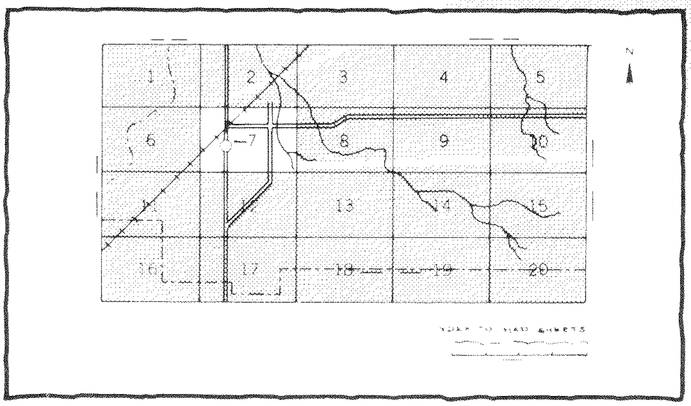
Soil Survey of

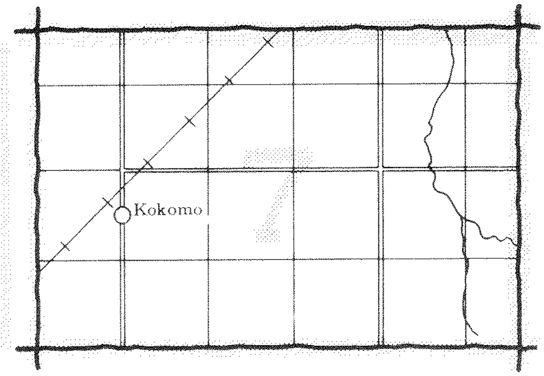
STANTON COUNTY NEBRASKA

United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Nebraska
Conservation and Survey Division

HOW TO USE

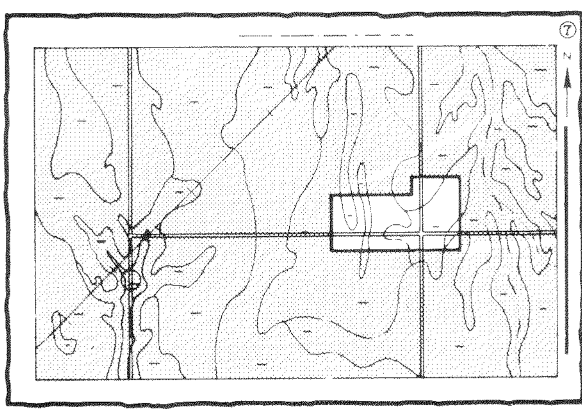
1. Locate your area of interest on the ''Index to Map Sheets'' (the last page of this publication).

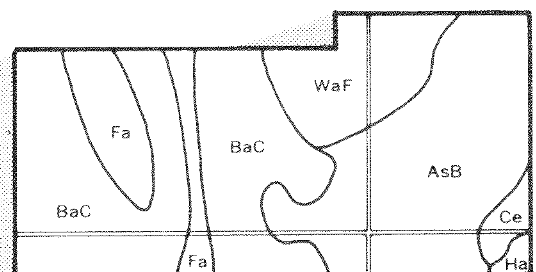




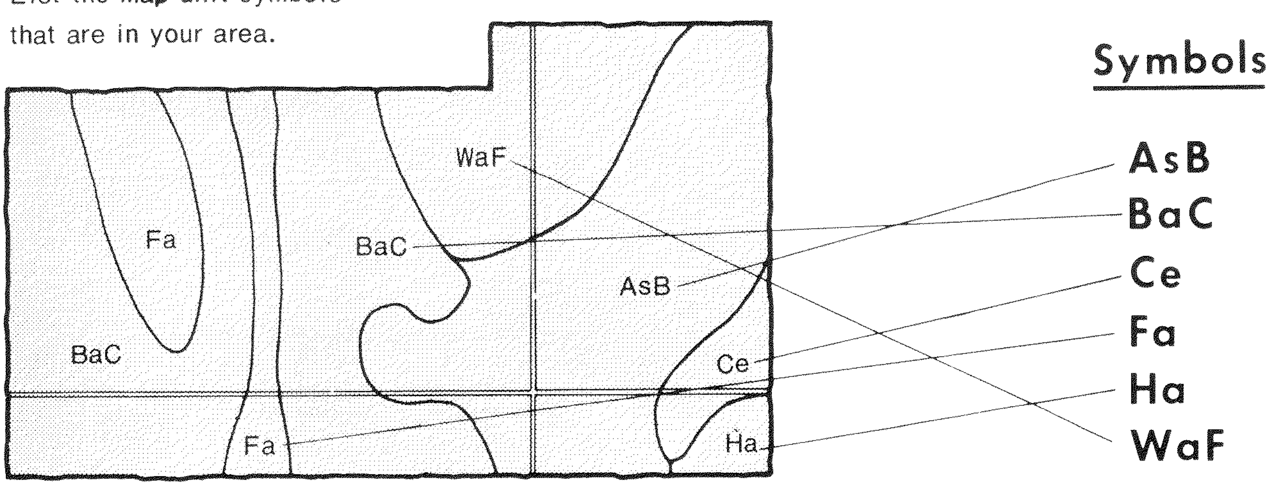
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



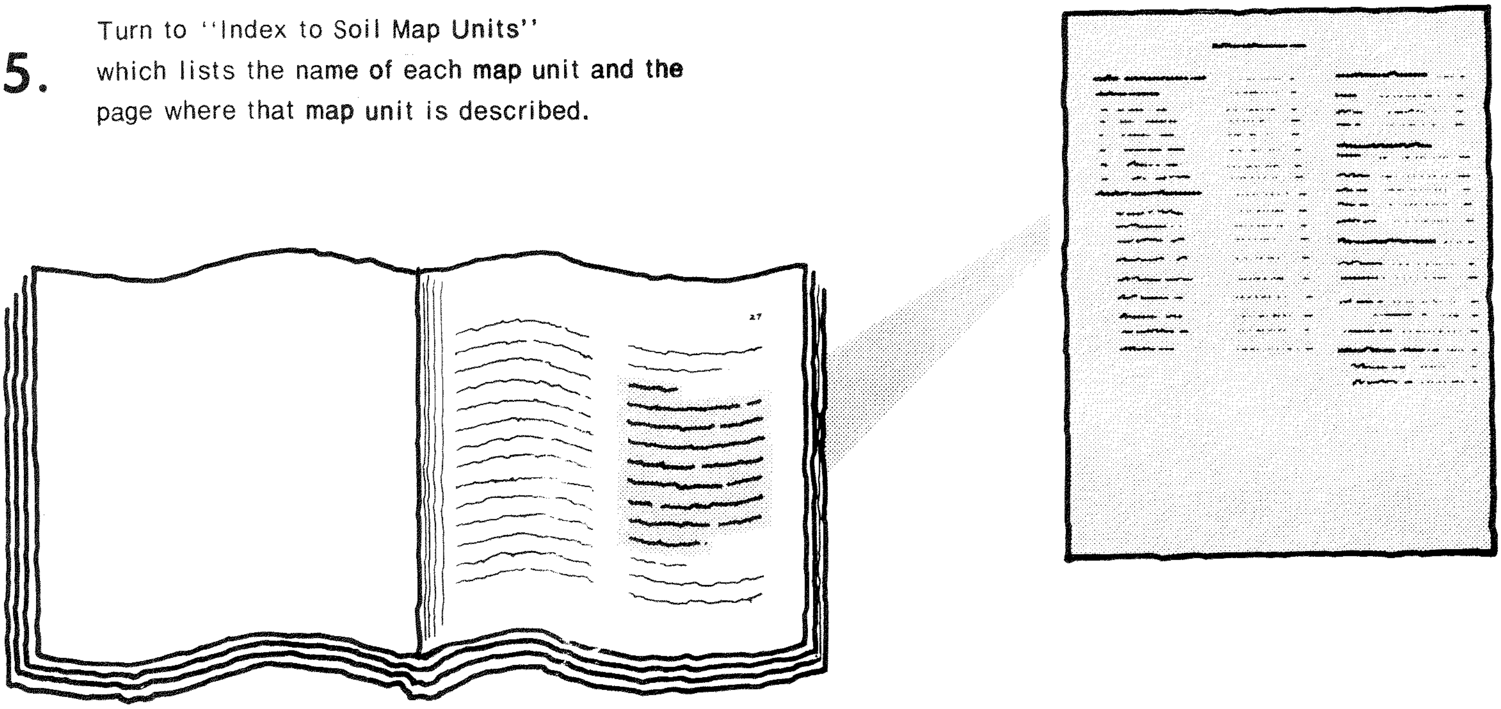


4. List the map unit symbols that are in your area.

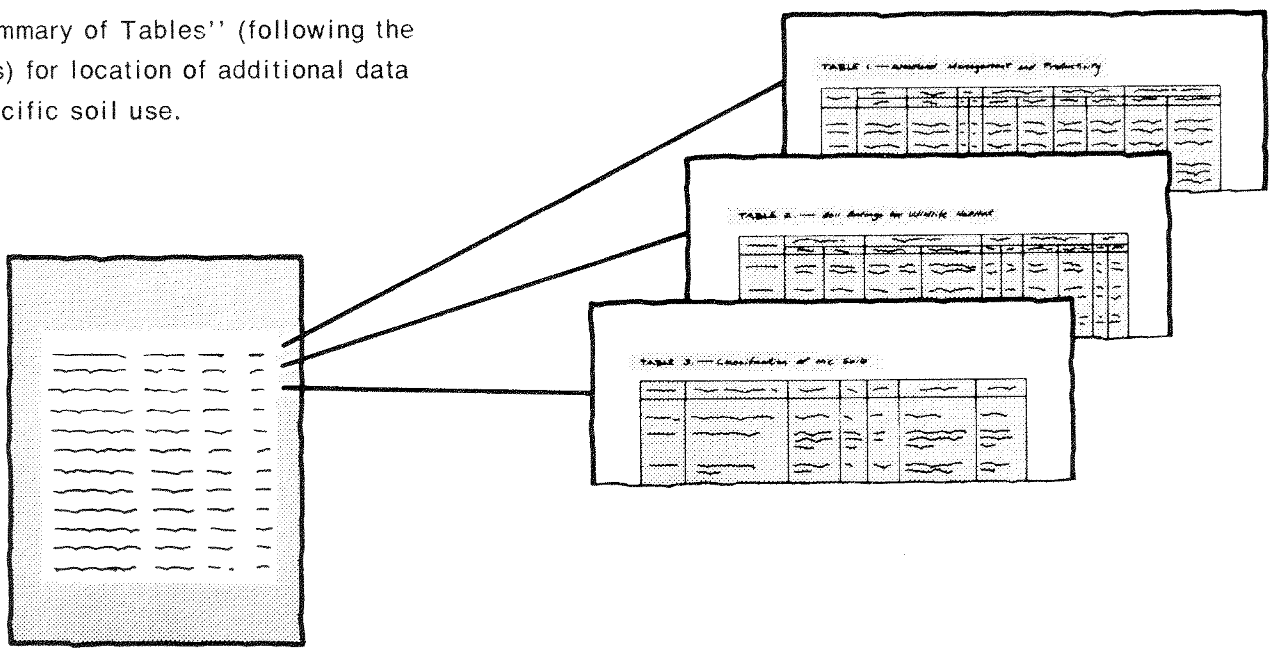


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a Joint effort of the United States Department of Agriculture and other federal agencies, and state agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska Conservation and Survey Division. It is part of the technical assistance furnished to the Lower Elkhorn Natural Resources District. Major field work was performed in the period 1974 to 1979. Soil names and Descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979. The Stanton County Board of Commissioners and the Lower Elkhorn Natural Resources District provided financial assistance to the survey.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Contour farming, grassed waterways, and a farmstead windbreak in the Crofton-Nora association.

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soil series

Issued January 1982

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foreword

This soil survey contains information that can be used in land-planning programs in Stanton County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Albert E. Sullivan
State Conservationist
Soil Conservation Service

Soil survey of
Stanton County, Nebraska

by Charles L. Hammond
fieldwork by Wayne J. Vanek, Duane L. Rieke, Mark E. Willoughby, and Rita Dallavalle, Soil Conservation Service, and
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United States Department of Agriculture, Soil Conservation Service
in cooperation with
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STANTON COUNTY is in the northeastern part of Nebraska (fig. 1). It is rectangular, being 24 miles long from north to south and 18 miles wide. The county comprises a land area of 431 square miles or 275,840 acres. It is bordered on the east by Cuming County, on the south by Colfax and Platte Counties, on the west by Madison County, and on the north by Wayne County. Stanton is the largest town and the county seat. Pilger is the only other town in Stanton County. Each community has most of the services required in a farming area.

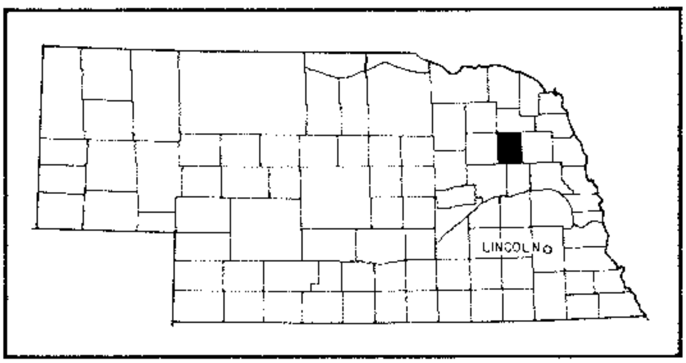

Figure 1.—Locator map of Stanton County in Nebraska.

Farming is the main economic enterprise in Stanton County. Corn, soybeans, alfalfa, grain sorghum, oats, and other small grain are the main crops. Most of the people are employed in agriculture or related businesses. Some residents of the county, especially in Woodland Park and in other small housing developments in the northwestern part of the county, work in Norfolk in neighboring Madison County.

Under dryland farming, according to the land capability classification, about 4.4 percent of the total area is in Class I soils, 27.3 percent is in Class II soils, 31.3 percent is in Class III soils, 26.4 percent is in Class IV soils, 0.6 percent is in Class V soils, 9.5 percent is in Class VI soils, 0.1 percent is in Class VII soils, and 0.3 percent is in Class VIII soils. About 0.4 percent is in water areas.

Stanton County consists of areas of bottom lands and stream terraces, loessial uplands, mixed sandy and loamy uplands, and a small area of sandhills. The bottom lands are mainly along the Elkhorn River, which flows from west to east, and its major tributaries. The bottom lands range from 1/2 mile to 3 miles wide. The stream terraces are adjacent to the bottom lands and also are along the major creeks. The silty loessial uplands is the major soil area in Stanton County. It is extensive in all parts of the county. The mixed sandy and loamy uplands are transitional soil areas. They are mainly south of the Elkhorn River but also are in the northwestern corner of the county. These upland areas are a mixture of silty soils of the loess uplands and sandy soils of the sandhills. The sandhills are mainly in two areas to the south and southeast of the town of Stanton. These areas consist mainly of excessively drained sandy soils. In addition to these general soil areas, a small area of soils that formed from glacial till is in the extreme northwestern corner of the county.

About 31 percent of the soils in Stanton County are nearly level, about 4 percent are very gently sloping, about 16 percent are gently sloping, and about 25 percent are strongly sloping. In addition, moderately steep soils make up about 21 percent of the county; steep soils, about 3 percent; and very steep soils, less than 1 percent.

The soils in Stanton County are mainly silty, loamy, or sandy. Only a few of the soils have a clayey texture. The soils range from shallow over coarse sand to deep and from excessively drained soils to very poorly drained. About 6.4 percent of the soils are excessively drained, about 10 percent are somewhat excessively drained, about 76 percent are well drained, and about 0.3 percent are moderately well drained. In addition, somewhat poorly drained soils make up about 5 percent of the county; poorly drained soils, about 2.2 percent; and very poorly drained soils, about 0.1 percent.

State highways and county roads provide most of the transportation in Stanton County. U.S. Highway 275 crosses the northern part of the county, and Nebraska Highway 32 crosses the southern part of the county. Nebraska Highways 15 and 57 pass through Stanton County in a north-south direction. Nebraska Highway 24 passes diagonally along the Elkhorn River between Stanton and Norfolk, and Nebraska Highway 35 passes diagonally through the northwestern corner of the county. County roads are on most section lines. A few are hard surfaced, but most are graveled. There are a few dirt roads along seldom used routes. The Chicago and Northwestern Railroad traverses the county in the Elkhorn River valley.

Stanton has the only high school in the county. Students from the northeastern part of the county are bused to Wisner in neighboring Cuming County or to Stanton. Most of the students in Woodland Park and other small rural communities in the northwestern part of Stanton County attend school in Madison County. Stanton County has rural schools that provide elementary classes for many students.

The first soil survey of Stanton County was made in 1929 (*3*). This new survey updates the earlier survey and provides additional information. The maps are larger and show the soils in greater detail.

general nature of the county

This section provides information about Stanton County. It discusses history and population; climate; geology; ground water supply; physiography, relief, and drainage; and trends in farming and soil use.

history and population

Between 1856 and 1862, the area that now makes up Stanton County was part of Izard County. Izard County was square and comprised 16 townships. The name Izard County was changed to Stanton County in 1862. The first permanent settlement in Stanton County was made on Humbug Creek in 1865. The county was organized in 1865, and the four eastern townships were added to Cuming County. Since that time, Stanton County boundaries have remained unchanged. The early settlers came mostly from the eastern and east-central parts of the United States. They were chiefly of German descent, although many were Americans by birth. Other nationalities that settled in the county were Czech, Swedish, and Danish.

In 1979, Stanton County had a population of 6,416. Stanton, the largest town, had a population of 1,528. Pilger had a population of 410, and Woodland Park had a population of 1,300.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Stanton County is cold in winter and quite hot with occasional cool spells in summer. During the winter, precipitation frequently occurs as snowstorms. During the warm months, when warm air moves in from the south, precipitation is chiefly showers, which are often heavy. Total annual rainfall is normally adequate for the production of corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Stanton in the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 23 degrees F, and the average daily minimum temperature is 12 degrees. The lowest temperature on record, which occurred at Stanton on January 19, 1966, is -27 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on July 11, 1954, is 112 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation 19 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 16 inches. The heaviest 1-day rainfall during the period of record was 4.15 inches at Stanton on July 13, 1955. Thunderstorms occur on about 50 days each year, and most occur in summer.

Average seasonal snowfall is 32 inches. The greatest snow depth at any one time during the period of record was 16 inches. On an average of 10 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 14 miles per hour, in spring.

Tornadoes and severe thunderstorms strike occasionally. These storms are local and of short duration, and result in sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and in relatively small areas.

geology

The uppermost bedrock units underlying Stanton County are the Carlile Shale and Niobrara Chalk of Cretaceous age and the Ogallala Formation of Tertiary age. The Carlile Shale underlies most of the southeastern half of the county, and the Niobrara Chalk underlies most of the northwestern half of the county. The Ogallala Formation, which consists of poorly consolidated silt and sand and some gravel and clay, overlies the Carlile Shale and Niobrara Chalk in the northwestern and west-central parts of the county and reaches a maximum thickness of about 100 feet. None of these bedrock units are exposed in the county because they are overlain by generally less than 100 feet of unconsolidated sand, gravel, silt, and clay in the Elkhorn River valley to as much as 400 feet of sediment in the uplands. These accumulations are of Quaternary age. Precambrian igneous rocks, such as granite, are at depths ranging from about 2,300 feet below the land surface in the Elkhorn valley to about 2,700 feet in the uplands in the southern part of the county.

The unconsolidated sediment of Quaternary age consists of wind deposited silt (loess); ice deposited silty clay that has pebble to boulder-size rock fragments (glacial till); water deposited silt, sand, and gravel; and lake deposits of silt and clay. The glacial till, which in places rests on the bedrock, is throughout most of the county, except in the Elkhorn valley where it has been removed by erosion. In addition to the sand and gravel in the Elkhorn valley, sand and gravel also occurs in much of the county at the base of the till immediately overlying the bedrock. The thickness of this sand and gravel varies, and in some places it is absent. Some sand and gravel and many of the lake deposited silts and clays are interbedded in the till. At one time, loess mantled much of the upland area; but, like glacial till, it also has been removed in the Elkhorn valley by erosion.

ground water supply

The availability of ground water for domestic, livestock, and irrigation use varies across the county and depends on the occurrence of saturated geologic material that yields water to wells at the desired rates. Coarse-grained material, such as sand and gravel, yields water to wells at a greater rate than fine-grained material, such as silt and clay. For practical purposes, domestic wells cannot be completed in clay, even though low yields are expected. Occasionally, domestic wells can be completed in silt if they have large diameters.

The primary sources of ground water in Stanton County are the sand and gravel in the Elkhorn valley and some of the tributary valleys and the sand and gravel interbedded with or at the base of the till in the upland areas. In the Elkhorn valley, wells generally range between a depth of 50 and 150 feet. Depth to water generally ranges from 10 to 20 feet near the Elkhorn River to as much as 50 feet near the valley sides. In places in the uplands, there is as much as 200 to 300 feet of loess and till over the sand and gravel that overlies the bedrock. For this reason, wells in the uplands generally range between a depth of 175 and 350 feet, with the water levels ranging from a depth of 100 to as much as 240 feet. In most of the upland areas, one or more test holes need to be drilled to determine the presence of water. The quality of water in the sand and gravel generally is suitable for domestic, livestock, and irrigation uses. However, in parts of the uplands where thick deposits of loess and till overlie the sand and gravel, the water may be quite hard and have high concentrations of sulfates.

In addition, some of the bedrock units underlying Stanton County may yield significant amounts of water to wells. Wells completed in the Niobrara Chalk in the Elkhorn valley northwest of Stanton may obtain water stored in and transmitted along fractures, crevices, and solution cavities. However, because adequate amounts of water generally can be obtained from the Quaternary sands and gravels in this area, the Niobrara Chalk is not extensively utilized. Adequate amounts of water can also be obtained from the Dakota Sandstone, which underlies the county. Depths to the top of the Dakota Formation generally range between 500 and 700 feet. For domestic use, wells probably would need to penetrate only the upper 20 to 50 feet of the sandstone, whereas for irrigation purposes, wells probably would need to penetrate 100 to 200 feet or more of the sandstone. Water obtained from the Dakota Formation generally is of poorer quality than that in the sand and gravel.

Water-yielding sandstone also occurs at a depth of about 2,000 to 2,600 feet. However, the greater depth and generally poor quality of the water probably limit the economic feasibility of constructing wells in these units.

physiography, relief, and drainage

Stanton County is part of the Great Plains. The most prominent relief feature in the county is the areas of bluffs that border the north side of the Elkhorn River valley. These areas are northwest of Stanton. Areas of bluffs are also on the south side of Union Creek valley. In these areas, the slopes range from steep to very steep. The maximum relief between the ridgetops and the bottom of adjacent drainageways is about 80 to 150 feet. The lowest point in the county is about 1,410 feet at Pilger, and the highest point is about 1,800 feet above sea level in the southern part of the county. The average elevation of Stanton County is about 1,500 feet.

All parts of the uplands have drainageways, except for two sandy areas on the south side of the Elkhorn River. In the loess hills, the slopes range from nearly level on the tablelands to very steep on the side slopes to drainageways. Most of the slopes are gently sloping to moderately steep. In the sandy areas, the relief is nearly level to hummocky, the unevenness of the surface being determined by the amount of wind to which the sandy material has been exposed. The stream terraces and bottom lands are nearly level to gently sloping.

Stanton County is drained by the Elkhorn River, the Platte River, and their tributaries. The Elkhorn River flows through Stanton County in a southeasterly direction until it reaches Stanton. From there it proceeds in a northeasterly direction until it leaves the county at a place east of Pilger. Almost 80 percent of the county is drained by the Elkhorn River and its tributaries. Spring, Pleasant Run, Maskenthine, and Humbug Creeks flow in a southerly direction in the northern part of the county. Meridian, Union, Butterfly, Cedar, and Rock Creeks flow in a northerly direction on the south side of the Elkhorn River. The extreme southern part of Stanton County is drained by Maple Creek, which flows south into the Platte River.

trends in farming and soil use

Farming has been the most important enterprise in Stanton County since the land was settled. In the early years, crops were produced only for local use. When railroads and elevators made markets available, crop and livestock production increased. The rapid increase in irrigation, more efficient machinery, use of herbicides and pesticides, and increased crop yields have increased farm income significantly. The Nebraska Agricultural Statistics for 1970 listed 860 farms in Stanton County. By 1977, the number of farms had decreased to 815. This reduction was due mostly to an increase in the size of farms and partly to the effects of urban expansion, mainly in the northwestern part of the county. Most of the farms are combination cash-grain and livestock operations. The acreage of irrigated crops is steadily increasing. In 1970, there were 9,300 acres of irrigated land. In 1977, this acreage had increased to 24,000 acres. Most of the irrigation water is from wells, but some water is pumped from the Elkhorn River. The largest increase in irrigated acres in the last 5 years has been due to the use of center-pivot systems. In 1971, there were 109 irrigation wells in Stanton County. By 1978, this number had increased to 219. More wells are being drilled each year.

Corn is the main cultivated crop in Stanton County. Other crops are soybeans, alfalfa, sorghum, oats, introduced grasses, wheat, and rye. The acreage in corn and soybeans has generally increased over the last 10 years. According to Nebraska Agricultural Statistics, in 1970 there were 84,000 acres of corn, of which 6,500 acres were irrigated. In 1977, there were 88,800 acres, of which 14,700 acres were irrigated. Soybeans were planted on 16,500 acres in 1970, and the acreage had increased to 27,800 acres by 1977. The acreage of alfalfa, oats, and sorghum has remained about the same for the last 10 years. In 1977, there were 25,700 acres of alfalfa and 19,400 acres of oats in Stanton County.

The raising of livestock is an important enterprise on most farms. The number of cattle in Stanton County has decreased in recent years. In 1970, there were 99,000 cattle, but this number decreased to 83,700 by 1977. The number of dairy cattle decreased from 3,150 in 1970 to 1,900 in 1977. The number of hogs ranged from 66,500 in 1970 to 61,500 in 1977. A few hogs are fattened for market, and in a few places, hogs are fed in confinement areas. About 1,100 sheep and 42,000 chickens were raised in Stanton County in 1977. The number of sheep has increased since 1970, but the number of chickens has decreased.

Watermelon and muskmelon are grown on some farms for commercial use.

The amount of fertilizer used in Stanton County has increased greatly since 1970. In 1970, the county used 4,643 tons of commercial fertilizer. This amount had increased to 12,867 tons by 1977.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one soil association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

sandy and loamy soils on uplands

Two associations are in this group. The soils are deep, nearly level to strongly sloping, and somewhat excessively drained and well drained. Most of the acreage in this group is cultivated and farmed dryland. Some areas of the sandy soils are in introduced or native grasses. A small part of the acreage is irrigated, mainly by center-pivot, but also by other sprinkler systems. Soil blowing and water erosion are the main hazards. Conserving water for plant use and maintaining fertility are the main concerns of management.

1. Thurman-Hadar-Clarno association

Deep, nearly level to strongly sloping, somewhat excessively drained and well drained, sandy and loamy soils that formed in eolian sands and glacial till; on uplands

This association consists mainly of gently undulating soils on convex ridges and gently sloping to strongly sloping soils on upland side slopes.

This association makes up about 5,100 acres or about 2 percent of the county. It is about 44 percent Thurman soils, 18 percent Hadar soils, 16 percent Clarno soils, and 22 percent soils of minor extent.

The Thurman soils are on eolian uplands. They are mostly gently undulating, but a small acreage is strongly sloping. These soils are deep and somewhat excessively drained. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 10 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand. The underlying material is light yellowish brown fine sand to a depth of 60 inches.

The Hadar soils are on uplands. They are deep, gently undulating to gently rolling, and well drained. These soils consist of eolian sand deposited over glacial till. Typically, the surface layer is grayish brown, very friable loamy fine sand about 14 inches thick. Below this the subsoil is brown, very friable loamy fine sand in the upper part and light brownish gray, firm clay loam in the middle and lower parts. The underlying material is light gray clay loam to a depth of 60 inches.

The Clarno soils are mainly on smooth ridgetops and side slopes of glacial uplands. These soils are deep, well drained, and gently sloping to strongly sloping. Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is clay loam about 22 inches thick. The upper part is brown and friable; the middle part is brown and firm; and the lower part is pale brown, mottled, and friable. The underlying material is light gray, mottled clay loam to a depth of 60 inches.

Of minor extent in this association are mainly the Crofton, Elsmere, Lawet, Loup, and Valentine soils. The Crofton soils are strongly sloping. They are on ridgetops and side slopes and formed in loess. The Elsmere soils are somewhat poorly drained. They are in basins and depressional areas. The Lawet and Loup soils are poorly drained. They are on bottom lands. The Valentine soils are excessively drained and gently rolling. They are on the highest part of the landscape.

Farms in this association are diversified and are mainly a combination of cash-grain and livestock enterprises. Most of the acreage is used for dryland crops and pasture. A few acres are irrigated. Corn, soybeans, oats, and alfalfa are the main crops. Smooth brome is the main grass in the areas used for pasture. The potential for additional irrigation is low because high-producing wells are not common. Some livestock, mainly cattle and hogs, are fattened and sold. Small cow-calf herds are common. Two housing developments are in this association.

The soils in this association are mainly limited by the high risk of erosion by water and wind. Maintaining soil fertility is a concern of management. Wetness of some minor soils on bottom lands limits their use.

The farms in this association average about 400 acres. Most cash-grain crops are marketed locally. Feeder cattle and hogs are sold locally or shipped to market in adjacent counties.

2. Thurman-Boelus-Loretto association

Deep, nearly level to strongly sloping, somewhat excessively drained and well drained, sandy and loamy soils that formed in eolian sands and loess; on uplands and stream terraces

This association consists mainly of nearly level to strongly sloping soils on broad areas on uplands (fig. 2).

This association makes up about 22,000 acres or about 8 percent of the county. It is about 61 percent Thurman soils, 15 percent Boelus soils, 13 percent Loretto soils, and 11 percent soils of minor extent.

The Thurman soils are on eolian uplands and nearly level areas on stream terraces. These soils are deep, gently sloping to strongly sloping, and somewhat excessively drained. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 10 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand. The underlying material is light yellowish brown fine sand to a depth of 60 inches.

