percent slopes	2,780	0.2
Bh	Bridget very fine sandy loam, 0 to 1 percent slopes	3,190	0.2
BhB	Bridget very fine sandy loam, 1 to 3 percent slopes	6,160	0.4
Bm	Bridget loam, 0 to 1 percent slopes	4,200	0.3
BnB	Bufton silty clay loam, 1 to 3 percent slopes	1,630	0.1
BnE	Bufton silty clay loam, 9 to 20 percent slopes	2,130	0.1
BoD	Bufton-Orella complex, 3 to 9 percent slopes	2,440	0.2
BsB	Busher fine sandy loam, 0 to 3 percent slopes	2,010	0.1
BsC	Busher fine sandy loam, 3 to 6 percent slopes	6,470	0.4
BsD	Busher fine sandy loam, 6 to 9 percent slopes	6,290	0.4
BvC	Busher-Tassel complex, 0 to 6 percent slopes	3,340	0.2
BvF	Busher-Tassel complex, 6 to 30 percent slopes	14,020	0.9
Ca	Calamus loamy fine sand, 0 to 2 percent slopes	4,100	0.3
Cr	Crowther loam, 0 to 1 percent slopes	1,740	0.1
Cs	Crowther loam, wet, 0 to 1 percent slopes	2,310	0.1
DuB	Dailey loamy fine sand, 0 to 3 percent slopes	45,200	2.9
DuD	Dailey loamy fine sand, 3 to 9 percent slopes	40,860	2.6
Dw	Duroc loam, 0 to 1 percent slopes	4,850	0.3
DwB	Duroc loam, 1 to 3 percent slopes	7,010	0.4
Ec	Els fine sand, calcareous, 0 to 2 percent slopes	4,200	0.3
Ef	Els, calcareous-Hoffland complex, 0 to 2 percent slopes	6,840	0.4
EgB	Els, calcareous-Ipage complex, 0 to 3 percent slopes	12,960	0.8
En	Els, calcareous-Tryon complex, 0 to 2 percent slopes	1,100	0.1
Es	Elsmere loamy fine sand, 0 to 2 percent slopes	2,440	0.2
EuE	Enning-Minnequa complex, 6 to 20 percent slopes	3,340	0.2
EvG	Enning-Rock outcrop complex, 9 to 40 percent slopes	9,420	0.6
EwG	Epping-Badland complex, 3 to 60 percent slopes	3,970	0.3
Fu	Fluvaquents, sandy, 0 to 1 percent slopes	300	*
Gg	Gannett loam, 0 to 1 percent slopes	1,070	0.1
Gh	Gannett loam, wet, 0 to 1 percent slopes	1,410	0.1
Hm	Hoffland fine sandy loam, 0 to 1 percent slopes	1,680	0.1
Hn	Hoffland fine sandy loam, wet, 0 to 1 percent slopes	2,740	0.2
IpB	Ipage fine sand, 0 to 3 percent slopes	14,380	0.9
JgB	Jayem fine sandy loam, 0 to 3 percent slopes	7,030	0.4
JgC	Jayem fine sandy loam, 3 to 6 percent slopes	7,680	0.5
JgD	Jayem fine sandy loam, 6 to 9 percent slopes	990	0.1
Jo	Johnstown loam, 0 to 1 percent slopes	4,510	0.3
Kd	Kadoka silt loam, 0 to 2 percent slopes	970	0.1
KdC	Kadoka silt loam, 2 to 6 percent slopes	980	0.1
KdD	Kadoka silt loam, 6 to 9 percent slopes	4,190	0.3
Ke	Keith loam, 0 to 1 percent slopes	9,660	0.6
KeB	Keith loam, 1 to 3 percent slopes	11,970	0.8
KeC	Keith loam, 3 to 6 percent slopes	2,340	0.1
Kg	Keith loam, gravelly substratum, 0 to 1 percent slopes	9,580	0.6
KgB	Keith loam, gravelly substratum, 1 to 3 percent slopes	1,300	0.1
KgC	Keith loam, gravelly substratum, 3 to 6 percent slopes	280	*
Ky	Keya loam, 0 to 2 percent slopes	29,020	1.8
La	Las Animas loam, 0 to 2 percent slopes	1,020	0.1
Lg	Lodgepole silt loam, 0 to 1 percent slopes	1,290	0.1
Lu	Lute loam, 0 to 2 percent slopes	5,800	0.4
MbC	Manvel silty clay loam, 2 to 6 percent slopes	1,860	0.1
Mc	Marlake fine sandy loam, 0 to 1 percent slopes	6,580	0.4
Mk	McCook loam, 0 to 2 percent slopes	4,320	0.3
Mm	McCook loam, channeled, 0 to 2 percent slopes	2,130	0.1
MxF	Mitchell-Epping complex, 9 to 30 percent slopes	5,390	0.3
My	Munjor fine sandy loam, 0 to 2 percent slopes	3,250	0.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Mz	Munjor fine sandy loam, channeled, 0 to 2 percent slopes	5,530	0.3
OhC	Oglala-Canyon complex, 3 to 6 percent slopes	24,530	1.6
OhD	Oglala-Canyon complex, 6 to 11 percent slopes	54,430	3.4
OhF	Oglala-Canyon complex, 11 to 30 percent slopes	22,650	1.4
On	Onita silty clay loam, 0 to 1 percent slopes	460	*
OrF	Orella silty clay loam, 3 to 30 percent slopes	1,190	0.1
OvD	Orpha loamy fine sand, 3 to 9 percent slopes	1,060	0.1
OwF	Orpha-Niobrara complex, 9 to 30 percent slopes	13,020	0.8
OxG	Orpha-Rock outcrop complex, 20 to 60 percent slopes	14,300	0.9
PoC	Ponderosa very fine sandy loam, 3 to 6 percent slopes	1,890	0.1
PoD	Ponderosa very fine sandy loam, 6 to 9 percent slopes	5,010	0.3
PtF	Ponderosa-Tassel-Vetal complex, 6 to 30 percent slopes	43,370	2.7
RoB	Rosebud loam, 1 to 3 percent slopes	5,240	0.3
SnB	Satanta fine sandy loam, 0 to 3 percent slopes	12,760	0.8
SnC	Satanta fine sandy loam, 3 to 6 percent slopes	12,740	0.8
SnD	Satanta fine sandy loam, 6 to 11 percent slopes	3,090	0.2
SsD	Satanta-Canyon complex, 6 to 11 percent slopes	15,750	1.0
SsE	Satanta-Canyon complex, 11 to 20 percent slopes	3,450	0.2
TfG	Tassel-Rock outcrop complex, 9 to 70 percent slopes	9,350	0.6
TgG	Tassel-Ponderosa-Rock outcrop association, 9 to 70 percent slopes	80,340	5.1
ThB	Thirtynine loam, 1 to 3 percent slopes	3,220	0.2
ThC	Thirtynine loam, 3 to 6 percent slopes	4,080	0.3
ThD	Thirtynine loam, 6 to 9 percent slopes	7,110	0.4
To	Tryon fine sandy loam, 0 to 1 percent slopes	5,010	0.3
Tp	Tryon fine sandy loam, wet, 0 to 1 percent slopes	2,670	0.2
TtB	Tuthill loamy fine sand, 0 to 3 percent slopes	5,530	0.3
TtD	Tuthill loamy fine sand, 3 to 9 percent slopes	16,150	1.0
TwB	Tuthill fine sandy loam, 0 to 3 percent slopes	22,470	1.4
TwC	Tuthill fine sandy loam, 3 to 6 percent slopes	24,400	1.5
TwD	Tuthill fine sandy loam, 6 to 11 percent slopes	5,360	0.3
VaB	Valent fine sand, 0 to 3 percent slopes	23,570	1.5
VaD	Valent fine sand, 3 to 9 percent slopes	120,630	7.6
VaE	Valent fine sand, rolling	209,270	13.2
VaF	Valent complex, rolling and hilly	159,360	10.1
VaG	Valent fine sand, hilly	71,880	4.5
VeB	Valent loamy fine sand, 0 to 3 percent slopes	3,110	0.2
VeD	Valent loamy fine sand, 3 to 9 percent slopes	8,480	0.5
VnD	Valentine fine sand, 3 to 9 percent slopes	10,770	0.7
VnE	Valentine fine sand, rolling	13,900	0.9
VnF	Valentine complex, rolling and hilly	34,610	2.2
VnG	Valentine fine sand, hilly	7,580	0.5
VsB	Vetal loamy fine sand, 0 to 3 percent slopes	4,850	0.3
Vt	Vetal fine sandy loam, 0 to 2 percent slopes	16,300	1.0
WrB	Wildhorse fine sand, 0 to 3 percent slopes	9,970	0.6
WsB	Wildhorse-Hoffland complex, 0 to 3 percent slopes	18,880	1.2
WtB	Wildhorse-Ipage, calcareous complex, 0 to 3 percent slopes	27,370	1.7
	Water areas more than 40 acres in size	12,470	0.8
	Water areas less than 40 acres in size	1,289	0.1
	Total	1,582,189	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
Ac	Alliance loam, 0 to 1 percent slopes (where irrigated)
AcB	Alliance loam, 1 to 3 percent slopes (where irrigated)
AcC	Alliance loam, 3 to 6 percent slopes (where irrigated)
Bh	Bridget very fine sandy loam, 0 to 1 percent slopes (where irrigated)
BhB	Bridget very fine sandy loam, 1 to 3 percent slopes (where irrigated)
Bm	Bridget loam, 0 to 1 percent slopes (where irrigated)
BsB	Busher fine sandy loam, 0 to 3 percent slopes (where irrigated)
BsC	Busher fine sandy loam, 3 to 6 percent slopes (where irrigated)
Dw	Duroc loam, 0 to 1 percent slopes (where irrigated)
DwB	Duroc loam, 1 to 3 percent slopes (where irrigated)
JgB	Jayem fine sandy loam, 0 to 3 percent slopes (where irrigated)
JgC	Jayem fine sandy loam, 3 to 6 percent slopes (where irrigated)
Jo	Johnstown loam, 0 to 1 percent slopes (where irrigated)
Kd	Kadoka silt loam, 0 to 2 percent slopes (where irrigated)
KdC	Kadoka silt loam, 2 to 6 percent slopes (where irrigated)
Ke	Keith loam, 0 to 1 percent slopes (where irrigated)
KeB	Keith loam, 1 to 3 percent slopes (where irrigated)
KeC	Keith loam, 3 to 6 percent slopes (where irrigated)
Kg	Keith loam, gravelly substratum, 0 to 1 percent slopes (where irrigated)
KgB	Keith loam, gravelly substratum, 1 to 3 percent slopes (where irrigated)
KgC	Keith loam, gravelly substratum, 3 to 6 percent slopes (where irrigated)
Ky	Keya loam, 0 to 2 percent slopes (where irrigated)
La	Las Animas loam, 0 to 2 percent slopes (where drained)
Mk	McCook loam, 0 to 2 percent slopes (where irrigated)
My	Munjor fine sandy loam, 0 to 2 percent slopes (where irrigated)
PoC	Ponderosa very fine sandy loam, 3 to 6 percent slopes (where irrigated)
RoB	Rosebud loam, 1 to 3 percent slopes (where irrigated)
SnB	Satanta fine sandy loam, 0 to 3 percent slopes (where irrigated)
SnC	Satanta fine sandy loam, 3 to 6 percent slopes (where irrigated)
ThB	Thirtynine loam, 1 to 3 percent slopes (where irrigated)
ThC	Thirtynine loam, 3 to 6 percent slopes (where irrigated)
TwB	Tuthill fine sandy loam, 0 to 3 percent slopes (where irrigated)
TwC	Tuthill fine sandy loam, 3 to 6 percent slopes (where irrigated)
Vt	Vetal fine sandy loam, 0 to 2 percent slopes (where irrigated)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
Ac---------- Alliance	IIc	I	---	150	43	---	1.8	5.6	---	38
AcB---------- Alliance	IIe	IIe	---	145	39	---	1.6	5.2	---	34
AcC---------- Alliance	IIIe	IIIe	---	130	34	---	1.3	4.7	---	32
An---------- Almeria	VIw	---	---	---	---	---	---	---	---	---
Bc---------- Bankard	VIw	---	---	---	---	---	---	---	---	---
Bd---------- Beckton	IVs	IVs	---	---	---	---	---	---	---	---
Bf---------- Bolent	IVw	IVw	---	80	---	---	1.4	3.4	---	---
Bh---------- Bridget	IIc	IIe	---	145	40	---	1.5	5.0	---	---
BhB---------- Bridget	IIe	IIe	---	140	39	---	1.4	4.6	---	---
Bm---------- Bridget	IIc	I	---	150	40	---	1.6	5.2	---	35
BnB---------- Bufton	IIIe	IIIe	---	100	30	---	1.5	3.8	---	---
BnE---------- Bufton	VIe	---	---	---	---	---	---	---	---	---
BoD:										
Bufton----------	IVe	IVe	---	80	25	---	1.3	3.4	---	---
Orella----------	VIs	---	---	---	---	---	---	---	---	---
BsB---------- Busher	IIIe	IIe	---	115	34	---	1.2	4.6	---	30
BsC---------- Busher	IIIe	IIIe	---	110	32	---	1.0	4.0	---	26
BsD---------- Busher	IVe	IVe	---	75	25	---	0.8	3.6	---	---
BvC:										
Busher----------	IIIe	IIIe	---	110	32	---	1.0	4.0	---	---
Tassel----------	VIs	---	---	---	---	---	---	---	---	---

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
BvF:										
Busher	VIe	---	---	---	---	---	---	---	---	---
Tassel	VIs	---	---	---	---	---	---	---	---	---
Ca	VIe	IVe	---	100	26	---	1.4	3.8	---	---
Calamus										
Cr, Cs	Vw	---	---	---	---	---	---	---	---	---
Crowther										
DuB	IVe	IVe	---	100	---	---	1.5	4.0	---	28
Dailey										
DuD	VIe	IVe	---	95	---	---	1.0	3.5	---	26
Dailey										
Dw	IIc	I	---	150	45	---	2.0	6.0	---	40
Duroc										
DwB	IIe	IIe	---	145	42	---	1.8	5.4	---	38
Duroc										
Ec	VIe	IVw	---	85	---	---	1.4	2.8	---	---
Els										
Ef:										
Els	VIe	IVw	---	---	---	---	---	---	---	---
Hoffland	Vw	---	---	---	---	---	---	---	---	---
EgB:										
Els	VIe	IVw	---	85	---	---	1.4	2.8	---	---
Ipage	VIe	IVe	---	100	---	---	1.2	3.6	---	---
En:										
Els	VIe	IVw	---	---	---	---	---	---	---	---
Tryon	Vw	---	---	---	---	---	---	---	---	---
Es	IVw	IVw	---	90	---	---	1.7	3.5	---	---
Elsmere										
EuE:										
Enning	VIs	---	---	---	---	---	---	---	---	---
Minnequa	VIe	---	---	---	---	---	---	---	---	---
EvG*:										
Enning	VIIs	---	---	---	---	---	---	---	---	---
Rock outcrop	VIIIs	---	---	---	---	---	---	---	---	---
EwG:										
Epping	VIIs	---	---	---	---	---	---	---	---	---
Badland	VIIIs	---	---	---	---	---	---	---	---	---
Fu	VIIIw	---	---	---	---	---	---	---	---	---
Fluvaquents										

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
Gg, Gh---------- Gannett	Vw	---	---	---	---	---	---	---	---	---
Hm, Hn---------- Hoffland	Vw	---	---	---	---	---	---	---	---	---
IpB---------- Ipage	VIe	IVe	---	100	---	---	1.2	3.6	---	---
JgB---------- Jayem	IIIe	IIe	---	125	38	---	1.3	4.9	---	33
JgC---------- Jayem	IVe	IIIe	---	110	32	---	1.1	4.3	---	28
JgD---------- Jayem	IVe	IVe	---	100	29	---	1.0	4.1	---	---
Jo---------- Johnstown	IIc	I	---	150	44	---	1.8	5.6	---	38
Kd---------- Kadoka	IIc	I	---	150	43	---	1.8	5.6	---	---
KdC---------- Kadoka	IIIe	IIIe	---	125	34	---	1.3	4.7	---	---
KdD---------- Kadoka	IVe	IVe	---	115	33	---	1.0	4.3	---	---
Ke---------- Keith	IIc	I	---	150	44	---	1.8	5.6	---	38
KeB---------- Keith	IIe	IIe	---	145	40	---	1.6	5.2	---	34
KeC---------- Keith	IIIe	IIIe	---	130	34	---	1.3	4.7	---	32
Kg---------- Keith	IIc	I	---	150	44	---	1.8	5.6	---	38
KgB---------- Keith	IIe	IIe	---	145	40	---	1.6	5.2	---	34
KgC---------- Keith	IIIe	IIIe	---	125	34	---	1.3	4.7	---	30
Ky---------- Keya	IIc	I	---	150	43	---	2.0	5.6	---	36
La---------- Las Animas	IIw	IIw	---	100	26	---	1.8	4.1	---	30
Lg---------- Lodgepole	IIIw	IVw	---	90	20	---	2.0	3.8	---	25
Lu---------- Lute	VIs	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
MbC---------- Manvel	IVe	IVe	---	---	---	---	0.9	4.0	---	---
Mc---------- Marlake	VIIIw	---	---	---	---	---	---	---	---	---
Mk---------- McCook	IIc	I	---	150	42	---	2.0	5.6	---	37
Mm---------- McCook	VIw	---	---	---	---	---	---	---	---	---
MxF:										
Mitchell----------	VIe	---	---	---	---	---	---	---	---	---
Epping----------	VIs	---	---	---	---	---	---	---	---	---
My---------- Munjor	IIIe	IIe	---	100	25	---	1.8	4.5	---	---
Mz---------- Munjor	VIw	---	---	---	---	---	---	---	---	---
OhC:										
Oglala----------	IIIe	IIIe	---	105	30	---	1.0	3.9	---	---
Canyon----------	VIs	---	---	---	---	---	---	---	---	---
OhD:										
Oglala----------	IVe	IVe	---	---	26	---	0.8	3.6	---	---
Canyon----------	VIs	---	---	---	---	---	---	---	---	---
OhF:										
Oglala----------	VIe	---	---	---	---	---	---	---	---	---
Canyon----------	VIs	---	---	---	---	---	---	---	---	---
On---------- Onita	IIs	IIs	---	140	43	---	1.8	5.6	---	38
OrF---------- Orella	VIs	---	---	---	---	---	---	---	---	---
OvD---------- Orpha	VIe	IVe	---	---	---	---	---	2.5	---	---
OwF:										
Orpha----------	VIe	---	---	---	---	---	---	---	---	---
Niobrara----------	VIs	---	---	---	---	---	---	---	---	---
OxG*:										
Orpha----------	VIIe	---	---	---	---	---	---	---	---	---
Rock outcrop-------	VIIIs	---	---	---	---	---	---	---	---	---
PoC---------- Ponderosa	IIIe	IIIe	---	---	32	---	1.2	4.2	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
PoD---------- Ponderosa	IVe	IVe	---	---	27	---	1.0	4.0	---	---
PtF*:										
Ponderosa----------	VIe	---	---	---	---	---	---	---	---	---
Tassel----------	VIs	---	---	---	---	---	---	---	---	---
Vetal----------	VIe	---	---	---	---	---	---	---	---	---
RoB---------- Rosebud	IIIe	IIIe	---	130	36	---	1.3	4.8	---	30
SnB---------- Satanta	IIIe	IIe	---	140	40	---	1.7	5.3	---	34
SnC---------- Satanta	IIIe	IIIe	---	130	34	---	1.3	4.8	---	30
SnD---------- Satanta	IVe	IVe	---	120	28	---	1.0	4.1	---	---
SsD:										
Satanta----------	IVe	IVe	---	---	---	---	---	---	---	---
Canyon----------	VIs	---	---	---	---	---	---	---	---	---
SsE:										
Satanta----------	VIe	---	---	---	---	---	---	---	---	---
Canyon----------	VIs	---	---	---	---	---	---	---	---	---
TfG*:										
Tassel----------	VIIs	---	---	---	---	---	---	---	---	---
Rock outcrop-------	VIIIs	---	---	---	---	---	---	---	---	---
TgG*:										
Tassel----------	VIIs	---	---	---	---	---	---	---	---	---
Ponderosa----------	VIe	---	---	---	---	---	---	---	---	---
Rock outcrop-------	VIIIs	---	---	---	---	---	---	---	---	---
ThB---------- Thirtynine	IIe	IIe	---	145	40	---	1.6	5.2	---	---
ThC---------- Thirtynine	IIIe	IIIe	---	130	34	---	1.3	4.7	---	---
ThD---------- Thirtynine	IVe	IVe	---	120	33	---	1.0	4.3	---	---
To, Tp---------- Tryon	Vw	---	---	---	---	---	---	---	---	---
TtB---------- Tuthill	IVe	IIIe	---	115	25	---	1.0	4.0	---	---
TtD---------- Tuthill	VIe	IVe	---	90	---	---	---	3.8	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
TwB---------- Tuthill	IIIe	IIe	---	120	33	---	1.4	4.3	---	---
TwC---------- Tuthill	IIIe	IIIe	---	115	31	---	1.3	4.0	---	---
TwD---------- Tuthill	IVe	IVe	---	95	26	---	1.1	3.2	---	---
VaB---------- Valent	VIe	IVe	---	90	---	---	---	3.2	---	---
VaD---------- Valent	VIe	IVe	---	80	---	---	---	3.0	---	---
VaE---------- Valent	VIe	---	---	---	---	---	---	---	---	---
VaF:										
Valent, rolling----	VIe	---	---	---	---	---	---	---	---	---
Valent, hilly------	VIIe	---	---	---	---	---	---	---	---	---
VaG---------- Valent	VIIe	---	---	---	---	---	---	---	---	---
VeB---------- Valent	VIe	IVe	---	100	---	---	---	3.5	---	---
VeD---------- Valent	VIe	IVe	---	95	---	---	---	3.4	---	---
VnD---------- Valentine	VIe	IVe	---	80	---	---	---	3.2	---	---
VnE---------- Valentine	VIe	---	---	---	---	---	---	---	---	---
VnF:										
Valentine, rolling-	VIe	---	---	---	---	---	---	---	---	---
Valentine, hilly---	VIIe	---	---	---	---	---	---	---	---	---
VnG---------- Valentine	VIIe	---	---	---	---	---	---	---	---	---
VsB---------- Vetal	IIIe	IIIe	---	120	36	---	1.3	4.8	---	32
Vt---------- Vetal	IIe	IIe	---	140	37	---	1.4	5.0	---	34
WrB---------- Wildhorse	VIs	---	---	---	---	---	---	---	---	---
WsB:										
Wildhorse----------	VIs	---	---	---	---	---	---	---	---	---
Hoffland----------	Vw	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Alfalfa hay		Beans, other dry	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu
WtB:										
Wildhorse	VIs	---	---	---	---	---	---	---	---	---
Ipage	VIe	IVe	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	68,740	---	---	---	---
II (N)	119,230	45,820	1,020	460	71,930
(I)	114,310	112,830	1,020	460	---
III (N)	164,442	163,152	1,290	---	---
(I)	112,542	112,542	---	---	---
IV (N)	157,556	136,126	5,220	16,210	---
(I)	411,245	371,388	23,647	16,210	---
V (N)	28,017	---	28,017	---	---
VI (N)	834,168	695,395	8,970	129,803	---
VII (N)	232,773	183,606	---	49,167	---
VIII (N)	32,241	---	6,880	25,361	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Ac, AcB, AcC---- Alliance	Silty - Veg. Zone 2----------	Favorable	3,300	Western wheatgrass----------	20
		Normal	2,500	Blue grama----------	15
		Unfavorable	1,700	Needleandthread----------	15
				Little bluestem----------	10
				Buffalograss----------	5
				Sedge----------	5
				Green needlegrass----------	5
				Big bluestem----------	5
An---------- Almeria	Wetland - Veg. Zone 2---------	Favorable	5,500	Prairie cordgrass----------	30
		Normal	5,000	Northern reedgrass----------	15
		Unfavorable	4,500	Sedge----------	15
				Bluejoint reedgrass----------	15
				Rush----------	10
				Slender wheatgrass----------	5
Bc---------- Bankard	Sandy Lowland - Veg. Zone 2---	Favorable	900	Blue grama----------	30
		Normal	700	Needleandthread----------	10
		Unfavorable	400	Fendler threeawn----------	10
				Prairie sandreed----------	5
				Sand bluestem----------	5
				Sand dropseed----------	5
				Sedge----------	5
				Little bluestem----------	5
				Buffalograss----------	5
Bd---------- Beckton	Saline Lowland - Veg. Zone 2--	Favorable	2,500	Alkali sacaton----------	25
		Normal	1,800	Western wheatgrass----------	15
		Unfavorable	1,000	Blue grama----------	10
				Sedge----------	10
				Slender wheatgrass----------	10
				Inland saltgrass----------	10
				Buffalograss----------	5
Bf---------- Bolent	Subirrigated - Veg. Zone 2----	Favorable	5,500	Big bluestem----------	30
		Normal	5,000	Indiangrass----------	15
		Unfavorable	4,200	Little bluestem----------	15
				Prairie cordgrass----------	10
				Switchgrass----------	10
				Sedge----------	5
Bh, BhB, Bm-------- Bridget	Silty - Veg. Zone 2----------	Favorable	3,300	Needleandthread----------	20
		Normal	2,500	Blue grama----------	15
		Unfavorable	1,700	Western wheatgrass----------	15
				Threadleaf sedge----------	10
				Little bluestem----------	10
				Big bluestem----------	10
				Buffalograss----------	5
				Sideoats grama----------	5
BnB, BnE---------- Bufton	Clayey - Veg. Zone 2----------	Favorable	2,000	Western wheatgrass----------	50
		Normal	1,700	Blue grama----------	15
		Unfavorable	1,100	Threadleaf sedge----------	10
				Green needlegrass----------	10
				Buffalograss----------	5

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
BoD*:					
Bufton	Clayey - Veg. Zone 2	Favorable	2,000	Western wheatgrass	50
		Normal	1,700	Blue grama	15
		Unfavorable	1,100	Threadleaf sedge	10
				Green needlegrass	10
				Buffalograss	5
Orella	Saline Upland - Veg. Zone 2	Favorable	1,000	Western wheatgrass	40
		Normal	700	Blue grama	20
		Unfavorable	400	Buffalograss	10
				Green needlegrass	10
				Sandberg bluegrass	5
				Common pricklypear	5
BsB, BsC, BsD---- Busher	Sandy - Veg. Zone 2	Favorable	3,000	Prairie sandreed	25
		Normal	2,300	Sand bluestem	20
		Unfavorable	1,700	Little bluestem	20
				Needleandthread	10
				Blue grama	10
				Threadleaf sedge	5
BvC*, BvF*:					
Busher	Sandy - Veg. Zone 2	Favorable	3,000	Prairie sandreed	25
		Normal	2,300	Sand bluestem	20
		Unfavorable	1,700	Little bluestem	20
				Needleandthread	10
				Blue grama	10
				Threadleaf sedge	5
Tassel	Shallow Limy - Veg. Zone 2	Favorable	1,500	Little bluestem	20
		Normal	1,100	Blue grama	20
		Unfavorable	700	Needleandthread	15
				Sand bluestem	10
				Western wheatgrass	10
				Sideoats grama	10
				Threadleaf sedge	5
Ca---------- Calamus	Sandy - Veg. Zone 2	Favorable	2,600	Sand bluestem	25
		Normal	2,200	Prairie sandreed	20
		Unfavorable	1,600	Little bluestem	15
				Needleandthread	10
				Blue grama	10
				Switchgrass	5
				Sedge	5
				Indiangrass	5
Cr---------- Crowther	Wet Subirrigated - Veg. Zone 2.	Favorable	5,300	Big bluestem	20
		Normal	4,800	Switchgrass	15
		Unfavorable	4,300	Prairie cordgrass	15
				Indiangrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Cs---------- Crowther	Wetland - Veg. Zone 2	Favorable	5,500	Prairie cordgrass	30
		Normal	5,000	Northern reedgrass	15
		Unfavorable	4,500	Bluejoint reedgrass	15
				Slender wheatgrass	10
				Rush	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
DuB, DuD Dailey	Sandy - Veg. Zone 2	Favorable	3,000	Prairie sandreed	30
		Normal	2,300	Sand bluestem	20
		Unfavorable	1,700	Little bluestem	15
				Needleandthread	15
				Blue grama	10
Dw Duroc	Silty Lowland - Veg. Zone 2	Favorable	3,800	Western wheatgrass	20
		Normal	3,000	Needleandthread	15
		Unfavorable	2,300	Big bluestem	10
				Blue grama	10
				Little bluestem	10
				Prairie junegrass	5
				Threadleaf sedge	5
				Buffalograss	5
DwB Duroc	Silty - Veg. Zone 2	Favorable	3,300	Big bluestem	15
		Normal	2,500	Needleandthread	15
		Unfavorable	1,700	Western wheatgrass	15
				Blue grama	10
				Green needlegrass	10
				Little bluestem	10
				Threadleaf sedge	10
				Buffalograss	5
Ec Els	Subirrigated - Veg. Zone 2	Favorable	4,800	Little bluestem	25
		Normal	4,600	Indiangrass	20
		Unfavorable	4,300	Switchgrass	15
				Big bluestem	10
				Plains bluegrass	5
				Slender wheatgrass	5
				Sedge	5
Ef*:					
Els	Subirrigated - Veg. Zone 2	Favorable	4,800	Little bluestem	25
		Normal	4,600	Indiangrass	20
		Unfavorable	4,300	Switchgrass	15
				Big bluestem	10
				Plains bluegrass	5
				Slender wheatgrass	5
				Sedge	5
Hoffland	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem	20
		Normal	4,800	Switchgrass	15
		Unfavorable	4,300	Prairie cordgrass	15
				Indiangrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
EgB*:					
Els	Subirrigated - Veg. Zone 2	Favorable	4,800	Little bluestem	25
		Normal	4,600	Indiangrass	20
		Unfavorable	4,300	Switchgrass	15
				Big bluestem	10
				Plains bluegrass	5
				Slender wheatgrass	5
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
EgB*:					
Ipage	Sandy Lowland - Veg. Zone 2---	Favorable	3,500	Sand bluestem	25
		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
En*:					
Els	Subirrigated - Veg. Zone 2----	Favorable	4,800	Little bluestem	25
		Normal	4,600	Indiangrass	20
		Unfavorable	4,300	Switchgrass	15
				Big bluestem	10
				Plains bluegrass	5
				Slender wheatgrass	5
				Sedge	5
Tryon	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem	20
		Normal	5,000	Switchgrass	15
		Unfavorable	4,700	Prairie cordgrass	15
				Indiangrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Es	Subirrigated - Veg. Zone 2----	Favorable	5,000	Big bluestem	25
Elsmere		Normal	4,800	Little bluestem	20
		Unfavorable	4,500	Switchgrass	10
				Indiangrass	10
				Prairie cordgrass	10
				Sedge	5
				Plains bluegrass	5
				Slender wheatgrass	5
EuE*:					
Enning	Shallow Limy - Veg. Zone 2----	Favorable	1,900	Little bluestem	30
		Normal	1,600	Sideoats grama	25
		Unfavorable	1,100	Blue grama	15
				Needleandthread	10
				Sedge	10
Minnequa	Limy Upland - Veg. Zone 2-----	Favorable	2,000	Blue grama	20
		Normal	1,700	Big bluestem	20
		Unfavorable	1,500	Western wheatgrass	10
				Needlegrass	10
				Sedge	10
				Sideoats grama	10
				Little bluestem	5
EvG*:					
Enning	Shallow Limy - Veg. Zone 2----	Favorable	1,900	Little bluestem	30
		Normal	1,600	Sideoats grama	25
		Unfavorable	1,100	Blue grama	15
				Needleandthread	10
				Sedge	10
Rock outcrop.					

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
EwG*:					
Epping	Shallow Limy - Veg. Zone 2	Favorable	1,500	Little bluestem	20
		Normal	1,100	Blue grama	15
		Unfavorable	700	Needleandthread	10
				Sideoats grama	10
				Western wheatgrass	10
				Threadleaf sedge	5
				Buffalograss	5
				Prairie sandreed	5
Badland.					
Gg	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Prairie cordgrass	20
Gannett		Normal	5,000	Big bluestem	20
		Unfavorable	4,700	Switchgrass	15
				Indiangrass	10
				Northern reedgrass	5
				Slender wheatgrass	5
				Plains bluegrass	5
Gh	Wetland - Veg. Zone 2	Favorable	5,500	Prairie cordgrass	35
Gannett		Normal	5,300	Northern reedgrass	15
		Unfavorable	5,200	Bluejoint reedgrass	10
				Slender wheatgrass	10
				Plains bluegrass	5
Hm	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem	20
Hoffland		Normal	4,800	Switchgrass	15
		Unfavorable	4,300	Prairie cordgrass	15
				Indiangrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Hn	Wetland - Veg. Zone 2	Favorable	5,500	Prairie cordgrass	30
Hoffland		Normal	5,000	Northern reedgrass	15
		Unfavorable	4,500	Bluejoint reedgrass	15
				Slender wheatgrass	10
				Rush	5
IpB	Sandy Lowland - Veg. Zone 2	Favorable	3,500	Sand bluestem	25
Ipage		Normal	3,200	Little bluestem	20
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Indiangrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
JgB, JgC, JgD	Sandy - Veg. Zone 2	Favorable	3,000	Prairie sandreed	20
Jayem		Normal	2,300	Little bluestem	15
		Unfavorable	1,600	Needleandthread	15
				Sand bluestem	15
				Blue grama	10
				Fringed sagebrush	5
				Sand dropseed	5
				Threadleaf sedge	5
				Western wheatgrass	5
				Switchgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Jo Johnstown	Silty - Veg. Zone 2	Favorable	3,800	Big bluestem	20
		Normal	3,500	Little bluestem	15
		Unfavorable	3,000	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Needleandthread	10
				Switchgrass	5
				Indiangrass	5
Kd, KdC, KdD Kadoka	Silty - Veg. Zone 2	Favorable	3,300	Western wheatgrass	20
		Normal	2,500	Needleandthread	15
		Unfavorable	1,700	Blue grama	15
				Green needlegrass	10
				Big bluestem	10
				Little bluestem	10
				Sideoats grama	10
Ke, KeB, KeC Keith	Silty - Veg. Zone 2	Favorable	3,300	Blue grama	20
		Normal	2,500	Needleandthread	20
		Unfavorable	1,700	Western wheatgrass	15
				Little bluestem	10
				Buffalograss	5
				Sedge	5
				Big bluestem	5
				Sideoats grama	5
				Green needlegrass	5
Kg, KgB, KgC Keith	Silty - Veg. Zone 2	Favorable	3,300	Blue grama	20
		Normal	2,500	Needleandthread	20
		Unfavorable	1,700	Little bluestem	15
				Western wheatgrass	15
				Big bluestem	10
				Green needlegrass	5
				Sideoats grama	5
Ky Keya	Silty - Veg. Zone 2	Favorable	3,700	Green needlegrass	40
		Normal	3,200	Western wheatgrass	15
		Unfavorable	2,200	Big bluestem	10
				Needleandthread	10
				Sideoats grama	10
				Blue grama	5
				Little bluestem	5
La Las Animas	Subirrigated - Veg. Zone 2	Favorable	5,000	Little bluestem	20
		Normal	4,500	Big bluestem	15
		Unfavorable	3,250	Indiangrass	10
				Sedge	10
				Prairie cordgrass	10
				Switchgrass	5
				Kentucky bluegrass	5
				Western wheatgrass	5
				Slender wheatgrass	5
				Plains bluegrass	5
Lg Lodgepole	Clayey Overflow - Veg. Zone 2	Favorable	1,200	Western wheatgrass	40
		Normal	1,000	Blue grama	15
		Unfavorable	700	Green needlegrass	15
				Buffalograss	10
				Sedge	10

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Lu Lute	Saline Subirrigated - Veg. Zone 2.	Favorable Normal Unfavorable	3,300 3,000 2,400	Cordgrass Western wheatgrass Inland saltgrass	35 30 25
MbC Manvel	Limy Upland - Veg. Zone 2	Favorable Normal Unfavorable	1,800 1,500 1,000	Blue grama Needlegrass Sedge Western wheatgrass	25 25 20 15
Mk McCook	Silty Lowland - Veg. Zone 2	Favorable Normal Unfavorable	3,800 2,800 2,300	Western wheatgrass Big bluestem Needleandthread Little bluestem Blue grama Sideoats grama Sedge Switchgrass	20 15 15 10 10 10 5 5
Mm McCook	Silty Overflow - Veg. Zone 2	Favorable Normal Unfavorable	3,000 2,800 2,500	Western wheatgrass Big bluestem Little bluestem Blue grama Sideoats grama Sedge	30 15 15 10 10 5
MxF*:					
Mitchell	Limy Upland - Veg. Zone 2	Favorable Normal Unfavorable	2,800 2,000 1,500	Little bluestem Blue grama Needleandthread Sideoats grama Big bluestem Threadleaf sedge Western wheatgrass Prairie sandreed	20 15 15 10 10 5 5 5
Epping	Shallow Limy - Veg. Zone 2	Favorable Normal Unfavorable	1,000 700 500	Blue grama Needleandthread Threadleaf sedge Sideoats grama Western wheatgrass Little bluestem Buffalograss Prairie sandreed	20 15 10 10 10 10 5 5
My Munjor	Sandy Lowland - Veg. Zone 2	Favorable Normal Unfavorable	3,000 2,300 1,700	Prairie sandreed Sand bluestem Little bluestem Needleandthread Blue grama Sand dropseed Switchgrass Scribner panicum	20 15 15 10 10 5 5 5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Mz	Sandy Lowland - Veg. Zone 2	Favorable	3,000	Prairie sandreed	20
Munjor		Normal	2,300	Sand bluestem	15
		Unfavorable	1,700	Little bluestem	15
				Needleandthread	10
				Blue grama	10
				Sand dropseed	5
				Sedge	5
				Switchgrass	5
				Scribner panicum	5
OhC*, OhD*, OhF*:					
Oglala	Silty - Veg. Zone 2	Favorable	3,300	Western wheatgrass	20
		Normal	2,500	Blue grama	15
		Unfavorable	1,700	Little bluestem	15
				Needleandthread	15
				Green needlegrass	10
				Big bluestem	5
				Sideoats grama	5
				Sedge	5
Canyon	Shallow Limy - Veg. Zone 2	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Threadleaf sedge	10
				Needleandthread	10
				Sideoats grama	5
				Sand bluestem	5
				Bluegrass	5
On	Clayey - Veg. Zone 2	Favorable	3,000	Western wheatgrass	35
Onita		Normal	2,100	Blue grama	15
		Unfavorable	1,200	Green needlegrass	10
				Sedge	10
				Big bluestem	5
				Sideoats grama	5
				Buffalograss	5
OrF	Saline Upland - Veg. Zone 2	Favorable	1,000	Western wheatgrass	40
Orella		Normal	700	Blue grama	20
		Unfavorable	400	Buffalograss	10
				Green needlegrass	10
				Sandberg bluegrass	5
				Common pricklypear	5
OvD	Sands - Veg. Zone 2	Favorable	3,000	Prairie sandreed	30
Orpha		Normal	2,300	Sand bluestem	20
		Unfavorable	1,700	Little bluestem	15
				Needleandthread	15
				Sedge	10
				Blue grama	5
				Switchgrass	5
OwF*:					
Orpha	Sands - Veg. Zone 2	Favorable	3,000	Prairie sandreed	30
		Normal	2,300	Sand bluestem	20
		Unfavorable	1,700	Little bluestem	15
				Needleandthread	15
				Sedge	10
				Blue grama	5
				Switchgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
OwF*:					
Niobrara	Shallow Limy - Veg. Zone 2	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Sideoats grama	10
				Needleandthread	10
				Western wheatgrass	10
				Threadleaf sedge	10
OxG*:					
Orpha	Sands - Veg. Zone 2	Favorable	3,000	Prairie sandreed	30
		Normal	2,300	Sand bluestem	20
		Unfavorable	1,700	Little bluestem	15
				Needleandthread	15
				Sedge	10
				Blue grama	5
				Switchgrass	5
Rock outcrop.					
PoC, PoD	Sandy - Veg. Zone 2	Favorable	3,000	Little bluestem	20
Ponderosa		Normal	2,300	Prairie sandreed	20
		Unfavorable	1,700	Needleandthread	15
				Blue grama	10
				Sand bluestem	10
				Green needlegrass	5
				Sedge	5
PtF*:					
Ponderosa	Sandy - Veg. Zone 2	Favorable	3,000	Little bluestem	20
		Normal	2,300	Prairie sandreed	20
		Unfavorable	1,700	Needleandthread	15
				Blue grama	10
				Sand bluestem	10
				Green needlegrass	5
				Sedge	5
Tassel	Shallow Limy - Veg. Zone 2	Favorable	1,500	Little bluestem	20
		Normal	1,100	Blue grama	20
		Unfavorable	700	Needleandthread	15
				Sand bluestem	10
				Western wheatgrass	10
				Sideoats grama	10
				Threadleaf sedge	5
Vetal	Sandy - Veg. Zone 2	Favorable	3,000	Little bluestem	25
		Normal	2,300	Prairie sandreed	20
		Unfavorable	1,700	Needleandthread	10
				Sand bluestem	10
				Blue grama	10
				Western wheatgrass	5
				Switchgrass	5
RoB	Silty - Veg. Zone 2	Favorable	3,300	Needleandthread	15
Rosebud		Normal	2,500	Blue grama	15
		Unfavorable	1,700	Western wheatgrass	15
				Little bluestem	10
				Sideoats grama	10
				Green needlegrass	10
				Big bluestem	5
				Threadleaf sedge	5
				Buffalograss	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
SnB, SnC, SnD------	Silty - Veg. Zone 2----------	Favorable	3,200	Blue grama----------	20
Satanta		Normal	2,500	Western wheatgrass----------	20
		Unfavorable	1,800	Big bluestem----------	15
				Little bluestem----------	15
				Needleandthread----------	15
				Sideoats grama----------	10
SsD*, SsE*:					
Satanta----------	Silty - Veg. Zone 2----------	Favorable	3,200	Blue grama----------	20
		Normal	2,500	Western wheatgrass----------	20
		Unfavorable	1,800	Big bluestem----------	15
				Little bluestem----------	15
				Needleandthread----------	15
				Sideoats grama----------	10
Canyon----------	Shallow Limy - Veg. Zone 2----	Favorable	1,500	Little bluestem----------	20
		Normal	1,100	Blue grama----------	20
		Unfavorable	700	Needleandthread----------	15
				Sideoats grama----------	10
				Sand bluestem----------	10
				Western wheatgrass----------	10
				Threadleaf sedge----------	5
TfG*:					
Tassel----------	Shallow Limy - Veg. Zone 2----	Favorable	1,500	Little bluestem----------	20
		Normal	1,100	Blue grama----------	20
		Unfavorable	700	Needleandthread----------	15
				Sand bluestem----------	10
				Western wheatgrass----------	10
				Sideoats grama----------	10
				Threadleaf sedge----------	5
Rock outcrop.					
TgG*:					
Tassel----------	Shallow Limy - Veg. Zone 2----	Favorable	1,500	Little bluestem----------	20
		Normal	1,100	Blue grama----------	20
		Unfavorable	700	Needleandthread----------	15
				Sand bluestem----------	10
				Western wheatgrass----------	10
				Sideoats grama----------	10
				Threadleaf sedge----------	5
Ponderosa---------	Savannah - Veg. Zone 2--------	Favorable	2,500	Little bluestem----------	15
		Normal	2,000	Prairie sandreed----------	15
		Unfavorable	1,500	Ponderosa pine----------	15
				Needleandthread----------	10
				Sideoats grama----------	10
				Blue grama----------	5
				Green needlegrass----------	5
				Sand bluestem----------	5
				Sedge----------	5
Rock outcrop.					