The Boelus soils are on uplands. These soils are deep, nearly level to gently sloping, and well drained. Typically, the surface layer is dark grayish brown, loose loamy fine sand about 11 inches thick. The subsoil is about 39 inches thick. It is brown, very friable loamy fine sand in the upper part; pale brown, friable silty clay loam in the middle part; and light yellowish brown, friable silty clay loam in the lower part. The underlying material is light yellowish brown silt loam to a depth of 60 inches.

The Loretto soils are on uplands. These soils are deep, nearly level to gently sloping, and well drained. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsoil is friable and about 25 inches thick. It is brown loam in the

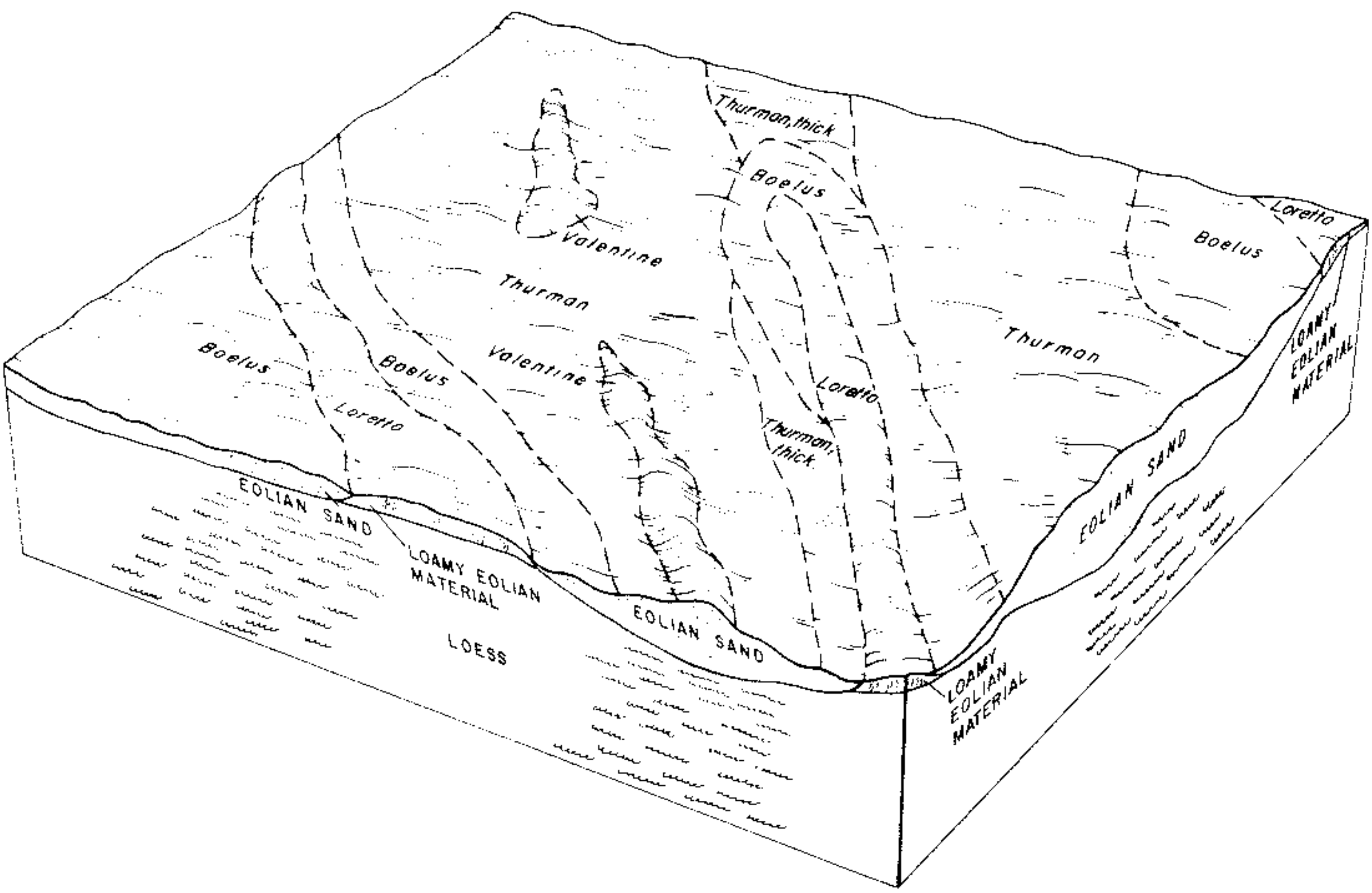

Figure 2.—Typical pattern of soils in the Thurman-Boelus-Loretto association, showing the relationship of soils to topography and parent material.

upper part and light yellowish brown silt loam in the lower part. The underlying material is light yellowish brown silt loam to a depth of 60 inches.

Of minor extent in this association are mainly the Blendon, Shell, and Valentine soils. The well drained Blendon soils are in concave areas. The Shell soils are well drained and on bottom lands. The sandy Valentine soils are on the highest parts of the landscape.

Farms in this association are diversified and are mainly a combination of cash-grain and livestock enterprises. Corn, soybeans, oats, and alfalfa are the main crops. Most of the acreage is in dryland crops. Part of the area is irrigated by sprinklers, mainly by the center-pivot system. Yields of irrigation water in wells are high. Many farms have small pastures of smooth brome or native grasses. Cattle and hogs are fattened on most farms, and some farms have small dairy herds.

The soils in this association are mainly limited by the hazard of soil blowing in cultivated areas. Soil blowing can be controlled by conservation tillage practices that keep crop residue on the surface. Water erosion also is a hazard in areas that have long smooth slopes. Maintaining soil fertility and efficient use of irrigation water are important concerns of management.

The farms in this association average about 400 acres. Most farm produce is marketed within the county or shipped to adjacent counties.

sandy and silty soils on uplands

One association is in the group. The soils are deep, very gently sloping to very steep, and excessively drained to well drained. Most of the very gently sloping to strongly sloping areas are cultivated and farmed dryland. The steep and very steep areas and small areas of the less sloping soils are in rangeland or pasture. A small part of the acreage is irrigated, mainly by a center-pivot system but also by other sprinkler systems. Water erosion and soil blowing are the main hazards. Maintaining a high level of fertility and conserving moisture for use by plants are concerns of management.

3. Thurman-Nora-Crofton association

Deep, very gently sloping to very steep, excessively drained to well drained, sandy and silty soils that formed in eolian sands and loess; on uplands

This association consists of very gently sloping and gently sloping soils on broad undulating areas on ridgetops or side slopes on uplands and strongly sloping to very steep soils on side slopes and ridgetops on uplands.

This association makes up about 8,500 acres or about 3 percent of the county. It is about 35 percent Thurman soils, 17 percent Nora soils, 14 percent Crofton soils, and 34 percent soils of minor extent.

The Thurman soils are on undulating areas on uplands. These soils are very gently sloping to strongly sloping and somewhat excessively drained. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 10 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand. The underlying material is light yellowish brown fine sand to a depth of 60 inches.

The Nora soils are on narrow ridgetops and side slopes of loess uplands. These soils are gently sloping to moderately steep and well drained. Typically, the surface layer is very dark grayish brown, very friable silty clay loam about 7 inches thick. The subsoil is friable and 20 inches thick. It is brown silty clay loam in the upper part and pale brown, calcareous silt loam in the lower part. The underlying material is pale brown and very pale brown, calcareous silt loam to a depth of 60 inches.

The Crofton soils are on narrow ridgetops and side slopes of loess uplands. These soils are gently sloping to very steep and are well drained, somewhat excessively drained, and excessively drained. Typically, the surface layer is dark grayish brown, very friable silt loam about 6 inches thick. Below this is a transitional layer of pale brown, calcareous silt loam about 5 inches thick. The underlying material is calcareous silt loam. It is light yellowish brown in the upper part and pale yellow in the lower part to a depth of 60 inches.

Of minor extent in this association are mainly the Alcester, Colo, Elsmere, and Lawet soils. The Alcester soils are well drained. They are on foot slopes below Nora and Crofton soils. The Colo soils are somewhat poorly drained. They are in narrow upland drainageways. The Elsmere soils are somewhat poorly drained. They are in depressional areas and basins below Thurman soils. The Lawet soils are poorly drained. They are on the lowest part of the landscape.

Farms in this association are diversified and are mainly a combination of cash-grain and livestock enterprises. Corn, soybeans, oats, and alfalfa are the main crops. These soils are mainly under dryland cultivation. A few areas are irrigated by a center-pivot sprinkler system. Smooth brome is the main introduced grass for pasture. It is commonly seeded on the gently sloping to moderately steep soils. The steep and very steep Crofton soils are mainly in native grass, but a few areas are seeded to smooth brome and alfalfa. On most farms, irrigation is not feasible because the yields of most wells are low, or the soils are too steep to successfully irrigate. A few farms have dairy herds, and some farms fatten cattle and hogs for market. Soil blowing and water erosion are the main hazards on cultivated areas. Maintaining fertility is the most important concern in management.

The farms in this association average about 320 acres. Farm produce, especially livestock, is marketed locally, or it is shipped to Norfolk or to other larger cities outside the county.

silty soils on uplands

Two associations are in this group. The soils are deep, very gently sloping to very steep, and excessively drained to well drained. Most of the acreage of this group is cultivated and farmed dryland. The soils with steep and very steep slopes are mainly in rangeland. Where wells are available, a small acreage is irrigated, mainly by the center-pivot system. Water erosion is the principal hazard. Maintaining a high level of fertility and conserving water and soil are the main concerns of management.

4. Crofton-Nora association

Deep, gently sloping to very steep, well drained to excessively drained, silty soils that formed in loess; on uplands

This association consists mainly of gently sloping to very steep soils on side slopes and ridgetops of rolling hills of the loess uplands (fig. 3).

This association makes up about 21,700 acres or about 8 percent of the county. It is about 43 percent Crofton soils, 29 percent Nora soils, and 28 percent soils of minor extent.

Figure 3.—Terraces, grassed waterways, and contour farming are used to help control erosion on this farm. The windbreak provides good protection for the farmstead and feedlot. This farm is in the Crofton-Nora association.

The Crofton soils are on upper side slopes and narrow ridgetops of loess uplands. These soils are gently sloping to very steep and are well drained, somewhat excessively drained, and excessively drained. Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. Below this is a transitional layer of pale brown, very friable, calcareous silt loam about 6 inches thick. The underlying material is calcareous silt loam. It is light yellowish brown in the upper part and pale yellow in the lower part to a depth of 60 inches.

The Nora soils are on lower side slopes and broad ridgetops on uplands. These soils are gently sloping to moderately steep and are well drained. Typically, the surface layer is very dark grayish brown, very friable silty clay loam about 7 inches thick. The subsoil is friable and about 20 inches thick. It is brown silty clay loam in the upper part and pale brown, calcareous silt loam in the lower part. The underlying material is calcareous silt loam. It is pale brown in the upper part and very pale brown in the lower part.

Of minor extent in this association are mainly the Alcester, Hobbs, Moody, and Thurman soils. The Alcester soils are on foot slopes and are in a lower position than Crofton and Nora soils. The Hobbs soils are in narrow drainageways of loess uplands. The Moody soils are on long smooth broad divides and are in a higher position than Crofton and Nora soils. The Thurman soils are sandy and are generally in a higher position than Crofton and Nora soils.

Much of the acreage of this association is in rangeland and used for grazing cattle. Part of the acreage is mowed for hay, and a few areas are cultivated. This association is better suited to range than to most other farm uses. Establishing a planned grazing system and proper grazing use are the main concerns in the management of rangeland. If the soils are overgrazed, soil blowing becomes a severe hazard. Under dryland cultivation, these soils are highly erosive. Water for livestock is provided mainly by streams and farm ponds.

A few farmsteads are in this association. They average between 320 and 640 acres and are commonly managed from headquarters located in areas adjoining this soil association.

5. Nora-Crofton-Moody association

Deep, very gently sloping to steep, well drained and excessively drained, silty soils that formed in loess; on uplands

This association consists mainly of gently sloping to strongly sloping soils on divides and moderately steep soils on hillsides (fig. 4).

This association makes up about 163,940 acres or about 59 percent of the county. It is about 34 percent Nora soils, 29 percent Crofton soils, 10 percent Moody soils, and 27 percent soils of minor extent.

The Nora soils are gently sloping to strongly sloping soils on ridgetops and strongly sloping to moderately steep soils on lower side slopes of loess uplands. They are deep and well drained. Typically, the surface layer is very dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is friable and about 20 inches thick. It is brown silty clay loam in the upper part and pale brown, calcareous silt loam in the lower part. The underlying material is calcareous silt loam. It is pale brown in the upper part and very pale brown in the lower part.

The Crofton soils are gently sloping to strongly sloping soils on narrow ridgetops and upper side slopes and moderately steep and steep soils on hillsides. They are well drained and somewhat excessively drained. Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. Below this is a transitional layer of pale brown, very friable, calcareous silt loam about 6 inches thick. The underlying material is calcareous silt loam. It is light yellowish brown in the upper part and pale brown in the lower part to a depth of 60 inches.

The Moody soils are gently sloping soils on ridgetops and side slopes of loess uplands. They are deep and well drained. Typically, the surface layer is dark grayish brown, friable silty clay loam about 11 inches thick. The subsoil is firm silty clay loam about 29 inches thick. It is grayish brown in the upper part, brown in the middle part, and pale brown in the lower part. The underlying material is pale brown silt loam to a depth of 60 inches.

Of minor extent in this association are mainly the Alcester, Belfore, Colo, and Hobbs soils. The Alcester soils have a thick dark surface layer. They are on gently sloping foot slopes. The Belfore soils are on broad, nearly level divides. They are on loess uplands. The Colo soils are somewhat poorly drained. They are in narrow drainageways. The Hobbs soils are occasionally flooded. They are in narrow drainageways.

Farms in this association are diversified and are mainly a combination of cash-grain and livestock enterprises. Most of the acreage is used for dryland cultivated crops. Corn, soybeans, grain sorghum, oats, and alfalfa are the main crops. A few areas are seeded to introduced grasses or in native grasses and are grazed by cattle or mowed for hay. A few areas are irrigated by sprinklers, generally by the self-propelled, center-pivot system. Irrigation wells are commonly high yielding. Runoff of water and the hazard of erosion are the main concerns. Flooding is the principal hazard in the narrow drainageways and valleys. Maintaining fertility is also a concern of management. Beef cattle and hogs are fattened on most farms, and some farms have small dairy herds.

The farms in this association average about 320 to 400 acres. Much of the grain and hay raised is fed to cattle and hogs on the farm. Most cash-grain crops are marketed locally. Most of the cattle and hogs are marketed within the county or shipped to Norfolk or other larger cities in adjacent counties.

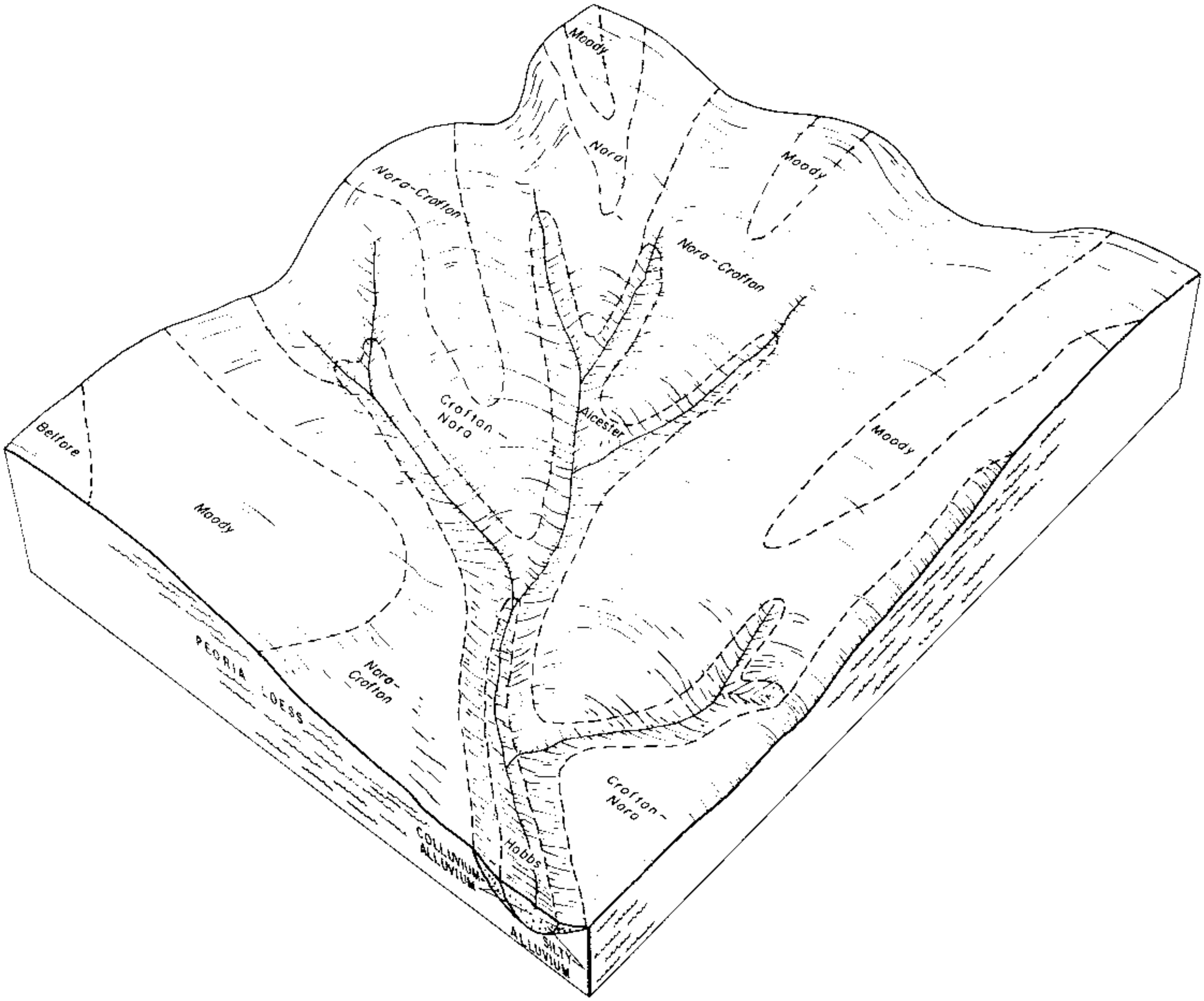

Figure 4.—Typical pattern of soils in the Nora-Crofton-Moody association, showing the relationship of soils to topography and parent material.

sandy soils on uplands

One association is in this group. The soils are deep, very gently sloping to steep, and excessively drained and somewhat excessively drained. Most of the acreage of this group is in rangeland and is used for grazing or hay. A small part of the acreage is cultivated and farmed dryland. Soil blowing is a hazard if the soils are overgrazed. Keeping the range in good or excellent condition is an important concern of management.

6. Valentine-Thurman association

Deep, very gently sloping to steep, excessively drained and somewhat excessively drained, sandy soils that formed in eolian sands; on uplands

This association consists mainly of very gently sloping to steep soils on smooth, round-topped sandhills (fig. 5). The area has few established drainage channels.

This association makes up about 10,250 acres or about 4 percent of the county. It is about 75 percent

Valentine soils, 22 percent Thurman soils, and 3 percent soils of minor extent.

The Valentine soils are on hummocks and low sandhills, and some areas are on ridgetops. These soils are very gently sloping to steep and are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 7 inches thick. Below this is a transitional layer of brown, loose fine sand. The underlying material is fine sand. It is brown in the upper part and pale brown in the lower part to a depth of 60 inches.

The Thurman soils are on the lower slopes of hummocks and in concave areas. These soils are very gently sloping to strongly sloping and are somewhat excessively drained. Typically, the surface layer is dark grayish brown, very friable loamy fine sand 10 inches thick. Below this is a transitional layer of grayish brown, friable loamy fine sand 6 inches thick. The underlying material is light yellowish brown fine sand to a depth of 60 inches.

Of minor extent in this association are mainly the Blendon, Boelus, and Elsmere soils. The Blendon soils are in concave areas. The Boelus soils are well drained. They are in long smooth areas in a lower position than Thurman soils. The Elsmere soils are in basins and depressional areas. They are in the lowest part of the landscape.

Most of the acreage of this association is in range and used for grazing cattle. Part of the acreage is mowed for hay, and a few small areas are cultivated. This association is better suited to range than to most other farm uses.

Establishing a planned grazing system and proper grazing use are the main concerns in rangeland

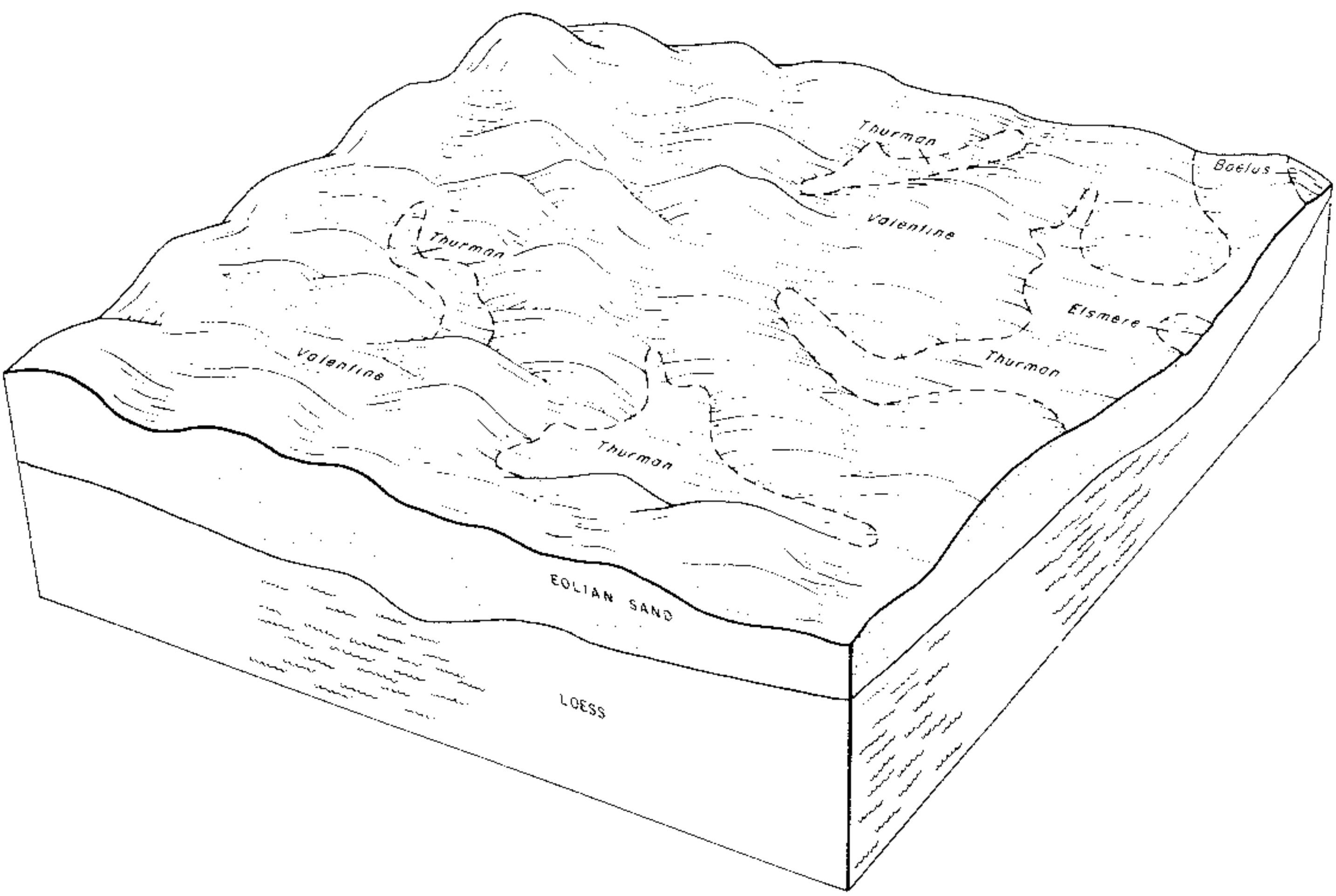

Figure 5.—Typical pattern of soils in the Valentine-Thurman association, showing the relationship of soils to topography and parent material.

management. If the soils are overgrazed, soil blowing becomes a hazard. Under dryland cultivation, these soils are droughty because of the low available water capacity. Wells, however, provide water of good quality for use by livestock and for the irrigation of crops. Where irrigation is feasible, some of the less sloping soils have potential for cultivated crops.

The farms in this association average between 600 and 1,200 acres. There are few farmsteads because most of the farms are managed from headquarters located in areas adjoining this soil association.

silty soils on bottom lands and low stream terraces

One association is in this group. The soils are deep, nearly level, and well drained. Most of the acreage is used for cultivated crops that are irrigated by gravity systems. A few sprinkler systems are also used. A small acreage is farmed dryland. Some small areas along the deeply entrenched stream channels are used for rangeland or pasture. These soils are subject to rare flooding on the higher parts of the bottom lands and to occasional flooding on the lower parts. Maintaining fertility and efficient use of irrigation water are important concerns of management.

7. Muir-Shell-Hobbs association

Deep, nearly level, well drained, silty soils that formed in alluvium; on bottom lands and low stream terraces

This association consists mainly of nearly level, long areas of soils on bottom lands of stream valleys.

This association makes up about 23,000 acres or about 8 percent of the county. It is about 30 percent Muir soils, 30 percent Shell soils, 22 percent Hobbs soils, and 18 percent soils of minor extent.

The Muir soils are on low stream terraces. These soils are nearly level and well drained. Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 34 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The underlying material is light yellowish brown, calcareous silt loam to a depth of 60 inches.

The Shell soils are on long areas of bottom lands. These soils are nearly level and well drained. They are subject to occasional or rare flooding. Typically, the surface layer is dark grayish brown, friable silty clay loam 27 inches thick. The subsurface layer is grayish brown, friable silty clay loam about 18 inches thick. The underlying material is stratified, light brownish gray and dark grayish brown silty clay loam to a depth of 32 inches. Below this is a buried soil. It is very dark grayish brown silty clay loam in the upper part and dark grayish brown silty clay loam in the lower part to a depth of 60 inches.

The Hobbs soils are in long, narrow areas on bottom lands and in narrow drainageways. These soils are nearly level and are well drained. They are subject to occasional flooding. Typically, the surface layer is dark grayish brown, very friable silt loam about 9 inches thick. The underlying material is stratified, dark grayish brown and grayish brown silt loam in the upper part and very dark grayish brown silty clay loam in the lower part. Some areas of Hobbs soils are frequently flooded and are channeled.

Of minor extent in this association are mainly the Colo, Kezan, Lamo, and Zook soils. The somewhat poorly drained Colo and Lamo soils and the poorly drained Kezan and Zook soils are in lower positions on the landscape than the major Muir, Hobbs, and Shell soils.

Farms in this association are diversified and are mainly a combination of cash-grain and livestock enterprises. Most of the acreage is used for cultivated crops. Corn, soybeans, grain sorghum, and alfalfa are the main crops. A substantial part of this acreage is irrigated from high-producing, deep wells. In addition, some farmers near Union Creek pump water from the creek. Gravity irrigation systems are well suited to these soils, but a few areas are irrigated by a sprinkler system. Small areas of introduced and native grass pastures are near the stream channels. These areas are occasionally flooded. Flooding, which occurs in spring and early in summer of some years, damages young plants and brings in fresh deposits of silty sediment. Maintaining fertility and efficient use of irrigation water are the important concerns of management.

Farms in this association average about 320 acres. Some livestock, mostly cattle and hogs, are fattened for market. Farm produce is marketed mainly within the county or shipped to adjacent counties. Areas adjacent to the streams have good potential for hunting and fishing.

sandy, loamy, and silty soils on bottom lands

Two associations are in this group. The soils are deep; nearly level and very gently sloping; and somewhat excessively drained, somewhat poorly drained, and well drained. Most of the acreage near the Elkhorn River is mixed native grasses and trees. This area is used for grazing and for wildlife habitat. The acreage farthest from the river is cultivated and farmed dryland. A small part of this area is irrigated by gravity systems. Soil blowing, droughtiness, and flooding are the main hazards. In places, wetness due to the seasonal high water table is a limitation. Improving the fertility of these soils is an important concern of management. If the area is used for range, maintaining the grasses in good condition is the principal concern.

8. Inavale-Boel-Ord association

Deep, nearly level and very gently sloping, somewhat excessively drained and somewhat poorly drained, sandy, loamy, and silty soils that formed in alluvium; on bottom lands

This association consists mainly of bottom lands of the Elkhorn River valley. The soils are mainly nearly level and very gently sloping, but a few areas are gently undulating (fig. 6). A few areas are dissected by shallow swales and old channels.

This association makes up about 10,050 acres or about 4 percent of the county. It is about 32 percent Inavale soils, 25 percent Boel soils, 15 percent Ord soils, and 28 percent soils of minor extent.

The Inavale soils are in channeled areas adjacent to the Elkhorn River. They are deep, somewhat excessively drained, and nearly level or very gently sloping soils. Typically, the surface layer is dark grayish brown, very friable loamy fine sand 7 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand 5 inches thick. The underlying material is stratified, light brownish gray, grayish brown, and light gray fine sand to a depth of 60 inches.

The Boel soils are on bottom lands of the Elkhorn River valley. They are deep, somewhat poorly drained, nearly level soils. Typically, the surface layer is very dark grayish brown, very friable loam about 8 inches thick. Below this is a transitional layer of dark grayish brown, very friable fine sandy loam about 8 inches thick. The underlying material is mottled fine sand. It is very pale brown in the upper part and light brownish gray in the lower part to a depth of 60 inches.

The Ord soils are on bottom lands. They are deep, somewhat poorly drained, nearly level soils. Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is dark gray, very friable silt loam about 10 inches thick. Below this is a transitional layer of gray, very friable fine

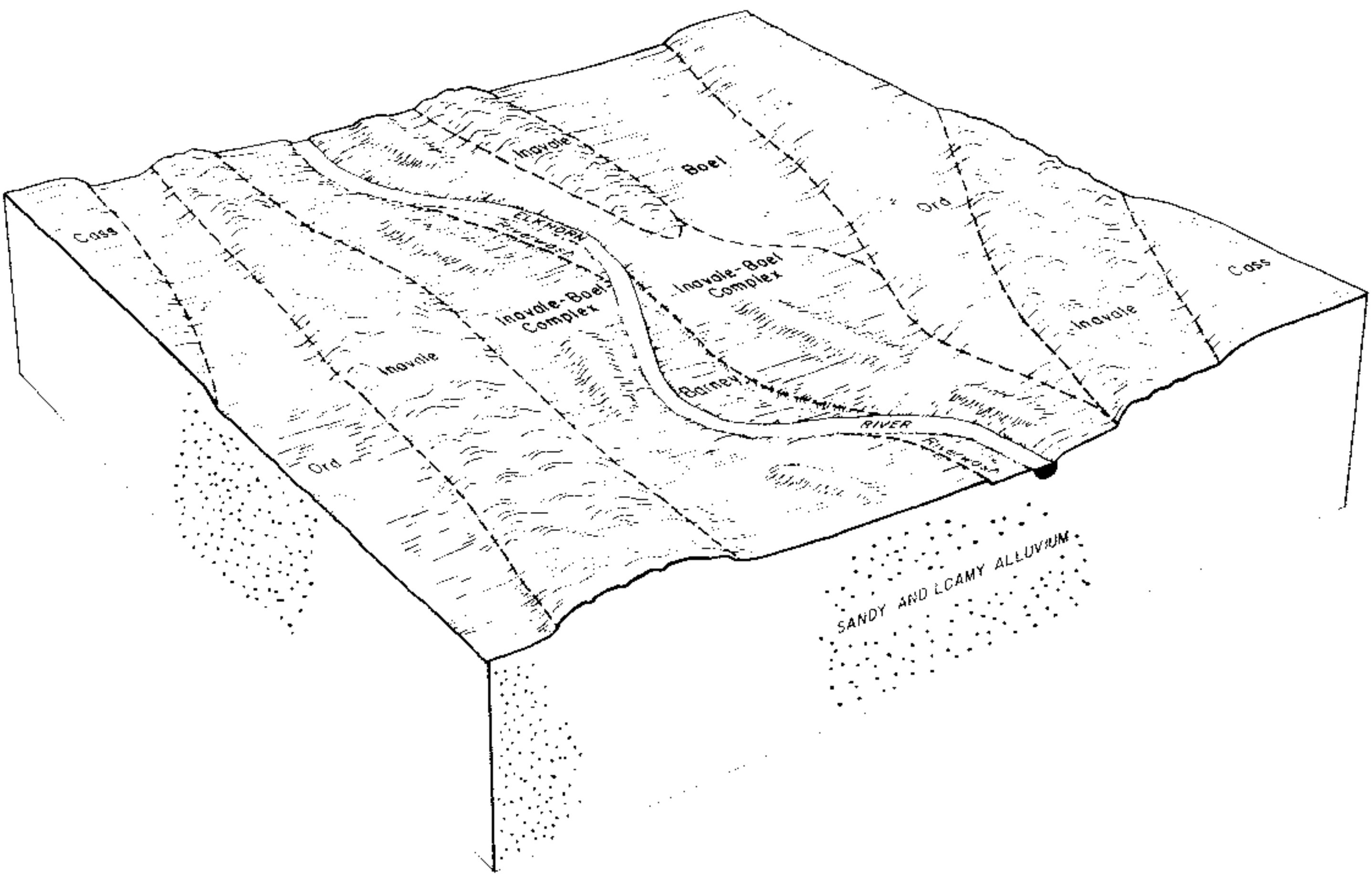

Figure 6.—Typical pattern of soils in the Inavale-Boel-Ord association, showing the relationship of soils to topography and parent material.

sandy loam about 10 inches thick. The underlying material is stratified. It is light brownish gray fine sand in the upper part, light gray loamy fine sand in the middle part, and light brownish gray fine sand in the lower part to a depth of 60 inches.

Of minor extent in this association are the Barney, Cass, and Marlake Variant soils, and, in addition, Pits and Dumps and Riverwash. Barney and Marlake Variant soils are in old oxbow stream channels at a lower elevation than the major soils. Cass soils are well drained and at a higher elevation than the major soils. Pits and Dumps and Riverwash are near channels of the Elkhorn River.

Very few farmsteads are in this association. Most of the acreage is in mixed native grasses and trees or is seeded to introduced grasses. These areas are used mainly for grazing cattle. They are also used for recreation areas and as wildlife habitat. Wildlife common to the area are fairly abundant in this association. A few small areas of soils are used for cultivated crops. Corn and soybeans are the main crops. These areas are poorly suited to irrigation because of the hazard of flooding, wetness from the seasonal high water table, and the high risk of soil blowing.

Soil blowing, droughtiness, and flooding are hazards if these soils are used for cultivated crops. Conserving moisture, maintaining a plant cover, and improving fertility are concerns of management. Proper grazing use and a planned grazing system are needed if the soils are used for rangeland.

The farms in this association average about 300 acres. Most of the owners or operators reside in areas outside of this association. The farms mostly consist of combination cash-grain and livestock enterprises, with headquarters in areas adjacent to this association. Water for use by livestock is available from streams. Most of the cattle and hogs raised are marketed in Norfolk or shipped to larger cities outside the county. Most cash-grain crops are sold locally.

9. Gibbon-Ord-Cass association

Deep, nearly level, somewhat poorly drained and well drained, silty and loamy soils that formed in alluvium; on bottom lands

This association consists mainly of nearly level bottom lands of the Elkhorn River valley.

This association makes up about 6,000 acres or about 2 percent of the county. It is about 42 percent Gibbon soils, 25 percent Ord soils, 23 percent Cass soils, and 10 percent soils of minor extent.

The Gibbon soils are on bottom lands. These soils are deep, nearly level, and somewhat poorly drained. Typically, the surface layer is dark gray, friable, calcareous silty clay loam about 8 inches thick. The subsurface layer is gray, friable, calcareous silty clay loam about 10 inches thick. It is dark gray in the upper part and gray in the middle and lower parts. The underlying material is light brownish gray loam in the upper part and light gray, stratified fine sand and loamy fine sand in the lower part to a depth of 60 inches.

The Ord soils are on bottom lands. These soils are deep, nearly level, and somewhat poorly drained. Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is dark gray, very friable silt loam about 10 inches thick. Below this is a transitional layer of gray, very friable fine sandy loam about 10 inches thick. The underlying material is stratified. It is light brownish gray fine sand in the upper part, light gray loamy fine sand in the middle part, and light brownish gray fine sand in the lower part to a depth of 60 inches.

The Cass soils are on bottom lands. These soils are deep, nearly level, and well drained. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 9 inches thick. Below this is a transitional layer of brown, very friable, very fine sandy loam about 14 inches thick. The underlying material is pale brown fine sand stratified with thin layers of silt loam, loam, and fine sandy loam to a depth of 60 inches.

Of minor extent in this association are the Colo, Lamo, Muir, and Zook soils. The Colo and Lamo soils are in positions on the landscape similar to the major Gibbon and Ord soils. The well drained Muir soils are on low stream terraces. Zook soils are in a lower position than the major soils.

Farms in this association are diversified and are mainly a combination of cash-grain and livestock enterprises. Most of the acreage is used for dryland crops and pasture. Corn, soybeans, grain sorghum, and alfalfa are the main crops. A few areas are irrigated. Both gravity systems and sprinkler systems are used. A small acreage is in native grasses and is used for grazing or mowed for hay. Some cattle and hogs are fattened for market.

Wetness due to a seasonal high water table is the main limitation of these soils. Surface drainage is needed on silty clay loam and silt loam soils to improve the ease of tillage. Improving fertility and tilth are the major concerns of management. Soil blowing is a hazard on soils that have a surface layer of fine sandy loam.

Farms in this association average about 400 acres. Much of the grain and hay raised is fed to cattle and hogs. The cash-grain crops are marketed locally. Most of the cattle and hogs are marketed locally or shipped to Norfolk or larger cities in adjacent counties.

sandy and loamy soils on stream terraces

One association is in this group. The soils are deep, nearly level and very gently sloping, and somewhat poorly drained and poorly drained. Most of the acreage is cultivated and farmed dryland. A small acreage is in native grass and is used for grazing or hay. Sprinkler irrigation is used in a few areas. Wetness in spring and soil blowing in summer and fall are the principal hazards. Maintaining fertility is the important concern of management.

10. Elsmere-Ovina-Loup association

Deep, nearly level and very gently sloping, somewhat poorly drained and poorly drained, sandy and loamy soils that formed in eolian sands and alluvium; on stream terraces

This association consists of nearly level and very gently sloping soils on stream terraces.

This association makes up about 5,300 acres or about 2 percent of the county. It consists of 63 percent Elsmere soils, 11 percent Ovina soils, 5 percent Loup soils, and 21 percent soils of minor extent.

The Elsmere soils are on stream terraces. These soils are deep, somewhat poorly drained, and nearly level. Typically, the surface layer is dark gray and grayish brown, very friable loamy fine sand about 11 inches thick. Below this is a transitional layer of light brownish gray, very friable loamy fine sand about 14 inches thick. The underlying material is light gray, mottled fine sand to a depth of 60 inches.

The Ovina soils are on stream terraces. These soils are deep, nearly level and very gently sloping, and somewhat poorly drained. Typically, the surface layer is dark grayish brown loamy fine sand about 3 inches thick. The subsurface layer is grayish brown loamy fine sand about 5 inches thick. The underlying material is pale brown loamy fine sand in the upper part, pale brown loam and light brownish gray clay loam in the middle part, and pale yellow, mottled fine sand in the lower part to a depth of 60 inches.

The Loup soils are on stream terraces. These soils are deep, nearly level, and poorly drained. Typically, the surface layer is very dark gray, very friable fine sandy loam about 10 inches thick. The subsurface layer is very dark gray, very friable fine sandy loam about 6 inches thick. Below this is a transitional layer of gray, very friable fine sandy loam about 4 inches thick. The underlying material is light gray, mottled loamy fine sand in the upper part and very pale brown, mottled fine sand in the lower part to a depth of 60 inches.

Of minor extent in this association are mainly the Lawet and Thurman soils. The Lawet soils are poorly drained and are in a lower position on the landscape. The Thurman soils are somewhat excessively drained and are in a higher position on the landscape.

Farms in this association are diversified. They are combination cash-grain and livestock enterprises. A large part of this association is used for dryland crops. The rest is in native grass and is used for grazing or mowed for hay. A few areas are irrigated by a sprinkler system. Corn, soybeans, grain sorghum, and alfalfa are the main crops. This association is well suited to native grass because it is subirrigated by the seasonal high water table. Cattle and hogs are fattened for market on most farms, and some farms maintain dairy herds.

Wetness and soil blowing are the main hazards on these soils. The somewhat poorly drained soils have a seasonal high water table that fluctuates between a depth of 2 feet in most wet years and 4 feet in most dry years. Somewhat poorly drained soils can be farmed in most years without tile drainage. The poorly drained soils have a seasonal high water table that fluctuates between a depth of 1 foot in most wet years and 3 feet in most dry years. Poorly drained soils are better suited to native grass than to farming. Maintaining fertility is a concern of management if the soils are used for cropland.

The farms in this association average about 400 acres. Most of the farmsteads are located in areas adjacent to this association and on soils in higher positions on the landscape. Cash-grain crops are mostly marketed locally. Feeder cattle and hogs are mostly sold locally or shipped to Norfolk or larger cities in adjacent counties.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Shell loam, 0 to 1 percent slopes, is one of several phases in the Shell series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Inavale-Boel complex, channeled is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. Also, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Riverwash is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Some soil boundaries and soil names may not agree with those of adjoining areas in adjacent counties. This discrepancy is the result of changes or refinements in series concepts, changes in the acreage or relative extent of individual soils, slope groupings, and application of the latest classification system.

AcC—Alcester silty clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on foot slopes generally below loess uplands (fig. 7). Areas are long and narrow and range from about 10 to 100 acres.

Typically, the surface layer is dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 14 inches thick. The subsoil is friable silty clay loam about 36 inches thick. It is brown in the upper part, grayish brown in the middle part, and brown in the lower part. The underlying material is pale brown, calcareous silt loam to a depth of 60 inches. In some small areas, this soil is grayish brown below a depth of 48 inches. In other small areas, the surface soil is less than 20 inches thick. Some small areas are nearly level.

Included with this soil in mapping are small areas of Colo, Hobbs, and Nora soils. The commonly flooded Hobbs soils and somewhat poorly drained Colo soils are in narrow upland drainageways and are in a lower position on the landscape than Alcester soil. Nora soils have a thinner, dark surface layer and are on loess uplands. The included soils make up about 5 to 15 percent of the map unit.

The permeability of this Alcester soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. The intake rate of water is low. Runoff is medium. The surface layer is easily tilled through a narrow range of

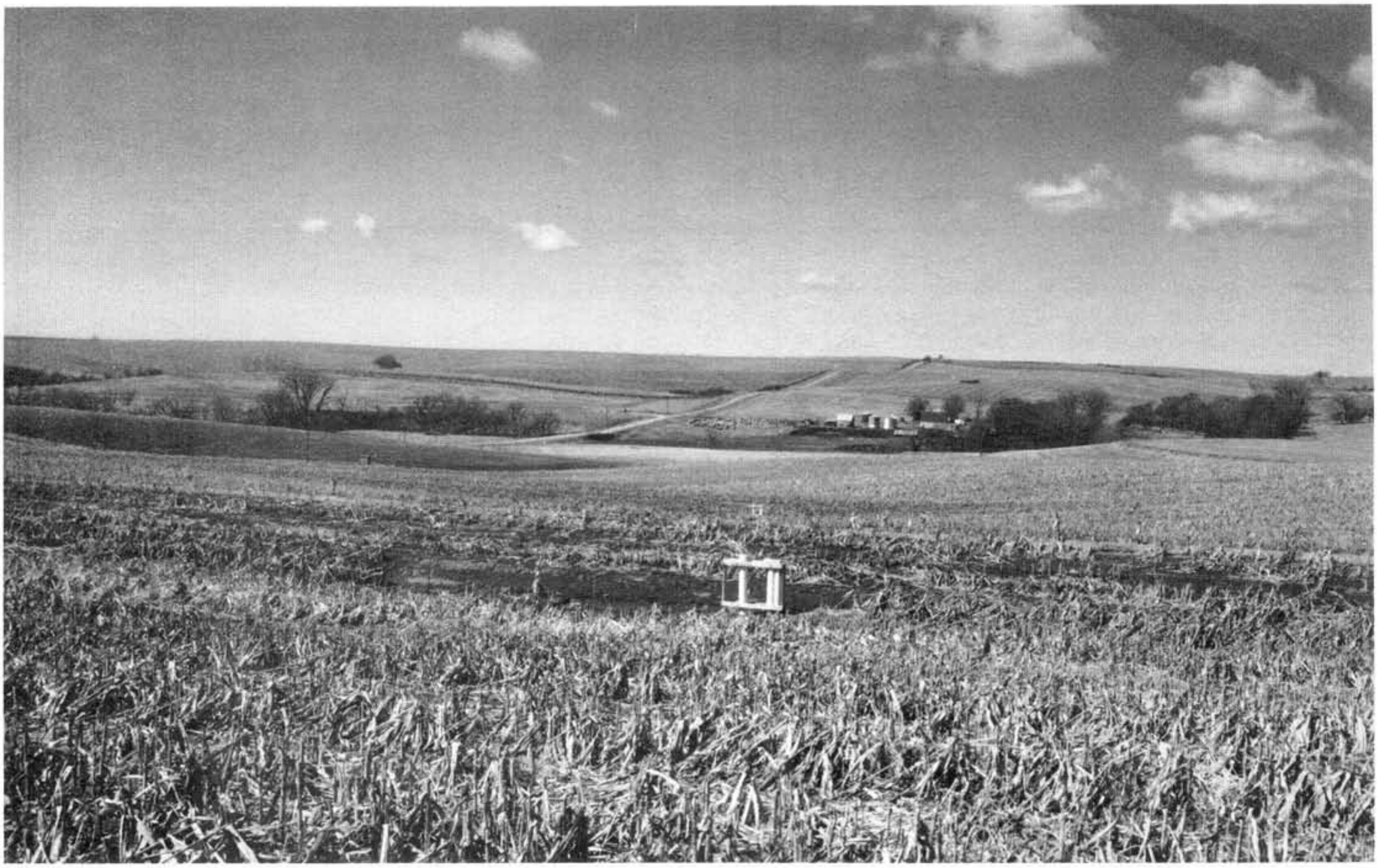

Figure 7.—Alcester soils are on the lower slopes, Nora soils are on the middle slopes, and Crofton soils are on the upper slopes.

moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. Some of the acreage is seeded to introduced grass and is used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, oats, and alfalfa. Conservation tillage practices, such as discing and chiseling, keep crop residue on the surface and help to prevent erosion and control runoff. Terraces, contour farming, and grassed waterways also help to control erosion and protect the area from runoff from soils in higher lying positions. Returning crop residue to the soil and including grasses and legumes in the cropping sequence help to maintain and improve the content of organic matter and fertility.

If irrigated, this soil is suited to both sprinkler and gravity systems of irrigation. All crops commonly raised in the area, including corn, soybeans, and alfalfa can be grown. Bench leveling can be used to lower the effective gradient. Contour furrows are suited if they are used with terraces and grassed waterways, and if an adequate amount of crop residue is kept on the surface. This soil needs to be protected from runoff from soils on the higher lying slopes. Conservation tillage practices, such as discing or chiseling, help to control runoff. Terraces and grassed waterways also help to control runoff.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Pasture grasses can also be used in sequence with row crops as part of the cropping system. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of fertilizer and irrigation water increase the growth and vigor of grasses.

This soil provides a good site for planting trees and shrubs in windbreaks. Seedlings generally survive and grow if competing grasses and weeds are controlled. Undesirable weeds can be controlled by cultivation between the rows and careful use of appropriate herbicides, or by hand hoeing in the row.

This soil is well suited to septic tank absorption fields. For sewage lagoons, grading is required to modify the slope or shape the lagoon. Sealing or lining the floor of the lagoon to prevent seepage is needed.

Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Runoff from higher lying areas should be considered in the construction of sanitary facilities, building sites, and roads or streets.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material helps to ensure better performance. Crowning the road by grading and constructing adequate side ditches help to provide good surface drainage and reduce the damage caused by frost action.

This soil is in capability units IIe-1, dryland, and IIIe-3, irrigated. It is in the Silty range site and windbreak suitability group 3.

Ba—Barney loam, 0 to 2 percent slopes. This poorly drained, nearly level soil is on swales and abandoned channels of the Elkhorn River. The channels are from 1 foot to 3 feet deep. The soil is shallow over coarse sand that contains a small amount of gravel. It is frequently ponded. Areas range from 5 to 45 acres.

Typically, this soil has a surface layer of dark grayish brown, friable loam about 6 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand about 4 inches thick. The underlying material is light gray and very pale brown coarse sand that is stratified with layers of fine sandy loam to a depth of 60 inches. In some small areas, the surface layer is grayish brown fine sand. In other areas, the surface layer is silt loam or silty clay loam. Channels make up 15 to 35 percent of the area.

Included with this soil in mapping are small areas of Boel, Inavale, and Marlake Variant soils. The somewhat poorly drained Boel soils are in a slightly higher position on the landscape than Barney soil. The somewhat excessively drained Inavale soils are in a higher position. The very poorly drained Marlake Variant soils are in a lower position. The included soils make up 5 to 10 percent of the map unit.

The permeability of this Barney soil is rapid, and the available water capacity is low. Runoff is very slow. The organic matter content is moderate, and natural fertility is low. This soil has a seasonal high water table that fluctuates from ponding in most wet years to a depth of about 2 feet in most dry years. Moisture is released readily to plants.

Most of the acreage of this soil is in native grass and is used for grazing or mowed for hay. In some areas, scattered trees grow along with the native grass. Some areas are used as wildlife habitat.

This soil is not suited to cultivated crops or pasture because of the seasonal high water table and frequent ponding.

Rangeland is the best agricultural use of this soil. Improper timing of haying and mowing to improper heights reduce the protective vegetative cover and cause deterioration of desired grasses.

This soil is not suited to trees and shrubs in windbreaks because of frequent ponding and the seasonal high water table.

This soil is not suited to septic tank absorption fields, sewage lagoons, or buildings because it ponds frequently and is subject to flooding. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the ponding level and providing adequate side ditches for drainage help to protect roads from damage by ponding and wetness from the seasonal high water table.

This soil is in capability unit Vw-7, dryland. It is in the Wet Land range site and windbreak suitability group 10.

Be—Belfore silty clay loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on broad ridgetops and tablelands of uplands. It formed in loess. Areas range from 5 to 250 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is about 36 inches thick. It is brown, firm silty clay in the upper part; brown and yellowish brown, firm silty clay in the middle part; and light yellowish brown, friable silty clay loam in the lower part. The underlying material is light yellowish brown silt loam to a depth of 60 inches. In a few small areas, the dark upper layers are more than 20 inches thick. In a few small areas, the underlying material is silty clay loam.

Included with this soil in mapping are small areas of Moody soils. They have less clay in the subsoil than Belfore soil and are on narrow ridgetops and side slopes below the Belfore soil. Also included are small depressional areas where the soil has a claypan subsoil. The included soils make up about 3 to 8 percent of the map unit.

The permeability of this Belfore soil is moderately slow, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. Runoff is slow, and the intake rate of water is low.

Most of the acreage of this soil is cultivated. A small acreage is used for pastureland.

Under dryland farming, this soil is suited to corn, soybeans, and oats. Alfalfa can be grown for hay and pasture. If this soil is tilled when wet, it becomes cloddy and hard upon drying. Repeated tillage when the soil is wet tends to form a plowpan that slows the intake of water and penetration by most crop roots. Alfalfa roots help to break up this plowpan. Returning crop residue to the soil improves tilth. Conservation tillage practices, such as discing or chiseling, keep crop residue on the surface and help to keep the soil friable. No-till planting is suited to row crops. Liming is generally needed for legumes.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa can be grown. Tilling the soil when it is wet compacts the surface layer and slows the intake of water. Alfalfa roots help to increase the intake of water. Land leveling is generally needed to improve surface drainage and increase the efficiency of the irrigation system. Liming is generally needed for legumes.

This soil is suited to introduced grasses for pasture. Cool-season species, such as smooth brome or orchardgrass, can be mixed with alfalfa. Pasture grasses can also be used as part of a cropping sequence with row crops. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water help to maintain fertility and increase the growth and vigor of grasses.

This soil is suited to most trees and shrubs that can tolerate the climate. Capability for survival and growth is good. Competition from undesirable grasses and weeds is a concern. Undesirable plants can be controlled by cultivation between the trees and careful use of appropriate herbicides, or by roto-tilling within the row.

The moderately slow permeability of this soil is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption area. Sewage lagoons are well suited to this soil.

The foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from the shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Coarser-grained material for the subgrade or base material can be used to ensure better performance. In addition, base material can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling.

This soil is in capability units I-1, dryland, and I-3, irrigated. It is in the Clayey range site and windbreak suitability group 3.

Bn—Blendon fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on stream terraces. It formed in loamy and sandy alluvium. Areas range from 5 to 150 acres.

Typically, the surface layer is very dark gray, very friable fine sandy loam about 9 inches thick. The subsurface layer is dark gray, very friable fine sandy loam about 7 inches thick. The subsoil is very friable fine sandy loam about 20 inches thick. The upper part is dark gray, and the lower part is dark grayish brown. The underlying material is loamy fine sand to a depth of about 60 inches. It is brown in the upper part and pale brown in the lower part. In some small areas, the upper part of the surface layer is loamy fine sand. In other small areas, the surface layer is loam.

Included with this soil in mapping are small areas of Elsmere, Loretto, and Thurman soils. The somewhat poorly drained Elsmere soils are in a lower position on the landscape than Blendon soil. Loretto soils have more clay in the subsoil and are in a slightly higher position on the landscape. The somewhat excessively drained Thurman soils are in a higher position. The included soils make up 5 to 10 percent of the map unit.

The permeability of the Blendon soil is moderately rapid in the subsoil and rapid in the underlying material. The available water capacity is moderate. The organic matter content is moderate, and natural fertility is high. Runoff is slow. The intake rate of water is moderately high. The surface layer is easily tilled through a wide range of moisture conditions. Moisture is absorbed readily and released readily to plants.

Most of the acreage of this soil is cultivated. A few areas are seeded to introduced grass and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, sorghum, soybeans, oats, and alfalfa. Soil blowing is the main hazard. Maintaining the fertility and content of organic matter are the principal concerns of management. Conservation tillage practices, such as discing or chiseling, keep crop residue on the surface and help to prevent soil blowing and evaporation of soil moisture. Cover crops are also helpful.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa can be grown. Land leveling is generally needed, but deep cuts should be avoided. Returning crop residue to the soil and applying feedlot manure help to control soil blowing. Conservation tillage practices, such as no-till planting, keep crop residue on the surface and help to control soil blowing. The proper amount of water needs to be applied to prevent leaching of nutrients.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome and orchardgrass, can be mixed with alfalfa, or a cropping sequence can be used that alternates these grasses with row crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water help to improve the vigor and growth of pasture grasses.

This soil provides a good site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Cultivation should be restricted to the tree row. Appropriate herbicides can be applied, or the soil can be roto-tilled to control weeds and grasses in the row.

The contamination of the underground water table by pollution from septic tank absorption fields is a hazard on this soil. The floor of sewage lagoons needs to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be temporarily shored to prevent sloughing or caving.

This soil is suited to the construction of buildings and dwellings.

Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the roadbed by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIs-6, dryland, and IIe-8, irrigated. It is in the Sandy range site and windbreak suitability group 5.

Bp—Boel loam, 0 to 2 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom lands of the Elkhorn River valley. It is subject to occasional flooding. Areas range from 5 to 50 acres.

Typically, the surface layer is very dark grayish brown, very friable, calcareous loam about 8 inches thick. Below this is a transitional layer of dark grayish brown, very friable fine sandy loam about 8 inches thick. The underlying material is light brownish gray, mottled fine sand to a depth of 60 inches. Some small areas have a surface layer of silt loam or fine sandy loam.

Included with this soil in mapping are small areas of Cass, Gibbon, Inavale, and Ord soils. The well drained Cass soils are in a slightly higher position on the landscape than Boel soil. Gibbon and Ord soils have less sand in the upper part of the profile and are in a similar position on the landscape. The somewhat excessively drained Inavale soils are in a higher position. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Boel soil is rapid, and the available water capacity is low. Runoff is slow. The organic matter content is moderate. The seasonal high water table is at a depth of about 1.5 feet in most wet years and at a depth of about 3.5 feet in most dry years. The water table is generally highest in winter and spring and is at a depth of about 3 feet during most of the growing season. The intake rate of water is moderately high, and natural fertility is medium. The surface layer is easily tilled through a fairly wide range of moisture content. Moisture is released readily to plants.

Most of the acreage of this soil is in native grass and is used for grazing or mowed for hay. In some of the areas adjacent to river channels, trees and shrubs are the dominant vegetation. A small acreage is used for cultivated crops. Only a few areas are irrigated or in pasture.

Under dryland farming, this soil is suited to corn, sorghum, soybeans, and alfalfa. Small grain that is sown in spring is generally not grown because wetness delays tilling and planting. Conservation tillage practices, such as chiseling and discing, keep crop residue on the surface and help to prevent evaporation of soil moisture. Flooding can be controlled by dikes and levees.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, grain sorghum, and alfalfa are grown. Land leveling is generally needed, but deep cuts that expose the underlying material of fine sand should be avoided. Because of the coarse textured underlying material, the length of runs needs to be short under gravity irrigation. Frequent, light applications of water help to prevent leaching of nutrients and herbicides through the soil. In some areas, drainage ditches can be used to improve surface drainage and make tillage in spring feasible. Returning crop residue to the soil and applying feedlot manure improve the organic matter content and fertility and help to prevent the evaporation of soil moisture.

This soil is suited to introduced grasses for grazing or haying. Cool-season grasses, such as smooth brome, orchardgrass, or reed canarygrass, can be mixed with alfalfa. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to maintain the desired grasses. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of grasses.

This soil is suited to native grasses that can tolerate the seasonal high water table. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. In addition, overgrazing when the soil is wet causes compaction, and it becomes difficult for animals to graze or hay to be harvested. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is good if the plants selected can tolerate occasional wetness. The establishment of seedlings can be difficult in the spring of wet years. Undesirable weeds and grasses can be controlled by cultivating between the rows and using appropriate herbicides, or by roto-tilling in the tree rows. Areas near the trees can be hoed by hand.

This soil is generally not suitable for the construction of buildings or septic tank absorption fields because of wetness, the hazard of flooding, and the poor filtering capacity of the underlying material. An alternate site is needed. The floors of sewage lagoons need to be sealed or lined to prevent seepage. In addition, sewage lagoons need to be diked as protection from flooding or constructed on fill material so that the bottom of the lagoon is raised to a sufficient height above the seasonal high water table.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate drainage of side ditches and culverts help to protect the roads from flood damage and wetness.

This soil is in capability units IIIw-4, dryland, and IIIw-8, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

BsC—Boelus loamy fine sand, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. It formed in a layer of sandy material deposited over loess. Areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 11 inches thick (fig. 8).