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
ThB, ThC, ThD---------- Thirtynine	Silty - Veg. Zone 2----------	Favorable	2,500	Western wheatgrass----------	25
		Normal	1,700	Blue grama----------	20
		Unfavorable	1,000	Needleandthread----------	20
				Green needlegrass----------	10
				Little bluestem----------	5
				Sideoats grama----------	5
				Sedge----------	5
To---------- Tryon	Wet Subirrigated - Veg. Zone 2	Favorable	5,300	Big bluestem----------	20
		Normal	5,000	Switchgrass----------	15
		Unfavorable	4,700	Prairie cordgrass----------	15
				Indiangrass----------	10
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
Tp---------- Tryon	Wetland - Veg. Zone 2---------	Favorable	5,500	Prairie cordgrass----------	30
		Normal	5,300	Northern reedgrass----------	15
		Unfavorable	5,000	Bluejoint reedgrass----------	15
				Slender wheatgrass----------	10
				Rush----------	5
TtB, TtD---------- Tuthill	Sandy - Veg. Zone 2----------	Favorable	3,000	Prairie sandreed----------	20
		Normal	2,300	Little bluestem----------	15
		Unfavorable	1,700	Sand bluestem----------	15
				Needleandthread----------	10
				Blue grama----------	10
				Western wheatgrass----------	5
				Threadleaf sedge----------	5
				Sand dropseed----------	5
TwB, TwC, TwD------ Tuthill	Sandy - Veg. Zone 2----------	Favorable	3,000	Prairie sandreed----------	25
		Normal	2,500	Little bluestem----------	20
		Unfavorable	1,700	Needleandthread----------	20
				Sideoats grama----------	10
				Big bluestem----------	10
				Western wheatgrass----------	5
				Blue grama----------	5
VaB---------- Valent	Sandy - Veg. Zone 2----------	Favorable	2,600	Prairie sandreed----------	20
		Normal	2,300	Sand bluestem----------	15
		Unfavorable	1,900	Little bluestem----------	15
				Needleandthread----------	15
				Blue grama----------	10
				Sand dropseed----------	5
				Threadleaf sedge----------	5
VaD, VaE---------- Valent	Sands - Veg. Zone 2----------	Favorable	3,000	Sand bluestem----------	25
		Normal	2,600	Prairie sandreed----------	20
		Unfavorable	2,000	Little bluestem----------	10
				Needleandthread----------	10
				Switchgrass----------	10
				Blue grama----------	5
VaF*:					
Valent, rolling---	Sands - Veg. Zone 2----------	Favorable	3,000	Sand bluestem----------	25
		Normal	2,600	Prairie sandreed----------	20
		Unfavorable	2,000	Little bluestem----------	10
				Needleandthread----------	10
				Switchgrass----------	10
				Blue grama----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
VaF*:					
Valent, hilly-----	Choppy Sands - Veg. Zone 2----	Favorable	2,800	Sand bluestem----------	30
		Normal	2,400	Prairie sandreed----------	20
		Unfavorable	1,800	Little bluestem----------	15
				Switchgrass----------	10
				Blue grama----------	5
				Needleandthread----------	5
VaG----------	Choppy Sands - Veg. Zone 2----	Favorable	2,800	Sand bluestem----------	30
Valent		Normal	2,400	Prairie sandreed----------	20
		Unfavorable	1,800	Little bluestem----------	15
				Switchgrass----------	10
				Blue grama----------	5
				Needleandthread----------	5
VeB----------	Sandy - Veg. Zone 2----------	Favorable	2,600	Prairie sandreed----------	20
Valent		Normal	2,300	Sand bluestem----------	15
		Unfavorable	1,900	Little bluestem----------	15
				Needleandthread----------	15
				Blue grama----------	10
				Sand dropseed----------	5
				Threadleaf sedge----------	5
VeD----------	Sands - Veg. Zone 2----------	Favorable	3,000	Sand bluestem----------	25
Valent		Normal	2,600	Prairie sandreed----------	20
		Unfavorable	2,000	Little bluestem----------	10
				Needleandthread----------	10
				Switchgrass----------	10
				Blue grama----------	5
VnD, VnE----------	Sands - Veg. Zone 2----------	Favorable	3,000	Sand bluestem----------	25
Valentine		Normal	2,600	Little bluestem----------	20
		Unfavorable	2,200	Prairie sandreed----------	15
				Needleandthread----------	10
				Switchgrass----------	5
				Blue grama----------	5
				Sand lovegrass----------	5
VnF*:					
Valentine, rolling	Sands - Veg. Zone 2----------	Favorable	3,000	Sand bluestem----------	25
		Normal	2,600	Little bluestem----------	20
		Unfavorable	2,200	Prairie sandreed----------	15
				Needleandthread----------	10
				Switchgrass----------	5
				Blue grama----------	5
				Sand lovegrass----------	5
Valentine, hilly--	Choppy Sands - Veg. Zone 2----	Favorable	2,800	Little bluestem----------	25
		Normal	2,600	Sand bluestem----------	20
		Unfavorable	2,300	Prairie sandreed----------	15
				Switchgrass----------	10
				Needleandthread----------	5
				Sand lovegrass----------	5
				Sandhill muhly----------	5
VnG----------	Choppy Sands - Veg. Zone 2----	Favorable	2,800	Little bluestem----------	25
Valentine		Normal	2,600	Sand bluestem----------	20
		Unfavorable	2,300	Prairie sandreed----------	15
				Switchgrass----------	10
				Needleandthread----------	5
				Sand lovegrass----------	5
				Sandhill muhly----------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
VsB---------- Vetal	Sandy - Veg. Zone 2----------	Favorable	2,000	Needleandthread----------	25
		Normal	1,500	Blue grama----------	25
		Unfavorable	800	Threadleaf sedge----------	15
				Prairie sandreed----------	10
				Western wheatgrass----------	10
				Sand dropseed----------	5
Vt---------- Vetal	Sandy - Veg. Zone 2----------	Favorable	3,000	Little bluestem----------	25
		Normal	2,300	Prairie sandreed----------	20
		Unfavorable	1,700	Needleandthread----------	10
				Sand bluestem----------	10
				Blue grama----------	10
				Western wheatgrass----------	5
				Switchgrass----------	5
WrB---------- Wildhorse	Saline Subirrigated - Veg. Zone 2.	Favorable	3,200	Alkali sacaton----------	35
		Normal	2,800	Inland saltgrass----------	15
		Unfavorable	2,400	Western wheatgrass----------	10
				Switchgrass----------	5
				Alkali cordgrass----------	5
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
				Sedge----------	5
WsB*:					
Wildhorse----------	Saline Subirrigated - Veg. Zone 2.	Favorable	3,200	Alkali sacaton----------	35
		Normal	2,800	Inland saltgrass----------	15
		Unfavorable	2,400	Western wheatgrass----------	10
				Switchgrass----------	5
				Alkali cordgrass----------	5
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
				Sedge----------	5
Hoffland----------	Wet Subirrigated - Veg. Zone 2.	Favorable	5,300	Big bluestem----------	20
		Normal	4,800	Switchgrass----------	15
		Unfavorable	4,300	Prairie cordgrass----------	15
				Indiangrass----------	10
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
WtB*:					
Wildhorse----------	Saline Subirrigated - Veg. Zone 2.	Favorable	3,200	Alkali sacaton----------	35
		Normal	2,800	Inland saltgrass----------	15
		Unfavorable	2,400	Western wheatgrass----------	10
				Switchgrass----------	5
				Alkali cordgrass----------	5
				Slender wheatgrass----------	5
				Plains bluegrass----------	5
				Sedge----------	5
Ipage----------	Sandy Lowland - Veg. Zone 2---	Favorable	3,500	Sand bluestem----------	25
		Normal	3,200	Little bluestem----------	20
		Unfavorable	3,000	Prairie sandreed----------	15
				Needleandthread----------	10
				Indiangrass----------	5
				Sedge----------	5
				Switchgrass----------	5
				Blue grama----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--POTENTIAL PRODUCTIVITY FOR PONDEROSA PINE AND DEGREE OF LIMITATIONS OF WOODLAND SUITABILITY GROUPS

(The symbol > means more than; < means less than)

Woodland suitability group number and soil series	Potential productivity			Management concerns				
	Aspect	Site index	Approximate annual growth per acre at 80 years of age*	Erosion hazard	Seedling mortality	Plant competition	Equipment limitation	Windthrow hazard
Group 1--Ponderosa (moist)	North and east.	>70	>65	Moderate or severe	Slight	Slight	Moderate or severe	Slight.
Group 2--Canyon and Tassel (moist)	North and east.	50-59	40	Severe	Slight or moderate.	Moderate	Severe	Severe.
Group 3--Ponderosa (moist)	South and west.	40-49	30	Moderate or severe	Moderate or severe	Moderate	Severe	Severe.
Group 4--Canyon and Tassel	South and west.	<40	<25	Severe	Severe	Severe	Severe	Severe.

* Annual growth is expressed in cubic feet. Divide by 90 to convert to approximate cords; multiply by 6 to convert to approximate board feet.

TABLE 10.--TREE PLANTING SITE PREPARATION GUIDE

Texture	Slope	Site preparation	
		Cropland	Grassland
Loamy or clayey--	Level--	Plant directly into site; do not destroy the existing crop residue; check for hardpan (see footnotes 1, 2, and 3).	Summer fallow the entire site 1 year prior to planting (see footnote 4); plant directly into site; do not destroy dead grass residue; check for hardpan (see footnotes 1 and 2).
Sandy----	Level--	Sow a cover crop late in summer if the soil will be bare over winter; plant directly into site or into cover crop; do not destroy the existing crop residue (see footnotes 2 and 3).	Summer fallow 4- to 8-foot strips 1 year prior to planting (see footnote 4); plant directly into the strips; do not destroy dead grass residue (see footnote 2).
Loamy or clayey--	Sloping	Plant directly into site; do not destroy the existing crop residue (see footnotes 2 and 3); if possible, plant on the contour; check for hardpan.	Summer fallow the entire site 1 year prior to planting (see footnote 5); plant directly into site; do not destroy dead grass residue (see footnote 6); if possible, plant on the contour.
Sandy----	Sloping	Sow a cover crop late in summer if the soil will be bare over winter; plant directly into site or into cover crop; do not destroy the existing crop residue (see footnotes 2 and 3); if possible, plant on the contour.	Summer fallow 4- to 8-foot strips 1 year prior to planting (see footnote 5); plant directly into the strips; do not destroy dead grass residue (see footnote 6); if possible, plant on the contour.

[1] The soil may have a hardpan as a result of farming, grazing, or soil geology, especially if the texture is loamy or clayey. Check for hardpan and deep chisel the subsoil during the fall prior to planting.

[2] Till the soil lightly or treat with labeled postemergence herbicide prior to planting if weeds are beginning to emerge.

[3] Check for herbicide carry-over via cooperator records or soil analysis. Avoid planting on cropland that has been treated with nonlabeled, residual herbicide during the prior growing season.

[4] Fallow either mechanically (tillage) or chemically (no-till) with labeled postemergence herbicide.

[5] Fallow chemically (no-till) with labeled postemergence herbicide.

[6] Treat with labeled postemergence herbicide prior to planting if weeds are beginning to emerge.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ac, AcB, AcC---- Alliance	Skunkbush sumac, lilac, Amur honeysuckle.	Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, honeylocust, Russian-olive, bur oak, hackberry, green ash.	Siberian elm----	---
An. Almeria					
Bc---- Bankard	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Bd---- Beckton	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Bf---- Bolent	American plum, lilac, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, ponderosa pine, hackberry, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
Bh, BhB, Bm---- Bridget	Amur honeysuckle, lilac.	Rocky Mountain juniper, Russian-olive, common chokecherry, American plum.	Hackberry, ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm----	---
BnB, BnE---- Bufton	Siberian peashrub, lilac, American plum.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, green ash, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
BoD*: Bufton----	Siberian peashrub, lilac, American plum.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, green ash, Russian-olive, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Orella.					

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BsB, BsC, BsD----- Busher	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm------	---
BvC*: Busher----------	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm------	---
Tassel.					
BvF*: Busher.					
Tassel.					
Ca---------- Calamus	---	Eastern redcedar, Rocky Mountain juniper.	Scotch pine, jack pine, ponderosa pine, Austrian pine.	---	---
Cr---------- Crowther	Redosier dogwood	---	---	Golden willow-----	Eastern cottonwood.
Cs. Crowther					
DuB---------- Dailey	Common chokecherry, American plum, lilac, Tatarian honeysuckle.	Rocky Mountain juniper, Siberian peashrub, Russian-olive, Manchurian crabapple.	Ponderosa pine, green ash, honeylocust.	Siberian elm------	---
DuD---------- Dailey	American plum, lilac, Siberian peashrub, skunkbush sumac.	Rocky Mountain juniper, eastern redcedar, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm------	---
Dw---------- Duroc	Amur honeysuckle, lilac, American plum.	---	Rocky Mountain juniper, ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, hackberry.	Siberian elm------	Eastern cottonwood.
DwB---------- Duroc	Lilac, American plum.	Rocky Mountain juniper, Siberian peashrub, skunkbush sumac, hackberry.	Ponderosa pine, honeylocust, eastern redcedar, Scotch pine, green ash.	Siberian elm------	---
Ec---------- Els	Lilac, American plum, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Golden willow, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ef*:					
Els	Lilac, American plum, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
Hoffland	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
EgB*:					
Els	Lilac, American plum, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
En*:					
Els	Lilac, American plum, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, hackberry, ponderosa pine, green ash.	Golden willow, honeylocust.	Eastern cottonwood.
Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Es	Lilac, American plum, Siberian peashrub.	Manchurian crabapple.	Eastern redcedar, ponderosa pine, hackberry, blue spruce, green ash.	Golden willow	Eastern cottonwood.
Elsmere					
EuE*:					
Enning.					
Minnequa.					
EvG*:					
Enning.					
Rock outcrop.					
EwG*:					
Epping.					
Badland.					
Fu.					
Fluvaquents					
Gg	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Gannett					
Gh.					
Gannett					
Hm	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Hoffland					

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Hn. Hoffland					
IpB---------- Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
JgB, JgC, JgD----- Jayem	Peking cotoneaster, Amur honeysuckle, Siberian peashrub, lilac.	Rocky Mountain juniper, eastern redcedar, Russian-olive, common chokecherry.	Green ash, ponderosa pine, Siberian elm, honeylocust.	---	---
Jo---------- Johnstown	Skunkbush sumac, Peking cotoneaster, American plum.	Eastern redcedar, Siberian peashrub.	Ponderosa pine, bur oak, Russian-olive, honeylocust, green ash, hackberry.	Siberian elm------	---
Kd, KdC, KdD------ Kadoka	Peking cotoneaster, skunkbush sumac, Siberian peashrub, lilac.	Eastern redcedar, Russian-olive, green ash, hackberry, Rocky Mountain juniper.	Siberian elm, ponderosa pine, honeylocust.	---	---
Ke, KeB, KeC------ Keith	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust, Russian-olive.	Siberian elm------	---
Kg, KgB, KgC------ Keith	Peking cotoneaster, skunkbush sumac, American plum, Siberian peashrub.	Russian-olive, Rocky Mountain juniper.	Eastern redcedar, hackberry, green ash, ponderosa pine, honeylocust.	Siberian elm------	---
Ky---------- Keya	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
La---------- Las Animas	Lilac, American plum.	Rocky Mountain juniper, Tatarian honeysuckle.	Eastern redcedar, green ash, ponderosa pine, hackberry, honeylocust.	Golden willow, Siberian elm.	Eastern cottonwood.
Lg---------- Lodgepole	Lilac, American plum, common chokecherry.	---	Eastern redcedar, ponderosa pine, honeylocust, hackberry, green ash, Russian mulberry.	Silver maple, golden willow.	---

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Lu. Lute					
MbC---------- Manvel	Siberian peashrub, fragrant sumac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, black locust, green ash, Russian-olive.	Honeylocust, Siberian elm.	---	---
Mc. Marlake					
Mk---------- McCook	American plum, lilac.	---	Eastern redcedar, ponderosa pine, hackberry, green ash, Russian-olive, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
Mm. McCook					
MxF*: Mitchell.					
Epping.					
My---------- Munjor	---	Siberian peashrub, silver buffaloberry.	Ponderosa pine, Russian-olive, green ash, Russian mulberry, eastern redcedar.	Siberian elm, hackberry, honeylocust.	Eastern cottonwood.
Mz. Munjor					
OhC*, OhD*: Oglala----------	American plum, lilac.	Manchurian crabapple, common chokecherry, Siberian peashrub.	Ponderosa pine, honeylocust, hackberry, Russian-olive, green ash, Rocky Mountain juniper.	Siberian elm------	---
Canyon.					
OhF*: Oglala.					
Canyon.					
On---------- Onita	Lilac----------	Siberian peashrub, American plum.	Ponderosa pine, blue spruce, green ash, hackberry, Russian mulberry, eastern redcedar.	Honeylocust-------	Eastern cottonwood.