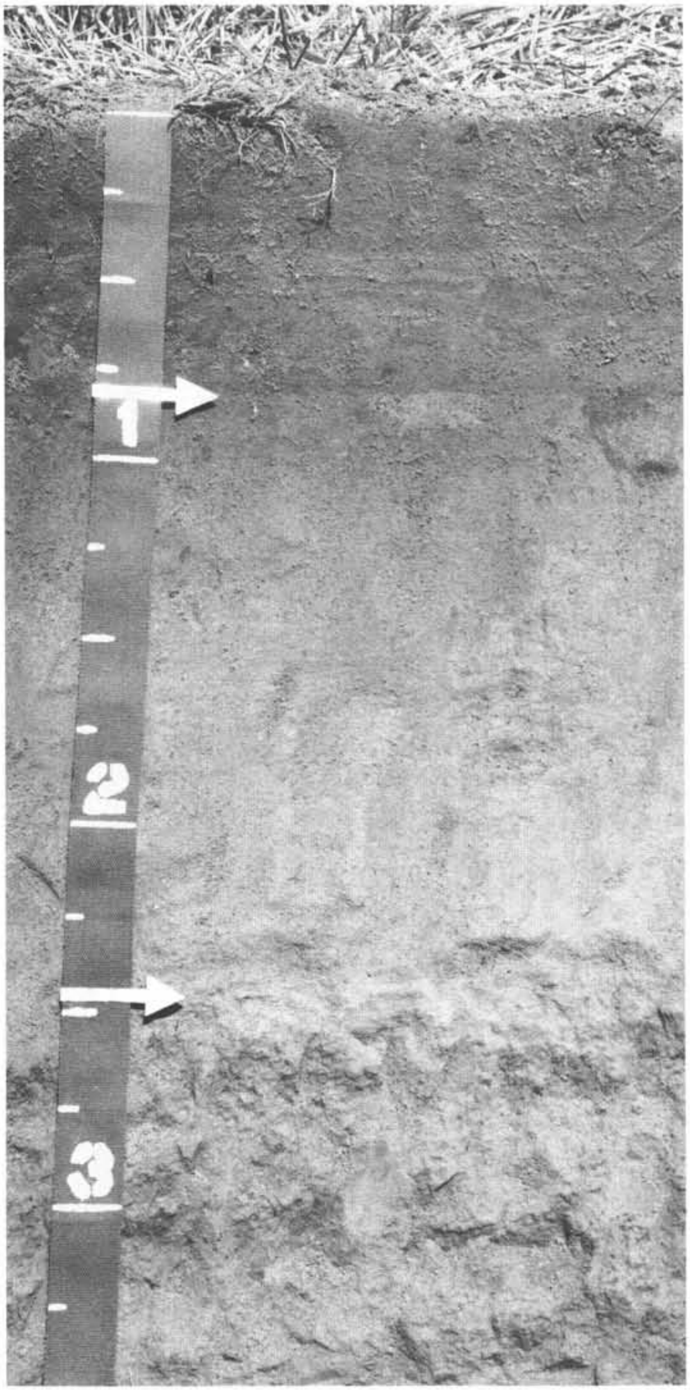

Figure 8.—Profile of Boelus loamy fine sand. Typically, this soil is made up of loamy fine sand about 26 inches thick deposited over silty clay loam and silt loam. Depth is marked in feet.

Below this is a layer of subsoil that is brown, very friable loamy fine sand about 13 inches thick. The layer of subsoil that developed in loess is silty clay loam about 26 inches thick. It is pale brown in the upper part and light yellowish brown in the lower part. The underlying material is light yellowish brown silt loam to a depth of 60 inches. In some small areas, the surface layer is fine sand, and, in some areas, the surface layer is less than 10 inches thick. In a few areas, the soil is strongly sloping. In some small areas, fine sand is below a depth of 40 inches.

Included with this soil in mapping are small areas of Loretto, Nora, Ovina, Thurman, and Valentine soils. Loretto soils have more clay in the surface layer than Boelus soil. They are in a similar position on the landscape. Nora soils are in a lower position. The somewhat poorly drained Ovina soils are also in a lower position. The Thurman and Valentine soils have more sand in the underlying horizons and are in slightly higher positions on the landscape than Boelus soil. The included soils make up about 10 to 15 percent of the map unit.

The permeability of this Boelus soil is rapid in the upper part of the profile and moderate in the lower part. Runoff is slow. The available water capacity and the intake rate of water are high. The organic matter content is moderately low, and natural fertility is medium. The surface layer is easily tilled through a wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. A few areas are in native grasses or seeded to introduced grasses. These areas are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, sorghum, soybeans, oats, and alfalfa. Soil blowing and water erosion are the main hazards. Conservation tillage practices, such as discing and chiseling, keep crop residue on the surface and help to lessen soil blowing and evaporation of soil moisture. A no-till planting system can be used for row crops. Terraces, grassed waterways, and contour farming help to prevent water erosion. Applying feedlot manure helps to improve the organic matter content and fertility of the soil.

If irrigated, this soil is suited to a sprinkler system of irrigation. Corn, soybeans, grain sorghum, and alfalfa can be grown. Soil blowing and water erosion are the main hazards. Maintaining fertility is an important concern of management. Conservation tillage systems, such as discing and chiseling, keep crop residue on the surface during and after planting and help to control soil blowing and water erosion. Contour furrowing is suited if it is used with terraces and grassed waterways, and if an adequate amount of crop residue is left on the surface.

This soil can be seeded to introduced pasture grasses to effectively control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Introduced grasses also can be used as part of a cropping sequence with row crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of pasture grasses.

This soil is suited to native grasses for rangeland. Use of the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. The reduction of protective cover can cause severe losses by soil blowing. A planned grazing system, proper grazing use, and timely deferment from grazing help to maintain or improve the range condition.

This soil generally provides a good site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Lack of adequate moisture and the hazard of soil blowing are the principal concerns of management. Planting a cover crop between the rows helps to prevent soil blowing. Undesirable grasses and weeds can be controlled by cultivation between the trees and careful use of appropriate herbicides, or by roto-tilling in the row.

This soil is suited to septic tank absorption fields. The floors of sewage lagoons need to be sealed or lined to prevent seepage. Grading is also needed to modify the slope and shape the lagoon.

The foundations for buildings and dwellings need to be strengthened and backfilled with coarse material to prevent damage from the shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Coarser-grained material for subgrade or base material can be used to ensure better performance.

This soil is in capability units IIIe-6, dryland, and IIIe-10, irrigated. It is in the Sandy range site and windbreak suitability group 5.

Cf—Cass fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on bottom lands along major stream valleys. It is subject to rare flooding. Areas range from 5 to several hundred acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 9 inches thick. Below this is a transitional layer of brown, very friable very fine sandy loam about 14 inches thick. The underlying material is pale brown fine sand stratified with thin layers of silt loam, loam, and fine sandy loam to a depth of 60 inches. In some areas, the upper part of the surface layer is loamy fine sand. In other areas, it is loam.

Included with this soil in mapping are small areas of Boel, Inavale, and Ord soils. All of these soils are in lower positions on the bottom lands than Cass soil and have more sand in the upper part of the profile. The included soils make up about 5 to 10 percent of the map unit.

The permeability of this Cass soil is moderately rapid in the upper part of the profile and rapid in the lower part. The intake rate of water is moderately high, and the available water capacity is moderate. The organic matter content is moderately low, and natural fertility is medium. Runoff is slow. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. A few areas are in native grass and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, sorghum, soybeans, and alfalfa. Droughtiness and soil blowing are the main hazards. Maintaining fertility is a concern of management. Conservation tillage practices, such as discing, chiseling, and no-till planting, keep crop residue on the surface and help to prevent soil blowing and conserve soil moisture. Cover crops are also helpful. Returning crop residue to the soil helps to control soil blowing, maintain the content of organic matter, and improve the fertility of the soil.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, grain sorghum, and alfalfa are grown. Where land grading is needed, deep cuts should be avoided. Land leveling increases the efficiency of the irrigation system. Because of the underlying material of fine sand, light, frequent applications of water and short length of runs are needed to prevent leaching of plant nutrients and herbicides below the depth of the plant roots. Conservation tillage practices, such as discing or chiseling, help to prevent soil blowing. Keeping crop residue on the surface and applying feedlot manure help to maintain the content of organic matter and improve the fertility of the soil.

This soil is suited to cool-season grasses, such as smooth brome, tall fescue, and orchardgrass, mixed with alfalfa. Introduced grasses can be used as part of a cropping sequence that alternates with row crops. Single species, warm-season grasses are also suited to this soil. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Application of nitrogen fertilizer commonly increases the growth and vigor of introduced grasses.

This soil is suited to use as rangeland. Use of the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain and improve the range condition.

This soil provides a good site for the planting of trees and shrubs in windbreaks. Capability for the survival of adapted species is generally good. Sod or a cover crop can be established between the rows to help control soil blowing. Cultivation or use of appropriate herbicides to control grass and weeds should be restricted to the tree row, or to the areas that can be hoed by hand or roto-tilled.

If this soil is used for sanitary facilities and building sites, the hazard of rare flooding needs to be considered. Extreme care should be taken so that the underground water table does not become polluted by seepage from septic tank absorption fields. Lining or sealing the floor of sewage lagoons is needed to prevent seepage. Diking can help to prevent flooding.

Dwellings and buildings can be constructed on elevated, well compacted fill material above the flood level to protect against flooding. The walls or sides of shallow excavations can be temporarily shored to prevent sloughing or caving.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts for drainage help to protect roads from flood damage. Crowning the road by grading and constructing adequate side ditches help to provide good surface drainage and reduce the damage caused by frost action.

This soil is in capability units IIs-6, dryland, and IIs-8, irrigated. It is in the Sandy Lowland range site and windbreak suitability group 1.

CnC—Clarno loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on ridgetops and side slopes of uplands. It formed in glacial till. Areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is clay loam about 22 inches thick. The upper part is brown and friable; the middle part is brown and firm; and the lower part is pale brown, calcareous, and friable. The underlying material is light gray, mottled, calcareous clay loam to a depth of 60 inches. It contains small gravel, pebbles, or stones. The depth to lime is 22 inches. Some small areas are made up of reddish loamy material of the Loveland Formation. Other small areas have a surface layer less than 6 inches thick. In some areas, the surface layer is fine sandy loam or silt loam. Pebbles are on the surface in many places.

Included with this soil in mapping are small areas of Blendon, Hadar, Lawet, and Thurman soils. The moderately coarse-textured Blendon soils are in a lower position on the landscape than Clarno soil. Hadar soils have a sandy surface layer and are in a similar position on the landscape. The sandy Thurman soils are in a higher position, and the poorly drained Lawet soils are in a lower position. The included soils make up 10 to 20 percent of the map unit.

The permeability of this Clarno soil is moderately slow, and the available water capacity is moderate. The organic matter content is moderate, and natural fertility is medium. The intake rate of water is moderately low. Runoff is medium. The surface layer is easily tilled through a fairly narrow range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated. A few areas are in pasture and rangeland and are used for grazing or mowed for hay. A few areas are used for homesites.

Under dryland farming, this soil is suited to corn, soybeans, sorghum, and alfalfa. Water erosion is the principal hazard. Maintaining the fertility and organic matter content are concerns of management. Terraces, contour farming, and grassed waterways can be used to help control runoff and erosion. Conservation tillage practices, such as chiseling and discing, keep crop residue on the surface and help to prevent water erosion. Returning crop residue to the soil also helps to maintain fertility and improve tilth.

This soil is suited to sprinkler irrigation. It also is suited to gravity irrigation if it is bench leveled or contour furrowed and if terraces and grassed waterways are established and an adequate amount of crop residue is kept on the surface. Corn, soybeans, and alfalfa can be grown. Water erosion and runoff are concerns of management. The rate of water application should be carefully controlled. Conservation tillage practices, such as chiseling or discing, leave crop residue on the surface and help to prevent water erosion and runoff. Returning crop residue to the soil and applying feedlot manure help to maintain the organic matter content and fertility and improve tilth.

The use of this soil for pasture is an effective way to control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Introduced grasses can also be used in a cropping sequence with row crops. Overgrazing or grazing when the soil is wet reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of grasses.

This soil is suited to native grasses for rangeland. Use of the soil for range is an effective way to help control erosion. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. A planned grazing system, proper grazing use, deferred grazing, and restricted use during very wet periods help to maintain the desired range condition.

This soil provides a good site for trees and shrubs in windbreaks. Capability is good for the survival and fair for the growth of adapted species. Competition for moisture from weeds and grass is the main management concern. Cultivation between the rows and careful use of appropriate herbicides can help to control weeds and grasses. Planting trees on the contour and using terraces help to control erosion and runoff.

The moderately slow permeability of this soil is a limitation for septic tank filter fields, but this limitation can generally be overcome by increasing the size of the absorption field. Grading is needed to modify the slope and shape the sewage lagoon, and lining or sealing the floor is needed to prevent seepage.

Foundations of buildings need to be strengthened and backfilled with coarse material to prevent damage from the shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser-grained material for subgrade or base material can be used to ensure better performance.

This soil is in capability units IIe-1, dryland, and IIIe-4, irrigated. It is in the Silty range site and windbreak suitability group 3.

CnD—Clarno loam, 6 to 11 percent slopes. This deep, well drained, strongly sloping soil is on side slopes and ridgetops of uplands. It formed in glacial till. Areas range from 5 to 50 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 20 inches thick. It is grayish brown, friable clay loam in the upper part and light brownish gray, mottled, firm clay loam in the lower part. The underlying material is light yellowish brown, mottled clay loam to a depth of 60 inches. It has a few pebbles and stones. Depth to lime is 20 inches. Some small areas have a surface layer less than 6 inches thick, and other areas have a surface layer of fine sandy loam or silt loam. In places, this soil has a slope of 11 to 15 percent.

Included with this soil in mapping are small areas of Blendon, Hadar, and Thurman soils. The moderately coarse-textured Blendon soils are in a slightly lower position on the landscape than Clarno soil. Hadar soils have a sandy surface layer and are in a similar position on the landscape. The somewhat excessively drained Thurman soils are in a higher position. Also included in some areas is a soil that formed in reddish brown loamy material of the Loveland Formation. The included soils make up about 10 to 20 percent of the map unit.

The permeability of this Clarno soil is moderately slow, and the available water capacity is moderate. The organic matter content is moderate, and natural fertility is medium. The intake rate is moderately low. Runoff is rapid. The surface layer is easily tilled through a fairly narrow range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. A few small areas are in native grass and are used for grazing or mowed for hay. A few areas near urban developments are used for residential housing.

Under dryland farming, this soil is suited to corn, soybeans, sorghum, oats, and alfalfa. Water erosion is the main hazard. Improving fertility is a concern of management. Terraces, contour farming, and grassed waterways help to control erosion and runoff. Conservation tillage practices, such as no-till planting or disc-planting, keep crop residue on the surface and help to control erosion and runoff. Returning crop residue to the soil also helps to prevent excess evaporation of soil moisture.

If irrigated, this soil is suited to a sprinkler system of irrigation, but it is not suited to a gravity system. Corn, grain sorghum, and soybeans are poorly suited because of the erosion hazard. The hazard of water erosion is severe. Terraces, contour farming, grassed waterways, and the proper rate of water application help to control erosion and runoff. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to prevent runoff and control erosion. Applying feedlot manure helps to maintain or improve the fertility of the soil.

This soil is suited to introduced grasses for pasture. Use of this soil for pasture is an effective way to control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Introduced grasses can also be used as part of a cropping sequence with row crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of commercial fertilizer and irrigation water increase the vigor and growth of grasses.

This soil is suited to native grasses for rangeland. Native grasses control erosion effectively if they are well managed. Overgrazing, improper methods of haying, or mowing to improper heights reduces the vegetative cover and causes deterioration of desired grasses. Reduction of the protective cover can cause severe soil losses by water erosion. A planned grazing system, proper grazing use, and deferred grazing help to maintain or improve the range condition.

This soil generally provides a good site for trees and shrubs in windbreaks. Capability is good for the survival and fair for the growth of adapted species. Water erosion, drought, and moisture competition from weeds and grasses are the main hazards. Planting trees on the contour and terracing help to prevent runoff and erosion. Timely cultivation between the tree rows and careful use of appropriate herbicides in the row help to control weeds and grasses. Supplemental watering may be needed for new plantings during periods of low rainfall.

The moderately slow permeability and slope of this soil are limitations for septic tank filter fields. These limitations can generally be overcome by increasing the size of the absorption area and installing the absorption field on the contour. Land shaping and grading are needed to modify the slope for sewage lagoons.

Dwellings and small commercial buildings need to be properly designed to fit the slope, or the soil can be graded to an acceptable gradient. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser-grained material for subgrade or base material can be used to ensure better performance.

This soil is in capability units IIIe-1, dryland, and IVe-4, irrigated. It is in the Silty range site and windbreak suitability group 3.

Co—Colo silty clay loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom lands of major creeks and on the lower ends of narrow upland drainageways. It is subject to occasional flooding. Areas range from 10 to 50 acres.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, friable and firm silty clay loam about 20 inches thick. The transitional layer is dark gray, firm silty clay loam about l2 inches thick. The underlying material is gray silty clay loam to a depth of 60 inches. In some areas, carbonates are in the lower part of the profile. In a few areas, the surface layer is an overwash of stratified, grayish brown and dark grayish brown silty clay loam or silt loam.

Included with this soil in mapping are small areas of Kezan, Lamo, Hobbs, and Shell soils. The poorly drained Kezan soils and the calcareous Lamo soils are in positions on the landscape similar to Colo soil. The well drained Hobbs soils are in a slightly higher position. The well drained Shell soils are in a higher position. The included soils make up about 10 to 15 percent of the map unit.

The permeability of this Colo soil is moderately slow, and the available water capacity is high. Runoff is slow. The soil has a seasonal high water table that is at a depth of about 2 feet in most wet years and at a depth of about 3 feet in most dry years. The water table is generally highest early in spring. The organic matter content and natural fertility are high. The intake rate of water is low. The surface layer is easily tilled through a fairly narrow range of moisture conditions. Moisture is released readily to plants.

Most areas of this soil are cultivated. A few areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, soybeans, sorghum, and alfalfa. Wetness is the main limitation. Tillage is generally delayed in spring. Tile drains can be installed, or V-shaped drainage ditches can be constructed to help lower the seasonal high water table if suitable outlets are available. Conservation tillage practices, such as discing, keep crop residue on the surface and help to prevent crusting and evaporation of soil moisture.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, grain sorghum, and alfalfa can be grown. Tillage is commonly delayed in the spring of most years. Perforated tile can be installed, or V-shaped drainage ditches can be constructed to improve drainage if a suitable outlet is available. Land leveling helps to improve the surface drainage and increase the efficiency of the irrigation system. Returning crop residue to the surface and adding feedlot manure help to maintain fertility of the soil and improve tilth.

This soil is suited to introduced grasses used for pasture. Proper stocking and rotation grazing help to keep the grass in good condition. Cool-season grasses, such as smooth brome and reed canarygrass, or single species, warm-season grasses can be grown. Overgrazing reduces the vegetative cover and encourages the growth of weeds and forbs. Grazing when the soil is wet causes compaction. Applying fertilizer increases the growth and vigor of the grasses.

This soil is suited to native grasses for grazing or haying. Using this soil for rangeland requires proper management. Overgrazing, improper timing of haying, or mowing to improper heights reduces the vegetative cover and causes deterioration of the native plants. Grazing when the soil is wet can cause surface compaction. Proper grazing use, restricted use during wet periods, and timely deferment from grazing or haying help to maintain the grasses in good condition.

This soil is suited to trees and shrubs that can tolerate wetness from the seasonal high water table and occasional flooding. Capability for the survival and growth of adapted species is good. Undesirable grasses and weeds are a common concern in windbreaks. These plants can be controlled by cultivation and by careful use of appropriate herbicides. Seedlings can be difficult to establish during wet years.

This soil is generally not suited to septic tank absorption fields or the construction of dwellings because of wetness due to the seasonal high water table and flooding. An alternate site is needed. Dikes are needed to protect sewage lagoons from flooding. The lagoon can also be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flooding and wetness. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance.

This soil is in capability units IIw-4, dryland, and IIw-3, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

CrC2—Crofton silt loam, 2 to 6 percent slopes, eroded. This deep, well drained, gently sloping soil is on narrow ridgetops of uplands. It formed in silty loess. Rills are common after heavy rains. In most places, tillage is in the underlying material because the surface layer has been partly removed by erosion. Areas range from 5 to 20 acres.

Typically, the surface layer is pale brown, very friable, calcareous silt loam about 5 inches thick. Below this is a transitional layer of brown, very friable, calcareous silt loam about 4 inches thick. The underlying material is calcareous silt loam to a depth of 60 inches. It is brown in the upper part and light yellowish brown in the lower part. Lime concretions are common on the surface. In a few small areas, the surface layer is thicker than typical. In a few small areas, the soil has slopes of 6 to 11 percent. In some severely eroded areas, the underlying material is exposed at the surface. Some small areas of this underlying material are light gray.

Included with this soil in mapping are small areas of noncalcareous Moody soils, which are generally in a higher position on the landscape than Crofton soil. Also included are small areas of Nora soils, which are generally in a lower position. The included areas make up about 10 to 20 percent of the map unit.

The permeability of this Crofton soil is moderate, and the available water capacity is high. Runoff is medium. The organic matter content and natural fertility are low. The intake rate of water is moderate. The surface layer is easily tilled through a fairly wide range of moisture conditions. Water is released readily to plants. This soil generally is low in nitrogen, phosphorus, and zinc.

Nearly all of the acreage of this soil is cultivated. A few areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, oats, and alfalfa. Water erosion is difficult to control if the soil is used for row crops. Conservation tillage practices, such as discing or chiseling, and stubble mulching keep crop residue on the surface and help to control water erosion and prevent excessive loss of soil moisture. Contour stripcropping also helps to control erosion. Returning crop residue to the soil helps to maintain the organic matter content and improve fertility. Applying feedlot manure also helps to improve fertility.

If irrigated, this soil is suited to a sprinkler system of irrigation. Corn, soybeans, and alfalfa can be grown. Water erosion, runoff, and low fertility are concerns of management. Conservation tillage practices, such as discing or chiseling, keep crop residue on the surface and help to control water erosion and runoff. Terraces and grassed waterways are also helpful. Irrigation water needs to be carefully controlled. Returning crop residue to the soil and applying feedlot manure help to improve the fertility and organic matter content of the soil.

If this soil is used for pasture, it is generally suited to cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Pasture grasses also can be used in a cropping sequence with row crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking, rotation grazing, and weed control help to keep the grasses in good condition. Application of commercial fertilizer or feedlot manure is especially needed on this soil to improve fertility.

If this soil is used for windbreaks, trees and shrubs that can tolerate a high content of lime are best suited. Water erosion is the principal hazard. Competition for available moisture is a major hazard in the establishment of seedlings. Seedlings of adapted species generally survive and grow if weeds and undesirable grasses are controlled. Weeds can be controlled by good site preparation and by timely cultivation between the tree rows. Water erosion can be controlled if terraces are used and tree rows placed on the contour.

This soil is suited to septic tank absorption fields and dwellings. The floors of sewage lagoons need to be lined or sealed to control seepage. Grading is required to modify the slope and shape the lagoon.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance.

This soil is in capability units IIIe-8, dryland, and IIIe-6, irrigated. It is in the Limy Upland range site and windbreak suitability group 8.

CrD2—Crofton silt loam, 6 to 11 percent slopes, eroded. This deep, well drained, strongly sloping soil is on narrow ridgetops and short, uneven side slopes of uplands. It formed in loess. Rills are common after heavy rains. Erosion has not been uniform and, in places, the surface layer is similar in color to the underlying material. In many areas, tillage takes place in the parent material because most of the original surface layer has been eroded away. Areas range from 3 to 50 acres.

Typically, the surface layer is pale brown, very friable, calcareous silt loam about 6 inches thick. The transitional layer is brown, very friable, calcareous silt loam about 5 inches thick. The underlying material is light yellowish brown, calcareous silt loam to a depth of 60 inches. Lime concretions are common on the surface. In some small areas, the underlying material is gray.

Included with this soil in mapping are small areas of Nora soils. They are mainly on side slopes and are in a lower position on the landscape than Crofton soil. Nora soils do not have carbonates in the surface layer. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Crofton soil is moderate, and the available water capacity is high. Runoff is rapid. The organic matter content and natural fertility are low. The intake rate of water is moderate. Because of the high content of lime, this soil is low in available phosphorus. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Nearly all of the acreage of this soil is used for cultivated crops. A few small areas are in native grass or are seeded to introduced grasses.

This soil is poorly suited to dryland crops because of the strong slopes and the hazard of erosion. Under dryland farming, corn, oats, and alfalfa are grown. Water erosion is the principal hazard. Loss of moisture by runoff and maintenance of fertility are concerns of management. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to control erosion and runoff. Keeping crop residue on the surface also helps to improve the organic matter content and conserve soil moisture. Some areas of smoothly sloping soils can be terraced and cultivated on the contour. Additions of phosphate and zinc fertilizer and application of feedlot manure help to improve the fertility of the soil.

If irrigated, a sprinkler system is the only suitable method that can be used. Row crops are poorly suited because of the strong slopes and high risk of erosion. Close-grown crops, such as alfalfa, are better suited. Row crops, such as corn, can be grown occasionally in a crop rotation if the crop is carefully managed. Water erosion is the main hazard. Controlling runoff and improving fertility are management concerns. Conservation tillage practices, such as chiseling or discing, are important measures because they keep crop residue on the surface and help to control erosion and runoff and conserve soil moisture. The proper rate of water application is needed. Terraces, contour farming, and grassed waterways can be used to help control erosion and runoff. Applying feedlot manure helps to maintain the organic matter content and fertility of the soil.

This soil is suited to introduced grasses for pasture. Pastures generally consist of cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Pasture grasses can also be used in rotation with row crops as part of a cropping system. Overgrazing reduces the protective vegetative cover, causes deterioration of grasses, and increases the hazard of erosion. The proper amount of use and rotation grazing help to keep desired grasses in good condition. Applications of commercial fertilizers and feedlot manure help to increase fertility. Irrigation increases the vigor and growth of grasses.

This soil is suited to range. Using the soil for range is an effective way to control erosion. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. Reduction of the protective grass cover can cause severe soil losses by water erosion. A planned grazing system, proper grazing use, and deferred grazing help to maintain or improve the range condition. Eroded areas of cropland can be seeded to native grasses to stabilize the soil and provide usable forage.

This soil provides a fair planting site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Only trees and shrubs that can tolerate a high amount of calcium in the soil are suited. Water erosion and lack of adequate moisture are the main management concerns. Planting trees on the contour and terracing store the moisture in the soil and help to control erosion. Cultivation between the rows and careful use of appropriate herbicides or hoeing by hand help to control weeds. Supplemental watering may be needed during periods when rainfall is inadequate.

Land shaping is generally needed on this soil before septic tank absorption fields are installed. In addition, the absorption field should be placed on the contour for proper operation. For sewage lagoons, grading is needed to modify the slope and shape the lagoon. Lining or sealing the floor to prevent seepage is also needed.

Dwellings and small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level.

Local roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material helps to ensure better performance. Cutting and filling are generally needed to provide a suitable grade.

This soil is in capability units IVe-8, dryland, and IVe-6, irrigated. It is in the Limy Upland range site and windbreak suitability group 8.

CrE2—Crofton silt loam, 11 to 15 percent slopes, eroded. This deep, well drained, moderately steep soil is on short, uneven side slopes of uplands. It formed in loess. Rills are common after heavy rains. Over most of this eroded area, tillage is in the remaining part of the surface layer and in the underlying material. Areas range from 3 to 50 acres.

Typically, the surface layer is pale brown, very friable, calcareous silt loam about 4 inches thick. A few medium lime concretions are on the surface. The underlying material is calcareous silt loam. It is light yellowish brown in the upper part and very pale brown in the lower part. In a few small areas the underlying material is gray.

Included with this soil in mapping are small areas of Alcester, Hobbs, and Nora soils. Hobbs soils are stratified and are in narrow drainageways of the uplands. Alcester soils have a thick surface layer and are on foot slopes. Nora soils do not have carbonates in the surface layer. They are on side slopes and are commonly in a lower position on the landscape than Crofton soil. In a few small areas, the Nora soil has slopes of 15 to 30 percent. The included soils make up 5 to 10 percent of the map unit.

The permeability of this Crofton soil is moderate, and the available water capacity is high. Runoff is rapid. The organic matter content and natural fertility are low. The intake rate of water is moderate. Because of the high lime content, this soil is low in available phosphorus. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Nearly all of the acreage of this soil is cultivated. A few small areas are in native grass or are seeded to introduced grasses. These areas are used for grazing or mowed for hay.

This soil is poorly suited to dryland crops because of moderately steep slopes and the severe hazard of erosion. Corn, oats, and alfalfa are grown. Water erosion is the principal hazard. Controlling runoff and improving fertility are concerns of management. Contour farming and terracing help to conserve soil moisture and control runoff and erosion. Seeding introduced grasses or a mixture of these grasses with alfalfa helps to improve fertility and control erosion. In a good cropping system, row crops should be grown less frequently than close-sown crops. Conservation tillage practices, such as discing and chiseling, keep crop residue on the surface and help to control water erosion and conserve soil moisture. Terraces and grassed waterways are also needed. Additions of zinc and phosphate fertilizer improve the fertility of this soil.

This soil is not suited to irrigation because of slope and the difficulty in controlling additional water.

This soil is suited to cool-season grasses, such as smooth brome or orchardgrass, mixed with alfalfa. Cool-season grasses and single species, warm-season grasses can be grown in separate pastures to provide a long season of grazing. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Application of nitrogen fertilizer increases the growth and vigor of introduced grasses.

Use of this soil for rangeland is an effective way to control erosion. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native grasses. Reducing the protective cover can result in severe soil loss by water erosion. Proper grazing use and timely deferment from grazing or haying help to maintain or improve the range condition. Eroded areas of cropland can be seeded to native grasses to stabilize the soil.

This soil provides a fair site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Lack of adequate moisture and water erosion are the main concerns of management. Planting trees on the contour and terracing decreases runoff and erosion and increases the supply of soil moisture. Only trees and shrubs that tolerate a high amount of carbonates should be planted. Careful use of appropriate herbicides can control weeds.

Land shaping is needed on this soil before septic tank absorption fields are installed. In addition, the absorption field should be placed on the contour for successful operation. For sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining the floor or sealing to prevent seepage also are needed.

Dwellings and small commercial buildings need to be designed to accommodate the slope, or the soil can be graded to an acceptable level.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material helps to ensure better performance. Cutting and filling are needed to establish a suitable grade.

This soil is in capability unit IVe-8, dryland. It is in the Limy Upland range site and windbreak suitability group 8.

CrF—Crofton silt loam, 15 to 30 percent slopes. This deep, excessively drained, steep soil is on short side slopes of loess uplands that border the Elkhorn River valley (fig. 9). Areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, very friable, calcareous silt loam about 5 inches thick. Below this is a transitional layer of pale brown, very friable, calcareous silt loam 6 inches thick. The underlying material is calcareous silt loam. It is light yellowish brown in the upper part and pale yellow in the lower part to a depth of 60 inches. In a few small areas where the soil is cultivated, the surface layer is eroded, lighter colored than typical, and calcareous on the surface. In some places, small areas of this Crofton soil have slopes of 11 to 15 percent. In other places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Nora and Thurman soils. The well drained Nora soils are in a lower position on the landscape than Crofton soil. The sandy Thurman soils are in a similar position on the landscape. The included soils make up 10 to 15 percent of the map unit.

The permeability of this Crofton soil is moderate, and the available water capacity is high. Runoff is rapid. The organic matter content is moderately low, and natural fertility is low. Moisture is released readily to plants.

Most of the acreage of this soil is in native grass and is used for grazing or mowed for hay. A few small areas are cultivated, but the soil is generally not suited to cropland because erosion is very severe on cultivated soils.

This soil is suited to rangeland. Soil erosion is the principal hazard. The native grasses are effective in controlling erosion on this soil. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help to maintain or improve the range condition.

This soil is not suited to trees or shrubs in windbreaks because of steep slopes. In some areas, trees can be planted by hand for use as wildlife habitat.

This soil is generally not suited to sanitary facilities and building sites, septic tank absorption fields, and

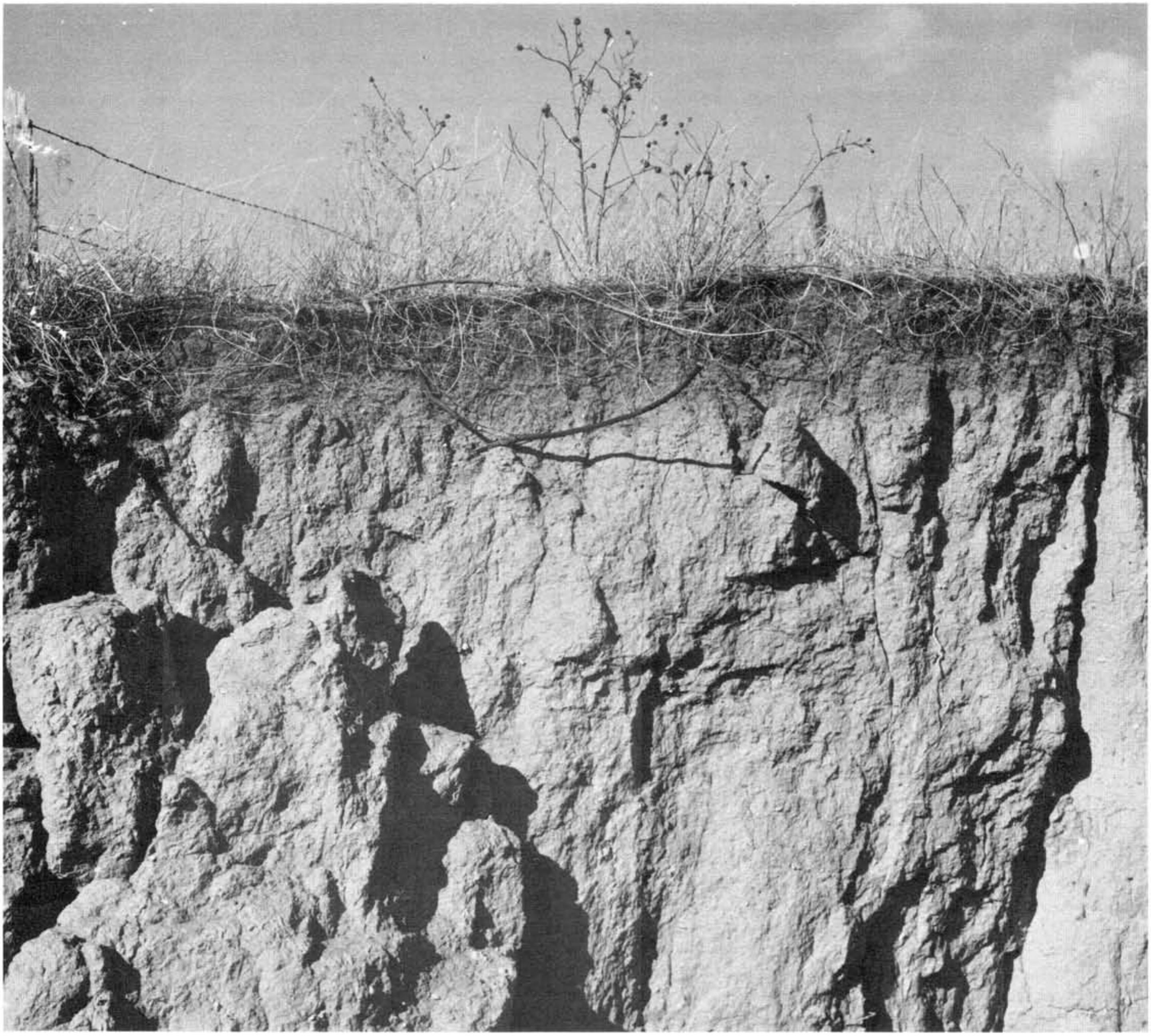

Figure 9.—Profile of Crofton silt loam. Typically, this soil has a thin surface layer and is calcareous at or near the surface. It formed in loess, a silty wind-deposited material.

sewage lagoons because of the steep slope. An alternate site is needed.

Roads need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser grained material for the subgrade or base material helps to ensure better performance. Cutting and filling generally are needed to provide a suitable grade.

This soil is in capability unit VIe-9, dryland. It is in the Limy Upland range site and windbreak suitability group 10.

CrG—Crofton silt loam, 30 to 60 percent slopes. This deep, excessively drained, very steep soil is on side slopes of the loess uplands. Short, nearly vertical slopes or catsteps are common. Large gullies and entrenched, intermittent drainageways are characteristic of the landscape. Areas range from 10 to 50 acres.

Typically, the surface layer is brown, friable, calcareous silt loam about 7 inches thick. The transitional layer is pale brown, friable, calcareous silt loam about 7 inches thick. The underlying material is calcareous silt loam. It is pale brown in the upper part and very pale brown in the lower part to a depth of 60 inches. Free carbonates are in all parts of the profile. Some small areas have slopes of 15 to 30 percent.

Included with this soil in mapping are small areas of sandy Thurman and Valentine soils. These soils are in positions on the landscape similar to Crofton soil. Also included are small areas of soils that formed in glacial till, and a few areas of poorly drained Kezan soils that are in a lower position on the landscape. The included soils make up 5 to 20 percent of the map unit.

The permeability of this Crofton soil is moderate, and the available water capacity is high. Runoff is very rapid. The organic matter content is moderately low, and natural fertility is low. Moisture is released readily to plants.

Nearly all of the acreage of this soil is in native grass, scattered trees, and brush and is used mainly for grazing. In some areas, dams are constructed to hold water for use by wildlife and livestock.

This soil is not suited to cultivated crops or to introduced grasses because of very steep slopes.

Rangeland is the best agricultural use of this soil. Use of this soil for range is the most effective way to control erosion on these very steep slopes. Overgrazing by livestock reduces the protective vegetative cover and causes deterioration of native plants. Severe gully erosion is a hazard. Proper grazing use, timely deferment from grazing, and a planned grazing system help to maintain or improve the range condition. Brush management may be needed to control undesirable woody plants on the steeper slopes.

This soil is not suited to plantings of trees and shrubs in windbreaks because of very steep slopes and the very severe hazard of erosion.

This soil is not suited to sanitary facilities and building sites because of the very steep slopes. An alternate site is needed.

Roads and streets need to designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material helps to ensure better performance. Cutting and filling are needed to provide a suitable grade for roads.

This soil is in capability unit VIIe-9. It is in the Thin Loess range site and windbreak suitability group 10.

CuE2—Crofton-Nora complex, 11 to 15 percent slopes, eroded. This complex consists of deep, well drained, moderately steep soils on ridges and side slopes of uplands. These soils formed in loess. Areas of this map unit range from 5 to several hundred acres. The Crofton soil in this complex is on ridgetops and the upper part of the side slopes, and the Nora soil is on the lower part of the side slopes. This complex is 50 to 60 percent Crofton soil and 30 to 45 percent Nora soil. The soils are so intricately mixed or so small that it is not practical to separate them in mapping. In many places the underlying material is at the surface. In other areas the surface layer is dark grayish brown or brown. Erosion has not been uniform. Rills are common after heavy rains.

Typically, the Crofton soil has a surface layer of pale brown, very friable, calcareous silt loam about 5 inches thick. Lime concretions are commonly at the surface, and the soil is calcareous throughout. Below this is a transitional layer of brown, friable, calcareous silt loam about 8 inches thick. The underlying material is calcareous silt loam. It is pale brown in the upper part and light gray in the lower part to a depth of 60 inches. In some small areas the underlying material is gray.

Typically, the Nora soil has a surface layer of brown, friable silty clay loam about 5 inches thick. The subsoil is friable silty clay loam about 19 inches thick. It is yellowish brown in the upper part and pale brown in the lower part. Lime is at a depth of about 15 inches. The underlying material is calcareous silt loam. It is light yellowish brown in the upper part and very pale brown in the lower part to a depth of 60 inches. In a few small areas, the surface layer is more than 7 inches thick, and in other areas, lime is below a depth of 30 inches.

Included with this complex in mapping are small areas of Alcester, Hobbs, Kezan, and Moody soils. Alcester soils are on foot slopes and are in a lower position on the landscape than Crofton and Nora soils. They have a thick surface layer. Hobbs soils are in upland drainageways and are also in a lower position than Crofton and Nora soils. They are occasionally flooded. Kezan soils are on bottom lands of upland drainageways. They are poorly drained. Moody soils are on broad ridgetops and are in a higher position than Crofton and Nora soils. The included soils make up 5 to 15 percent of the map unit.

The permeability is moderate, and the available water capacity is high on the Crofton and Nora soils. Runoff is very rapid. The organic matter content is low in the Crofton soil and moderately low in the Nora soil. Natural fertility is medium in the Nora soil and low in the Crofton soil. The surface layer of the Crofton soil is very friable, and it is easily tilled through a fairly wide range of moisture conditions. The surface layer of the Nora soils is not so friable, and it is more cloddy. Both soils release moisture readily to plants. Both soils are commonly low in available phosphorus. The Crofton soil generally responds favorably to applications of zinc.

Most of the acreage of this complex is cultivated, but some areas are in native grass or seeded to introduced grasses. These areas are used for grazing or mowed for hay.

These soils are poorly suited to dryland farming because of moderately steep slopes and the severe

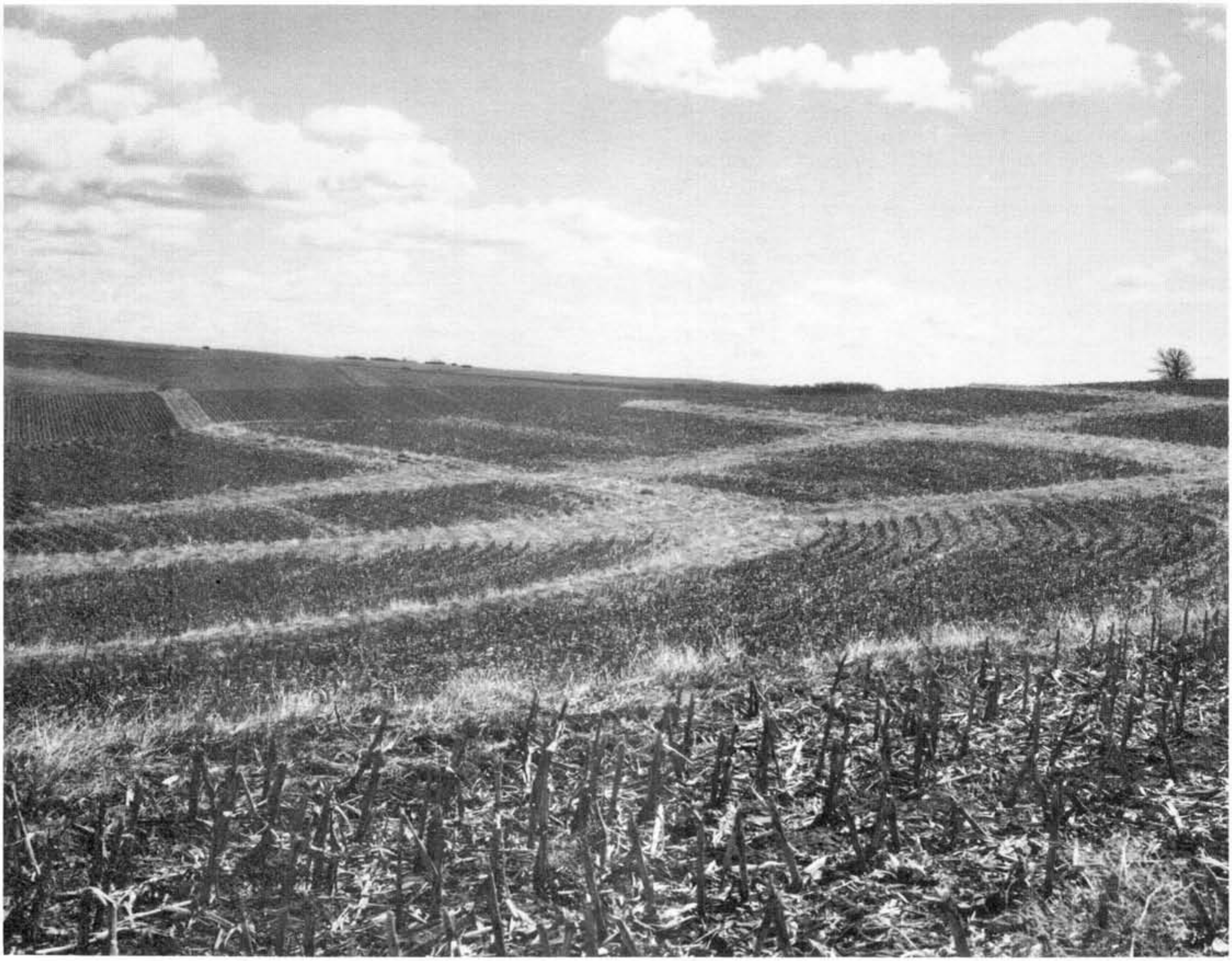

Figure 10.—Parallel terraces and grassed waterways help to control water erosion on this area of Crofton and Nora soils.

hazard of erosion. They are better suited to close-sown crops, such as alfalfa and oats, than to row crops, such as corn. If row crops are grown, erosion is difficult to control. Terraces, grassed waterways, and farming on the contour help to slow runoff and control erosion (fig. 10). In a good cropping sequence, grasses and legumes should be grown during most years, and row crops grown only infrequently. Conservation tillage practices, such as discing and chiseling, keep crop residue on the soil. Additions of nitrogen and phosphorus as commercial fertilizer or as feedlot manure help to maintain or improve fertility.

These soils are not suited to irrigation because of moderately steep slopes and the high risk of erosion.

Use of these soils for pasture is an effective way to control erosion. These soils are suited to cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, mixed with alfalfa. Warm-season grasses are also suited. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Overgrazing causes deterioration of desired grasses. The proper amount of use and rotation grazing help to keep the grasses in good condition. Application of nitrogen fertilizer can increase the vigor and growth of grasses.

These soils are suited to native grasses for rangeland. Use of these soils for rangeland is an effective way to control erosion. Overgrazing reduces the protective vegetative cover and can result in severe soil losses by water erosion. Proper grazing use and timely deferment from grazing or haying help to keep the range in good condition. Range seeding may be needed in areas of severely eroded cropland to control erosion.

The Crofton soil provides a fair site for planting trees and shrubs in windbreaks. Capability is fair for the survival and growth of adapted species. Competition for moisture from weeds and grasses, the calcareous soil condition, and water erosion are the main management concerns. Cultivation between the rows and careful use of appropriate herbicides in the tree row help to control undesirable weeds and grasses. Only trees and shrubs that can tolerate a calcareous soil condition should be planted. Trees can be planted on the contour and terraces can be used to control erosion and runoff. Irrigation may be needed during periods of insufficient rainfall.

Land shaping is generally needed on these soils before septic tank absorption fields are installed. In addition, the absorption field should be placed on the contour for proper operation. The moderate permeability is a limitation for absorption fields, but this limitation can generally be overcome by increasing the size of the absorption area. For sewage lagoon areas, grading is needed to modify the slope and shape the lagoon. Lining or sealing the floor to prevent seepage is also needed.

Dwellings and small commercial buildings need to be designed to accommodate the slope, or the soil can be graded to an acceptable level. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material helps to ensure better performance. Crowning the road by grading and constructing adequate side ditches help to provide good surface drainage and reduce the damage by frost action.

This complex is in capability unit IVe-8, dryland. The Crofton soil is in the Limy Upland range site, and the Nora soil is in the Silty range site. The Crofton soil is in windbreak suitability 8, and the Nora soil is in windbreak suitability group 3.

Eh—Elsmere loamy fine sand, 0 to 2 percent slopes. This somewhat poorly drained, nearly level soil is on stream terraces and swales in areas of the sandhills. It is subject to rare flooding. Areas range from 5 to 250 acres.

Typically, the surface layer is dark gray and grayish brown, very friable loamy fine sand about 11 inches thick. Below this is a transitional layer of light brownish gray, very friable loamy fine sand about 14 inches thick. The underlying material is light gray, mottled fine sand to a depth of 60 inches. In a few places, the surface layer is 20 to 26 inches thick.

Included with this soil in mapping are small areas of poorly drained Loup and Lawet soils. These soils are slightly lower in the landscape than Elsmere soil. Also included are small areas of somewhat excessively drained Thurman soils that are in a higher position on the landscape. The included soils make up 10 to 20 percent of the map unit.

The permeability of this Elsmere soil is rapid, and the available water capacity is low. The seasonal high water table ranges from a depth of 1.5 feet in most wet years to a depth of 2.5 feet in most dry years. Runoff is slow. The organic matter content is moderately low, and natural fertility is low. The intake rate of water is very high. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated, but some areas are in native grass or seeded to introduced grasses. These areas are used for grazing or mowed for hay.

Under dryland farming, this soil is poorly suited to corn and grain sorghum. It is not well suited to alfalfa because of wetness. The seasonal high water table, which delays tillage and causes the soil to warm slowly in spring, is the main limitation. Soil blowing is a hazard if the vegetative cover is removed. Conservation tillage practices, such as chiseling, discing, or no-till planting, leave crop residue on the surface and help to prevent soil blowing. Narrow field windbreaks also help to prevent soil blowing. Returning crop residue to the soil helps to conserve soil moisture. Applying feedlot manure helps to maintain the organic matter content and improve the fertility of the soil.

This somewhat poorly drained soil is poorly suited to irrigation because it has a seasonal high water table during part of the growing season in most years. Extreme care is needed if irrigation water is applied through a sprinkler system. An excessive amount of water commonly results in ponding and drowning of the crop plants. This soil is not suited to gravity irrigation because of the high intake rate of the sandy soil. Deep cuts that expose the underlying material of fine sand should be avoided. Frequent applications of water are needed because of the rapid permeability and low available water capacity of the soil, but excessive applications should be avoided to prevent leaching of plant nutrients below the root zone. Conservation tillage practices, such as chiseling or a no-till planting system, leave crop residue on the surface and help to prevent soil blowing. Cover crops are also helpful. Drainage ditches can be constructed to help lower the seasonal high water table.

This soil is suited to introduced grasses that tolerate a high water table, such as reed canarygrass, orchardgrass, creeping foxtail, and smooth brome. The use of this soil for pasture or hay effectively controls soil blowing. Alternate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Overgrazing reduces the protective vegetative cover and permits the growth of weeds. Proper stocking, rotation grazing, and weed control help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water help to increase the vigor and growth of grasses.

Use of this soil for rangeland is a very effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper height reduces the vegetative cover and causes deterioration of desired grasses. Proper grazing use, timely deferment from grazing or haying, and restricted use during very wet periods help to maintain the native plants in good condition.

If this soil is used for windbreaks, trees and shrubs should be selected that can tolerate wetness due to the seasonal high water table. In some years, the establishment of seedlings is difficult because of wetness. Sod or other vegetative cover maintained between the rows helps to control soil blowing. Moisture competition from grass and weeds is a common concern. Careful application of appropriate herbicides and hand hoeing or roto-tilling within the row can control weeds.

This soil generally is not suited to septic tank absorption fields because of wetness caused by the seasonal high water table. An alternate site is needed. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table, and the floor needs to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

Dwellings and buildings need to be constructed on elevated, well compacted fill material to overcome the wetness caused by the seasonal high water table and flooding. Constructing roads on suitable, compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage and wetness. Damage to roads by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide needed surface drainage.

This soil is in capability units IIIw-5, dryland, and IIIw-11, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

Gk—Gibbon silty clay loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom lands of the Elkhorn River valley. It is subject to occasional flooding. Areas range from 5 to several hundred acres.

Typically, the surface layer is dark gray, friable, calcareous silty clay loam about 8 inches thick. The subsurface layer is gray, friable, calcareous silty clay loam about 10 inches thick. Below this is a transitional layer of gray, friable, calcareous silty clay loam about 10 inches thick. The underlying material is light brownish gray, calcareous loam in the upper part and light gray fine sand in the lower part to a depth of 60 inches. In some areas the surface layer is thicker than typical. In some areas the surface layer is silt loam or loam. In other small areas, the fine sand is generally present within a depth of 60 inches.

Included with this soil in mapping are small areas of Cass and Ord soils. The well drained Cass soils are in a slightly higher position on the landscape than Gibbon soil. Ord soils are in a similar position on the landscape. They have fine sand higher in the profile. The included soils make up 10 to 20 percent of the map unit.

The permeability of this Gibbon soil is moderate, and the available water capacity is high. Runoff is slow. The seasonal high water table is at a depth of about 1.5 feet in most wet years and at a depth of 3 feet in most dry years. The water table is generally highest in spring. The organic matter content is moderate, and natural fertility is high. The intake rate of water is low. The surface layer is easily tilled. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. The rest is mainly in native grass. Some small areas are irrigated or are seeded to introduced grasses.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, and alfalfa. It is not so well suited to spring-sown small grain because wetness early in spring delays planting. In wet years the seasonal high water table limits the production of alfalfa. If suitable outlets are available, tile drains can be installed to lower the water table and control wetness. Conservation tillage practices, such as no-till planting, keep crop residue on the surface and help to prevent evaporation of soil moisture.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa are the main crops. Soil wetness is the principal limitation. If suitable outlets are available, tile drains can be installed to help lower the seasonal high water table. Land leveling may be needed for gravity irrigation. Diversion terraces can be used to help lessen the damage from flooding. Keeping crop residue on the surface and applying feedlot manure help to maintain or improve fertility and slow the evaporation of soil moisture. Conservation tillage practices, such as chiseling, discing, or no-till planting, are suited to this soil.

This soil is suited to introduced grasses, such as smooth brome, reed canarygrass, or creeping foxtail, mixed with alfalfa. Alternate pastures of cool-season grasses and single species, warm-season grasses can be used to provide a long season of grazing. Pasture grasses can be used in rotation with row crops. Overgrazing causes deterioration of desired grasses. Grazing when the soil is wet causes compaction. Proper stocking and rotation grazing help to maintain desired grasses. Applications of nitrogen fertilizer and irrigation water improve the growth and vigor of grasses.

This soil is suited to native grasses for rangeland, either for grazing or haying. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Overgrazing when the soil is wet causes compaction. Proper grazing use, timely deferment from grazing or haying, and restricted use during wet periods help to maintain the desired grasses and keep the soil in good condition.

This soil is suited to trees and shrubs in windbreaks. Species that can tolerate a seasonal high water table and occasional flooding are best suited. The establishment of seedlings can be difficult in wet years. Undesirable grasses and weeds are a concern in windbreaks. Cultivation between the rows and careful use of appropriate herbicides in the tree row can control weeds. Areas near the trees can be hoed by hand or roto-tilled.

This soil is not suited to septic tank absorption fields because of wetness, flooding, and moderate permeability. An alternate site is needed. Lining or sealing the floor of sewage lagoons is needed to prevent seepage. Constructing the lagoon on fill material to raise the floor sufficiently above the seasonal high water table and diking to prevent damage from flooding are also needed.

This soil is not suitable for the construction of buildings because of the hazard of flooding and wetness. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage. Damage to roads by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide surface drainage.

This soil is in capability units IIw-4, dryland, and IIw-3, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

HaC—Hadar loamy fine sand, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on upland ridges and side slopes. Areas range from 5 to 150 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 14 inches thick. Below this is a layer of brown, loose loamy fine sand about 6 inches thick. The subsoil is mottled, firm clay loam 16 inches thick. The upper part is light brownish gray, and the lower part is light brownish gray and calcareous, with many accumulations of lime. The underlying material is calcareous, light gray clay loam to a depth of 60 inches. In a few small areas the surface layer is 6 to 14 inches thick. In a few small areas the surface layer is fine sandy loam. In cultivated areas the plowed layer is commonly lighter colored than is typical and has the texture of fine sand because of winnowing. In places, the subsoil and underlying material are made up of reddish brown loess of the Loveland Formation.

Included with this soil in mapping are small areas of Thurman and Clarno soils. The sandy Thurman soils are in a higher position on the landscape than Hadar soil, and the loamy Clarno soils are in a lower position. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Hadar soil is rapid in the sandy material in the upper part of the profile and moderately slow in the clay loam glacial material in the lower part. The available water capacity is moderate, and the intake rate of water is high. Runoff is slow. The organic matter content is moderately low, and natural fertility is medium. The surface layer is easily tilled through a wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated, but a few areas are in native grass or seeded to introduced grasses. These areas are used for grazing or mowed for hay. Some areas near urban developments are used for the construction of dwellings.

Under dryland farming, this soil is suited to corn, soybeans, grain sorghum, oats, and alfalfa. Soil blowing and water erosion are the principal hazards. Conservation tillage practices, such as discing and stubble mulching, keep crop residue on the surface and help to prevent soil blowing. Terraces, grassed waterways, and contour stripcropping help to prevent water erosion. Keeping crop residue on the surface also helps to prevent evaporation of soil moisture.

If irrigated, this soil is suited to a sprinkler system of irrigation. Gravity irrigation is not suited unless land preparation is extensive. Corn, grain sorghum, and alfalfa can be grown. Soil blowing and water erosion are the principal hazards. Maintaining fertility is a concern of management. Land leveling helps to improve surface drainage and increase the efficiency of the irrigation system. Conservation tillage practices, such as no-till planting for row crops, keeps crop residue on the surface and helps to control soil blowing and water erosion. Applying feedlot manure helps to maintain fertility and improve tilth.

This soil is suited to introduced grasses for pasture. Use of this soil for pasture is an effective way to control soil blowing. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or warm-season grasses can be grown. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Pasture grasses can also be used in a cropping sequence with row crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water can increase the vigor and growth of grasses.

This soil is suited to native grass in rangeland and can be used for grazing or mowed for hay. Use of the soil for rangeland is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. Reduction of this protective cover can cause severe soil loss by soil blowing or water erosion. A planned grazing system, proper grazing use, and timely deferment from grazing help to maintain or improve the range condition.

This soil generally provides a fair planting site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair, but lack of adequate moisture limits growth. Soil blowing is the main hazard. Planting a cover crop between the rows helps to prevent soil blowing, but increases the competition for moisture. Undesirable grasses and weeds can be controlled by cultivation between the trees and by careful use of appropriate herbicides in the tree row.

The moderately slow permeability of this soil is a limitation for septic absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. For sewage lagoons, land grading is generally needed to modify the slope and shape the lagoon. Lining or sealing the floor of the lagoon is needed to prevent seepage.

Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material can ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent shrinking and swelling.

This soil is in capability units IIIe-6, dryland, and IIIe-10, irrigated. It is in the Sandy range site and windbreak suitability group 5.

Hd—Hobbs silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is in narrow drainageways of uplands (fig. 11). It is subject to occasional flooding. Areas are long and narrow and range from 10 to several hundred acres.

Typically, the surface layer is grayish brown, very friable silt loam about 9 inches thick. The underlying material is stratified, dark grayish brown and grayish brown silt loam. Below this is a buried soil of very dark grayish brown silty clay loam. In a few small areas the surface layer is silty clay loam. In a few small areas the soil is calcareous at the surface because of recent deposition. In a few places, a buried dark soil is above a depth of 40 inches.

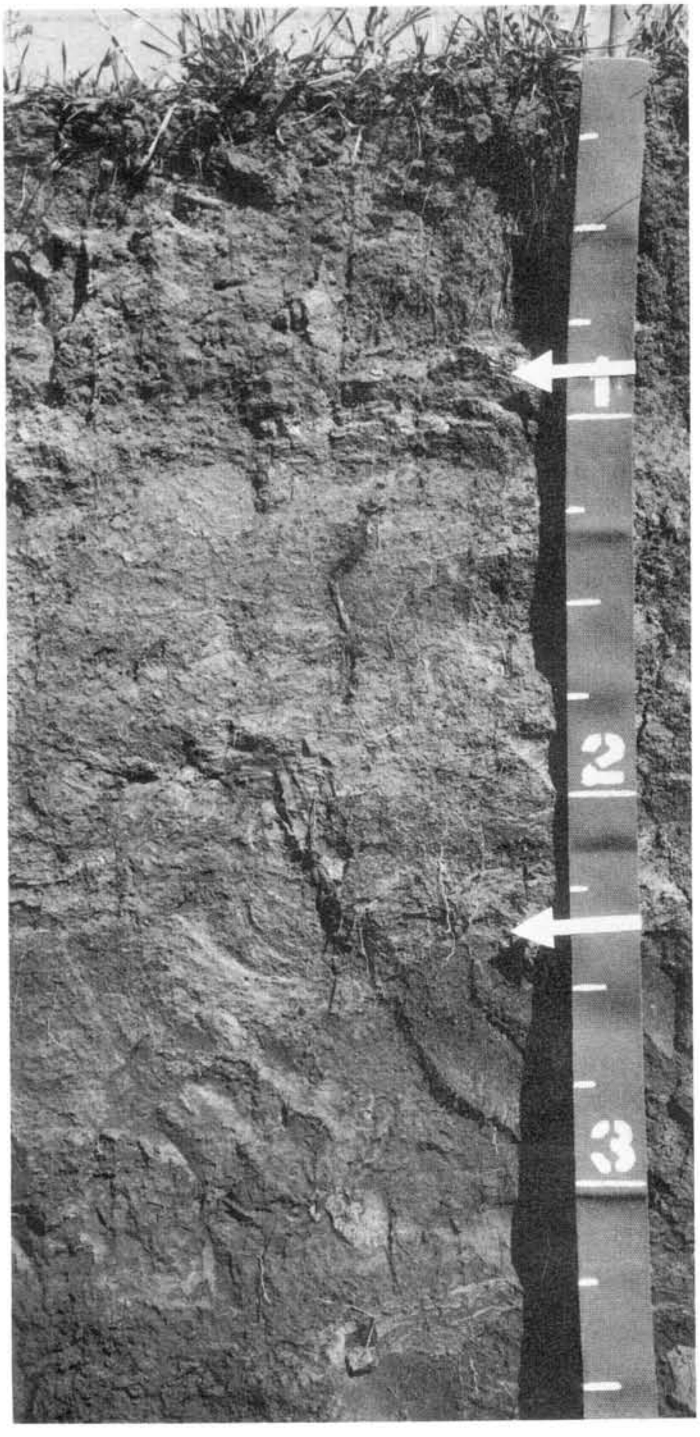

Figure 11.—Profile of Hobbs silt loam. This soil is stratified and weakly developed. It formed in recently deposited alluvium. Depth is marked in feet.