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
OrF. Orella					
OvD Orpha	---	Eastern redcedar, Austrian pine, Scotch pine, Rocky Mountain juniper, ponderosa pine, jack pine.	---	---	---
OwF*: Orpha.					
Niobrara.					
OxG*: Orpha.					
Rock outcrop.					
PoC, PoD Ponderosa	Skunkbush sumac, lilac.	Eastern redcedar, Siberian peashrub, Rocky Mountain juniper, American plum.	Green ash, bur oak, hackberry, ponderosa pine, honeylocust.	Siberian elm	---
PtF*: Ponderosa.					
Tassel.					
Vetal	Lilac	Eastern redcedar, Rocky Mountain juniper, common chokecherry, Russian-olive, Siberian peashrub.	Hackberry, ponderosa pine, honeylocust, green ash.	Siberian elm	---
RoB Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
SnB, SnC, SnD Satanta	Tatarian honeysuckle, American plum, Peking cotoneaster.	Eastern redcedar, common chokecherry, Rocky Mountain juniper.	Green ash, black locust, hackberry, Siberian elm, ponderosa pine, honeylocust.	---	---

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
SsD*, SsE*:					
Satanta	Tatarian honeysuckle, American plum, Peking cotoneaster.	Eastern redcedar, common chokecherry, Rocky Mountain juniper.	Green ash, black locust, hackberry, Siberian elm, ponderosa pine, honeylocust.	---	---
Canyon.					
TfG*:					
Tassel.					
Rock outcrop.					
TgG*:					
Tassel.					
Ponderosa.					
Rock outcrop.					
ThB, ThC, ThD	American plum, Amur honeysuckle, lilac.	Russian-olive, Rocky Mountain juniper, common chokecherry.	Austrian pine, eastern redcedar, green ash, honeylocust, ponderosa pine, hackberry.	---	---
Thirtynine					
To	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Tryon					
Tp.					
Tryon					
TtB, TtD	Amur honeysuckle, common chokecherry, Peking cotoneaster, American plum, Siberian peashrub.	Eastern redcedar, red mulberry, Rocky Mountain juniper, Russian-olive, Austrian pine.	Black locust, hackberry, green ash, Siberian elm, ponderosa pine, honeylocust.	---	---
Tuthill					
TwB, TwC, TwD	Peking cotoneaster, Siberian peashrub, lilac, skunkbush sumac.	Green ash, Rocky Mountain juniper, eastern redcedar, Russian-olive, hackberry.	Honeylocust, ponderosa pine, Siberian elm.	---	---
Tuthill					
VaB, VaD, VaE	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
Valent					
VaF*:					
Valent, rolling	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
VaF*: Valent, hilly.					
VaG. Valent					
VeB, VeD---------- Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine----	---	---
VnD, VnE---------- Valentine	---	Eastern redcedar, Austrian pine, Rocky Mountain juniper, jack pine.	Ponderosa pine----	---	---
VnF*: Valentine, rolling---------	---	Eastern redcedar, Austrian pine, Rocky Mountain juniper, jack pine.	Ponderosa pine----	---	---
Valentine, hilly.					
VnG. Valentine					
VsB---------- Vetal	Skunkbush sumac, common chokecherry, American plum, lilac.	Siberian peashrub	Honeylocust, Austrian pine, green ash, ponderosa pine, Rocky Mountain juniper, eastern redcedar.	Siberian elm------	---
Vt---------- Vetal	Lilac----------	Eastern redcedar, Rocky Mountain juniper, common chokecherry, Russian-olive, Siberian peashrub.	Hackberry, ponderosa pine, honeylocust, green ash.	Siberian elm------	---
WrB. Wildhorse					
WsB*: Wildhorse.					
Hoffland---------	Redosier dogwood	---	---	Golden willow-----	Eastern cottonwood.
WtB*: Wildhorse.					

See footnote at end of table.

TABLE 11.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WtB*: Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ac Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AcB, AcC Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
An Almeria	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
Bc Bankard	Severe: flooding.	Moderate: flooding, too sandy.	Severe: flooding.	Moderate: too sandy, flooding.
Bd Beckton	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.
Bf Bolent	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
Bh Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BhB Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Bm Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BnB Bufton	Slight	Slight	Moderate: slope.	Severe: erodes easily.
BnE Bufton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
BoD*: Bufton	Slight	Slight	Severe: slope.	Severe: erodes easily.
Orella	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
BsB Busher	Slight	Slight	Slight	Slight.
BsC Busher	Slight	Slight	Moderate: slope.	Slight.
BsD Busher	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BvC*:				
Busher	Slight	Slight	Moderate: slope.	Slight.
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
BvF*:				
Busher	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
Ca Calamus	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Cr Crowther	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Cs Crowther	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
DuB Dailey	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
DuD Dailey	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
Dw Duroc	Severe: flooding.	Slight	Slight	Slight.
DwB Duroc	Slight	Slight	Moderate: slope.	Slight.
Ec Els	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Ef*:				
Els	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Hoffland	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
EgB*:				
Els	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
En*:				
Els	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Es	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Elsmere				
EuE*:				
Enning	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.
Minnequa	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
EvG*:				
Enning	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
EwG*:				
Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Badland	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Fu	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.
Fluvaquents				
Gg	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Gannett				
Gh	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Gannett				
Hm	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Hoffland				
Hn	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Hoffland				

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
IpB---- Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
JgB---- Jayem	Slight	Slight	Moderate: small stones.	Slight.
JgC---- Jayem	Slight	Slight	Moderate: slope, small stones.	Slight.
JgD---- Jayem	Slight	Slight	Severe: slope.	Slight.
Jo---- Johnstown	Slight	Slight	Slight	Slight.
Kd---- Kadoka	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
KdC---- Kadoka	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.
KdD---- Kadoka	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Ke---- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
KeB, KeC---- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Kg---- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
KgB, KgC---- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ky---- Keya	Slight	Slight	Slight	Slight.
La---- Las Animas	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
Lg---- Lodgepole	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
Lu---- Lute	Severe: flooding, wetness, excess sodium.	Severe: excess sodium.	Severe: wetness, excess sodium.	Moderate: wetness.
MbC---- Manvel	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mc Marlake	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Mk McCook	Severe: flooding.	Slight	Slight	Slight.
Mm McCook	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
MxF*: Mitchell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
My Munjor	Severe: flooding.	Slight	Slight	Slight.
Mz Munjor	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
OhC*: Oglala	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
OhD*: Oglala	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
OhF*: Oglala	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
On Onita	Severe: flooding.	Slight	Slight	Slight.
OrF Orella	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
OvD Orpha	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
OwF*:				
Orpha	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Niobrara	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
OxG*:				
Orpha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
PoC Ponderosa	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
PoD Ponderosa	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
PtF*:				
Ponderosa	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Vetal	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
RoB Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.
SnB Satanta	Slight	Slight	Slight	Slight.
SnC Satanta	Slight	Slight	Moderate: slope.	Slight.
SnD Satanta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
SsD*:				
Satanta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
SsE*:				
Satanta	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SsE*:				
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
TfG*:				
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
TgG*:				
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
Ponderosa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
ThB, ThC Thirtynine	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
ThD Thirtynine	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
To Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Tp Tryon	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
TtB Tuthill	Slight	Slight	Slight	Slight.
TtD Tuthill	Slight	Slight	Severe: slope.	Slight.
TwB Tuthill	Slight	Slight	Slight	Slight.
TwC Tuthill	Slight	Slight	Moderate: slope.	Slight.
TwD Tuthill	Slight	Slight	Severe: slope.	Slight.
VaB Valent	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VaD--- Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaE--- Valent	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaF*:				
Valent, rolling---	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Valent, hilly---	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VaG--- Valent	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VeB--- Valent	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
VeD--- Valent	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
VnD--- Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VnE--- Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VnF*:				
Valentine, rolling---	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Valentine, hilly---	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VnG--- Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VsB, Vt--- Vetal	Slight---	Slight---	Slight---	Slight.
WrB--- Wildhorse	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.
WsB*:				
Wildhorse---	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
WsB*:				
Hoffland	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WtB*:				
Wildhorse	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ac, AcB, AcC---- Alliance	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Poor	Good.
An---- Almeria	Very poor.	Poor	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	Poor.
Bc---- Bankard	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Bd---- Beckton	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor.
Bf---- Bolent	Poor	Fair	Good	Good	Good	Good	Fair	Very poor.	Fair	Good	Poor	Good.
Bh, BhB, Bm---- Bridget	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BnB---- Bufton	Fair	Good	Good	Fair	Good	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
BnE---- Bufton	Poor	Fair	Fair	Fair	Good	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
BoD*:												
Bufton----	Fair	Good	Good	Fair	Good	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Orella----	Poor	Poor	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
BsB, BsC, BsD---- Busher	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
BvC*:												
Busher----	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Tassel----	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
BvF*:												
Busher----	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Tassel----	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Ca---- Calamus	Poor	Good	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
Cr, Cs---- Crowther	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
DuB, DuD---- Dailey	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Dw, DwB---- Duroc	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Ec---- Els	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Fair.
Ef*:												
Els----	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Fair.
Hoffland----	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
EgB*:												
Els----	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Fair.
Ipage----	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
En*:												
Els----	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Fair.
Tryon----	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Es---- Elsmere	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
EuE*:												
Enning----	Very poor.	Very poor.	Fair	Poor	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Minnequa----	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Poor	---	Very poor.	Poor.
EvG*:												
Enning----	Very poor.	Very poor.	Fair	Poor	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Rock outcrop----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
EwG*:												
Epping----	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Badland----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Fu---- Fluvaquents	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Gg, Gh---- Gannett	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Hm, Hn---- Hoffland	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
IpB---------- Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
JgB, JgC---------- Jayem	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
JgD---------- Jayem	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Jo---------- Johnstown	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Kd---------- Kadoka	Good	Good	Fair	Good	Very poor.	Fair	Poor	Very poor.	Good	Very poor.	Very poor.	Fair.
KdC, KdD---------- Kadoka	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Ke, KeB---------- Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
KeC---------- Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Kg, KgB---------- Keith	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
KgC---------- Keith	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Ky---------- Keya	Good	Good	Fair	Good	Poor	---	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
La---------- Las Animas	Fair	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
Lg---------- Lodgepole	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor.
Lu---------- Lute	Very poor.	Very poor.	Poor	Poor	Very poor.	---	Poor	Poor	Very poor.	Very poor.	Poor	Poor.
MbC---------- Manvel	Poor	Fair	Fair	Poor	Very poor.	---	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Mc---------- Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Mk---------- McCook	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Mm---------- McCook	Poor	Poor	Fair	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
MxF*: Mitchell----------	Poor	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Epping----------	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
My---------- Munjor	Fair	Good	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Mz---------- Munjor	Poor	Poor	Fair	Good	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.	Fair.
OhC*, OhD*:												
Oglala----------	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Canyon----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
OhF*:												
Oglala----------	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Canyon----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
On---------- Onita	Good	Good	Fair	Good	Poor	---	Very poor.	Very poor.	Good	Poor	Very poor.	Fair.
OrF---------- Orella	Poor	Poor	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
OvD---------- Orpha	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
OwF*:												
Orpha----------	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Niobrara----------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
OxG*:												
Orpha----------	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Rock outcrop------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
PoC, PoD---------- Ponderosa	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
PtF*:												
Ponderosa---------	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Tassel----------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Vetal----------	Poor	Good	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
RoB---------- Rosebud	Good	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
SnB---- Satanta	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
SnC, SnD---- Satanta	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
SsD*:												
Satanta----	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Canyon----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
SsE*:												
Satanta----	Poor	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Good	Very poor.	Fair.
Canyon----	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
TfG*:												
Tassel----	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Rock outcrop----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
TgG*:												
Tassel----	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Ponderosa----	Very poor.	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Poor.
Rock outcrop----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
ThB---- Thirtynine	Good	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Good.
ThC, ThD---- Thirtynine	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
To, Tp---- Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
TtB---- Tuthill	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
TtD---- Tuthill	Poor	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
TwB, TwC---- Tuthill	Fair	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
TwD---- Tuthill	Poor	Fair	Good	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
VaB, VaD, VaE---- Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
VaF*:												
Valent, rolling	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Valent, hilly	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VaG---Valent	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VeB---Valent	Fair	Good	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VeD---Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VnD, VnE---Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VnF*:												
Valentine, rolling	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Valentine, hilly	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VnG---Valentine	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VsB---Vetal	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
Vt---Vetal	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
WrB---Wildhorse	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
WsB*:												
Wildhorse	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
Hoffland	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
WtB*:												
Wildhorse	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ac, AcB---------- Alliance	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
AcC---------- Alliance	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
An---------- Almeria	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
Bc---------- Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Bd---------- Beckton	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.	Severe: excess sodium.
Bf---------- Bolent	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, droughty, flooding.
Bh, BhB, Bm------- Bridget	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength.	Slight.
BnB---------- Bufton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
BnE---------- Bufton	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
BoD*:						
Bufton----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
Orella----------	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: depth to rock.
BsB---------- Busher	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
BsC, BsD---------- Busher	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
BvC*:						
Busher----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
Tassel----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BvF*:						
Busher	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Ca Calamus	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: droughty.
Cr Crowther	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.
Cs Crowther	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding.	Severe: ponding.
DuB Dailey	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
DuD Dailey	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Dw Duroc	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, low strength, flooding.	Slight.
DwB Duroc	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
Ec Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Ef*:						
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Hoffland	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
EgB*:						
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
En*:						
Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Es Elsmere	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
EuE*:						
Enning	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Severe: thin layer, area reclaim.
Minnequa	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope, depth to rock.
EvG*:						
Enning	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope, thin layer, area reclaim.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
EwG*:						
Epping	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Badland	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Fu Fluvaquents	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: ponding, flooding.
Gg Gannett	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness.
Gh Gannett	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, frost action.	Severe: ponding.
Hm Hoffland	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Hn---------- Hoffland	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
IpB---------- Ipage	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Severe: droughty.
JgB---------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
JgC, JgD---------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
Jo---------- Johnstown	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Kd---------- Kadoka	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Severe: low strength.	Moderate: depth to rock.
KdC, KdD---------- Kadoka	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.	Moderate: depth to rock.
Ke, KeB---------- Keith	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
KeC---------- Keith	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
Kg, KgB---------- Keith	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
KgC---------- Keith	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
Ky---------- Keya	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
La---------- Las Animas	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, flooding.
Lg---------- Lodgepole	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
Lu---------- Lute	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Severe: excess sodium.
MbC---------- Manvel	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
Mc---------- Marlake	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mk McCook	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Mm McCook	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
MxF*: Mitchell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Epping	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
My Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
Mz Munjor	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
OhC*: Oglala	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
OhD*: Oglala	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Canyon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.
OhF*: Oglala	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
On Onita	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
OrF Orella	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope, depth to rock.
OvD Orpha	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OwF*:						
Orpha	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Niobrara	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
OxG*:						
Orpha	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
PoC, PoD Ponderosa	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
PtF*:						
Ponderosa	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Vetal	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
RoB Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: frost action.	Moderate: depth to rock.
SnB Satanta	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
SnC Satanta	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
SnD Satanta	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
SsD*:						
Satanta	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
Canyon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SsE*:						
Satanta	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
TfG*:						
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
TgG*:						
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Ponderosa	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
ThB Thirtynine	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.
ThC, ThD Thirtynine	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
To Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Tp Tryon	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
TtB Tuthill	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
TtD Tuthill	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Slight.
TwB Tuthill	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: droughty.
TwC, TwD Tuthill	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Moderate: droughty.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
VaB--Valent	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VaD--Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaE--Valent	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VaF*:						
Valent, rolling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valent, hilly	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VaG--Valent	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VeB--Valent	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VeD--Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VnD--Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VnE--Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VnF*:						
Valentine, rolling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valentine, hilly	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VnG--Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VsB, Vt--Vetal	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
WrB--Wildhorse	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Severe: excess sodium, droughty.
WsB*:						
Wildhorse	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Severe: excess sodium, droughty.

See footnote at end of table.

TABLE 14.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WsB*:						
Hoffland	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
WtB*:						
Wildhorse	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Severe: excess sodium, droughty.
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ac Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Slight	Fair: depth to rock.
AcB, AcC Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight	Fair: depth to rock.
An Almeria	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, ponding.
Bc Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
Bd Beckton	Severe: percs slowly.	Moderate: seepage.	Severe: wetness, excess salt.	Moderate: flooding, wetness.	Good.
Bf Bolent	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Bh Bridget	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
BhB Bridget	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Bm Bridget	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
BnB Bufton	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Poor: hard to pack.
BnE Bufton	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: hard to pack.
BoD*:					
Bufton	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Poor: hard to pack.
Orella	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock, hard to pack.
BsB, BsC Busher	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight	Fair: depth to rock, thin layer.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BsD---------- Busher	Moderate: depth to rock.	Severe: seepage, slope.	Severe: depth to rock.	Slight----------	Fair: depth to rock, thin layer.
BvC*:					
Busher----------	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock.	Slight----------	Fair: depth to rock, thin layer.
Tassel----------	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Slight----------	Poor: depth to rock.
BvF*:					
Busher----------	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Tassel----------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Ca---------- Calamus	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Cr---------- Crowther	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Cs---------- Crowther	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
DuB, DuD---------- Dailey	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Dw---------- Duroc	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
DwB---------- Duroc	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
Ec---------- Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ef*:					
Els----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ef*:					
Hoffland	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
EgB*:					
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
En*:					
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Es	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage.
EuE*:					
Enning	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, hard to pack.
Minnequa	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
EvG*:					
Enning	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
EwG*:					
Epping	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Badland	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Fu---------- Fluvaquents	Severe: flooding, ponding.	Severe: seepage, flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding.
Gg---------- Gannett	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Gh---------- Gannett	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Hm---------- Hoffland	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Hn---------- Hoffland	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
IpB---------- Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
JgB, JgC---------- Jayem	Slight----------	Severe: seepage.	Moderate: too sandy.	Slight----------	Good.
JgD---------- Jayem	Slight----------	Severe: seepage, slope.	Moderate: too sandy.	Slight----------	Good.
Jo---------- Johnstown	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight----------	Fair: too clayey, thin layer.
Kd, KdC---------- Kadoka	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Poor: depth to rock.
KdD---------- Kadoka	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight----------	Poor: depth to rock.
Ke---------- Keith	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
KeB, KeC---------- Keith	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
Kg---------- Keith	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Fair: thin layer.
KgB, KgC---------- Keith	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Fair: thin layer.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ky Keya	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
La Las Animas	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: too sandy, wetness, thin layer.
Lg Lodgepole	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Lu Lute	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, excess sodium.	Severe: seepage, wetness.	Poor: wetness, excess sodium.
MbC Manvel	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
Mc Marlake	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Mk McCook	Moderate: flooding, percs slowly.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Good.
Mm McCook	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
MxF*:					
Mitchell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Epping	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
My Munjor	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Mz Munjor	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: thin layer.
OhC*:					
Oglala	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight	Fair: depth to rock, thin layer.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OhD*:					
Oglala	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: depth to rock, slope, thin layer.
Canyon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
OhF*:					
Oglala	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
On	Severe: wetness, percs slowly.	Moderate: seepage.	Moderate: flooding, wetness, too clayey.	Moderate: flooding.	Poor: hard to pack.
Onita					
OrF	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, hard to pack, slope.
Orella					
OvD	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
Orpha					
OwF*:					
Orpha	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
Niobrara	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
OxG*:					
Orpha	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
PoC	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Ponderosa					
PoD	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
Ponderosa					

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PtF*:					
Ponderosa	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Vetal	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, thin layer.
RoB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: depth to rock.
Rosebud					
SnB, SnC	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Good.
Satanta					
SnD	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Satanta					
SsD*:					
Satanta	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Canyon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
SsE*:					
Satanta	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
TfG*:					
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
TgG*:					
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Ponderosa	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TgG*:					
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
ThB, ThC Thirtynine	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
ThD Thirtynine	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
To Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Tp Tryon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
TtB Tuthill	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
TtD Tuthill	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
TwB, TwC Tuthill	Severe: poor filter.	Severe: seepage.	Slight	Slight	Fair: thin layer.
TwD Tuthill	Severe: poor filter.	Severe: seepage, slope.	Slight	Slight	Fair: thin layer.
VaB, VaD Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
VaE Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.
VaF*:					
Valent, rolling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.
Valent, hilly	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.
VaG Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 15.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VeB, VeD---------- Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight----------	Poor: seepage, too sandy.
VnD---------- Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VnE---------- Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VnF*: Valentine, rolling-	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Valentine, hilly---	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VnG---------- Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VsB, Vt---------- Vetal	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
WrB---------- Wildhorse	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
WsB*: Wildhorse----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
Hoffland----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
WtB*: Wildhorse----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
Ipage----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ac, AcB, AcC---------- Alliance	Fair: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
An---------- Almeria	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
Bc---------- Bankard	Good----------	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy.
Bd---------- Beckton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Bf---------- Bolent	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy.
Bh, BhB, Bm---------- Bridget	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BnB, BnE---------- Bufton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BoD*: Bufton----------	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Orella----------	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, excess salt.
BsB, BsC, BsD---------- Busher	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
BvC*: Busher----------	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Tassel----------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
BvF*: Busher----------	Fair: depth to rock, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BvF*:				
Tassel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Ca Calamus	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Cr, Cs Crowther	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
DuB, DuD Dailey	Good	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy.
Dw, DwB Duroc	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ec Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Ef*:				
Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Hoffland	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
EgB*:				
Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
En*:				
Els	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Tryon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Es Elsmere	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
EuE*:				
Enning	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim.
Minnequa	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, slope.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EvG*:				
Enning	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
Rock outcrop	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
EwG*:				
Epping	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Badland	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Fu Fluvaquents	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Gg, Gh Gannett	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Hm, Hn Hoffland	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
IpB Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
JgB, JgC, JgD Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Jo Johnstown	Good	Probable	Probable	Good.
Kd, KdC, KdD Kadoka	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, thin layer.
Ke, KeB, KeC Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Kg, KgB, KgC Keith	Good	Probable	Probable	Fair: area reclaim.
Ky Keya	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
La Las Animas	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
Lg Lodgepole	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Lu Lute	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
MbC Manvel	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Mc Marlake	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Mk, Mm McCook	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
MxF*: Mitchell	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Epping	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
My, Mz Munjor	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
OhC*: Oglala	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
OhD*: Oglala	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
OhF*: Oglala	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
On Onita	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
OrF Orella	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, excess salt.
OvD Orpha	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OwF*:				
Orpha	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Niobrara	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, area reclaim, slope.
OxG*:				
Orpha	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, slope.
Rock outcrop	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
PoC, PoD Ponderosa	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
PtF*:				
Ponderosa	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Tassel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
RoB Rosebud	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
SnB, SnC Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
SnD Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
SsD*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
SsE*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SsE*:				
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
TfG*:				
Tassel	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Rock outcrop	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
TgG*:				
Tassel	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Ponderosa	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
ThB, ThC, ThD Thirtynine	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
To, Tp Tryon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
TtB, TtD Tuthill	Good	Probable	Improbable: too sandy.	Fair: too clayey, thin layer.
TwB, TwC, TwD Tuthill	Good	Probable	Improbable: too sandy.	Fair: too clayey.
VaB, VaD Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VaE Valent	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VaF*:				
Valent, rolling	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Valent, hilly	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VaG Valent	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.