Included with this soil in mapping are small areas of Colo, Kezan, Nora, and Shell soils. The somewhat poorly drained Colo soils and the poorly drained Kezan soils are in lower positions on the landscape than Hobbs soil. Nora soils have a silty clay loam subsoil and are on side slopes of uplands. Shell soils are not stratified in the upper part of the profile and are in a higher position on the landscape. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Hobbs soil is moderate, and the available water capacity is high. Runoff is medium. The organic matter content is moderate, and natural fertility is high. The intake rate of water is moderate. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. A few areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, oats, soybeans, and alfalfa. Flooding, however, can delay tillage and limit production of small grain and alfalfa, and siltation after flooding can limit the production of row crops. Diversions and drainage ditches can be used to intercept runoff and keep the water from spreading. Conservation tillage practices, such as no-till planting and discing, keep crop residue on the surface and prevent evaporation of soil moisture. They also help to maintain or improve the organic matter content.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation, but flooding needs to be controlled. Corn, soybeans, and alfalfa are suitable crops. For gravity irrigation, land preparation is needed to divert and intercept floodwaters. Sprinkler irrigation is well suited to this soil. Controlling runoff from adjoining uplands by using a diversion terrace reduces flooding. Conservation tillage practices, such as chiseling, no-till planting, and discing, keep crop residue on the surface and effectively prevent evaporation of soil moisture.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Warm-season grasses can also be grown. Siltation from flooding can prevent the establishment of newly planted grasses and alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Pasture grasses can also be used in rotation with cultivated crops. Overgrazing or grazing when the soil is wet causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of grasses.

This soil generally provides a good site for trees and shrubs in windbreaks. Capability for the survival and growth of seedlings is good. Trees and shrubs that can tolerate occasional flooding are best suited. Competition for moisture from weeds and grasses is the main concern of management. Undesirable weeds and grasses can be controlled by cultivation between the rows and by careful use of appropriate herbicides, or by roto-tilling in the row.

This soil is not suited to septic tank absorption fields or buildings because it is subject to flooding. An alternate site is needed. Sewage lagoons need to be diked as protection from flooding.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage. Roads need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material can ensure better performance.

This soil is in capability units IIw-3, dryland, and IIw-6, irrigated. It is in the Silty Overflow range site and windbreak suitability group 1.

He—Hobbs silt loam, channeled. This deep, well drained, nearly level soil is on bottom lands. It is frequently flooded. The landscape is dissected by entrenched stream channels that meander across the area. Areas are long and narrow and range from 20 to 200 acres.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The underlying material is stratified, dark grayish brown and light brownish gray silt loam. Below this material is a buried soil of very dark grayish brown silty clay loam to a depth of 60 inches. In a few small areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Shell soils. These soils are not stratified in the upper part of the profile, and they are in a higher position on the landscape than Hobbs soils. Also included are a few small areas of Hobbs soils that do not have channels. The included soil makes up about 5 to 10 percent of this map unit.

The permeability of this Hobbs soil is moderate, and the available water capacity is high. Runoff is slow. The organic matter content is moderate, and natural fertility is medium. Moisture is released readily to plants.

Most of the acreage of this soil is in native grass and trees and is used for grazing.

This soil is not suited to cultivated crops because it is frequently flooded and is channeled. A few small areas that can be tilled are suited to introduced grasses. Flooding is the principal hazard. Inaccessibility by livestock limits the use of these areas.

This soil is used mostly for rangeland. Overgrazing and deposition of silt reduce the protective vegetative cover and cause deterioration of native plants. Grazing when the soil is wet causes compaction and reduces the intake rate of moisture. Proper grazing use, timely deferment from grazing, and restricted use during very wet periods help to maintain the grasses in good condition.

This soil is not suited to trees and shrubs in windbreaks mainly because it is subject to frequent flooding. Some areas can be used for recreation, forestation, and wildlife plantings if the trees or shrubs are hand planted, or if other special practices are used.

This soil is not suited to septic tank absorption fields, sewage lagoons, or dwellings because it is frequently flooded. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches, culverts, and bridges help to protect the roads from flood damage. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material can ensure better performance.

This soil is in capability unit VIw-7, dryland. It is in the Silty Overflow range site and windbreak suitability group 10.

InB—Inavale loamy fine sand, 0 to 3 percent slopes. This deep, somewhat excessively drained, nearly level and very gently sloping soil is on bottom lands. It formed in sandy alluvium. This soil is subject to occasional flooding. Areas range from 5 to 50 acres.

Typically, the surface layer is dark gray, very friable loamy fine sand about 7 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand about 5 inches thick. The underlying material is light brownish gray fine sand in the upper part, grayish brown fine sand stratified with fine sandy loam in the middle part, and light gray fine sand in the lower part. In some small areas the surface layer is fine sand. In other small areas, thin strata of silt loam or loam are in the underlying material.

Included with this soil in mapping are small areas of Barney, Boel, and Cass soils. Barney soils are poorly drained and are in a lower position on the landscape than Inavale soil. Boel soils are somewhat poorly drained and are in a slightly lower position. Cass soils are well drained and are in a slightly higher position. The included soils make up 5 to 20 percent of the map unit.

The permeability of this Inavale soil is rapid, and the available water capacity is low. The organic matter content and natural fertility are low. Runoff is slow. The intake rate of water is very high. The workability of this sandy soil is fair. Moisture is released readily to plants.

Most of the areas of this soil are used for cultivated crops. A few areas are in rangeland or are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is poorly suited to most crops. Oats, alfalfa, vetch, and rye, however, can be grown. Soil blowing is a severe hazard on this soil. Conservation tillage practices, such as discing or no-till planting, keep crop residue on the surface and help to prevent soil blowing. Field windbreaks also help to prevent the soil from blowing.

If irrigated, this sandy soil is suited to a sprinkler system of irrigation, but it is not suited to a gravity system. Corn, grain sorghum, and alfalfa can be grown. Light, frequent applications of water are needed because of the rapid permeability and very high intake rate of water. Excessive amounts of water leach plant nutrients and herbicides below the depth of the plant roots. Soil blowing is a serious hazard if a protective vegetative cover is not maintained throughout the year. Conservation tillage practices that keep crop residue on the surface help to prevent soil blowing and reduce the evaporation of soil moisture. Applying feedlot manure helps to maintain the organic matter content and improve the fertility of the soil.

This soil is suited to cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, mixed with alfalfa. Seeding the soil to grasses is an effective way to control soil blowing. Single species, warm-season grasses are also suited. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Introduced grasses can also be used in rotation with crops as part of a cropping sequence. If this soil is overgrazed, the protective vegetative cover is weakened or reduced, desirable grasses deteriorate, and the hazard of soil blowing is increased. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of grasses.

This soil is suited to native grasses for rangeland. Use of the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Severe soil blowing and small blowouts can result if the range is in poor condition. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain or improve the range condition.

This soil provides a fair site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Only trees and shrubs that can tolerate somewhat droughty soils should be planted. Soil blowing is the main hazard, and competition for moisture from weeds and grasses is the principal limitation. Soil blowing can be controlled by maintaining strips of sod or by planting a cover crop between the rows. Cultivation needs to be restricted to the tree row. Weeds and grasses can be controlled by use of appropriate herbicides or by roto-tilling in the tree row. Newly planted trees and shrubs may need irrigating during periods of inadequate rainfall.

This soil is not suited to septic tank absorption fields because it is subject to flooding and the filtering action of the fine sand underlying material is poor. An alternate site is needed. Sewage lagoons need to be diked as protection from flooding, and the floor of the lagoon should be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is not suitable for the construction of buildings because of the hazard of flooding. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect roads from flood damage.

This soil is in capability units IVe-5, dryland, and IIIe-11, irrigated. It is in the Sandy Lowland range site and windbreak suitability group 5.

Ip—Inavale-Boel complex, channeled. This complex consists of deep soils on channeled bottom lands of the Elkhorn River valley (fig. 12). The Inavale soils are somewhat excessively drained and are subject to occasional flooding. The Boel soils are somewhat poorly drained and are subject to frequent flooding. Areas range from 5 to several hundred acres. This complex is 50 to 60 percent Inavale soils and 30 to 40 percent Boel soils. The soils are so intricately mixed that it is not practical to separate them in mapping.

Typically, the Inavale soil has a surface layer of dark grayish brown, loose loamy fine sand about 8 inches thick. Below this is a transitional layer of light brownish gray, loose fine sand about 5 inches thick. The underlying material is fine sand that is light gray in the

Figure 12.—This landscape of Inavale-Boel complex, channeled, is adjacent to the Elkhorn River. It is suited mainly to habitat for wildlife and to recreation.

upper part and light brownish gray in the lower part to a depth of 60 inches. It has thin strata of loam and silt loam. Some small areas have a surface layer of loam or silt loam. Other small areas have a surface layer as much as 15 inches thick.

Typically, the Boel soil has a surface layer of dark grayish brown, very friable loam about 10 inches thick. Below this is a transitional layer of grayish brown, friable loam about 4 inches thick. The underlying material is mottled fine sand that is light gray in the upper part and light brownish gray in the lower part to a depth of 60 inches. In many places, it has thin strata of loam or fine sandy loam. In some areas, the surface layer is fine sandy loam or silt loam.

The permeability of the Boel and Inavale soils is rapid, and the available water capacity is low. The organic matter content is low in the Inavale soil and moderately low in the Boel soil. Natural fertility is low in the Inavale soil and medium in the Boel soil. Runoff is slow. The Boel soil has a seasonal high water table that fluctuates from a depth of about 1.5 feet in most wet years to a depth of about 3.5 feet in most dry years. The water table is usually highest in the spring. Moisture is released readily to plants in both soils.

Included with this complex in mapping are small areas of Barney, Cass, Loup, Marlake Variant, and Ord soils. Barney and Loup soils are poorly drained and are in a lower position on the landscape than Inavale and Boel soils. Cass soils are well drained and are in a higher position. Ord soils are deeper to fine sand and are in a slightly higher position. Marlake Variant soils are wetter and are in a lower position on the landscape than Inavale and Boel soils. Marlake Variant soils are ponded. The included soils make up 10 to 20 percent of the map unit.

Most of the acreage of this complex is in grass, trees, and shrubs and is used for grazing or as habitat for wildlife. A few small areas are used for cultivated crops. Cabins for hunters and duck blinds are commonly constructed in this area for recreational use. Fishing is a common sport.

The soils in this complex are not suited to dryland or irrigated cultivated crops or to introduced grasses for pasture or hayland because they are subject to frequent flooding.

The Inavale soils in this complex are suited to trees and shrubs in windbreaks if the plants selected can withstand droughty soils. Soil blowing is the principal hazard, but it can be controlled by maintaining strips of sod between the rows. Irrigation may be needed during times of inadequate rainfall. The Boel soils are not suited to trees or shrubs in windbreaks.

The soils in this complex are not suited to sanitary facilities, buildings, and dwellings because of the hazard of flooding, seepage, and wetness. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage and wetness.

This complex is in capability unit VIw-7, dryland. A range site is not assigned. The Inavale soils are in windbreak suitability group 7, and the Boel soil is in windbreak suitability group 10.

Kz—Kezan silt loam, 0 to 2 percent slopes. This deep, poorly drained, nearly level soil is on bottom lands of narrow upland drainageways. It is subject to frequent flooding. Areas range from 10 to 50 acres.

Typically, the surface layer is stratified, dark grayish brown and grayish brown, very friable silt loam about 8 inches thick. The upper part of the underlying material is stratified, grayish brown and light brownish gray, friable silt loam about 6 inches thick. The middle part is grayish brown silt loam. Below this, at a depth of 24 inches, is a buried soil. It is very dark gray silt loam in the upper part and very dark gray silty clay loam in the lower part to a depth of 60 inches. In most areas, carbonates are absent throughout the profile, but, in a few areas, carbonates are in the surface layer. In a few small areas the surface layer is silty clay loam and does not have stratification.

Included with this soil in mapping are small areas of Colo, Lamo, Hobbs, and Shell soils. The somewhat poorly drained Colo soils are in a position on the landscape similar to Kezan soil. The well drained Hobbs soils are in a higher position on the landscape. Lamo soils have lime at a depth of less than 10 inches and are in a slightly higher position on the landscape. The well drained Shell soils are also in a slightly higher position. The included soils make up about 10 to 20 percent of the map unit.

The permeability of this Kezan soil is moderate, and the available water capacity is high. Runoff is slow. This soil has a seasonal high water table that fluctuates from a depth of about 1 foot in most wet years to a depth of about 3 feet in most dry years. The water table is generally highest in spring. The organic matter content is moderate, and natural fertility is medium. The surface layer is easy to till if the soil is dry but difficult to till if the soil is wet. Moisture is released readily to plants.

Most areas of this soil are in native grass and are used for grazing or mowed for hay. A few areas are used for dryland cultivated crops or are seeded to introduced grasses. Scattered trees grow in a few areas. Some areas are used as habitat for wildlife.

This soil is poorly suited to dryland crops because it has a seasonal high water table and is subject to flooding. Only those crops that tolerate a high water table and flooding are suited. Short-season corn and grain sorghum are better suited than other row crops. Small grain is not well suited because of the wetness. Tilling and planting are delayed during most years because of wetness. Tile drains can be installed or V-ditches can be constructed to lower the seasonal high water table if suitable outlets are available. Conservation tillage practices, such as discing or chiseling, keep crop residue on the surface and help to maintain the organic matter content of the soil.

This soil is not suited to irrigated crops because it is excessively wet and is subject to flooding.

This soil is suited to introduced grasses that tolerate a seasonal high water table. If the soil is used for pasture, cool-season grasses, such as reed canarygrass and creeping foxtail, can be grown. Single species, warm-season grasses can also be grown. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Overgrazing or grazing when the soil is wet reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to maintain the desired grasses in good condition. Application of nitrogen fertilizer increases the growth and vigor of grasses.

This soil is suited to rangeland. Native grasses that are suited to subirrigated sites generally grow well. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired plants. Deposition of silt can also cause deterioration of grasses. Grazing when the soil is wet causes compaction. Proper range use, timely deferment from grazing or haying, and restricted use during very wet periods help to keep the native grasses in good condition.

This soil provides a poor site for the planting of trees and shrubs in windbreaks. However, capability for the survival and growth of adapted species is good if the trees and shrubs selected can tolerate wetness. An abundance of undesirable weeds and grasses and difficulty in the establishment of seedlings during wet years are the principal management concerns. Weeds and grasses can be controlled by cultivating between the rows and by careful use of appropriate herbicides within the row. Areas in the tree row can also be hoed by hand.

This soil is not suited to septic tank absorption fields, dwellings, and small commercial buildings because of frequent flooding and wetness. An alternate site is needed. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table and diked as protection from flooding.

Constructing roads on suitable fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage and wetness. Damage to roads by frost action can be reduced by providing good surface drainage and by using a gravel barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material can ensure better performance.

This soil is in capability unit IVw-4, dryland. It is in the Subirrigated range site and windbreak suitability group 2W.

La—Lamo silty clay loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom lands. It is subject to occasional flooding. Areas range from 5 to 80 acres.

Typically, the surface layer is dark gray, friable, calcareous silty clay loam about 10 inches thick. The subsurface layer is very dark gray, friable, calcareous silty clay loam about 12 inches thick. Below this is a transitional layer of dark gray, friable, calcareous silty clay loam about 10 inches thick. The underlying material is gray, calcareous silty clay loam in the upper part and light gray, calcareous silty clay loam in the lower part to a depth of 60 inches. In a few small areas the dark surface layer is 12 to 20 inches thick. In some places the surface layer is grayish brown silt loam. In other places the soil is fine sandy loam below a depth of 40 inches.

Included with this soil in mapping are small areas of Colo and Zook soils. Colo soils do not have carbonates in the surface layer. They are in a position on the landscape similar to Lamo soil. Zook soils are poorly drained. They are in a slightly lower position. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Lamo soil is moderately slow, and the available water capacity is high. The soil has a seasonal high water table that fluctuates from a depth of 1.5 feet in most wet years to a depth of about 3 feet in most dry years. Late in summer the water table may recede to a depth of 5 feet. The organic matter content is moderate, and natural fertility is high. The intake rate of water is low. Runoff is slow. Moisture is released readily to plants. The surface layer is easy to till if the soil is dry or moist but difficult to till if the soil is wet because of stickiness.

Most areas of this soil are used for cultivated crops. A few areas are in native grass or seeded to introduced grasses.

Under dryland farming, this soil is suited to corn, grain sorghum, oats, and soybeans. Alfalfa can be grown for hay. Soil wetness is the main limitation. Tillage generally is delayed early in spring. Tile drains can be installed or V-ditches can be constructed to help lower the seasonal high water table if a suitable outlet is available. Keeping crop residue on the surface helps to maintain and improve tilth. Conservation tillage practices, such as no-till planting or discing, help to maintain or increase the organic matter content and reduce evaporation of soil moisture.

If irrigated, this soil is suited to both sprinkler and gravity systems of irrigation. Corn, soybeans, and alfalfa can be grown. Wetness caused by the seasonal high water table is the main limitation. Tillage is commonly delayed in the spring of most years. Perforated tile can be installed or V-ditches can be constructed to help reduce wetness if a suitable outlet is available. Land leveling helps to improve the surface drainage and increase the efficiency of the irrigation system. Conservation tillage practices, such as chiseling or discing, help to maintain the organic matter content and reduce evaporation of soil moisture.

This soil is suited to use for pasture. Cool-season grasses, such as creeping foxtail, reed canarygrass, or orchardgrass, can be mixed with alfalfa. Single species, warm-season grasses can also be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be used in rotation with cultivated crops. Overgrazing reduces the vegetative cover and causes deterioration of the grasses. Grazing when the soil is wet causes the formation of small mounds and depressions, making it difficult to harvest the grass for hay. Proper stocking and rotation grazing help to keep the grasses in good condition. Applying nitrogen fertilizer increases the vigor and growth of grasses.

This soil is suited to native grasses for rangeland. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Grazing when the soil is wet can cause compaction. Proper grazing use, deferred grazing, and a planned grazing system help to keep the native grasses in good condition.

This soil provides a good site for trees and shrubs in windbreaks. It is suited to adapted species that can tolerate the seasonal high water table and occasional flooding. Undesirable grasses and weeds can be controlled by cultivation between the rows and by careful use of appropriate herbicides. The establishment of seedlings is a concern in wet years.

This soil is not suited to septic tank absorption fields, dwellings, or small commercial buildings because of flooding and wetness. An alternate site is needed. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table and diked as protection from flooding.

Constructing roads on suitable, well compacted fill material and providing adequate side ditches and culverts help to protect the roads from flood damage. Damage to roads by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches can provide the needed drainage. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Coarser-grained material for subgrade or base material can be used to ensure better performance.

This soil is in capability units IIw-4, dryland, and IIw-3, irrigated. It is in the Subirrigated range site and windbreak suitability group 2W.

Lc—Lamo silty clay loam, wet, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on bottom lands. It is subject to occasional flooding. Springs seep through the soil in a few areas. Areas range from 5 to 80 acres.

Typically, the surface layer is very dark gray, friable silty clay loam about 13 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 26 inches thick. The underlying material is silty clay loam. It is dark gray in the upper part and grayish brown in the lower part to a depth of 60 inches. In some small areas, fine sand is below a depth of 40 inches. In other small areas the dark surface layer is less than 10 to 20 inches thick. Some small areas are better drained than is typical.

Included with this soil in mapping are small areas of Lawet and Loup soils. Lawet soils are calcareous and are in a slightly higher position on the landscape than Lamo soil. Loup soils have sandy underlying material and are in a similar position on the landscape. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Lamo soil is moderately slow, and the available water capacity is high. This soil has a seasonal high water table that fluctuates from a depth of about 0.5 foot in most wet years to a depth of about 1.5 feet in most dry years. The organic matter content is moderate, and natural fertility is high. Runoff is slow. Moisture is released readily to plants.

Nearly all of the acreage of this soil is in native grass and is used for grazing or mowed for hay. Some small areas are used as habitat for wildlife.

This soil is not suited to the common cultivated crops or to introduced grasses because it is too wet for tillage.

This soil is suited to rangeland and hayland. Improper timing of haying or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants.

This soil is not suited to trees and shrubs in windbreaks because of excessive wetness from the seasonal high water table.

This soil is not suited to sanitary facilities and buildings because of the seasonal high water table and occasional flooding. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect roads from flood damage and wetness. Damage to roads and streets by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit Vw-7, dryland. It is in the Wet Land range site and windbreak suitability group 10.

Ld—Lawet silty clay loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on bottom lands. It is subject to occasional flooding. Areas range from 5 to 50 acres.

Typically, the surface layer is very dark grayish brown, very friable, calcareous silty clay loam about 12 inches thick. The subsurface layer is dark gray, friable, calcareous loam about 13 inches thick. The subsoil is gray, very friable, calcareous loam about 8 inches thick. The underlying material is light brownish gray, calcareous sandy clay loam. Below this is a buried soil of dark gray, mottled, calcareous sandy loam to a depth of 60 inches. In some small areas, fine sand is below a depth of 48 inches.

Included with this soil in mapping are small areas of Colo, Elsmere, and Loup soils, and Lamo, wet, soils. The somewhat poorly drained Colo and Elsmere soils are in a slightly higher position on the landscape than Lawet soil. Loup soils and Lamo, wet, soils are in similar positions on the landscape. The included soils make up 5 to 20 percent of the map unit.

The permeability of this Lawet soil is moderate, and the available water capacity is high. Runoff is slow. This soil has a seasonal high water table that fluctuates from a depth of about 1 foot in most wet years to a depth of about 2 feet in most dry years. The water table is generally highest in spring. The organic matter content is moderate, and natural fertility is high. The surface layer is easy to till when the soil is dry, but it is difficult to till when the soil is wet. Moisture is released readily to plants.

Most of the acreage of this soil is in native grasses and is used for grazing or mowed for hay. Drainage is needed if dryland crops or introduced grasses are grown.

This soil is poorly suited to dryland farming because it has a seasonal high water table and is subject to flooding. Only those crops that can tolerate a seasonal high water table and flooding are suited. Small grain is not well suited because of the wetness. Tile drains can be installed or V-ditches can be constructed to lower the high water table if a suitable outlet is available. Tilling and planting are delayed in most years because of wetness. Land leveling and the use of grassed waterways and diversion ditches help to control flooding and runoff. Conservation tillage practices, such as discing or chiseling, keep crop residue on the surface, help to maintain or increase the organic matter content, and improve tilth.

This soil is not suited to irrigated crops because of excessive wetness and the hazard of flooding. Drainage is needed, but outlets are commonly not available.

This soil is suited to introduced grasses that can tolerate a seasonal high water table. Smooth brome, creeping foxtail, and reed canarygrass can be grown. Separate pastures of cool-season grasses and single species, warm-season grasses can be used to provide a long season of grazing. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep desired grasses in good condition. Application of nitrogen fertilizer increases the growth and vigor of grasses.

This soil is suited to native grasses for range, either for grazing or haying. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Grazing when the soil is wet causes compaction and the formation of small mounds, making it difficult to graze or harvest the grasses for hay. Proper grazing use, timely deferment from grazing, and restricted use during very wet periods help to maintain the native plants in good condition.

This soil is suited to trees and shrubs in windbreaks. Species that can tolerate a seasonal high water table and occasional flooding should be selected. The establishment of seedlings is difficult in wet years. Undesirable grasses and weeds are a concern, but they can be controlled by cultivating between the rows and using appropriate herbicides in the tree row. Areas near the rows can be roto-tilled or hoed by hand.

This soil is generally not suited to septic tank absorption fields, sewage lagoons, or the construction of buildings because of the hazard of flooding and wetness. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage and wetness. Damage to roads by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit IVw-4, dryland. It is in the Subirrigated range site and windbreak suitability group 2W.

Lo—Loretto fine sandy loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands and stream terraces. It formed in mixed eolian sand and loess. Areas range from 3 to 160 acres.

Typically, this soil has a surface layer of dark grayish brown, very friable fine sandy loam about 13 inches thick. The subsoil is friable and about 23 inches thick. The upper part is brown loam, and the lower part is pale brown silt loam. The underlying material is pale brown silt loam to a depth of 60 inches. In some areas the surface layer is loam. In some areas the surface layer is 20 to 26 inches thick. In some areas, fine sand is below a depth of 40 inches.

Included with this soil in mapping are small areas of Blendon, Boelus, Nora, and Thurman soils. Blendon soils have more sand in the subsoil and are in a slightly lower position on the landscape than Loretto soil. Boelus soils have a sandy surface layer and are in a similar position on the landscape. The silty Nora soils are in a slightly lower position. The somewhat excessively drained Thurman soils are in a slightly higher position. The included soils make up 5 to 15 percent of the map unit.

The permeability of this Loretto soil is moderate, and the available water capacity is high. The organic matter content is moderately low, and natural fertility is high. Runoff is slow. The intake rate of water is moderate. The surface layer is easily tilled through a wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated. Most areas are farmed dryland, but some areas are irrigated. A few small areas are in native grass and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, soybeans, grain sorghum, oats, and alfalfa. Soil blowing is a hazard if the surface is not adequately protected by growing crops or crop residue. Conservation tillage practices, such as no-till planting for row crops and discing or chiseling, help to prevent soil blowing and conserve soil moisture. Stripcropping and field windbreaks also help to prevent soil blowing. Applying feedlot manure helps to improve the organic matter content, fertility, and tilth of the soil.

If irrigated, this soil is suited to a sprinkler system of irrigation. A gravity system is also suited if the soil is leveled to permit efficient application of water. Corn, soybeans, and alfalfa can be grown. Soil blowing is the principal hazard. Conservation tillage practices, such as no-till planting for row crops or discing or chiseling, keep crop residue on the surface and help to control soil blowing and conserve soil moisture. Applying feedlot manure helps to maintain the organic matter content and improve the fertility of the soil.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, and tall fescue, can be mixed with alfalfa. Introduced grasses can also be used as part of a cropping sequence with row crops. Separate pastures of cool-season grasses and single species, warm-season grasses can be used to provide a long season of grazing. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of grasses.

The soil is suited to trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Soil blowing is the main hazard. Competition for moisture from weeds and grasses is a concern of management. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Cultivation reduces the competition for moisture from weeds and grasses but generally should be restricted to the tree row. Appropriate herbicides can be applied in the tree row.

This soil is suited to septic tank absorption fields. Lining or sealing the floor of sewage lagoons is needed to prevent seepage.

This soil is suited to the construction of dwellings and small commercial buildings.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for subgrade or base material can ensure better performance.

This soil is in capability units IIe-3, dryland, and IIe-5, irrigated. It is in the Sandy range site and windbreak suitability group 5.

LoC—Loretto fine sandy loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. It formed in mixed eolian sand and loess. Areas range from 3 to 40 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsoil is friable and about 25 inches thick. It is brown loam in the upper part and light yellowish brown silt loam in the lower part. The underlying material is light yellowish brown silt loam to a depth of 60 inches. In some small areas the surface layer is loam. In other small areas the surface layer is 20 to 24 inches thick. Some small areas are nearly level.

Included with this soil in mapping are small areas of Blendon, Boelus, Nora, and Thurman soils. Blendon soils have less clay in the subsoil than Loretto soil. They are on stream terraces and are in a lower position on the landscape. Boelus soils have more sand in the surface layer. They are in a position similar to Loretto soil. The silty Nora soils are in a lower position on the landscape. The somewhat excessively drained Thurman soils are in a higher position. The included soils make up about 10 to 20 percent of the map unit.

The permeability of this Loretto soil is moderate, and the available water capacity is high. The organic matter content is moderately low, and natural fertility is high. The intake rate of water is moderate. Runoff is medium. The surface layer is easily tilled through a wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops, but a few areas are in native grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, soybeans, grain sorghum, oats, and alfalfa. Soil blowing and water erosion are the main hazards. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to control soil blowing. Stripcropping also helps to reduce soil blowing. Terraces and grassed waterways help to control water erosion.

This soil is well suited to a sprinkler system of irrigation. A gravity system is also suited if the soil is bench leveled or terraced and contour furrowed to control runoff. Corn, soybeans, and alfalfa can be grown. For sprinkler irrigation, contour furrows and terraces and grassed waterways can be used and an adequate amount of crop residue maintained on the surface. Soil blowing and water erosion are the principal hazards. Maintaining fertility is a concern of management.

Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to control soil blowing and water erosion.

This soil is suited to introduced grasses for pasture. The use of this soil for pasture is an effective way to control soil blowing and water erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used for a long season of grazing. Introduced grasses can also be used as part of a cropping sequence with row crops. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of fertilizer and irrigation water increase the vigor and growth of grasses.

This soil generally provides a good site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Soil blowing and water erosion are the main hazards. Competition for moisture from weeds and grasses is a concern of management. Soil blowing can be controlled by maintaining a cover crop between the tree rows. Cultivation should be restricted to the tree row. Planting trees on the contour and terracing can help to prevent erosion and runoff. Appropriate herbicides can be applied in the row, or the areas can be roto-tilled to control weeds and grasses.

This soil is generally suited to septic tank absorption fields. Lining or sealing the floor of sewage lagoons is needed to prevent seepage.

The soil is suited to the construction of dwellings. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance.

This soil is in capability units IIIe-3, dryland, and IIIe-5, irrigated. It is in the Sandy range site and windbreak suitability group 5.

LpC—Loretto loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on side slopes of uplands. It formed in mixed eolian sand and loess. Areas range from 3 to 25 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable loam about 6 inches thick. The subsoil is friable loam about 23 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material is silt loam. It is light yellowish brown in the upper part and very pale brown in the lower part to a depth of 60 inches. In some small areas the surface layer is silt loam. In some areas the surface layer is 20 to 26 inches thick. A few small areas are nearly level.

Included with this soil in mapping are small areas of Boelus, Hobbs, Nora, and Thurman soils. The Boelus soils have more sand in the surface layer and are in a position on the landscape similar to Loretto soil. The occasionally flooded Hobbs soils are on bottom lands of narrow upland drainageways. The silty Nora soils are in a slightly lower position on the landscape. The somewhat excessively drained Thurman soils are in a slightly higher position. The included soils make up 5 to 20 percent of the map unit.

The permeability of this Loretto soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. The intake rate is moderately low. Runoff is medium. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. A few areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, oats, and alfalfa. Water erosion is the principal hazard. Maintaining fertility is the main management concern. Conservation tillage practices, such as discing, chiseling, or no-till planting, help to control erosion. Terraces, contour farming, and grassed waterways on the long smooth slopes also help to prevent water erosion. Returning crop residue to the soil helps to maintain the organic matter content.

This soil is suited to a sprinkler system of irrigation. It is also suited to a gravity system if it is bench leveled or contour furrowed and if terraces and grassed waterways are established and an adequate amount of crop residue kept on the surface. Corn, soybeans, and alfalfa can be grown. Because of the uneven slope, water erosion and runoff are concerns unless water application is controlled. Conservation tillage practices, such as discing and chiseling the long smooth slopes, help to control erosion and runoff. Land leveling increases the efficiency of the irrigation system. Returning crop residue to the soil and applying fertilizer and feedlot manure help to maintain the organic matter content and fertility of the soil.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Warm-season grasses can also be grown. Alternate pastures of cool-season grasses and warm-season grasses can provide a long season of grazing. Grasses used for pasture can also be used as part of a cropping sequence with row crops. Rotation grazing and proper stocking help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of grasses.

This soil provides a good site for planting trees and shrubs in windbreaks. Capability is good for the survival and fair for the growth of adapted species. Water erosion is the principal hazard. Competition for moisture from weeds and grasses is a concern of management. Planting trees on the contour and terracing help to control erosion. Cultivation between the rows can control weeds and undesirable grasses. In addition, appropriate herbicides can be used.

This soil is suited to septic tank absorption fields. Lining or sealing the floor of the sewage lagoon is needed to prevent seepage.

This soil is suited to the construction of dwellings. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for subgrade or base material can ensure better performance.

This soil is in capability units IIe-1, dryland, and IIIe-4, irrigated. It is in the Silty range site and windbreak suitability group 3.

Lv—Loup fine sandy loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on stream terraces and in a few small areas on bottom lands. It is frequently ponded and occasionally flooded. Areas range from 5 to 80 acres.

Typically, the surface layer is very dark gray, very friable fine sandy loam about 10 inches thick. The subsurface layer is very dark gray, very friable fine sandy loam about 6 inches thick. Below this is a transitional layer of gray, very friable fine sandy loam about 4 inches thick. The underlying material is light gray, mottled loamy fine sand in the upper part and light gray, mottled fine sand in the lower part to a depth of 60 inches. In a few small areas, this soil has better drainage than is typical. In some small areas, the surface layer ranges from 3 to 10 inches thick.

Included with this soil in mapping are small areas of Elsmere, Lawet, and Thurman soils. The somewhat poorly drained Elsmere soils are on stream terraces and are in a slightly higher position on the landscape than Loup soil. The calcareous Lawet soils are in a similar position on the landscape. The somewhat excessively drained Thurman soils are in a higher position. The included soils make up 5 to 20 percent of the map unit.

The permeability of this Loup soil is rapid, and the available water capacity is low. This soil has a seasonal high water table that ranges from about 0.5 foot above the surface in most wet years to a depth of about 1 foot in most dry years. The organic matter content is moderate, and natural fertility is low. Runoff is slow. Moisture is released readily to plants.

Most of the acreage of this soil is in native grasses and is mowed for hay. A few areas are tilled and used for cultivated crops or for pasture.

This soil is generally not suited to dryland cultivated crops unless drainage is improved. Open V-ditches can be constructed or perforated tile can be installed to improve the drainage. Corn and grain sorghum are suitable crops, but the soil is too wet for deep rooted crops, such as alfalfa. Crop residue should be left on the surface as mulch. This soil warms up slowly in spring, and tilling and planting are delayed. Soil wetness is the principal hazard. Maintaining fertility is the main concern of management.

This soil is not suited to irrigated crops because of wetness caused by the seasonal high water table.

This soil is suited to introduced grasses for pasture, but because of wetness, seeding the grasses can be difficult. Creeping foxtail and reed canarygrass are suitable pasture grasses. Overgrazing, grazing when the soil is wet, or improper timing of haying reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applying nitrogen fertilizer increases the vigor and growth of pasture grasses.

This soil is better suited to rangeland or hayland than to other uses. Improper timing of haying or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Grazing can cause the formation of small mounds or bogs, making it difficult to harvest the grass for hay.

This soil is not suited to trees and shrubs in windbreaks because of excessive wetness due to the seasonal high water table.

This soil is not suited to septic tank absorption fields, sewage lagoons, or the construction of buildings because of ponding. The walls or sides of shallow excavations need to be temporarily shored to prevent sloughing or caving.

Constructing roads on suitable, well compacted fill material above the ponding level and providing adequate side ditches and culverts help to protect the roads from damage by ponding and wetness from the seasonal high water table.

This soil is in capability units Vw-7, dryland, if undrained, and IVw-6, dryland, if drained. A capability unit is not assigned for irrigation. Loup soil is in the Subirrigated range site and windbreak suitability group 10.

Ma—Marlake Variant silt loam, 0 to 1 percent slopes. This deep, nearly level, very poorly drained soil is on bottom lands of the Elkhorn River valley. It is subject to frequent ponding and occasionally flooded. Areas range from 3 to 15 acres.

Typically, 3 inches of partially decomposed organic matter, mainly leaves and stems, is at the surface. The mineral soil has a surface layer of dark gray, friable silt loam about 12 inches thick. The underlying material is gray, mottled silt loam to a depth of 60 inches. In some small areas, stratified fine sand is below a depth of 40 inches. In other small areas the surface layer is loamy fine sand that is lighter colored than is typical.

Included with this soil in mapping are small areas of Barney, Boel, and Loup soils. All of these soils are better drained than Marlake Variant soil and all are in slightly higher positions on the landscape. The included soils make up 3 to 8 percent of the map unit.

The permeability of this Marlake Variant soil is moderate, and the available water capacity is high. This soil has a seasonal high water table that ranges from 2 feet above the surface to a depth of about 1 foot below the surface. The organic matter content is high. Natural fertility is low. Runoff is ponded.

This soil is used mainly as habitat for wildlife. It is used principally by waterfowl.

Because of the very high water table, this soil is not suited to cultivated crops, native or introduced grasses, trees, or shrubs. It is better suited to use as habitat for wetland wildlife.

This soil is not suited to sanitary facilities or the construction of dwellings and buildings because it is frequently ponded. Alternate sites are needed.

Roads can be constructed on suitable, well compacted fill material above the ponding level, and adequate side ditches and culverts can be provided to help protect the roads from damage by ponding and wetness from the seasonal high water table.

This soil is in capability unit VIIIw-7 and windbreak suitability group 10. It is not assigned to a range site.

MoC—Moody silty clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on crests and side slopes of broad ridgetops on uplands. It formed in loess. Areas range from 5 to several hundred acres.

Typically, the surface layer is friable silty clay loam about 11 inches thick (fig. 13). It is dark grayish brown in the upper part and very dark grayish brown in the lower part. The subsoil is firm silty clay loam about 29 inches thick. It is grayish brown in the upper part, brown in the middle part, and pale brown in the lower part. The underlying material is pale brown silt loam to a depth of 60 inches. In many areas, lime is between a depth of 30 and 60 inches. Thirty to 40 percent of this map unit is moderately eroded. In these areas, the surface layer is thinner and lighter colored than is typical.

Included with this soil in mapping are small areas of Belfore soils. Belfore soils are nearly level. They are in a higher position on the landscape than Moody soil. In some small areas the soils are nearly level. In other small areas the soils are high in alkali. Some areas of soils in small depressions have a claypan subsoil. The included soil makes up 3 to 10 percent of the map unit.

The permeability of this Moody soil is moderately slow, and the available water capacity is high. Runoff is medium. The organic matter content is moderate, and natural fertility is high. The intake rate of water is low. The surface layer of this soil is easily tilled through a narrow range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops. A few areas are in native grass or seeded to

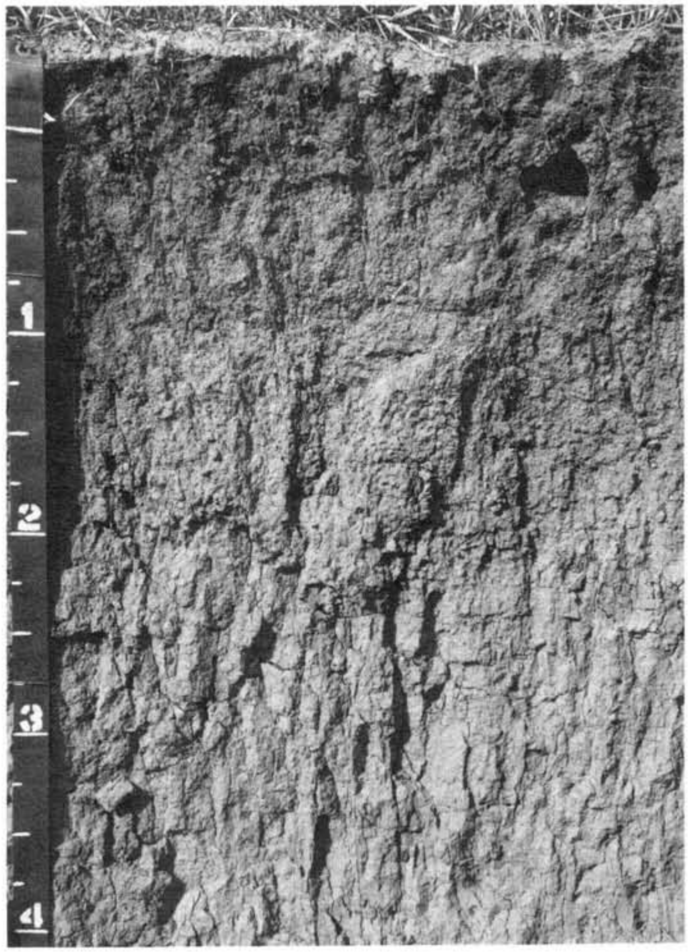

Figure 13.—Profile of Moody silty clay loam. This deep soil formed in loess. Depth is marked in feet.

introduced grasses and used for grazing or mowed for hay. Many areas are irrigated.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, oats, and alfalfa. Water erosion is the main hazard. Conservation tillage practices, such as discing, chiseling, or no-till planting, leave crop residue on the surface and help to control erosion and conserve soil moisture. Terraces, contour farming, and grassed waterways help to prevent erosion on long smooth slopes. Grasses and legumes can be included in the cropping system to control erosion and maintain the organic matter content.

This soil is suited to a sprinkler system of irrigation. It is also suited to a gravity system if it is bench leveled or contour furrowed and if terraces and grassed waterways are established and an adequate amount of crop residue kept on the surface. Corn, soybeans, and alfalfa can be grown. Erosion is the main hazard. Runoff is a concern of management. The application rate of irrigation water needs to be controlled. Conservation tillage practices that keep crop residue on the surface, terracing, and contour furrowing help to control runoff.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be used in rotation with cultivated crops. Overgrazing or improper timing of haying reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of pasture grasses.

This soil is suited to rangeland. Use of the soil for range is an effective way to control water erosion. Overgrazing by livestock, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help to maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. Seedlings generally survive and grow well if competing vegetation is controlled. Good site preparation and timely cultivation between the tree rows or careful use of appropriate herbicides in the row helps seedlings to survive and grow. Planting trees on the contour and terracing help to control runoff and erosion. Irrigating can provide supplemental moisture during periods of low rainfall.

The moderately slow permeability of this soil is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. Lining or sealing the floor of sewage lagoons is needed to prevent seepage. Grading is needed to modify the slope and shape the lagoon.

The foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Coarser-textured material for subbase or base material can be used. Crowning the roadbed by grading and constructing adequate side ditches can provide good surface drainage and reduce the damage to roads by frost action.

This soil is in capability units IIe-1, dryland, and IIIe-3, irrigated. It is in the Silty range site and windbreak suitability group 3.

Mp—Moody silty clay loam, terrace, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on stream terraces along major streams. Areas range from 5 to several hundred acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil is brown, firm silty clay loam about 26 inches thick. The underlying material is pale brown, calcareous silt loam to a depth of 60 inches. In places, free carbonates are above a depth of 50 inches. In some small areas, the subsoil is darker than is typical. In other small areas the surface layer is silt loam. Some small areas are gently sloping.

Included with this soil in mapping are small areas of Hobbs soils in narrow drainageways. The included soil makes up about 3 to 8 percent of the map unit.

The permeability of this Moody soil is moderately slow, and the available water capacity is high. Runoff is slow. The organic matter content is moderate, and natural fertility is high. The intake rate of water is low. The surface layer is easily tilled through a narrow range of moisture conditions.

This soil is used mainly for cultivated crops. Most of the acreage is irrigated. Some small areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, oats, and alfalfa. Maintaining fertility and tilth are the principal concerns of management. Conservation tillage practices, such as discing, no-till planting, and till-planting, keep crop residue on the surface and help to maintain tilth and conserve soil moisture.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa are the main crops. Some land leveling is generally needed if a gravity system is used. Land leveling improves the surface drainage and increases the efficiency of the irrigation system. Conservation tillage practices, such as no-till planting and discing, keep crop residue on the surface and help to conserve soil moisture. Returning crop residue to the soil and applying feedlot manure also help to increase the content of organic matter and maintain fertility of the soil.

This soil is suited to introduced grasses for pasture, either for grazing or mowing. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Pasture grasses can also be used as part of a cropping sequence with row crops. Overgrazing or mowing to improper heights causes deterioration of desired grasses. Rotation grazing, proper stocking, and proper timing of mowing help to keep desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of pasture grasses.

This soil is suited to trees and shrubs in windbreaks. It provides a good site for these plantings. Capability for the survival of adapted species is good. Competition for moisture from undesirable weeds and grasses is the main concern of management. Cultivation between the rows, careful use of appropriate herbicides, and rototilling in the tree row help to control this competition. Areas near the trees can be hoed by hand.

The moderately slow permeability of this soil is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption field. Lining or sealing the floor of the sewage lagoon is needed to prevent seepage.

The foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-textured material for the base material or subgrade ensures better performance. Crowning the road by grading and constructing adequate side ditches help to provide good surface drainage and reduce the damage by frost action.

This soil is in capability units I-1, dryland, and I-3, irrigated. It is in the Silty range site and windbreak suitability group 3.

Mu—Muir silty clay loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on low stream terraces. It is subject to rare flooding. Areas range from 3 to several hundred acres.

Typically, the surface layer is dark grayish brown, very friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil is friable silty clay loam about 34 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The underlying material is light yellowish brown silt loam to a depth of 60 inches. In some small areas the surface layer is thinner than is typical. In other small areas the soil is gently sloping. In a few places, silty clay is below a depth of 20 inches.

Included with this soil in mapping are small areas of Colo and Hobbs soils. The somewhat poorly drained Colo soils are on bottom lands. They are in a lower position on the landscape than Muir soil. Hobbs soils are in narrow drainageways that cross the Muir soil. The included soils make up about 5 to 10 percent of the map unit.

The permeability of this Muir soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. Runoff is slow. The intake rate of water is slow. The surface layer is easily tilled through a narrow range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated, but a few areas are in grass and are used for grazing or mowed for hay. Many areas are irrigated.

Under dryland farming, this soil is suited to corn, soybeans, sorghum, and legumes. Weed control and maintenance of fertility are the main concerns of management. Conservation tillage practices, such as discing, chiseling, and no-till planting, leave crop residue on the surface and help to maintain tilth and workability of the soil. Keeping crop residue on the surface also helps to conserve soil moisture.

This soil is suited to both sprinkler and gravity systems of irrigation. Corn, soybeans, and alfalfa can be grown. This soil has few limitations when it is irrigated. Land leveling is generally needed if a gravity system is used. Maintaining fertility is the main concern of management. Conservation tillage practices, such as discing or no-till planting, keep crop residue on the surface and help to conserve soil moisture and improve the organic matter content.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Pasture grasses also can be used as part of the cropping system. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Irrigated pastures respond to nitrogen fertilizer.

This soil provides a good site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is good. Moisture competition from weeds and grasses is the main limitation. Cultivation between the rows and use of appropriate herbicides, or roto-tilling in the tree row help to control this competition.

The hazard of rare flooding needs to be considered if this soil is used for sanitary facilities and building sites. Fill material can be used to elevate the septic tank absorption field as protection from flooding. Sewage lagoons need to be diked as protection from flooding, and the floor of the lagoon should be lined or sealed to prevent seepage.

Dwellings and small commercial buildings can be constructed on elevated, well compacted fill material as protection against flooding.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material helps to ensure better performance.

This soil is in capability units I-1, dryland, and I-3, irrigated. It is in the Silty Lowland range site and windbreak suitability group 1.

NoD—Nora silty clay loam, 6 to 11 percent slopes. This deep, well drained, strongly sloping soil is on ridgetops and side slopes of uplands (fig. 14). It formed in loess. Areas range from 10 to 50 acres.

Typically, the surface layer is very friable, very dark grayish brown silty clay loam about 7 inches thick. The subsoil is friable and about 20 inches thick. It is brown

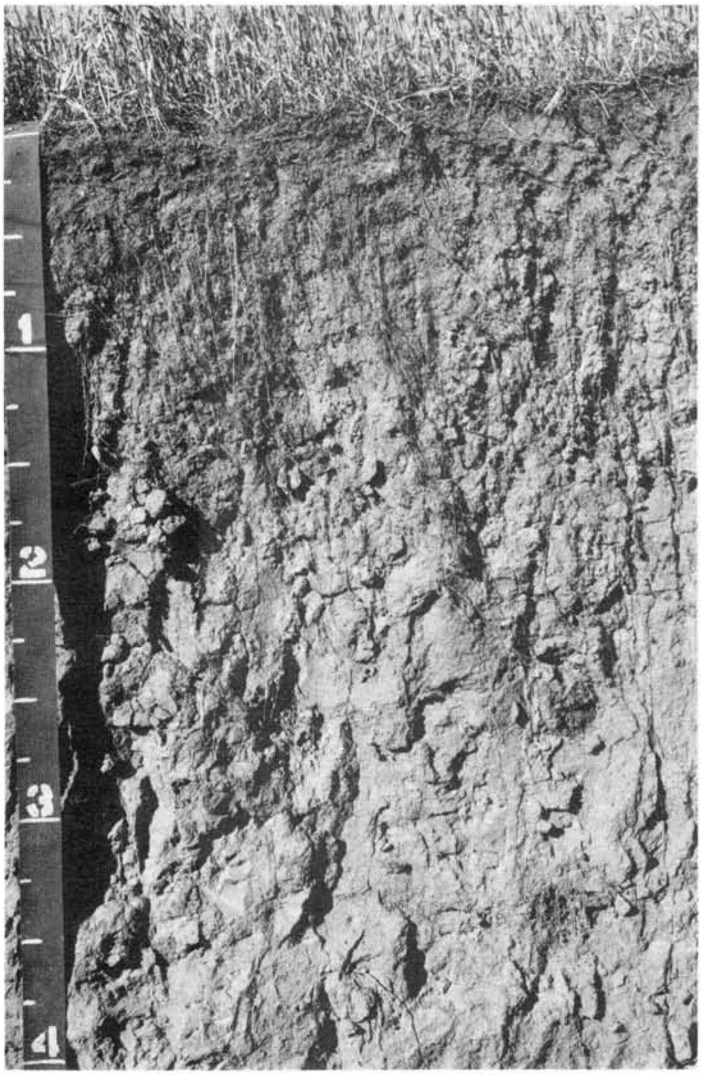

Figure 14.—Profile of Nora silty clay loam. This deep, well drained soil formed in loess. Depth to lime ranges from 14 to 30 inches.

silty clay loam in the upper part and pale brown, calcareous silt loam in the lower part. The underlying material is calcareous silt loam. It is pale brown in the upper part and very pale brown in the lower part to a depth of 60 inches. In a few small areas the soils are gently sloping or moderately steep. In other small areas the surface layer is 10 to 20 inches thick. In places the soil is eroded and lighter colored than is typical. In other places, lime is below a depth of 30 inches.

Included with this soil in mapping are small areas of Alcester, Crofton, and Hobbs soils. The gently sloping Alcester soils are on foot slopes. They are in a lower position on the landscape than Nora soil. The calcareous Crofton soils are in a slightly higher position. The occasionally flooded Hobbs soils are on bottom lands of narrow drainageways. The included soils make up 10 to 15 percent of the map unit.

The permeability of this Nora soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. The intake rate of water is moderate. Runoff is rapid. Moisture is released readily to plants. This soil is easily tilled through a narrow range of moisture conditions.

Most of the acreage of this soil is used for cultivated crops, but a few areas are in native grasses or are seeded to introduced grasses. These areas are used for grazing or mowed for hay. Some cultivated areas are irrigated by sprinklers.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, oats, and alfalfa. Water erosion is the principal hazard. Erosion can be controlled by terraces and grassed waterways. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to control erosion.

If irrigated, this soil is poorly suited to a sprinkler system of irrigation, and it is not suited to gravity irrigation. If the soil is irrigated, it is better suited to close-growing crops, such as alfalfa, than to row crops; however, row crops can be grown if erosion control is practiced. Controlling runoff and maintaining fertility are the main management concerns. The proper rate of water application and the use of terraces and grassed waterways help to control water erosion and runoff. If the soil is used for row crops, conservation tillage practices, such as discing, chiseling, or no-till planting, can be used with contouring to help control erosion and maintain good tilth.

This soil is suited to introduced grasses for pasture. Use of the soil for pasture is an effective way to control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can provide a long season of grazing. Pasture grasses can also be used in rotation with cultivated crops. Overgrazing or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of pasture grasses.

This soil is suited to native grass for rangeland. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. Reduction of the protective cover can result in severe soil losses by water erosion. A planned grazing system, proper grazing use, and timely deferment from grazing help to maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. Adapted species survive and grow well on this soil. Erosion by water, drought, and competition for moisture from weeds and grasses are the main hazards. Planting trees on the contour and terracing or planting a cover crop between the rows reduces water erosion. Undesirable grasses and weeds can be controlled by cultivation between the trees and by careful use of appropriate herbicides in the row.

Land shaping and contouring are needed to assure proper operation of septic tank absorption fields on this soil. Moderate permeability is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption area. For sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining or sealing the floor of the lagoon is needed to prevent seepage.

Dwellings and small commercial buildings need to be designed to accommodate the slope, or the soil should be graded to an acceptable level. In addition, foundations need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance. Damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIIe-1, dryland, and IVe-3, irrigated. It is in the Silty range site and windbreak suitability group 3.

NoE—Nora silty clay loam, 11 to 15 percent slopes. This deep, well drained, moderately steep soil is on side slopes of uplands. It formed in silty loess. Areas range from 3 to 20 acres.

Typically, the surface layer is dark grayish brown, very friable silty clay loam about 7 inches thick. The subsoil is friable silty clay loam about 30 inches thick. The upper and middle parts are brown, and the lower part is pale brown and calcareous. The underlying material is light yellowish brown, calcareous silt loam to a depth of 60 inches. In some small areas, lime is at a depth of more than 30 inches. In some small areas the surface layer is lighter colored than is typical. In other small areas, this soil is strongly sloping.

Included with this soil in mapping are small areas of Alcester, Crofton, and Hobbs soils. Alcester soils are on foot slopes. They are in a lower position on the landscape than Nora soil. The calcareous Crofton soils are in a similar position on the landscape. Hobbs soils are on bottom lands of upland drainageways and are occasionally flooded. The included soils make up 10 to 15 percent of the map unit.

The permeability of this Nora soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is medium. Runoff is rapid. Moisture is released readily to plants. This soil is easily tilled through a narrow range of moisture conditions.

Most of the acreage of this soil is cultivated, but a large acreage is in native grass or is seeded to introduced grasses. These areas are used for grazing or mowed for hay.

Under dryland farming, this soil is poorly suited to corn and grain sorghum. Alfalfa, oats, and close-sown crops are better suited than row crops. Water erosion is the principal hazard. Erosion and runoff can be controlled by terraces and grassed waterways. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to control erosion and runoff.

This soil is not suited to irrigation because of slope. The hazard of erosion is severe.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Pasture grasses also can be used in rotation with cultivated crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the grasses in good condition. Applying nitrogen fertilizer increases the growth and vigor of grasses.

This soil is suited to native grasses for rangeland. Use of the soil for range is an effective way to control erosion. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. Reduction of the protective cover can cause severe soil losses by water erosion. A planned grazing system, proper amount of use, and timely deferment from grazing help to maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. Capability for survival is good, and growth of adapted species is fair. Water erosion and drought are the principal hazards. Planting trees on the contour and terracing help to control erosion and runoff. Undesirable grasses and weeds can be controlled by cultivation between the tree rows and careful use of appropriate herbicides or by roto-tilling in the row.

Land shaping and contouring are needed to assure the proper operation of septic tank absorption fields on this soil. Moderate permeability is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. For sewage lagoons, extensive grading is required to modify the slope and shape the lagoon.

Dwellings and buildings need to be properly designed to accommodate the slope, or the soil should be graded to an acceptable level. In addition, foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from the shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability unit IVe-1, dryland. It is in the Silty range site and windbreak suitability group 3.

NpC2—Nora-Crofton complex, 2 to 6 percent slopes, eroded. This complex consists of deep, well drained, gently sloping soils on narrow ridgetops of uplands. These soils formed in calcareous loess. Areas of this map unit range from 5 to 30 acres. The Nora soil in this complex is in a lower position on the landscape than the Crofton soil and is on side slopes. The Crofton soil is generally on ridgetops. This complex is 40 to 55 percent Nora soil and 35 to 45 percent Crofton soil. The soils are so intricately mixed that it is not practical to separate them in mapping. Rills are common after heavy rains. Erosion has removed most of the original surface layer and, in places, part of the subsoil. In areas of Nora soil, the remaining part of the surface layer has been mixed with part of the subsoil by tillage.

Typically, the Nora soil has a surface layer of brown, friable silty clay loam about 5 inches thick. The subsoil is friable silty clay loam about 19 inches thick. It is brown in the upper part and pale brown and calcareous in the lower part. The underlying material is light yellowish brown, calcareous silt loam to a depth of 60 inches.

Typically, the Crofton soil has a surface layer of pale brown, very friable silt loam about 5 inches thick. In many areas, the underlying material is exposed and lime concretions are on the surface. The transitional layer is pale brown, friable, calcareous silt loam about 3 inches thick. The underlying material is light yellowish brown, calcareous silt loam to a depth of 60 inches. In some small areas the soil is reddish brown. In other areas the soil is gray.

Included with this complex in mapping are small areas of Moody soils. Moody soils have more clay in the subsoil, are on broader ridgetops, and are in a higher position on the landscape than Nora and Crofton soils. The included soil makes up 3 to 8 percent of the complex.

The permeability in both Nora and Crofton soils is moderate, and the available water capacity is high. The organic matter content is moderately low in the Nora soil and low in the Crofton soil. Runoff is medium. The intake rate of water is moderate in both soils. These soils are generally deficient in phosphorus and zinc. Natural fertility is medium in the Nora soil and low in the Crofton soil. The surface layer of the Crofton soil is very friable, and it is easily tilled through a fairly wide range of moisture conditions. The surface layer of the Nora soil is friable but is not as easily tilled. Moisture is released readily to plants.

Most of the areas of this complex are cultivated, but some areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, these soils are suited to corn, grain sorghum, oats, and alfalfa. Water erosion is the principal hazard. Conservation tillage practices, such as discing, chiseling, and no-till planting, keep crop residue on the surface and help to prevent excessive soil and water loss. Contouring also helps to reduce soil loss and conserve moisture. Returning crop residue to the soil helps to maintain and improve the content of organic matter and increases fertility. Applications of feedlot manure and commercial fertilizer also help to improve fertility.

If irrigated, these soils are suited to a gravity system of irrigation if they are bench leveled or contour furrowed and if terraces and grassed waterways are established and an adequate amount of crop residue maintained on the surface. Extensive land leveling is needed, and deep cuts are commonly required. Sprinkler irrigation is better suited than gravity irrigation, but conservation tillage practices, such as discing, chiseling and no-till planting, are needed to control runoff and erosion. Close-grown crops are better suited than row crops. Row crops can be grown, but irrigation water needs to be carefully controlled. Application of feedlot manure or commercial fertilizer is needed to maintain the organic matter content and improve the fertility of these soils.

The soils in this complex are suited to introduced grasses for pasture. Use of these soils for pasture is an effective way to control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be used as part of a cropping sequence that includes row crops. Overgrazing causes deterioration of desired grasses. Proper stocking, rotation grazing, and weed control help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of grasses.

These soils provide a fair site for trees and shrubs in windbreaks. Capability is good for the survival and fair for the growth of adapted species. Drought and competition for moisture from weeds and grasses are the main management concerns. Planting trees on the contour and terracing help to prevent erosion and control runoff. Cultivating between the rows and using appropriate herbicides in the row or hoeing by hand help to control weeds and grasses. Irrigation can provide supplemental moisture during periods of inadequate rainfall. On the Crofton soil, trees and shrubs should be selected that tolerate excessive amounts of lime.

Areas of Crofton soil are suited to septic tank absorption fields. In areas of Nora soil the moderate permeability may be a limitation, but this limitation generally can be overcome by increasing the size of the absorption area. For sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining or sealing the floor to prevent seepage is also needed.

Areas of the Crofton soil are suited to the construction of dwellings and buildings. In areas of Nora soil, the foundations need to be strengthened and backfilled with coarse material to prevent damage by shrinking and swelling of the soil. For both soils, small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance. In areas of Nora soil, crowning the road by grading and constructing adequate side ditches help to provide good surface drainage and reduce the damage by frost action.

The soils in this complex are in capability units IIIe-8, dryland, and IIIe-3, irrigated. The Nora soil is in the Silty range site, and the Crofton soil is in the Limy Upland range site. The Nora soil is in windbreak suitability group 3, and the Crofton soil is in windbreak suitability group 8.