See footnote at end of table.

TABLE 16.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
VeB, VeD---------- Valent	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
VnD---------- Valentine	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
VnE---------- Valentine	Fair: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
VnF*: Valentine, rolling---	Fair: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
Valentine, hilly-----	Poor: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
VnG---------- Valentine	Poor: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
VsB---------- Vetal	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
Vt---------- Vetal	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
WrB---------- Wildhorse	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy, excess sodium.
WsB*: Wildhorse----------	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy, excess sodium.
Hoffland----------	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy, wetness.
WtB*: Wildhorse----------	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: area reclaim, too sandy, excess sodium.
Ipage----------	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ac, AcB---------- Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
AcC---------- Alliance	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
An---------- Almeria	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, flooding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty, rooting depth.
Bc---------- Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.
Bd---------- Beckton	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly---	Too arid, excess salt, excess sodium.
Bf---------- Bolent	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Bh, BhB---------- Bridget	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Too arid, erodes easily.
Bm---------- Bridget	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
BnB---------- Bufton	Slight---------	Moderate: hard to pack.	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Too arid, erodes easily.
BnE---------- Bufton	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Slope, erodes easily, percs slowly.	Too arid, slope, erodes easily.
BoD*:						
Bufton----------	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily, percs slowly.	Too arid, erodes easily.
Orella----------	Severe: depth to rock.	Severe: hard to pack.	Deep to water	Slope, droughty.	Depth to rock, erodes easily.	Too arid, erodes easily.
BsB---------- Busher	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
BsC, BsD---------- Busher	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BvC*:						
Busher	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing	Too arid.
Tassel	Severe: depth to rock.	Slight	Deep to water	Slope, soil blowing, depth to rock.	Depth to rock	Too arid.
BvF*:						
Busher	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Tassel	Severe: depth to rock, slope.	Slight	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock.	Too arid, slope.
Ca Calamus	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Cr Crowther	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness	Wetness, too sandy.	Wetness.
Cs Crowther	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding	Ponding, too sandy.	Wetness.
DuB Dailey	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
DuD Dailey	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
Dw, DwB Duroc	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ec Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Ef*:						
Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Hoffland	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
EgB*:						
Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
En*:						
Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Es Elsmere	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
EuE*:						
Enning	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Minnequa	Severe: slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
EvG*:						
Enning	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Rock outcrop	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
EwG*:						
Epping	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Badland	Severe: depth to rock, slope.	Slight	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Fu Fluvaquents	Severe: seepage.	Severe: seepage, ponding.	Ponding, flooding.	Ponding, droughty, rooting depth.	Ponding, too sandy.	Wetness, droughty, rooting depth.
Gg Gannett	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Gh---------- Gannett	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
Hm---------- Hoffland	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Hn---------- Hoffland	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
IpB---------- Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
JgB---------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
JgC, JgD---------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
Jo---------- Johnstown	Severe: seepage.	Severe: thin layer.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Kd---------- Kadoka	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock, erodes easily.	Too arid, erodes easily.
KdC, KdD---------- Kadoka	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
Ke, KeB---------- Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
KeC---------- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
Kg, KgB---------- Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
KgC---------- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
Ky---------- Keya	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
La---------- Las Animas	Severe: seepage.	Severe: piping, wetness.	Flooding, cutbanks cave.	Wetness, flooding.	Wetness--------	Favorable.
Lg---------- Lodgepole	Severe: seepage.	Severe: ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Lu Lute	Severe: seepage.	Severe: seepage, piping, excess sodium.	Percs slowly, frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, excess salt, excess sodium.
MbC Manvel	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Too arid, erodes easily.
Mc Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
Mk McCook	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Mm McCook	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
MxF*: Mitchell	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Epping	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
My Munjor	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Favorable	Favorable.
Mz Munjor	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, flooding.	Favorable	Favorable.
OhC*: Oglala	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Too arid, erodes easily.
Canyon	Severe: depth to rock.	Slight	Deep to water	Slope, depth to rock.	Depth to rock	Too arid.
OhD*, OhF*: Oglala	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Too arid, slope, erodes easily.
Canyon	Severe: depth to rock, slope.	Slight	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope.
On Onita	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Percs slowly	Erodes easily	Erodes easily, percs slowly.
OrF Orella	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
OvD---------- Orpha	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
OwF*:						
Orpha----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
Niobrara----------	Severe: depth to rock, slope.	Slight----------	Deep to water	Slope, droughty, fast intake.	Slope, depth to rock, soil blowing.	Too arid, slope, droughty.
OxG*:						
Orpha----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
Rock outcrop-----	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
PoC, PoD---------- Ponderosa	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
PtF*:						
Ponderosa--------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Tassel----------	Severe: depth to rock, slope.	Slight----------	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Vetal----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
RoB---------- Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock, erodes easily.	Too arid, erodes easily.
SnB---------- Satanta	Severe: seepage.	Severe: thin layer.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
SnC---------- Satanta	Severe: seepage.	Severe: thin layer.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
SnD---------- Satanta	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
SsD*, SsE*:						
Satanta----------	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Canyon----------	Severe: depth to rock, slope.	Slight----------	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
TfG*:						
Tassel	Severe: depth to rock, slope.	Slight	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Rock outcrop	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
TgG*:						
Tassel	Severe: depth to rock, slope.	Slight	Deep to water	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Ponderosa	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
Rock outcrop	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
ThB Thirtynine	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Too arid, erodes easily.
ThC, ThD Thirtynine	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Too arid, erodes easily.
To Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Tp Tryon	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
TtB Tuthill	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Erodes easily, too sandy.	Too arid, erodes easily.
TtD Tuthill	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, fast intake, soil blowing.	Erodes easily, too sandy.	Too arid, erodes easily.
TwB Tuthill	Severe: seepage.	Severe: piping.	Deep to water	Droughty	Soil blowing	Too arid, droughty.
TwC, TwD Tuthill	Severe: seepage.	Severe: piping.	Deep to water	Slope, droughty.	Soil blowing	Too arid, droughty.
VaB Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VaD Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
VaE---------- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
VaF*: Valent, rolling--	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
Valent, hilly----	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
VaG---------- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.
VeB---------- Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VeD---------- Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VnD---------- Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
VnE---------- Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
VnF*: Valentine, rolling---------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Valentine, hilly-	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
VnG---------- Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
VsB---------- Vetal	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Favorable.
Vt---------- Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
WrB---------- Wildhorse	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave, excess sodium.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess salt, excess sodium, droughty.

See footnote at end of table.

TABLE 17.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
WsB*:						
Wildhorse	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave, excess sodium.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess salt, excess sodium, droughty.
Hoffland	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
WtB*:						
Wildhorse	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave, excess sodium.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess salt, excess sodium, droughty.
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Ac, AcB, AcC----- Alliance	0-8	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	2-15
	8-18	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	10-25
	18-49	Very fine sandy loam, silt loam, loam.	ML, CL-ML, SM, SC	A-4	0-5	85-100	85-100	70-100	40-90	15-30	NP-10
	49-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
An---------- Almeria	0-8	Loamy fine sand	SM, SC-SM	A-2	0	100	100	50-75	15-30	15-20	NP-5
	8-60	Stratified sand, fine sand.	SM, SP-SM, SC-SM, SP	A-2, A-3	0	95-100	90-100	50-75	0-30	15-20	NP-5
Bc---------- Bankard	0-7	Loamy fine sand	SM	A-2	0	95-100	90-100	50-90	15-35	<20	NP-5
	7-60	Stratified loamy fine sand to sand.	SM, SP-SM	A-2	0	95-100	75-100	60-80	10-25	<20	NP-5
Bd---------- Beckton	0-5	Silt loam--------	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	5-8	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SC-SM	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	8-18	Clay loam, silty clay loam, silty clay.	CL	A-7	0	90-100	75-100	70-95	60-85	40-50	20-30
	18-60	Silty clay, silty clay loam, silt loam.	CL	A-7, A-6	0	80-100	75-95	65-90	60-85	30-50	15-30
Bf---------- Bolent	0-7	Loamy fine sand	SM, SP-SM, SC-SM	A-2, A-3	0	95-100	90-100	60-80	5-25	15-20	NP-5
	7-60	Stratified loamy fine sand to sand.	SM, SP, SP-SM, SC-SM	A-2, A-3, A-1	0	95-100	90-100	40-70	3-35	10-20	NP-5
Bh, BhB---------- Bridget	0-15	Very fine sandy loam.	ML, CL-ML, CL, SM	A-4	0	95-100	95-100	75-100	45-65	20-35	2-15
	15-60	Very fine sandy loam, silt loam, loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-15
Bm---------- Bridget	0-9	Loam----------	ML, CL-ML, CL	A-4	0	95-100	95-100	75-100	55-75	20-35	2-15
	9-60	Very fine sandy loam, silt loam, loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-15
BnB---------- Bufton	0-6	Silty clay loam	CL, CH	A-7	0	100	95-100	80-100	80-95	40-60	20-30
	6-28	Clay loam, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	80-100	80-95	35-60	15-30
	28-60	Silty clay loam, silt loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	80-100	80-95	30-60	15-30

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BnE----------	0-4	Silty clay loam	CL, CH	A-7	0	100	95-100	80-100	80-95	40-60	20-30
Bufton	4-24	Clay loam, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	80-100	80-95	35-60	15-30
	24-60	Silty clay loam, silt loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	80-100	80-95	30-60	15-30
BoD*:											
Bufton----------	0-5	Silty clay loam	CL, CH	A-7	0	100	95-100	80-100	80-95	40-60	20-30
	5-23	Clay loam, silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	80-100	80-95	35-60	15-30
	23-60	Silty clay loam, silt loam, silty clay.	CL, CH	A-7, A-6	0	100	95-100	80-100	80-95	30-60	15-30
Orella----------	0-5	Silty clay loam	CH, CL	A-6, A-7	0	100	100	95-100	70-95	38-65	20-40
	5-16	Clay, clay loam, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BsB, BsC, BsD---- Busher	0-11	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	15-25	NP-5
	11-44	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	15-25	NP-5
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BvC*, BvF*:											
Busher----------	0-10	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	15-25	NP-5
	10-44	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	15-25	NP-5
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel----------	0-3	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	55-100	25-55	15-25	NP-8
	3-10	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC-SM	A-4, A-2	0	95-100	80-100	65-95	25-60	15-25	NP-8
	10-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ca---------- Calamus	0-9	Loamy fine sand	SP-SM, SM, SC-SM	A-2, A-3	0	100	90-100	65-80	5-35	10-20	NP-5
	9-18	Fine sand, loamy fine sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	90-100	65-80	3-35	10-20	NP-5
	18-60	Stratified loamy sand to coarse sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	75-100	30-90	3-35	10-20	NP-5

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Cr	0-3	Loam	CL	A-4, A-6	0	100	100	85-100	65-90	20-40	7-20
Crowther	3-28	Clay loam, loam, sandy clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	70-100	50-85	30-50	4-24
	28-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-85	5-35	---	NP
Cs	0-7	Loam	CL	A-4, A-6	0	100	100	85-100	65-90	20-40	7-20
Crowther	7-22	Clay loam, loam, sandy clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	70-100	50-85	30-50	4-24
	22-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-85	5-35	---	NP
DuB, DuD	0-15	Loamy fine sand	SM	A-2, A-4	0	100	100	70-95	20-40	<20	NP
Dailey	15-60	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	75-95	5-35	<20	NP
Dw	0-8	Loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	60-100	25-35	5-15
Duroc	8-50	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	50-60	Loam, silt loam, very fine sandy loam.	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
DwB	0-6	Loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	60-100	25-35	5-15
Duroc	6-32	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	32-60	Loam, silt loam, very fine sandy loam.	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
Ec	0-7	Fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-30	10-20	NP-5
Els	7-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	70-100	5-35	10-20	NP-5
Ef*:											
Els	0-7	Fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-30	10-20	NP-5
	7-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	70-100	5-35	10-20	NP-5
Hoffland	0-10	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	10-34	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
	34-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
EgB*:											
Els	0-8	Fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-30	10-20	NP-5
	8-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	70-100	5-35	10-20	NP-5
Ipage	0-4	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	4-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
En*:											
Els	0-9	Fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-30	10-20	NP-5
	9-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	95-100	95-100	70-100	5-35	10-20	NP-5

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
En*:											
Tryon	0-9	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	10-20	NP-5
	9-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SP	A-2, A-3	0	100	100	51-95	3-30	5-15	NP-5
Es	0-17	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	10-20	NP-5
Elsmere	17-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	60-100	5-30	5-15	NP-5
EuE*:											
Enning	0-3	Silty clay loam	ML, MH, CL, CH	A-7	0	95-100	95-100	90-100	85-100	40-55	15-25
	3-18	Silt loam, silty clay loam.	ML, MH, CL, CH	A-7	0	95-100	95-100	90-100	90-100	40-55	15-25
	18-60	Weathered bedrock	ML, MH, CL, CH	A-7	0	100	95-100	90-100	90-100	40-60	15-25
Minnequa	0-4	Silty clay loam	ML	A-4, A-6, A-7	0	100	100	95-100	85-95	30-45	5-15
	4-33	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	95-100	90-100	80-90	25-35	5-15
	33-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
EvG*:											
Enning	0-3	Silty clay loam	ML, MH, CL, CH	A-7	0	95-100	95-100	90-100	85-100	40-55	15-25
	3-18	Silt loam, silty clay loam.	ML, MH, CL, CH	A-7	0	95-100	95-100	90-100	90-100	40-55	15-25
	18-60	Weathered bedrock	ML, MH, CL, CH	A-7	0	100	95-100	90-100	90-100	40-60	15-25
Rock outcrop	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EwG*:											
Epping	0-4	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-95	15-30	2-10
	4-15	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Badland	0-60	Unweathered bedrock.	---	---	0	---	---	---	---	---	---
Fu	0-3	Loamy sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-70	5-40	<25	NP-5
Fluvaquents	3-60	Variable	---	---	---	---	---	---	---	---	---
Gg	0-16	Loam	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	50-65	25-35	3-13
Gannett	16-23	Fine sandy loam, sandy loam, loam.	SM, ML, CL, SC	A-2, A-4, A-6	0	100	100	95-100	30-65	15-35	NP-15
	23-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-3, A-2	0	100	100	90-100	5-15	---	NP

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Gh---------- Gannett	0-19	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	50-65	25-35	3-13
	19-29	Fine sandy loam, sandy loam, loam.	SM, ML, CL, SC	A-2, A-4, A-6	0	100	100	95-100	30-65	15-35	NP-15
	29-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-3, A-2	0	100	100	90-100	5-15	15-20	NP-5
Hm---------- Hoffland	0-11	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	11-41	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
	41-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
Hn---------- Hoffland	0-14	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	14-27	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
	27-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
IpB---------- Ipage	0-5	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP
JgB, JgC, JgD---- Jayem	0-11	Fine sandy loam	SM	A-4, A-2	0	100	85-100	55-95	25-50	<25	NP-5
	11-24	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	<25	NP-5
	24-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	100	85-100	70-95	25-60	<25	NP-5
Jo---------- Johnstown	0-11	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	70-100	20-40	3-18
	11-34	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	80-95	30-50	15-30
	34-43	Silty clay loam, silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-100	50-95	20-40	5-20
	43-60	Gravelly coarse sand, coarse sand, sand.	SM, SP-SM	A-1, A-2, A-3	0	60-100	50-95	25-70	5-15	5-15	NP-5
Kd, KdC, KdD---- Kadoka	0-7	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	70-100	30-45	5-20
	7-27	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	95-100	90-100	65-100	35-50	10-25
	27-32	Silt loam, loam	CL, ML	A-4, A-6, A-7	0-5	85-100	70-100	60-100	55-100	30-45	5-20
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ke, KeB, KeC---- Keith	0-9	Loam----------	CL, ML, CL-ML	A-4	0	100	100	85-100	80-100	20-35	2-10
	9-28	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	80-100	30-45	10-25
	28-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	80-100	20-35	2-12

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Kg, KgB, KgC----- Keith	0-12	Loam----------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-95	60-75	20-40	3-17
	12-20	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	95-100	85-100	60-80	30-45	5-20
	20-30	Loam, silt loam	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-95	60-75	20-40	3-17
	30-49	Loam----------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	85-95	60-75	20-40	3-17
	49-60	Gravelly coarse sand, gravelly loamy sand, gravelly sand.	SM, SP-SM	A-2, A-1, A-3	0	60-100	50-95	25-70	5-15	5-10	NP-5
Ky---------- Keya	0-17	Loam----------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	30-40	5-15
	17-40	Clay loam, loam	CL	A-6, A-7	0	100	95-100	85-100	60-80	30-45	10-20
	40-60	Fine sandy loam, loam, clay loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	70-85	40-80	25-40	3-15
La---------- Las Animas	0-5	Loam----------	CL-ML, CL	A-4	0	100	95-100	80-95	60-90	25-30	5-10
	5-60	Stratified very fine sandy loam to loamy fine sand.	SM, ML, SC-SM	A-2, A-4	0	95-100	90-100	55-90	25-55	20-25	NP-5
Lg---------- Lodgepole	0-5	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-95	20-40	3-20
	5-32	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	90-100	85-95	50-65	25-40
	32-46	Silt loam, very fine sandy loam, loam.	CL, CL-ML, ML	A-4	0	100	100	90-100	60-90	20-35	3-10
	46-60	Sandy loam, fine sandy loam, loamy sand.	SM, ML	A-4, A-2	0	100	100	70-90	15-60	15-20	NP-5
Lu---------- Lute	0-7	Loam----------	ML, CL	A-4, A-6	0	100	100	70-100	50-70	30-40	5-15
	7-18	Sandy clay loam, fine sandy loam.	SM, SC, SC-SM	A-4, A-6	0	100	100	60-100	35-50	20-35	2-15
	18-60	Stratified very fine sandy loam to loamy sand.	SM, SC, SC-SM	A-1, A-2, A-4	0	100	100	45-100	15-50	15-30	NP-10
MbC---------- Manvel	0-5	Silty clay loam	CL	A-6	0	100	95-100	95-100	80-90	35-40	10-15
	5-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	75-90	20-40	5-20
Mc---------- Marlake	0-7	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	40-55	<20	NP
	7-14	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-4, A-3	0	100	100	50-85	5-50	---	NP
	14-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
Mk---------- McCook	0-12	Loam----------	ML, CL, CL-ML	A-4, A-6	0	100	100	80-100	55-90	20-45	5-15
	12-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	80-100	50-100	15-45	NP-15

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mm----------	0-15	Loam----------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	20-35	2-10
McCook	15-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	80-100	15-25	NP-10
MxF*:											
Mitchell--------	0-4	Very fine sandy loam.	ML	A-4	0	100	100	85-100	65-95	20-35	NP-10
	4-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-100	20-35	NP-15
Epping----------	0-3	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-95	15-30	2-10
	3-15	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
My----------	0-6	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	95-100	90-100	65-95	40-65	15-30	NP-10
Munjor	6-60	Loam, sandy loam, loamy very fine sand.	SM, SC, ML, CL	A-4	0	95-100	95-100	85-100	35-65	15-20	NP-15
Mz----------	0-6	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	95-100	90-100	65-95	40-65	15-30	NP-10
Munjor	6-60	Loam, sandy loam, loamy very fine sand.	SM, ML	A-4	0	95-100	95-100	85-100	35-65	15-20	NP-5
OhC*, OhD*, OhF*:											
Oglala----------	0-8	Loam----------	ML, CL	A-4, A-6	0	100	100	85-100	60-90	30-40	5-15
	8-58	Loam, silt loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	85-100	51-75	25-40	NP-15
	58-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon----------	0-5	Loam----------	ML, CL, CL-ML, SM	A-4	0-5	90-100	75-100	50-95	40-75	15-30	2-10
	5-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-100	50-100	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
On----------	0-8	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-95	30-45	12-20
Onita	8-32	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	75-100	40-60	10-30
	32-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-6, A-7	0-5	95-100	95-100	85-100	65-100	30-55	10-30
OrF----------	0-5	Silty clay loam	CH, CL	A-6, A-7	0	100	100	95-100	70-95	38-65	20-40
Orella	5-16	Clay, clay loam, silty clay loam.	CH	A-7	0	100	100	90-100	75-95	50-70	30-50
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
OvD----------	0-6	Loamy fine sand	SM	A-2, A-4	0	100	95-100	65-100	15-40	10-20	NP-5
Orpha	6-12	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	75-100	70-90	5-35	10-20	NP-5
	12-60	Fine sand, sand	SM	A-2	0	100	75-100	75-85	5-30	10-20	NP-5
OwF*:											
Orpha----------	0-6	Loamy fine sand	SM	A-2, A-4	0	100	95-100	65-100	15-40	10-20	NP-5
	6-11	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	75-100	70-90	5-35	10-20	NP-5
	11-60	Fine sand, sand	SM	A-2	0	100	75-100	75-85	5-30	10-20	NP-5
Niobrara--------	0-4	Loamy fine sand	SM	A-2	0	85-100	85-100	65-95	15-30	---	NP
	4-13	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	80-100	75-95	75-95	5-30	---	NP
	13-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
OxG*:											
Orpha----------	0-6	Loamy fine sand	SM	A-2, A-4	0	100	95-100	65-100	15-40	10-20	NP-5
	6-32	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	75-100	70-90	5-35	10-20	NP-5
	32-60	Fine sand, sand	SM	A-2	0	100	75-100	75-85	5-30	10-20	NP-5
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
PoC, PoD---------	0-18	Very fine sandy loam.	SC-SM, SM, CL-ML, ML	A-4, A-6	0	100	95-100	75-100	45-65	15-30	NP-12
Ponderosa	18-30	Very fine sandy loam, loamy very fine sand.	SC-SM, SM, SC	A-4, A-2, A-6	0	95-100	75-100	65-100	30-50	15-30	NP-12
	30-60	Very fine sandy loam, loamy very fine sand.	SC-SM, SM, SC	A-4, A-2, A-6	0	85-100	75-100	65-100	30-50	15-30	NP-12
PtF*:											
Ponderosa-------	0-12	Very fine sandy loam.	SC-SM, SM, CL-ML, ML	A-4, A-6	0	100	95-100	75-100	45-65	15-30	NP-12
	12-27	Very fine sandy loam, loamy very fine sand.	SC-SM, SM, SC	A-4, A-2, A-6	0	95-100	75-100	65-100	30-50	15-30	NP-12
	27-60	Very fine sandy loam, loamy very fine sand.	SC-SM, SM, SC	A-4, A-2, A-6	0	85-100	75-100	65-100	30-50	15-30	NP-12
Tassel----------	0-3	Very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	95-100	90-100	75-100	40-60	15-25	NP-8
	3-15	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC-SM	A-4, A-2	0	95-100	80-100	65-95	25-60	15-25	NP-8
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
PtF*:											
Vetal----------	0-7	Very fine sandy loam.	CL, ML, SM, SC	A-4, A-6, A-2	0	100	95-100	90-100	30-55	20-35	NP-12
	7-42	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	95-100	60-100	30-65	20-30	NP-10
	42-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	90-100	60-100	30-65	20-30	NP-10
RoB---------- Rosebud	0-9	Loam----------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	24-34	3-12
	9-17	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	60-95	30-50	12-26
	17-32	Sandy loam, very fine sandy loam, loam.	SM, ML, CL-ML, SC-SM	A-4, A-6, A-2	0-5	95-100	80-100	60-100	30-90	20-40	2-12
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SnB, SnC, SnD---- Satanta	0-14	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	95-100	70-85	40-55	<25	NP-5
	14-35	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	45-75	30-45	10-20
	35-60	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	95-100	70-95	40-60	20-30	NP-5
SsD*:											
Satanta---------	0-10	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	95-100	70-85	40-55	<25	NP-5
	10-33	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	45-75	30-45	10-20
	33-60	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	95-100	70-95	40-60	20-30	NP-5
Canyon----------	0-6	Loam----------	ML, CL, CL-ML, SM	A-4	0-5	90-100	75-100	50-95	40-75	15-30	2-10
	6-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-100	50-100	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SsE*:											
Satanta---------	0-9	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	95-100	70-85	40-55	<25	NP-5
	9-32	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	45-75	30-45	10-20
	32-50	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	95-100	70-95	40-60	20-30	NP-5
	50-60	Loamy fine sand	SM	A-2-4, A-1-b	0	100	90-100	45-75	15-30	<25	NP
Canyon----------	0-6	Loam----------	ML, CL, CL-ML, SM	A-4	0-5	90-100	75-100	50-95	40-75	15-30	2-10
	6-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-100	50-100	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
TfG*:											
Tassel----------	0-9	Very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	95-100	90-100	75-100	40-60	15-25	NP-8
	9-16	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC-SM	A-4, A-2	0	95-100	80-100	65-95	25-60	15-25	NP-8
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
TgG*:											
Tassel----------	0-4	Very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	95-100	90-100	75-100	40-60	15-25	NP-8
	4-14	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC-SM	A-4, A-2	0	95-100	80-100	65-95	25-60	15-25	NP-8
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ponderosa-------	0-9	Very fine sandy loam.	SC-SM, SM, CL-ML, ML	A-4, A-6	0	100	95-100	75-100	45-65	15-30	NP-12
	9-23	Very fine sandy loam, loamy very fine sand.	SC-SM, SM, SC	A-4, A-2, A-6	0	95-100	75-100	65-100	30-50	15-30	NP-12
	23-60	Very fine sandy loam, loamy very fine sand.	SC-SM, SM, SC	A-4, A-2, A-6	0	85-100	75-100	65-100	30-50	15-30	NP-12
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ThB, ThC, ThD---- Thirtynine	0-8	Loam----------	ML, CL-ML, CL	A-4, A-6	0	100	95-100	75-100	70-90	20-35	2-20
	8-21	Silt loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	75-95	25-35	5-15
	21-60	Silt loam, loam, very fine sandy loam.	ML, CL-ML	A-4	0	95-100	85-100	85-100	70-90	15-25	NP-5
To---------- Tryon	0-6	Fine sandy loam	SM, SC-SM	A-2, A-4	0	100	100	70-100	30-45	15-25	NP-6
	6-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM, SP	A-2, A-3	0	100	100	51-95	3-30	5-15	NP-5
Tp---------- Tryon	0-5	Fine sandy loam	SC-SM, SM	A-2, A-4	0	100	100	70-100	30-45	15-25	NP-6
	5-60	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	50-90	5-30	5-15	NP-5
TtB, TtD--------- Tuthill	0-11	Loamy fine sand	SM, SC, SC-SM	A-2	0	100	100	50-75	15-30	15-30	NP-10
	11-30	Sandy clay loam, fine sandy loam, loam.	SC-SM, SC, CL-ML, CL	A-4, A-6, A-7	0	100	100	70-95	35-55	15-45	2-20
	30-60	Fine sand, loamy fine sand.	SP-SM, SM, SC-SM	A-2, A-3, A-1	0	100	95-100	45-70	5-30	15-20	NP-5

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
TwB, TwC, TwD---- Tuthill	0-9	Fine sandy loam	SM	A-4, A-2	0	100	100	85-100	30-50	20-35	NP-10
	9-21	Sandy clay loam, sandy loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	100	100	70-100	35-70	25-40	5-15
	21-60	Loamy sand, loamy fine sand, fine sand.	SM, SC-SM, SP-SM	A-2	0	100	95-100	50-100	10-30	15-25	NP-5
VaB, VaD, VaE---- Valent	0-4	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	4-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VaF*: Valent, rolling-	0-4	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	4-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
Valent, hilly---	0-4	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	4-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VaG---------- Valent	0-4	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	4-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VeB, VeD--------- Valent	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	<25	NP-5
	5-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VnD, VnE--------- Valentine	0-6	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	15-20	NP-5
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	15-20	NP-5
VnF*: Valentine, rolling--------	0-6	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	15-20	NP-5
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	15-20	NP-5
Valentine, hilly	0-6	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	15-20	NP-5
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	15-20	NP-5
VnG---------- Valentine	0-6	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	15-20	NP-5
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	15-20	NP-5
VsB---------- Vetal	0-7	Loamy fine sand	SM, SC-SM	A-2	0	100	100	85-100	15-35	15-25	NP-5
	7-40	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-7
	40-60	Loamy fine sand, fine sand, sand.	SM, SC-SM	A-2	0	100	90-100	85-100	15-35	15-25	NP-5

See footnote at end of table.

TABLE 18.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Vt Vetal	0-7	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	95-100	60-100	30-55	20-30	NP-10
	7-43	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	95-100	60-100	30-65	20-30	NP-10
	43-60	Loamy fine sand, fine sand, sand.	SM, SC-SM	A-2	0	100	90-100	85-100	15-35	15-25	NP-5
WrB Wildhorse	0-5	Fine sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-100	5-40	10-20	NP-5
	5-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5
WsB*:											
Wildhorse	0-6	Fine sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-100	5-40	10-20	NP-5
	6-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5
Hoffland	0-11	Fine sandy loam	SC, CL, CL-ML, SC-SM	A-4	0	100	100	70-95	40-55	15-25	4-10
	11-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	10-20	NP-5
WtB*:											
Wildhorse	0-6	Fine sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-100	5-40	10-20	NP-5
	6-60	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	10-20	NP-5
Ipage	0-6	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-30	---	NP
	6-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-100	2-30	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ac, AcB, AcC-----	0-8	15-20	1.25-1.45	0.6-2.0	0.20-0.22	6.6-7.8	0-0	Low-------	0.28	5	5	2-4
Alliance	8-18	25-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	0-0	Moderate	0.43			
	18-49	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	0-0	Low-------	0.24			
	49-60	---	---	0.2-0.6	---	---	---	----------	----			
An----------	0-8	3-10	1.35-1.55	6.0-20	0.10-0.12	6.1-8.4	0-4	Low-------	0.17	5	8	.5-4
Almeria	8-60	1-10	1.55-1.80	6.0-20	0.05-0.12	5.6-7.3	0-4	Low-------	0.15			
Bc----------	0-7	2-10	1.80-1.95	6.0-20	0.10-0.15	7.4-8.4	<2	Low-------	0.17	5	2	.5-2
Bankard	7-60	0-10	1.85-2.00	6.0-20	0.07-0.15	7.4-8.4	<2	Low-------	0.17			
Bd----------	0-5	20-40	1.30-1.40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate	0.32	2	7	1-3
Beckton	5-8	10-20	1.40-1.45	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low-------	0.20			
	8-18	35-50	1.40-1.50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High------	0.28			
	18-60	15-50	1.30-1.45	<0.2	0.10-0.13	>7.8	>4	High------	0.28			
Bf----------	0-7	3-10	1.40-1.60	6.0-20	0.10-0.12	7.4-8.4	0-0	Low-------	0.17	5	2	.5-1
Bolent	7-60	1-10	1.50-1.80	6.0-20	0.05-0.10	6.6-8.4	0-0	Low-------	0.15			
Bh, BhB----------	0-15	5-18	1.30-1.50	0.6-2.0	0.16-0.20	6.6-7.8	0-0	Low-------	0.32	5	3	1-3
Bridget	15-60	5-18	1.40-1.60	0.6-2.0	0.16-0.24	7.4-8.4	0-0	Low-------	0.43			
Bm----------	0-9	10-20	1.25-1.45	0.6-2.0	0.17-0.22	6.6-7.8	0-0	Low-------	0.28	5	5	1-3
Bridget	9-60	5-18	1.40-1.60	0.6-2.0	0.16-0.24	7.4-8.4	0-0	Low-------	0.43			
BnB----------	0-6	30-40	1.20-1.40	0.2-0.6	0.18-0.23	6.6-8.4	0-0	High------	0.43	5	4L	1-3
Bufton	6-28	35-45	1.20-1.40	0.06-0.6	0.12-0.20	7.4-9.0	0-4	High------	0.37			
	28-60	25-45	1.20-1.30	0.06-0.6	0.10-0.18	7.9-9.0	0-4	High------	0.37			
BnE----------	0-4	30-40	1.20-1.40	0.2-0.6	0.18-0.23	6.6-8.4	0-0	High------	0.43	5	4L	1-3
Bufton	4-24	35-45	1.20-1.40	0.06-0.6	0.12-0.20	7.4-9.0	0-4	High------	0.37			
	24-60	25-45	1.20-1.30	0.06-0.6	0.10-0.18	7.9-9.0	0-4	High------	0.37			
BoD*:												
Bufton----------	0-5	30-40	1.20-1.40	0.2-0.6	0.18-0.23	6.6-8.4	0-0	High------	0.43	5	4L	1-3
	5-23	35-45	1.20-1.40	0.06-0.6	0.12-0.20	7.4-9.0	0-4	High------	0.37			
	23-60	25-45	1.20-1.30	0.06-0.6	0.10-0.18	7.9-9.0	0-4	High------	0.37			
Orella----------	0-5	27-40	1.00-1.20	0.2-0.6	0.12-0.14	7.4-8.4	0-4	High------	0.37	2	4L	.5-1
	5-16	38-65	1.00-1.20	0.00-0.06	0.09-0.11	7.4-9.0	4-16	High------	0.32			
	16-60	---	---	0.06-0.2	---	---	---	----------	----			
BsB, BsC, BsD----	0-11	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	0-0	Low-------	0.20	5	3	1-3
Busher	11-44	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	0-0	Low-------	0.28			
	44-60	---	---	0.2-0.6	---	---	---	----------	----			
BvC*, BvF*:												
Busher----------	0-10	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	0-0	Low-------	0.20	5	3	1-3
	10-44	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	0-0	Low-------	0.28			
	44-60	---	---	0.2-0.6	---	---	---	----------	----			
Tassel----------	0-3	5-12	1.30-1.50	2.0-6.0	0.12-0.16	7.4-8.4	0-0	Low-------	0.24	2	3	1-3
	3-10	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low-------	0.28			
	10-60	---	---	0.2-0.6	---	---	---	----------	----			

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ca	0-9	1-10	1.50-1.60	6.0-20	0.06-0.11	5.6-7.8	0-0	Low	0.17	5	2	.5-1
Calamus	9-18	3-10	1.50-1.60	6.0-20	0.06-0.11	6.1-7.8	0-0	Low	0.17			
	18-60	1-10	1.50-1.70	6.0-20	0.02-0.11	6.1-7.8	0-0	Low	0.15			
Cr	0-3	15-35	1.20-1.40	0.6-6.0	0.17-0.23	7.4-8.4	<2	Moderate	0.24	5	8	8-16
Crowther	3-28	20-40	1.20-1.50	0.6-6.0	0.15-0.19	7.9-8.4	<2	Moderate	0.32			
	28-60	1-10	1.50-1.70	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.17			
Cs	0-7	15-35	1.20-1.40	0.6-6.0	0.17-0.23	7.4-8.4	<2	Moderate	0.24	5	8	8-16
Crowther	7-22	20-40	1.20-1.50	0.6-6.0	0.15-0.19	7.9-8.4	<2	Moderate	0.32			
	22-60	1-10	1.50-1.70	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.17			
DuB, DuD	0-15	2-5	1.70-1.85	6.0-20	0.07-0.12	6.6-7.3	<2	Low	0.17	5	2	1-3
Dailey	15-60	2-5	1.75-1.95	6.0-20	0.04-0.07	6.6-8.4	<2	Low	0.10			
Dw	0-8	15-20	1.20-1.45	0.6-2.0	0.12-0.22	6.6-7.8	0-0	Moderate	0.28	5	5	1-3
Duroc	8-50	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	0-0	Moderate	0.43			
	50-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	7.9-9.0	0-2	Moderate	0.43			
DwB	0-6	15-20	1.20-1.45	0.6-2.0	0.12-0.22	6.6-7.8	0-0	Moderate	0.28	5	5	1-3
Duroc	6-32	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	0-0	Moderate	0.43			
	32-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	7.9-9.0	0-2	Moderate	0.43			
Ec	0-7	1-8	1.60-1.70	6.0-20	0.07-0.09	7.4-8.4	0-2	Low	0.15	5	1	.5-3
Els	7-60	1-10	1.50-1.70	6.0-20	0.05-0.08	7.4-8.4	0-2	Low	0.15			
Ef*:												
Els	0-7	1-8	1.60-1.70	6.0-20	0.07-0.09	7.4-8.4	0-2	Low	0.15	5	1	.5-3
	7-60	1-10	1.50-1.70	6.0-20	0.05-0.08	7.4-8.4	0-2	Low	0.15			
Hoffland	0-10	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low	0.20	5	8	4-12
	10-34	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.15			
	34-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-7.8	0-0	Low	0.15			
EgB*:												
Els	0-8	1-8	1.60-1.70	6.0-20	0.07-0.09	7.4-8.4	0-2	Low	0.15	5	1	.5-3
	8-60	1-10	1.50-1.70	6.0-20	0.05-0.08	7.4-8.4	0-2	Low	0.15			
Ipage	0-4	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.3	0-0	Low	0.15	5	1	.5-1
	4-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.3	0-0	Low	0.15			
En*:												
Els	0-9	1-8	1.60-1.70	6.0-20	0.07-0.09	7.4-8.4	0-2	Low	0.15	5	1	.5-3
	9-60	1-10	1.50-1.70	6.0-20	0.05-0.08	7.4-8.4	0-2	Low	0.15			
Tryon	0-9	3-10	1.40-1.60	6.0-20	0.10-0.12	5.6-8.4	0-0	Low	0.17	5	8	4-8
	9-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	0-0	Low	0.17			
Es	0-17	3-10	1.55-1.70	6.0-20	0.10-0.12	5.6-7.3	0-0	Low	0.17	5	2	1-3
Elsmere	17-60	0-5	1.50-1.60	6.0-20	0.05-0.07	5.6-7.8	0-0	Low	0.15			
EuE*:												
Enning	0-3	27-30	1.15-1.25	0.6-2.0	0.14-0.17	6.6-8.4	<2	Low	0.43	2	4L	1-3
	3-18	18-35	1.20-1.35	0.6-2.0	0.14-0.17	7.4-8.4	<2	Low	0.43			
	18-60	---	---	0.06-0.6	---	7.4-8.4	---	---	----			
Minnequa	0-4	28-35	1.15-1.30	0.2-0.6	0.17-0.21	7.4-8.4	0-2	Low	0.32	2	4L	.5-2
	4-33	18-35	1.15-1.40	0.2-2.0	0.14-0.18	7.4-9.0	0-8	Low	0.37			
	33-60	---	---	0.00-2.0	---	---	---	---	----			

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
EvG*:												
Enning	0-3	27-30	1.15-1.25	0.6-2.0	0.14-0.17	6.6-8.4	<2	Low	0.43	2	4L	1-3
	3-18	18-35	1.20-1.35	0.6-2.0	0.14-0.17	7.4-8.4	<2	Low	0.43			
	18-60	---	---	0.06-0.6	---	7.4-8.4	---	---	---			
Rock outcrop	0-60	---	---	---	---	---	<2	---	---	---	8	---
EwG*:												
Epping	0-4	10-20	1.25-1.45	0.6-2.0	0.12-0.20	6.6-8.4	<2	Low	0.43	2	3	.5-2
	4-15	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low	0.43			
	15-60	---	---	0.06-0.2	---	---	---	---	---			
Badland	0-60	---	---	---	---	---	<2	---	---	---	8	---
Fu	0-3	1-18	1.30-1.80	6.0-20	0.07-0.13	6.6-8.4	<2	Low	0.17	5	8	2-8
Fluvaquents	3-60	---	---	0.06-20	---	---	---	---	---			
Gg	0-16	5-18	1.20-1.50	2.0-6.0	0.15-0.19	6.6-8.4	0-0	Low	0.24	4	8	4-12
Gannett	16-23	5-18	1.20-1.50	2.0-6.0	0.13-0.19	6.6-8.4	0-0	Low	0.20			
	23-60	2-7	1.50-1.70	6.0-20	0.05-0.07	6.6-8.4	0-0	Low	0.15			
Gh	0-19	5-18	1.20-1.50	2.0-6.0	0.15-0.19	6.6-8.4	0-0	Low	0.24	4	8	4-12
Gannett	19-29	5-18	1.20-1.50	2.0-6.0	0.13-0.19	6.6-8.4	0-0	Low	0.20			
	29-60	2-7	1.40-1.70	6.0-20	0.05-0.07	6.6-8.4	0-0	Low	0.15			
Hm	0-11	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low	0.20	5	8	4-12
Hoffland	11-41	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.15			
	41-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-7.8	0-0	Low	0.15			
Hn	0-14	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low	0.20	5	8	4-12
Hoffland	14-27	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.15			
	27-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-7.8	0-0	Low	0.15			
IpB	0-5	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.3	0-0	Low	0.15	5	1	.5-1
Ipage	5-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.3	0-0	Low	0.15			
JgB, JgC, JgD	0-11	5-15	1.20-1.35	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.20	5	3	1-3
Jayem	11-24	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.32			
	24-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.32			
Jo	0-11	12-22	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	0-0	Moderate	0.28	5	5	1-3
Johnstown	11-34	27-35	1.40-1.50	0.6-2.0	0.15-0.20	6.1-7.8	0-0	Moderate	0.37			
	34-43	15-32	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Moderate	0.43			
	43-60	0-5	1.50-1.70	6.0-20	0.02-0.04	6.6-7.8	0-0	Low	0.05			
Kd, KdC, KdD	0-7	20-27	1.20-1.30	0.6-2.0	0.19-0.22	6.6-7.8	0-2	Low	0.32	4	6	2-4
Kadoka	7-27	25-35	1.20-1.35	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.43			
	27-32	20-27	1.20-1.35	0.6-2.0	0.16-0.19	7.4-8.4	0-2	Low	0.43			
	32-60	---	---	0.06-0.2	---	---	---	---	---			
Ke, KeB, KeC	0-9	14-20	1.25-1.45	0.6-2.0	0.20-0.23	6.1-7.3	0-0	Low	0.28	5	5	1-3
Keith	9-28	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-7.3	0-0	Moderate	0.43			
	28-60	8-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	0-0	Low	0.43			
Kg, KgB, KgC	0-12	12-22	1.25-1.45	0.6-2.0	0.20-0.22	6.6-7.8	0-0	Low	0.28	5	5	1-3
Keith	12-20	18-35	1.30-1.50	0.6-2.0	0.17-0.19	6.6-7.8	0-0	Moderate	0.37			
	20-30	18-27	1.45-1.65	0.6-2.0	0.17-0.19	7.4-8.4	0-0	Low	0.37			
	30-49	12-22	1.45-1.65	0.6-2.0	0.17-0.19	7.4-8.4	0-0	Low	0.37			
	49-60	2-5	1.65-1.85	>20	0.02-0.04	7.4-8.4	0-0	Low	0.05			

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ky	0-17	20-26	1.15-1.30	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	5	6	2-4
Keya	17-40	24-34	1.20-1.40	0.6-2.0	0.16-0.22	6.6-7.8	0-2	Moderate	0.28			
	40-60	10-30	1.35-1.50	0.6-2.0	0.12-0.20	7.4-8.4	0-2	Low	0.32			
La	0-5	15-25	1.35-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-4	Low	0.32	5	4L	.5-2
Las Animas	5-60	8-18	1.50-1.70	2.0-6.0	0.12-0.18	7.4-8.4	0-2	Low	0.28			
Lg	0-5	16-25	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.8	0-0	Low	0.37	3	6	2-4
Lodgepole	5-32	35-50	1.25-1.50	0.00-0.06	0.13-0.18	6.1-7.8	0-0	High	0.28			
	32-46	8-27	1.30-1.50	0.6-2.0	0.22-0.24	6.6-8.4	0-0	Low	0.43			
	46-60	5-20	1.40-1.50	2.0-6.0	0.10-0.18	6.6-8.4	0-0	Low	0.28			
Lu	0-7	10-25	1.20-1.35	0.6-2.0	0.18-0.20	6.6-8.4	0-8	Low	0.32	3	6	1-3
Lute	7-18	18-26	1.25-1.35	0.06-0.2	0.09-0.15	7.4-9.8	4-16	Low	0.32			
	18-60	5-15	1.20-1.50	0.6-6.0	0.05-0.14	7.9-9.8	4-16	Low	0.28			
MbC	0-5	28-35	1.15-1.30	0.2-0.6	0.16-0.18	7.9-8.4	0-2	Moderate	0.32	5	4L	.5-2
Manvel	5-60	18-35	1.25-1.40	0.2-0.6	0.14-0.18	7.9-8.4	2-4	Low	0.43			
Mc	0-7	5-15	1.40-1.50	2.0-6.0	0.16-0.18	6.6-8.4	<2	Low	0.20	2	8	4-8
Marlake	7-14	3-8	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.17			
	14-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.6-8.4	<2	Low	0.17			
Mk	0-12	10-27	1.30-1.50	0.6-2.0	0.19-0.22	6.6-8.4	0-0	Moderate	0.28	5	4L	2-4
McCook	12-60	10-18	1.20-1.50	0.6-2.0	0.16-0.20	7.4-8.4	0-0	Low	0.43			
Mm	0-15	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	0-0	Low	0.28	5	4L	2-4
McCook	15-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	0-0	Low	0.43			
MxF*:												
Mitchell	0-4	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	0-0	Low	0.43	5	3	.5-2
	4-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	0-0	Low	0.43			
Epping	0-3	10-20	1.25-1.45	0.6-2.0	0.12-0.20	6.6-8.4	<2	Low	0.43	2	3	.5-2
	3-15	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low	0.43			
	15-60	---	---	0.06-0.2	---	---	---	---	----			
My, Mz	0-6	7-20	1.30-1.40	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low	0.24	5	3	.5-1
Munjor	6-60	7-18	1.30-1.40	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low	0.24			
OhC*, OhD*, OhF*:												
Oglala	0-8	10-18	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-2	Low	0.28	5	5	1-4
	8-58	5-18	1.25-1.40	0.6-2.0	0.16-0.23	6.6-7.8	0-2	Low	0.43			
	58-60	---	---	0.2-0.6	---	---	---	---	----			
Canyon	0-5	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-2	Low	0.32	2	4L	1-3
	5-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	0-2	Low	0.20			
	14-60	---	---	0.2-0.6	---	---	---	---	----			
On	0-8	27-35	1.15-1.25	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
Onita	8-32	40-50	1.20-1.40	0.06-0.2	0.11-0.17	6.1-7.3	<2	High	0.43			
	32-60	25-35	1.25-1.40	0.2-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
OrF	0-5	27-40	1.00-1.20	0.2-0.6	0.12-0.14	7.4-8.4	0-4	High	0.37	2	4L	.5-1
Orella	5-16	38-65	1.00-1.20	0.00-0.06	0.09-0.11	7.4-9.0	4-16	High	0.32			
	16-60	---	---	0.06-0.2	---	---	---	---	----			
OvD	0-6	5-9	1.35-1.45	6.0-20	0.07-0.09	6.6-7.8	0-0	Low	0.17	5	2	.5-1
Orpha	6-12	2-8	1.35-1.50	6.0-20	0.06-0.09	6.6-7.8	0-0	Low	0.15			
	12-60	2-6	1.45-1.55	6.0-20	0.05-0.07	6.6-8.4	0-0	Low	0.15			

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
OwF*:												
Orpha	0-6	5-9	1.35-1.45	6.0-20	0.07-0.09	6.6-7.8	0-0	Low	0.17	5	2	.5-1
	6-11	2-8	1.35-1.50	6.0-20	0.06-0.09	6.6-7.8	0-0	Low	0.15			
	11-60	2-6	1.45-1.55	6.0-20	0.05-0.07	6.6-8.4	0-0	Low	0.15			
Niobrara	0-4	2-5	1.70-1.90	6.0-20	0.10-0.12	7.4-8.4	0-0	Low	0.17	2	2	.5-2
	4-13	2-5	1.70-1.90	6.0-20	0.06-0.11	7.4-8.4	0-0	Low	0.15			
	13-60	---	---	0.2-0.6	---	---	---	---	---			
OxG*:												
Orpha	0-6	5-9	1.35-1.45	6.0-20	0.07-0.09	6.6-7.8	0-0	Low	0.17	5	2	.5-1
	6-32	2-8	1.35-1.50	6.0-20	0.06-0.09	6.6-7.8	0-0	Low	0.15			
	32-60	2-6	1.45-1.55	6.0-20	0.05-0.07	6.6-8.4	0-0	Low	0.15			
Rock outcrop	0-60	---	---	---	---	---	<2	---	---	---	8	---
PoC, PoD	0-18	10-18	1.20-1.40	2.0-6.0	0.17-0.19	6.6-7.3	0-0	Low	0.32	5	3	1-3
Ponderosa	18-30	5-18	1.55-1.80	2.0-6.0	0.12-0.18	6.6-7.8	0-0	Low	0.43			
	30-60	5-18	1.55-1.80	2.0-6.0	0.11-0.18	7.4-8.4	0-0	Low	0.43			
PtF*:												
Ponderosa	0-12	10-18	1.20-1.40	2.0-6.0	0.17-0.19	6.6-7.3	0-0	Low	0.32	5	3	1-3
	12-27	5-18	1.55-1.80	2.0-6.0	0.12-0.18	6.6-7.8	0-0	Low	0.43			
	27-60	5-18	1.55-1.80	2.0-6.0	0.11-0.18	7.4-8.4	0-0	Low	0.43			
Tassel	0-3	5-12	1.20-1.45	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.37	2	3	1-3
	3-15	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
	15-60	---	---	0.2-0.6	---	---	---	---	---			
Vetal	0-7	10-18	1.20-1.30	2.0-6.0	0.17-0.21	5.6-7.8	0-0	Low	0.32	5	3	1-3
	7-42	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	0-0	Low	0.20			
	42-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	0-0	Low	0.20			
RoB	0-9	8-20	1.20-1.45	0.6-2.0	0.22-0.24	6.6-7.8	0-2	Low	0.28	4	5	2-4
Rosebud	9-17	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	0-2	Moderate	0.37			
	17-32	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-9.0	0-2	Low	0.28			
	32-60	---	---	0.2-0.6	---	---	---	---	---			
SnB, SnC, SnD	0-14	5-15	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low	0.20	5	3	1-2
Satanta	14-35	18-35	1.35-1.45	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.28			
	35-60	5-15	1.30-1.40	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low	0.32			
SsD*:												
Satanta	0-10	5-15	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low	0.20	5	3	1-2
	10-33	18-35	1.35-1.45	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.28			
	33-60	5-15	1.30-1.40	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low	0.32			
Canyon	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-2	Low	0.32	2	4L	1-3
	6-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	0-2	Low	0.20			
	14-60	---	---	0.2-0.6	---	---	---	---	---			
SsE*:												
Satanta	0-9	5-15	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low	0.20	5	3	1-2
	9-32	18-35	1.35-1.45	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.28			
	32-50	5-15	1.30-1.40	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low	0.32			
	50-60	2-15	1.45-1.55	6.0-20	0.08-0.10	7.4-8.4	<2	Low	0.17			
Canyon	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	0-2	Low	0.32	2	4L	1-3
	6-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	0-2	Low	0.20			
	14-60	---	---	0.2-0.6	---	---	---	---	---			

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
TfG*:												
Tassel	0-9	5-12	1.20-1.45	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.37	2	3	1-3
	9-16	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
	16-60	---	---	0.2-0.6	---	---	---	---	---			
Rock outcrop	0-60	---	---	---	---	---	<2	---	---	---	8	---
TgG*:												
Tassel	0-4	5-12	1.20-1.45	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.37	2	3	1-3
	4-14	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	0-0	Low	0.28			
	14-60	---	---	0.2-0.6	---	---	---	---	---			
Ponderosa	0-9	10-18	1.20-1.40	2.0-6.0	0.17-0.19	6.6-7.3	0-0	Low	0.32	5	3	1-3
	9-23	5-18	1.55-1.80	2.0-6.0	0.12-0.18	6.6-7.8	0-0	Low	0.43			
	23-60	5-18	1.55-1.80	2.0-6.0	0.11-0.18	7.4-8.4	0-0	Low	0.43			
Rock outcrop	0-60	---	---	---	---	---	<2	---	---	---	8	---
ThB, ThC, ThD	0-8	10-24	1.25-1.45	0.6-2.0	0.20-0.22	6.1-7.8	0-2	Low	0.28	5	5	2-4
Thirtynine	8-21	15-30	1.15-1.25	0.6-2.0	0.19-0.22	7.9-9.0	0-2	Moderate	0.49			
	21-60	6-18	1.15-1.25	0.6-2.0	0.16-0.20	7.9-9.0	0-2	Low	0.55			
To	0-6	5-15	1.30-1.50	2.0-6.0	0.16-0.18	5.6-8.4	0-0	Low	0.20	5	8	4-8
Tryon	6-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	0-0	Low	0.17			
Tp	0-5	5-15	1.30-1.50	2.0-6.0	0.16-0.18	5.6-8.4	0-0	Low	0.20	5	8	4-8
Tryon	5-60	1-7	1.50-1.70	6.0-20	0.06-0.08	5.6-7.8	0-0	Low	0.17			
TtB, TtD	0-11	3-10	1.35-1.55	6.0-20	0.10-0.12	6.6-7.8	0-0	Low	0.17	5	2	1-3
Tuthill	11-30	10-27	1.30-1.65	0.6-2.0	0.15-0.19	6.6-7.8	0-0	Moderate	0.37			
	30-60	3-10	1.55-1.80	6.0-20	0.05-0.10	7.4-8.4	0-0	Low	0.15			
TwB, TwC, TwD	0-9	10-20	1.25-1.40	0.6-6.0	0.14-0.17	6.1-7.8	0-2	Low	0.20	4	3	1-3
Tuthill	9-21	18-35	1.25-1.40	0.6-2.0	0.09-0.18	6.1-7.8	0-2	Moderate	0.32			
	21-60	3-10	1.40-1.60	6.0-20	0.06-0.10	7.4-8.4	0-2	Low	0.17			
VaB, VaD, VaE	0-4	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15	5	1	.5-1
Valent	4-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
VaF*:												
Valent, rolling	0-4	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15	5	1	.5-1
	4-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
Valent, hilly	0-4	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15	5	1	.5-1
	4-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
VaG	0-4	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15	5	1	.5-1
Valent	4-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
VeB, VeD	0-5	3-10	1.55-1.65	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.17	5	2	.5-1
Valent	5-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
VnD, VnE	0-6	0-6	1.40-1.60	6.0-20	0.07-0.09	5.6-7.3	0-0	Low	0.15	5	1	.5-1
Valentine	6-60	0-8	1.55-1.80	6.0-20	0.05-0.11	5.6-7.3	0-0	Low	0.15			
VnF*:												
Valentine, rolling	0-6	0-6	1.40-1.60	6.0-20	0.07-0.09	5.6-7.3	0-0	Low	0.15	5	1	.5-1
	6-60	0-8	1.55-1.80	6.0-20	0.05-0.11	5.6-7.3	0-0	Low	0.15			
Valentine, hilly	0-6	0-6	1.40-1.60	6.0-20	0.07-0.09	5.6-7.3	0-0	Low	0.15	5	1	.5-1
	6-60	0-8	1.55-1.80	6.0-20	0.05-0.11	5.6-7.3	0-0	Low	0.15			

See footnote at end of table.

TABLE 19.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
VnG	0-6	0-6	1.40-1.60	6.0-20	0.07-0.09	5.6-7.3	0-0	Low	0.15	5	1	.5-1
Valentine	6-60	0-8	1.55-1.80	6.0-20	0.05-0.11	5.6-7.3	0-0	Low	0.15			
VsB	0-7	5-10	1.25-1.35	2.0-6.0	0.10-0.12	6.6-7.8	0-2	Low	0.17	5	2	1-3
Vetal	7-40	12-18	1.25-1.35	2.0-6.0	0.11-0.19	6.6-7.8	0-2	Low	0.20			
	40-60	5-10	1.40-1.50	6.0-20	0.08-0.10	7.4-8.4	0-2	Low	0.15			
Vt	0-7	10-18	1.25-1.40	2.0-6.0	0.11-0.17	5.6-7.8	0-0	Low	0.20	5	3	1-3
Vetal	7-43	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	0-0	Low	0.20			
	43-60	5-10	1.40-1.50	6.0-20	0.08-0.10	6.1-8.4	0-0	Low	0.20			
WrB	0-5	2-10	1.60-1.90	6.0-20	0.03-0.10	8.5-9.9	0-8	Low	0.15	5	1	.5-3
Wildhorse	5-60	1-10	1.50-1.70	6.0-20	0.01-0.08	8.5-9.6	0-4	Low	0.15			
WsB*:												
Wildhorse	0-6	2-10	1.60-1.90	6.0-20	0.03-0.10	8.5-9.9	0-8	Low	0.15	5	1	.5-3
	6-60	1-10	1.50-1.70	6.0-20	0.01-0.08	8.5-9.6	0-4	Low	0.15			
Hoffland	0-11	15-20	1.20-1.50	2.0-6.0	0.16-0.19	7.9-8.4	0-2	Low	0.20	5	8	4-12
	11-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	0-0	Low	0.15			
WtB*:												
Wildhorse	0-6	2-10	1.60-1.90	6.0-20	0.03-0.10	8.5-9.9	0-8	Low	0.15	5	1	.5-3
	6-60	1-10	1.50-1.70	6.0-20	0.01-0.08	8.5-9.6	0-4	Low	0.15			
Ipage	0-6	1-5	1.40-1.50	6.0-20	0.07-0.09	6.6-8.4	0-2	Low	0.15	5	1	.5-1
	6-60	1-8	1.50-1.60	6.0-20	0.04-0.10	6.6-8.4	0-2	Low	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--SOIL AND WATER FEATURES

("Flooding," "water table," and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ac, AcB, AcC----- Alliance	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
An---------- Almeria	D	Frequent----	Brief-----	Feb-Jul	+.5-1.0	Apparent	Nov-Jun	>80	---	Moderate	High-----	Low.
Bc---------- Bankard	A	Frequent----	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low------	Low------	Low.
Bd---------- Beckton	D	Rare--------	---	---	4.0-6.0	Apparent	Apr-May	>60	---	Low------	High-----	High.
Bf---------- Bolent	A	Occasional	Brief-----	Mar-Jun	1.5-3.0	Apparent	Nov-May	>60	---	Moderate	Low------	Low.
Bh, BhB, Bm------- Bridget	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
BnB, BnE---------- Bufton	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
BoD*:												
Bufton----------	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Orella----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	Low.
BsB, BsC, BsD----- Busher	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	Low------	Low.
BvC*, BvF*:												
Busher----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	Low------	Low.
Tassel----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
Ca---------- Calamus	A	Rare--------	---	---	3.0-6.0	Apparent	Mar-Jun	>80	---	Low------	Low------	Low.
Cr---------- Crowther	D	Rare--------	---	---	0-1.5	Apparent	Nov-May	>60	---	Moderate	High-----	Low.
Cs---------- Crowther	D	Rare--------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 20.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
DuB, DuD---------- Dailey	A	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Dw---------- Duroc	B	Rare--------	Very brief	---	>6.0	---	---	>60	---	Low------	Low------	Low.
DwB---------- Duroc	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Ec---------- Els	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	>80	---	Moderate	Moderate	Moderate.
Ef*:												
Els----------	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	>80	---	Moderate	Moderate	Moderate.
Hoffland----------	D	Rare--------	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High-----	Low.
EgB*:												
Els----------	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	>80	---	Moderate	Moderate	Moderate.
Ipage----------	A	None--------	---	---	3.0-5.0	Apparent	Dec-Jun	>80	---	Moderate	Low------	Moderate.
En*:												
Els----------	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	>80	---	Moderate	Moderate	Moderate.
Tryon----------	D	Rare--------	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High-----	Low.
Es---------- Elsmere	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	>80	---	Moderate	Moderate	Low.
EuE*:												
Enning----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate	Moderate.
Minnequa----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
EvG*:												
Enning----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Moderate	Moderate.
Rock outcrop-----	D	None--------	---	---	>6.0	---	---	0	Soft	---	---	---
EwG*:												
Epping----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Low------	Low.
Badland----------	D	None--------	---	---	>6.0	---	---	0-3	Soft	---	---	---

See footnote at end of table.

TABLE 20.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Fu---------- Fluvaquents	D	Frequent----	Brief to very long.	Nov-Jun	+2-1.0	Apparent	Jan-Dec	>60	---	Moderate	High-----	Low.
Gg---------- Gannett	D	Rare--------	---	---	0-1.5	Apparent	Nov-May	>60	---	High-----	High-----	Low.
Gh---------- Gannett	D	Rare--------	---	---	+.5-1.0	Apparent	Nov-May	>80	---	High-----	High-----	Low.
Hm---------- Hoffland	D	Rare--------	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High-----	Low.
Hn---------- Hoffland	D	Rare--------	---	---	+.5-1.0	Apparent	Nov-May	>80	---	Moderate	High-----	Low.
IpB---------- Ipage	A	None--------	---	---	3.0-5.0	Apparent	Dec-Jun	>80	---	Moderate	Low------	Moderate.
JgB, JgC, JgD----- Jayem	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
Jo---------- Johnstown	B	None--------	---	---	>6.0	---	---	>80	---	Moderate	Moderate	Low.
Kd, KdC, KdD------ Kadoka	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
Ke, KeB, KeC, Kg, KgB, KgC--------- Keith	B	None--------	---	---	>6.0	---	---	>80	---	Moderate	Moderate	Low.
Ky---------- Keya	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
La---------- Las Animas	C	Occasional	Brief-----	Mar-Aug	1.5-3.0	Apparent	Nov-May	>60	---	Moderate	High-----	Low.
Lg---------- Lodgepole	D	None--------	---	---	+.5-1.0	Perched	Mar-Jul	>80	---	High-----	High-----	Low.
Lu---------- Lute	D	Rare--------	---	---	1.0-3.0	Perched	Apr-Jul	>60	---	High-----	High-----	Moderate.
MbC---------- Manvel	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.

See footnote at end of table.

TABLE 20.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Mc Marlake	D	None	---	---	+2-1.0	Apparent	Oct-Jun	>60	---	Moderate	High	Low.
Mk McCook	B	Rare	---	---	>6.0	---	---	>80	---	Moderate	High	Low.
Mm McCook	B	Frequent	Very brief	Apr-Jul	>6.0	---	---	>80	---	Moderate	Low	Low.
MxF*:												
Mitchell	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Epping	D	None	---	---	>6.0	---	---	10-20	Soft	Low	Low	Low.
My Munjor	B	Rare	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Mz Munjor	B	Frequent	Very brief	Apr-Sep	>6.0	---	---	>60	---	Low	Moderate	Low.
OhC*, OhD*, OhF*:												
Oglala	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
On Onita	C	Rare	---	---	3.0-6.0	Perched	Mar-Jun	>60	---	High	High	Low.
OrF Orella	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
OvD Orpha	A	None	---	---	>6.0	---	---	>80	---	Low	Moderate	Low.
OwF*:												
Orpha	A	None	---	---	>6.0	---	---	>80	---	Low	Moderate	Low.
Niobrara	D	None	---	---	>6.0	---	---	10-20	Soft	Low	Low	Low.
OxG*:												
Orpha	A	None	---	---	>6.0	---	---	>80	---	Low	Moderate	Low.
Rock outcrop	D	None	---	---	>6.0	---	---	0	Soft	---	---	---
PoC, PoD Ponderosa	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.

See footnote at end of table.

TABLE 20.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
PtF*:												
Ponderosa	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
Vetal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
RoB Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
SnB, SnC, SnD Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
SsD*, SsE*:												
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
TfG*:												
Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
Rock outcrop	D	None	---	---	>6.0	---	---	0	Soft	---	---	---
TgG*:												
Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
Ponderosa	B	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Rock outcrop	D	None	---	---	>6.0	---	---	0	Soft	---	---	---
ThB, ThC, ThD Thirtynine	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
To Tryon	D	Rare	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High	Low.
Tp Tryon	D	Rare	---	---	+.5-1.0	Apparent	Nov-May	>80	---	Moderate	High	Low.
TtB, TtD Tuthill	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
TwB, TwC, TwD Tuthill	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
VaB, VaD, VaE Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.

See footnote at end of table.

TABLE 20.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
VaF*:												
Valent, rolling--	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Valent, hilly----	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
VaG, VeB, VeD----- Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
VnD, VnE---------- Valentine	A	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
VnF*:												
Valentine, rolling---------	A	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
Valentine, hilly-	A	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
VnG--------------- Valentine	A	None	---	---	>6.0	---	---	>80	---	Low	Low	Low.
VsB--------------- Vetal	B	None	---	---	>6.0	---	---	>80	---	Moderate	Moderate	Low.
Vt---------------- Vetal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
WrB--------------- Wildhorse	A	None	---	---	1.5-3.5	Apparent	Nov-May	>80	---	Moderate	High-----	High.
WsB*:												
Wildhorse--------	A	None	---	---	1.5-3.5	Apparent	Nov-May	>80	---	Moderate	High-----	High.
Hoffland---------	D	Rare	---	---	0-1.5	Apparent	Nov-May	>80	---	Moderate	High-----	Low.
WtB*:												
Wildhorse--------	A	None	---	---	1.5-3.5	Apparent	Nov-May	>80	---	Moderate	High-----	High.
Ipage------------	A	None	---	---	3.0-5.0	Apparent	Dec-Jun	>80	---	Moderate	Low------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 21.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. LL means liquid limit; PI, plasticity index; and NP, nonplastic)

Soil name, report number, horizon, and depth in inches*	Classification		Grain-size distribution								LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--				
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.002 mm			
											Pct		
Beckton silt loam (S89NE-161-26)													
A------ 0 to 5	A-5(8)	ML	---	---	---	---	100	88	78	15	41	7	2.46
Btn---- 8 to 18	A-7-6 (16)	CL	---	---	---	---	---	96	91	34	50	26	2.56
C1----- 35 to 50	A-7-6 (16)	CL	---	---	---	---	99	96	91	26	46	21	2.60
Ipage fine sand (S90NE-161-12)													
A------ 0 to 4	A-2-4 (2)	SP-SM	---	---	---	100	98	5	5	1	NP	NP	2.64
AC----- 4 to 9	A-2-4 (2)	SP	---	---	---	100	98	4	4	1	NP	NP	2.62
C------ 9 to 60	A-2-4 (2)	SP	---	---	---	100	98	3	3	0	NP	NP	2.62
Keith loam (S85NE-161-41)													
Ap----- 0 to 6	A-4(8)	CL-ML	---	---	---	---	99	81	68	16	25	5	2.60
Bt----- 11 to 19	A-6(12)	CL	---	---	---	---	99	85	76	32	39	20	2.64
BCk---- 28 to 38	A-4(8)	CL	---	---	---	---	---	93	80	17	30	7	2.67
C------ 38 to 60	A-4(8)	ML	---	---	---	---	99	82	60	11	25	3	2.66
Oglala loam (S90NE-161-24)													
A------ 0 to 8	A-4(8)	ML	---	---	---	100	99	88	59	16	33	9	2.56
C1----- 11 to 33	A-4(7)	ML	---	---	---	100	97	68	55	10	30	3	2.61
Ponderosa very fine sandy loam (S90NE-161-25)													
A------ 0 to 12	A-4(5)	ML	---	---	---	---	100	59	30	12	24	NP	2.62
C1----- 21 to 29	A-4(2)	ML	---	---	---	---	100	44	24	9	20	NP	2.61
Satanta fine sandy loam (S85NE-161-40)													
Ap----- 0 to 6	A-4(2)	ML	---	---	---	---	98	43	30	11	19	NP	2.62
Bt1---- 9 to 18	A-6(10)	CL	---	---	---	---	100	70	57	29	35	17	2.63
C------ 39 to 60	A-4(6)	ML	---	---	---	---	99	66	40	10	23	NP	2.63

See footnote at end of table.

TABLE 21.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches*	Classification		Grain-size distribution								LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--				
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.002 mm			
											Pct		
Tassel very fine sandy loam (S90NE-161-2)													
A------ 0 to 3	A-4(8)	ML	100	98	98	97	96	75	46	7	31	1	2.56
C------ 6 to 17	A-4(8)	ML	99	98	98	98	97	74	41	9	29	NP	2.58
Valent fine sand (S90NE-161-18)													
A------ 0 to 2	A-3(2)	SP-SM	---	---	---	---	100	6	5	1	NP	NP	2.60
C------ 2 to 60	A-4(2)	SP	---	---	---	---	100	3	3	1	NP	NP	2.63
Wildhorse fine sand (S90NE-161-10)													
A------ 0 to 2	A-4(0)	SM	---	---	---	100	99	37	30	6	NP	NP	2.50
C1----- 2 to 24	A-4(0)	SC-SM	---	---	---	100	99	31	24	10	23	6	2.60
C2----- 24 to 60	A-2-4 (0)	SM	---	---	---	100	99	27	22	10	20	3	2.62

* The locations of the sampled pedons are as follows:

Beckton silt loam, 450 feet west and 600 feet south of the northwest corner of sec. 31, T. 3 N., R. 45 W.

Ipage fine sand, 1,100 feet east and 1,400 feet north of the southwest corner of sec. 24, T. 35 N., R. 42 W.

Keith loam, 250 feet south and 250 feet west of the northeast corner of sec. 21, T. 35 N., R. 42 W.

Oglala loam, 2,200 feet west and 1,500 feet north of the southeast corner of sec. 35, T. 33 N., R. 45 W.

Ponderosa very fine sandy loam, 1,400 feet north and 600 feet east of the southwest corner of sec. 7, T. 34 N., R. 45 W.

Satanta fine sandy loam, 950 feet west and 550 feet south of the northeast corner of sec. 19, T. 26 N., R. 46 W.

Tassel very fine sandy loam, 1,400 feet east and 1,800 feet north of the southwest corner of sec. 36, T. 35 N., R. 43 W.

Valent fine sand, 250 feet north and 1,050 feet east of the southwest corner of sec. 5, T. 26 N., R. 44 W.

Wildhorse fine sand, 500 feet east and 500 feet north of the southwest corner of sec. 14, T. 26 N., R. 45 W.

TABLE 22.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alliance	Fine-silty, mixed, mesic Aridic Argiustolls
Almeria	Sandy, mixed, mesic Typic Fluvaquents
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Beckton	Fine, montmorillonitic, mesic Aridic Natrustolls
Bolent	Sandy, mixed, mesic Aquic Ustifluvents
Bridget	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Bufton	Fine, mixed, mesic Aridic Ustochrepts
Busher	Coarse-loamy, mixed, mesic Aridic Haplustolls
Calamus	Mixed, mesic Aquic Ustipsamments
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Crowther	Coarse-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
Duroc	Fine-silty, mixed, mesic Pachic Haplustolls
Els	Mixed, mesic Aquic Ustipsamments
Elsmere	Sandy, mixed, mesic Aquic Haplustolls
Enning	Loamy, carbonatic, mesic, shallow Ustic Torriorthents
Epping	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Fluvaquents	Fluvaquents
Gannett	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
Hoffland	Sandy, mixed, mesic Mollic Endoaquepts
Ipage	Mixed, mesic Oxyaquic Ustipsamments
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Johnstown	Fine-silty, mixed, mesic Pachic Argiustolls
Kadoka	Fine-silty, mixed, mesic Aridic Argiustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Keya	Fine-loamy, mixed, mesic Pachic Argiustolls
Las Animas	Coarse-loamy, mixed (calcareous), mesic Typic Fluvaquents
Lodgepole	Fine, montmorillonitic, mesic Typic Argiaquolls
Lute	Fine-loamy, mixed, mesic Typic Natraquolls
Manvel	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Marlake	Mixed, mesic Mollic Psammaquents
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Minnequa	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Mitchell	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Munjor	Coarse-loamy, mixed (calcareous), mesic Typic Ustifluvents
Niobrara	Mixed, mesic, shallow Ustic Torripsamments
Oglala	Coarse-silty, mixed, mesic Aridic Haplustolls
Onita	Fine, montmorillonitic, mesic Pachic Argiustolls
Orella	Clayey, mixed (calcareous), mesic, shallow Ustic Torriorthents
Orpha	Mixed, mesic Ustic Torripsamments
Ponderosa	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Rosebud	Fine-loamy, mixed, mesic Aridic Argiustolls
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Thirtynine	Fine-silty, mixed, mesic Aridic Argiustolls
Tryon	Mixed, mesic Typic Psammaquents
Tuthill	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Valent	Mixed, mesic Ustic Torripsamments
Valentine	Mixed, mesic Typic Ustipsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Wildhorse	Sandy, mixed, mesic Typic Halaquepts

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group. N means nonirrigated and I, irrigated)

Map symbol and soil name	Land capability		Prime farmland	Range site	Windbreak suitability group
	N	I			
Ac—Alliance	IIc-1	I-4	Yes*	Silty	3
AcB—Alliance	IIe-1	IIe-4	Yes*	Silty	3
AcC—Alliance	IIIe-1	IIIe-4	Yes*	Silty	3
An—Almeria	VIw-7	---	---	Wetland	10
Bc—Bankard	VIw-5	---	---	Sandy Lowland	10
Bd—Beckton	IVs-1	IVs-5	---	Saline Lowland	9S
Bf—Bolent	IVw-5	IVw-11	---	Subirrigated	2S
Bh—Bridget	IIc-1	IIe-6	Yes*	Silty	3
BhB—Bridget	IIe-3	IIe-6	Yes*	Silty	3
Bm—Bridget	IIc-1	I-6	Yes*	Silty	3
BnB—Bufton	IIIe-1	IIIe-3	---	Clayey	4L
BnE—Bufton	VIe-1	---	---	Clayey	4L
BoD:					
Bufton	IVe-1	IVe-3	---	Clayey	4L
Orella	VIs-4	---	---	Saline Upland	10
BsB—Busher	IIIe-3	IIe-8	Yes*	Sandy	5
BsC—Busher	IIIe-3	IIIe-8	Yes*	Sandy	5
BsD—Busher	IVe-3	IVe-8	---	Sandy	5
BvC:					
Busher	IIIe-3	IIIe-8	---	Sandy	5
Tassel	VIs-4	---	---	Shallow Limy	10
BvF:					
Busher	VIe-3	---	---	Sandy	10
Tassel	VIs-4	---	---	Shallow Limy	10

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland	Range site	Windbreak suitability group
Ca Calamus	VIe-5	IVe-11	---	Sandy	7
Cr Crowther	Vw-7	---	---	Wet Subirrigated	2D
Cs Crowther	Vw-7	---	---	Wetland	10
DuB Dailey	IVe-5	IVe-11	---	Sandy	5
DuD Dailey	VIe-5	IVe-11	---	Sandy	7
Dw Duroc	IIc-1	I-6	Yes*	Silty Lowland	1
DwB Duroc	IIe-1	IIe-6	Yes*	Silty	3
Ec Els	VIe-5	IVw-12	---	Subirrigated	2S
Ef: Els Hoffland	VIe-5 Vw-7	IVw-12 ---	--- ---	Subirrigated Wet Subirrigated	2S 2D
EgB: Els Ipage	VIe-5 VIe-5	IVw-12 IVe-12	--- ---	Subirrigated Sandy Lowland	2S 7
En: Els Tryon	VIe-5 Vw-7	IVw-12 ---	--- ---	Subirrigated Wet Subirrigated	2S 2D
Es Elsmere	IVw-5	IVw-11	---	Subirrigated	2S
EuE: Enning Minnequa	VIs-4 VIe-9	--- ---	--- ---	Shallow Limy Limy Upland	10 3
EvG: Enning Rock outcrop	VIIs-4 VIIIs-8	--- ---	--- ---	Shallow Limy ---	10 10
EwG: Epping Badland	VIIs-4 VIIIs-8	--- ---	--- ---	Shallow Limy ---	10 10
Fu Fluvaquents	VIIIw-7	---	---	---	10
Gg Gannett	Vw-7	---	---	Wet Subirrigated	2D
Gh Gannett	Vw-7	---	---	Wetland	10

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland	Range site	Windbreak suitability group
Hm---------- Hoffland	Vw-7	---	---	Wet Subirrigated-----	2D
Hn---------- Hoffland	Vw-7	---	---	Wetland----------	10
IpB---------- Ipage	VIe-5	IVe-12	---	Sandy Lowland--------	7
JgB---------- Jayem	IIIe-3	IIe-8	Yes*	Sandy----------	5
JgC---------- Jayem	IVe-3	IIIe-8	Yes*	Sandy----------	5
JgD---------- Jayem	IVe-3	IVe-8	---	Sandy----------	5
Jo---------- Johnstown	IIc-1	I-4	Yes*	Silty----------	3
Kd---------- Kadoka	IIc-1	I-4	Yes*	Silty----------	6R
KdC---------- Kadoka	IIIe-1	IIIe-4	Yes*	Silty----------	6R
KdD---------- Kadoka	IVe-1	IVe-4	---	Silty----------	6R
Ke---------- Keith	IIc-1	I-4	Yes*	Silty----------	3
KeB---------- Keith	IIe-1	IIe-4	Yes*	Silty----------	3
KeC---------- Keith	IIIe-1	IIIe-4	Yes*	Silty----------	3
Kg---------- Keith	IIc-1	I-4	Yes*	Silty----------	3
KgB---------- Keith	IIe-1	IIe-4	Yes*	Silty----------	3
KgC---------- Keith	IIIe-1	IIIe-4	Yes*	Silty----------	3
Ky---------- Keya	IIc-1	I-4	Yes*	Silty----------	3
La---------- Las Animas	IIw-4	IIw-8	Yes**	Subirrigated---------	2S
Lg---------- Lodgepole	IIIw-2	IVw-2	---	Clayey Overflow------	2W
Lu---------- Lute	VIs-1	---	---	Saline Subirrigated--	10

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland	Range site	Windbreak suitability group
MbC Manvel	IVe-1	IVe-3	---	Limy Upland	8
Mc Marlake	VIIIw-7	---	---	---	10
Mk McCook	IIc-1	I-6	Yes*	Silty Lowland	1L
Mm McCook	VIw-7	---	---	Silty Overflow	10
MxF: Mitchell	VIe-9	---	---	Limy Upland	10
Epping	VIs-4	---	---	Shallow Limy	10
My Munjor	IIIe-3	IIe-8	Yes*	Sandy Lowland	1L
Mz Munjor	VIw-7	---	---	Sandy Lowland	10
OhC: Oglala	IIIe-1	IIIe-6	---	Silty	3
Canyon	VIs-4	---	---	Shallow Limy	10
OhD: Oglala	IVe-1	IVe-6	---	Silty	3
Canyon	VIs-4	---	---	Shallow Limy	10
OhF: Oglala	VIe-1	---	---	Silty	10
Canyon	VIs-4	---	---	Shallow Limy	10
On Onita	IIs-2	IIs-3	---	Clayey	1
OrF Orella	VIs-4	---	---	Saline Upland	10
OvD Orpha	VIe-5	IVe-11	---	Sands	7
OwF: Orpha	VIe-5	---	---	Sands	10
Niobrara	VIs-4	---	---	Shallow Limy	10
OxG: Orpha	VIIe-5	---	---	Sands	10
Rock outcrop	VIIIs-8	---	---	---	10
PoC Ponderosa	IIIe-3	IIIe-8	Yes*	Sandy	5
PoD Ponderosa	IVe-3	IVe-8	---	Sandy	5

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability		Prime farmland	Range site	Windbreak suitability group
	N	I			
PtF:					
Ponderosa	VIe-3	---	---	Sandy	10
Tassel	VIs-4	---	---	Shallow Limy	10
Vetal	VIe-3	---	---	Sandy	5
RoB Rosebud	IIIe-1	IIIe-4	Yes*	Silty	6R
SnB Satanta	IIIe-3	IIe-5	Yes*	Silty	5
SnC Satanta	IIIe-3	IIIe-5	Yes*	Silty	5
SnD Satanta	IVe-3	IVe-5	---	Silty	5
SsD:					
Satanta	IVe-3	IVe-5	---	Silty	5
Canyon	VIs-4	---	---	Shallow Limy	10
SsE:					
Satanta	VIe-1	---	---	Silty	5
Canyon	VIs-4	---	---	Shallow Limy	10
TfG:					
Tassel	VIIs-4	---	---	Shallow Limy	10
Rock outcrop	VIIIs-8	---	---	---	10
TgG:					
Tassel	VIIs-4	---	---	Shallow Limy	10
Ponderosa	VIe-3	---	---	Savannah	10
Rock outcrop	VIIIs-8	---	---	---	10
ThB Thirtynine	IIe-1	IIe-4	Yes*	Silty	3
ThC Thirtynine	IIIe-1	IIIe-4	Yes*	Silty	3
ThD Thirtynine	IVe-1	IVe-4	---	Silty	3
To Tryon	Vw-7	---	---	Wet Subirrigated	2D
Tp Tryon	Vw-7	---	---	Wetland	10
TtB Tuthill	IVe-6	IIIe-10	---	Sandy	5
TtD Tuthill	VIe-6	IVe-10	---	Sandy	5
TwB Tuthill	IIIe-3	IIe-5	Yes*	Sandy	5
TwC Tuthill	IIIe-3	IIIe-5	Yes*	Sandy	5

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland	Range site	Windbreak suitability group
TwD---------- Tuthill	IVe-3	IVe-5	---	Sandy----------	5
VaB---------- Valent	VIe-5	IVe-12	---	Sandy----------	7
VaD---------- Valent	VIe-5	IVe-12	---	Sands----------	7
VaE---------- Valent	VIe-5	---	---	Sands----------	7
VaF:					
Valent, rolling----------	VIe-5	---	---	Sands----------	7
Valent, hilly----------	VIIe-5	---	---	Choppy Sands---------	10
VaG---------- Valent	VIIe-5	---	---	Choppy Sands---------	10
VeB---------- Valent	VIe-5	IVe-11	---	Sandy----------	7
VeD---------- Valent	VIe-5	IVe-11	---	Sands----------	7
VnD---------- Valentine	VIe-5	IVe-12	---	Sands----------	7
VnE---------- Valentine	VIe-5	---	---	Sands----------	7
VnF:					
Valentine, rolling----------	VIe-5	---	---	Sands----------	7
Valentine, hilly----------	VIIe-5	---	---	Choppy Sands---------	10
VnG---------- Valentine	VIIe-5	---	---	Choppy Sands---------	10
VsB---------- Vetal	IIIe-5	IIIe-10	---	Sandy----------	5
Vt---------- Vetal	IIe-3	IIe-8	Yes*	Sandy----------	5
WrB---------- Wildhorse	VIs-1	---	---	Saline Subirrigated--	10
WsB:					
Wildhorse----------	VIs-1	---	---	Saline Subirrigated--	10
Hoffland----------	Vw-7	---	---	Wet Subirrigated-----	2D
WtB:					
Wildhorse----------	VIs-1	---	---	Saline Subirrigated--	10
Ipage----------	VIe-5	IVe-12	---	Sandy Lowland--------	7

* Where irrigated.
** Where drained.

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