NpD2—Nora-Crofton complex, 6 to 11 percent slopes, eroded. This complex consists of deep, well drained, strongly sloping soils on ridgetops and side slopes of uplands. These soils formed in loess. Erosion has removed most of the original surface layer. In areas of Nora soil, the upper part of the subsoil has been mixed with the remaining part of the surface layer. If these areas are cultivated, the soil is patchy brown and grayish brown. Rills are common after heavy rains. Areas range from 10 to several hundred acres. This complex is 45 to 65 percent Nora soil on the lower side slopes and 30 to 45 percent Crofton soil on the narrow ridgetops and upper side slopes. Areas of the soils are so small or so intricately mixed that it is not practical to separate them in mapping.

Typically, the Nora soil has a surface layer of brown, friable silty clay loam about 5 inches thick. The friable, silty clay loam subsoil is about 16 inches thick. It is brown in the upper part and pale brown and calcareous in the lower part. The underlying material is pale brown and very pale brown, calcareous silt loam to a depth of 60 inches. Lime is at a depth of about 14 inches. In some areas, the surface layer is silt loam.

Typically, the Crofton soil has a surface layer of pale brown, very friable, calcareous silt loam about 5 inches thick. Below this is a transitional layer of pale brown, friable, calcareous silt loam about 3 inches thick. The underlying material is calcareous silt loam. It is pale brown in the upper part and very pale brown in the lower part to a depth of 60 inches. Small lime concretions are commonly on the surface and throughout the soil. In some small areas, the soil is gray, and in other areas the soil is reddish brown.

Included with this complex in mapping are small areas of Alcester, Hobbs, Kezan, and Moody soils. Alcester soils are on foot slopes. They are in a lower position on the landscape than Nora and Crofton soils. Hobbs soils are on bottom lands of narrow intermittent drainageways and are also in a lower position. These soils are occasionally flooded. Kezan soils are on bottom lands in a lower position on the landscape and are poorly drained. Moody soils have more clay in the subsoil. They are higher on the landscape than the Nora and Crofton soils. The included soils make up 5 to 20 percent of the complex.

The permeability of the Nora and Crofton soils is moderate, and the available water capacity is high. Runoff is rapid. The intake rate of water is moderate in both soils. The organic matter content is moderately low in the Nora soil and low in the Crofton soil. Natural fertility is medium in the Nora soil and low in the Crofton soil. The surface layer of the Crofton soil is very friable, and it is easily tilled through a fairly wide range of moisture conditions. The surface layer of the Nora soil is not so friable, and it becomes cloddy when it is tilled. Both soils release moisture readily to plants. The Crofton soil is low in available phosphorus and zinc.

Most of the acreage of this complex is cultivated, but a few areas are seeded to introduced grasses and are used for grazing.

Under dryland farming, these soils are suited to corn, soybeans, grain sorghum, oats, and alfalfa. Water erosion and drought are the principal hazards. Conservation tillage practices, such as discing, chiseling, and no-till planting, help to prevent erosion and conserve soil moisture. Terraces and grassed waterways also help to prevent water erosion (fig. 15). Applications of feedlot manure and commercial fertilizers help to increase the fertility of these soils.

These soils are poorly suited to irrigation. Only a sprinkler system can be used. Close-sown crops and legumes are better suited than row crops. Corn, soybeans, and grain sorghum can be grown if the irrigation water is properly managed. Water erosion is the principal hazard. Terraces and grassed waterways help to control erosion and runoff. Conservation tillage practices, such as discing and chiseling, help to control erosion and conserve soil moisture. If pivot irrigation is used, care needs to be taken to prevent erosion of wheel tracks. Applying feedlot manure and commercial fertilizers and returning crop residue to the soil help to maintain or improve the organic matter content and fertility of these soils.

The soils in this complex are suited to introduced grasses for pasture. Use of the soils for pasture is an effective way to control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season

Figure 15.—Parallel terraces and a close-growing crop, such as alfalfa, are used to effectively control water erosion on this area of Nora-Crofton complex, 6 to 11 percent slopes, eroded. This complex is in capability unit IIIe-8, dryland.

grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pastures grasses can also be used in rotation with cultivated crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the desired grasses in good condition and control weeds. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of grasses.

The soils in this complex are suited to native grass for rangeland. Use of these soils for range is an effective way to control both wind and water erosion. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and permits less productive grasses and weeds to become established. Overgrazing also results in severe soil losses by water erosion. Proper grazing use, timely deferment from grazing or haying, and a planned grazing system help to maintain and improve the range condition. Seeding native grasses may be needed on severely eroded areas of cropland to establish a protective cover that can control erosion.

These soils provide a fair site for planting trees and shrubs in windbreaks. Capability is fair for the survival and growth of adapted species. Drought, competition for moisture from weeds and grasses, and water erosion are the main management concerns. Cultivation between the rows and careful use of appropriate herbicides in the tree row help to control undesirable weeds and grasses. Planting trees on the contour and terracing help to control erosion and runoff. Irrigation can provide supplemental moisture during periods of inadequate rainfall. In areas of Crofton soil, trees and shrubs that tolerate an excessive amount of calcium carbonate should be selected for planting.

Land shaping and contouring are needed for the construction of septic tank absorption fields on these soils. Moderate permeability is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area. For sewage lagoon areas, extensive grading is required to modify the slope and shape the lagoon.

Dwellings and small commercial buildings need to be designed to accommodate the slope, or the soil should be graded to an acceptable level. Foundations for buildings constructed on areas of Nora soil need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material can ensure better performance. Crowning the roadbed by grading and constructing adequate side ditches provide good surface drainage and reduce the damage by frost action.

The soils in this complex are in capability units IIIe-8, dryland, and IVe-3, irrigated. The Nora soil is in the Silty range site, and the Crofton soil is in the Limy Upland range site. The Nora soil is in windbreak suitability group 3, and the Crofton soil is in windbreak suitability group 8.

Og—Ord fine sandy loam, 0 to 2 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom lands of the Elkhorn River valley. It is subject to occasional flooding. Areas range from 3 to 80 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown, very friable fine sandy loam about 7 inches thick. Below this is a transitional layer of brown, friable fine sandy loam about 10 inches thick. The underlying material, to a depth of 60 inches, is light yellowish brown loamy fine sand in the upper part and pale brown fine sand that has thin strata of fine sandy loam and loam in the lower part. In a few small areas the surface layer is loam or silt loam, and in other small areas the surface layer is 20 to 26 inches thick.

Included with this soil in mapping are small areas of Blendon, Boel, Cass, and Inavale soils. The well drained Blendon soils are on stream terraces. They are in a higher position on the landscape than Ord soil. Boel soils have sandy underlying material higher in the profile than Ord soil and are in a similar position on the landscape. The well drained Cass soils are in a slightly higher position. The somewhat excessively drained Inavale soils are in a higher position. The included soils make up about 5 to 15 percent of the map unit.

The permeability of this Ord soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. This soil has a seasonal high water table that fluctuates from a depth of about 1.5 feet in most wet years to a depth of about 3.5 feet in most dry years. The water table is generally highest in spring and is commonly at a depth of about 3 feet during the growing season. The organic matter content is moderately low, and natural fertility is medium. The intake rate of water is moderately high. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated, but some areas are in native grass and are used for grazing or mowed for hay. A small acreage is irrigated.

Under dryland farming, this soil is suited to corn, soybeans, and grain sorghum. Legumes are also suited. Spring-sown small grain is generally not grown because of wetness early in spring. Ditches or perforated tile can be used to improve the drainage if a suitable outlet is available. Soil blowing is a hazard if the surface layer is not protected by a vegetative cover. Conservation tillage practices that keep all or most of the crop residue on the surface help to prevent soil blowing and reduce evaporation of soil moisture.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa are grown. Because of wetness, tillage is commonly delayed in the spring of most years. Tile drainage can be installed or V-ditches can be constructed if a suitable outlet is available. Land leveling helps to improve surface drainage and increase the efficiency of the irrigation system. Deep cuts that expose the fine sand of the underlying material should be avoided. Frequent, light applications of water help to prevent leaching of water and herbicides through the soil. Conservation tillage practices, such as no-till planting, keep crop residue on the surface and help to control soil blowing and conserve soil moisture.

This soil is suited to introduced grasses for pasture or hay. Cool-season grasses, such as smooth brome, creeping foxtail, or reed canarygrass, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be alternated with row crops in the cropping system. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking, rotation grazing, and weed control help to keep the desired grasses in good condition. Pasture grasses generally respond to nitrogen fertilizer and irrigation water.

The use of this soil for rangeland is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native grasses. A planned grazing system, proper grazing use, deferred grazing, and restricted use during very wet periods help to keep the grasses in good condition.

This soil is suited to trees and shrubs that can tolerate a seasonal high water table and occasional flooding.

Capability is good for the survival and growth of seedlings. The establishment of seedlings can be difficult in wet years. Soil blowing is a hazard. Undesirable grasses and weeds can be controlled by cultivation between the trees and by careful use of appropriate herbicides. Areas near the trees can be hoed by hand.

This soil is not suited to septic tank absorption fields because of flooding, wetness, and the poor filtering ability of the sandy underlying material. An alternate site is needed. Sewage lagoons need to be constructed on well compacted fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. In addition, the lagoon should be diked as protection from flooding, and the floor of the lagoon should be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is not suitable for the construction of buildings because of flooding and wetness from the seasonal high water table. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect roads from flood damage and wetness. In addition, using a gravel moisture barrier in the subgrade and crowning the roadbed by grading help to provide good drainage and reduce the damage by frost action.

This soil is in capability units IIw-6, dryland, and IIw-8, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

Oh—Ord silt loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom lands of the Elkhorn River valley. It is subject to occasional flooding. Areas range from 3 to 75 acres.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is very dark gray, friable silt loam about 10 inches thick. Below this is a transitional layer of gray, very friable fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is stratified fine sand and loamy fine sand. It is light brownish gray in the upper part, light gray in the middle part, and light brownish gray in the lower part. In a few small areas the surface layer is fine sandy loam. In other small areas the surface layer is 20 to 26 inches thick.

Included with this soil in mapping are small areas of Blendon, Boel, Cass, and Inavale soils. The well drained Blendon soils are on stream terraces. They are in a higher position on the landscape than Ord soil. The well drained Cass soils are in a slightly higher position. Boel soils have more sand in the profile. They are in a position on the landscape similar to Ord soil. The somewhat excessively drained Inavale soils are in a slightly higher position. The included soils make up about 3 to 10 percent of the map unit.

The permeability of this Ord soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. This soil has a seasonal high water table that fluctuates from a depth of about 1.5 feet in most wet years to a depth of about 3.5 feet in most dry years. The water table is generally highest in the spring and is commonly at a depth of 3 feet during the growing season. The organic matter content is moderate, and natural fertility is medium. The intake rate of water is moderately high. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated, but some areas are in native grass or are seeded to introduced grasses. These areas are used for grazing or mowed for hay. Some small areas are irrigated.

Under dryland farming, this soil is suited to corn, soybeans, grain sorghum, and alfalfa. Spring-sown small grain is generally not grown because of the wetness early in spring. Wetness commonly delays tillage early in spring. V-ditches can be constructed or tile can be installed to improve the drainage if a suitable outlet is available. Conservation tillage practices, such as discing or no-till planting, keep crop residue on the surface and help to improve the organic matter content and conserve soil moisture. Cover crops help to prevent runoff and soil blowing. Application of feedlot manure helps to improve the fertility of the soils.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa are grown. Because of wetness, tillage is commonly delayed in the spring of most years. Tile can be installed or V-ditches can be constructed if a suitable outlet is available. Land leveling helps to improve surface drainage and increase the efficiency of the irrigation system. Deep cuts that expose the fine sand of the underlying material should be avoided. Frequent, light applications of water are needed to prevent leaching of water and herbicides through the soil. Returning crop residue to the soil and applying feedlot manure help to maintain fertility. Conservation tillage practices, such as no-till planting, keep crop residue on the surface and help to maintain the organic matter content and conserve soil moisture.

This soil is suited to introduced pasture grasses for grazing or hay. Cool-season grasses, such as smooth brome, creeping foxtail, or reed canarygrass, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be alternated with row crops in the crop rotation. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Grazing when the soil is wet causes compaction. Proper stocking and rotation grazing help to keep the grasses in good condition. Pasture grasses generally respond to nitrogen fertilizer and irrigation water.

This soil is suited to rangeland and can be used for either grazing or haying. Overgrazing, improper timing of haying, or mowing to improper heights causes deterioration of the native plants. Grazing when the soil is wet causes compaction. Proper grazing use, timely deferment from grazing, and restricted use during very wet periods help to maintain the native plants in good condition.

This soil is suited to trees and shrubs that can tolerate a seasonal high water table and occasional flooding. Capability is good for the survival and growth of adapted species. The establishment of seedlings can be difficult in wet years. Competition from undesirable grasses and weeds is a common concern, but grasses and weeds can be controlled by cultivation between the rows and by careful use of appropriate herbicides. Areas near the trees can be hoed by hand.

This soil is not suited to septic tank absorption fields because of wetness, flooding, and the poor filtering ability of the sandy underlying material. An alternate site is needed. Sewage lagoons should be constructed on suitable fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table, and the floor of the lagoon should be lined or sealed to prevent seepage. In addition, the lagoon needs to be diked as protection from flooding. Walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is not suitable for the construction of buildings because of flooding and wetness. An alternate site is needed.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the road from flood damage and wetness. In addition, using a gravel moisture barrier in the subgrade and crowning the roadbed by grading help to reduce the damage by frost action.

This soil is in capability units IIw-4, dryland, and IIw-8, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

OrC—Ortello fine sandy loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. It formed in mixed eolian sand and loess. Areas range from 5 to 25 acres.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 10 inches thick. The subsoil is brown, very friable fine sandy loam about 9 inches thick. The underlying material is light yellowish brown loamy fine sand to a depth of 60 inches. In some small areas, silt loam is below a depth of 40 inches. In other small areas the dark surface layer is 20 to 26 inches thick.

Included with this soil in mapping are small areas of Boelus, Loretto, and Thurman soils. The Boelus and Loretto soils have more clay in the subsoil and are in positions on the landscape similar to Ortello soil. The somewhat excessively drained Thurman soils are in a higher position. The included soils make up 10 to 15 percent of the map unit.

The permeability of this Ortello soil is moderately rapid in the subsoil and rapid in the underlying material. The available water capacity is moderate. The organic matter content is moderately low, and natural fertility is medium. The intake rate of water is moderately high. Runoff is slow. The surface layer is easily tilled through a wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is used for cultivated crops, but a few areas are in native grass or are seeded to introduced grasses. These areas are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, oats, and alfalfa. Wind erosion and water erosion are the principal hazards. Conservation tillage practices, such as discing or chiseling, keep crop residue on the surface and help to control erosion and conserve soil moisture. Cover crops are also helpful. This soil is droughty during years of below average rainfall. Contour farming, stripcropping, and field windbreaks reduce the risk of erosion and help to conserve moisture.

If irrigated, this soil is suited to a gravity system of irrigation, but a sprinkler system is generally more practical. Corn, soybeans, and alfalfa can be grown. Applications of water should be light but frequent to prevent leaching of nutrients below the root depth. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to control erosion and conserve moisture. Returning crop residue to the soil and applying feedlot manure help to maintain the organic matter content and improve fertility.

This soil is suited to introduced grasses for grazing or hay. Use of this soil for pasture is an effective way to control erosion. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season for grazing. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water improve the vigor and growth of grasses.

This soil is suited to rangeland. Use of this soil for range is an effective way to control soil blowing and water erosion. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native plants. Severe losses by soil blowing can result if the range is in poor condition. Proper grazing use, timely deferments from grazing or haying, and a planned grazing system help to maintain or improve the range condition.

This soil provides a good site for trees and shrubs in windbreaks. Capability is fair for the survival and growth of adapted species. Soil blowing is the principal hazard.

Droughtiness and competition for moisture from weeds and grasses are the main management concerns. Soil blowing can be contolled by maintaining strips of sod or a cover crop between the tree rows. Weeds and grasses can be controlled by use of appropriate herbicides in the tree row, or the areas can be hoed by hand or roto-tilled.

This soil is suited to use as septic tank absorption fields if extreme care is taken to assure that pollution by seepage does not contaminate the underground water table. Lining or sealing the floor of the sewage lagoon is needed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is suited to the construction of dwellings. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level. Crowning the roadbed by grading and constructing adequate side ditches can provide good surface drainage and reduce the damage to roads by frost action.

This soil is in capability units IIIe-3, dryland, and IIIe-8, irrigated. It is in the Sandy range site and windbreak suitability group 5.

OvB—Ovina loamy fine sand, 0 to 3 percent slopes. This deep, somewhat poorly drained, very gently sloping soil is on stream terraces. It is subject to rare flooding. Areas range from 10 to 50 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 8 inches thick. The subsurface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The underlying material is pale brown, very friable loamy fine sand in the upper part; pale brown loam and light brownish gray, mottled clay loam in the middle part; and light gray, mottled fine sand to a depth of 60 inches in the lower part. In some small areas the surface layer is fine sandy loam, and in other small areas the soil is better drained than is typical.

Included with this soil in mapping are small areas of Elsmere and Thurman soils. The somewhat poorly drained Elsmere soils are in a lower position on the landscape than Ovina soil. The somewhat excessively drained Thurman soils are on stream terraces and are in a higher position. The included soils make up 5 to 12 percent of the map unit.

The permeability of this Ovina soil is moderate in the upper part of the profile and rapid in the lower part. The available water capacity is moderate, and the intake rate of water is high. Runoff is slow. The organic matter content is moderately low, and natural fertility is medium. This soil has a seasonal high water table that fluctuates from a depth of about 2 feet in most wet years to a depth of about 4 feet in most dry years. Moisture is released readily to plants. This soil is easily tilled through a fairly wide range of moisture conditions.

Most of the acreage of this soil is used for cultivated crops. Both dryland and irrigated crops are grown. Some of the acreage is in native grass or seeded to introduced grasses. These areas are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, soybeans, grain sorghum, and alfalfa. Wetness is the principal hazard. Small grain, such as oats, is grown in lesser amounts than other crops. Conservation tillage practices, such as discing, chiseling, or no-till planting, help to conserve water and control soil blowing. Returning crop residue to the soil helps to maintain fertility and the organic matter content. Field windbreaks help to control soil blowing. Application of feedlot manure helps to increase fertility.

If irrigated, this soil is suited to a sprinkler system of irrigation. It is not suited to a gravity system because of the high water intake rate. Corn, soybeans, and alfalfa can be grown. No-till planting, discing, or chiseling keeps crop residue on the surface and helps to conserve soil moisture and control soil blowing. Because of the high water intake rate, frequent light applications of water are needed. Applications of feedlot manure and commercial fertilizer help to improve the fertility of the soil.

This soil is suited to introduced grasses for pasture. Use of the soil for pasture is an effective way to control soil blowing. Cool-season grasses, such as smooth brome, orchardgrass, and creeping foxtail, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be used in rotation with row crops. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Rotation grazing and proper stocking help to keep desired grasses in good condition. Weed control is needed to maintain the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the vigor and growth of introduced grasses.

This soil is suited to rangeland and can be used for either grazing or haying. Use of the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and permits less desirable grasses and weeds to become established. Grazing when the soil is wet results in compaction. Proper grazing use, timely deferment from grazing, and restricted use during very wet periods help to maintain the native plants in good condition.

This soil provides a fair site for the planting of trees and shrubs in windbreaks. The trees and shrubs selected should be able to withstand wetness from a moderately high water table. Capability is fair for the survival and growth of adapted species. Soil blowing, which can result in the covering of seedlings by drifting sand during high winds, is the principal hazard. Trees need to be planted in a shallow furrow where there is as little soil disturbance as possible. Sod should be maintained between the rows and in the rows. Areas near the trees can be hoed by hand.

The hazard of rare flooding needs to be considered if this soil is used for sanitary facilities and building sites. Septic tank absorption fields need to be constructed on fill material so that the absorption field is placed at a sufficient height above the seasonal high water table. Sewage lagoons also need to be constructed on fill material so that the bottom of the lagoon is raised sufficiently above the seasonal high water table. In addition, lining or sealing the floor of the lagoon is needed to prevent seepage, and diking is needed to protect from flooding.

Dwellings and buildings need to be constructed on elevated, well compacted fill material to protect against flooding and wetness caused by the seasonal high water table.

Roads should be constructed on suitable, well compacted fill material above the flood level and adequate side ditches and culverts should be provided to help protect the roads from flooding and wetness. The damage to roads by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the roadbed by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is in capability units IIIw-5, dryland, and IIIw-10, irrigated. It is in the Subirrigated range site and windbreak suitability group 2S.

Pb—Pits and Dumps. This map unit consists mainly of mounds of gravel, sand, and overburden, together with adjacent pits that contain water. The dumps of sand and gravel are storage areas for material used in construction, mainly of buildings and roads. This area also stores the pump equipment, roads, and loading docks used in the mining of sand and gravel. Areas range from 5 to 80 acres.

Typically, the earthen material to a depth of 60 inches consists of a mixture of fine, medium, and coarse sand and fine gravel. The material is principally recently deposited waste sand. There is no development of a soil profile.

Included with this unit in mapping are small areas of Boel and Inavale soils. Both of these soils are in a lower position than the dumps of sand but are in a higher position than the pit areas. These soils have not been disturbed or covered with sand or gravel. The included soils make up 3 to 25 percent of the map unit.

The permeability of Pits and Dumps is very rapid or rapid, and the available water capacity is very low. The organic matter content is very low, and fertility is low. The water level in a pit is generally 5 to 10 feet below that of the soil surface. The mounds of sand are devoid of vegegation; but within a year or two, after the mining of sand and gravel has ceased, sparse vegetation appears. Runoff is very slow.

Most of the acreage of this unit is used for the commercial mining of sand and gravel. In some areas, commercial mining has stopped and the areas are used as habitat for wildlife or for recreational purposes.

This unit is not suited to cultivated crops or introduced grasses. In areas where sand and gravel are no longer mined, vegetation gradually becomes established. Native grasses can be grown in these places if the areas are shaped and topsoil is replaced. A suitable seedbed needs to be prepared. Heavy mulching before seeding helps to protect the seedlings from blowing sand. Species that are adapted to dry sandy soils are most suitable.

This unit is not suited to trees and shrubs in windbreaks. However, plantings of tolerant trees and shrubs can be made if they are hand planted or if special practices are used. Trees require special care after planting if they are to survive. Newly planted trees may need supplemental watering, and seedlings need to be protected from blowing sand. A wooden barrier can provide this protection, or a native grass cover can be maintained among the individual trees. This unit is suitable as habitat for wetland wildlife. Some areas can be used for recreation.

If these areas are reshaped and stabilized, they are suited to recreational purposes. Roads can be constructed for accessibility to the lakes. Picnic areas can be built. The water areas can be developed for fishing and boating. The fine sand material provides excellent beaches for sunbathing and relaxation. Swimming areas can be developed if the mounds of sand are graded back into the lakes to reduce depth of the water.

These areas are not suited to septic tank absorption fields because they are subject to pollution by seepage. An alternate site is needed. Sewage lagoons are generally not suited because of rapid seepage and unstable soil material.

Summer cottages and permanent homes can be constructed around the shore lines of abandoned pits if the locations are carefully selected and protected from flooding. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Temporary roads can be constructed, but generally the sandy material needs to be stabilized by using gravel or asphalt material in construction.

This map unit is in capability unit VIIIs-8, dryland, and windbreak suitability group 10. It is not assigned to a range site.

Rw—Riverwash. This map unit consists of sandbars and islands adjacent to channels of the Elkhorn River. Areas are poorly drained and are frequently flooded. They are often reworked and shifted by floodwaters of the river. These areas are commonly channeled and are nearly void of vegetation. Slopes range from 0 to 2 percent. The areas are 5 to 20 acres.

Typically, the soil material is fine sand and coarse sand with a small percentage of gravel. It commonly contains thin strata of silty, clayey, and loamy material.

Included with this unit in mapping are small areas of Barney soils in a slightly higher position on the landscape. The included soil makes up 5 to 8 percent of the map unit.

The permeability of Riverwash is rapid, and the available water capacity is low. Runoff is slow. The seasonal high water table ranges from about 1 foot above the surface in most wet years to about 2 feet below the surface in most dry years. The organic matter content is very low, and natural fertility is low.

Most of the acreage of this map unit is adjacent to river channels and has little or no vegetation. Other areas that have been in place for several years commonly have a sparse stand of grass, shrubs, willows, or cottonwood trees. Most areas are used as habitat for wetland wildlife.

This unit is not suited to cropland, introduced grasses, or native grasses because it is subject to frequent flooding and has a seasonal high water table. It is not suited to trees and shrubs in windbreaks.

This unit is not suited to sanitary facilities or to the construction of buildings because of flooding and wetness. Alternate sites are needed.

Roads and streets can be constructed on suitable, well compacted fill material and provided with culverts, bridges, and side ditches as protection from flooding and wetness.

This map unit is in capability unit VIIIw-7, dryland, and windbreak suitability group 10. It is not assigned to a range site.

Sm—Shell loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on bottom lands. It is subject to occasional flooding. Areas range from 5 to several hundred acres.

Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsurface layer is dark grayish brown, very friable loam about 9 inches thick. Below this is a transitional layer of grayish brown silt loam about 9 inches thick. The underlying material is stratified, brown silt loam to a depth of 60 inches. In a few small places the surface layer is silty clay loam. In some small areas, fine sand is below a depth of 40 inches. In other small areas, silty clay is below a depth of 40 inches.

Included with this soil in mapping are small areas of Blendon, Hobbs, and Kezan soils. The moderately coarse-textured Blendon soils are in a slightly higher position on the landscape than Shell soil. The poorly drained Kezan soils are on narrow bottom lands and are in a lower position. Hobbs soils are in narrow upland drainageways. The included soils make up about 10 to 15 percent of the map unit.

The permeability of this Shell soil is moderate, and the available water capacity is high. Runoff is slow. The organic matter content is moderate, and natural fertility is high. The intake rate of water is moderate. The surface layer is easily tilled through a fairly wide range of moisture conditions. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated. A few areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, soybeans, grain sorghum, alfalfa, and oats. In some years, flooding delays planting and cultivation of crops. Weed control and maintenance of a high level of fertility are the main concerns of management. Conservation tillage practices, such as discing, chiseling, and no-till planting, help to maintain the tilth and workability of this soil and conserve soil moisture. Application of feedlot manure helps to maintain fertility.

If irrigated, this soil is suited to both sprinkler and gravity systems of irrigation. Corn and alfalfa are grown. Land leveling helps to improve surface drainage and increase the efficiency of the irrigation system. Conservation tillage practices that keep crop residue on the surface help to conserve soil and moisture and maintain high fertility.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water during dry periods in summer increase the vigor and growth of introduced grasses.

This soil is well suited to trees and shrubs in windbreaks. Species that are climatically adapted have a good chance for survival and growth. Competition from grasses and weeds for moisture and sunlight is a concern in establishing trees on this soil. Weeds can be controlled by cultivation between the rows and careful use of appropriate herbicides or by roto-tilling in the tree row.

This soil is not suited to septic tank absorption fields and the construction of dwellings because it is occasionally flooded. An alternate site is needed. Sewage lagoons need to be diked as protection from flooding and the floor of the lagoon should be lined or sealed to prevent seepage.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarse-grained material for the subgrade or base material ensures better performance. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect roads from flood damage.

This soil is in capability units IIw-3, dryland, and IIw-6, irrigated. It is in the Silty Lowland range site and windbreak suitability group 1.

Sn—Shell silty clay loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on high bottom lands. It is subject to occasional flooding. Areas range from 15 to several hundred acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsurface layer is grayish brown, friable silty clay loam about 18 inches thick. The upper part of the underlying material is stratified, dark grayish brown and light brownish gray silty clay loam. The lower part is a buried soil that is very dark grayish brown silty clay loam in the upper part and dark grayish brown silty clay loam in the lower part to a depth of 60 inches.

Included with this soil in mapping are areas of somewhat poorly drained Colo soils and stratified Hobbs soils. Both of these soils are in a lower position on the landscape than Shell soil. The included soils make up 5 to 10 percent of the map unit.

The permeability of this Shell soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. Runoff is slow. Tilth is good. The intake rate of water from irrigation is moderate. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated. Many areas are irrigated. A few small areas are in range or are seeded to introduced grasses.

Under dryland farming, this soil is suited to corn, soybeans, oats, grain sorghum, and alfalfa. In some years, flooding delays the planting and cultivation of crops. Diversions help to control flooding. Conservation tillage practices, such as discing or chiseling, keep all or most of the crop residue on the surface and help to conserve moisture for use by crops (fig. 16). A no-till planting system can be used for row crops. Applying feedlot manure helps to maintain the organic matter content and fertility of the soil.

If irrigated, this soil is suited to both sprinkler and gravity systems of irrigation. Corn, soybeans, and close-sown crops, such as alfalfa, can be grown. Land leveling and use of a tailwater recovery system can increase the efficiency of water use under gravity irrigation. The application rate of water needs to be adjusted to avoid exceeding the intake rate of the soil. Surface drainage and V-ditches help to remove floodwaters. The damage

Figure 16.—Conservation tillage practices conserve moisture and improve the content of organic matter on Shell silty clay loam. This soil is used for irrigated cropland. It is in capability unit IIw-3, irrigated.

from flooding, however, is generally slight. Conservation tillage practices that keep crop residue on the surface help to conserve soil moisture and improve the intake of water.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used for a long season of grazing. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water can increase the vigor and growth of grasses.

This soil is suited to rangeland. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of the native grasses. Proper grazing use, a planned grazing system, and timely deferment from grazing or haying help to maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. Healthy seedlings of adapted species, properly planted in a well prepared site, generally survive and grow well. Cultivating between the tree rows and hoeing in the row or careful use of appropriate herbicides help to control weeds and undesirable grasses. Newly planted trees may need watering during periods of insufficient rainfall.

This soil is not suited to septic tank absorption fields or the construction of buildings because it is occasionally flooded. An alternate site is needed. Sewage lagoons need to be diked as protection from flooding, and the floor of the lagoon lined or sealed to prevent seepage.

Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help to protect the roads from flood damage. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance.

This soil is in capability units IIw-3, dryland, and IIw-3, irrigated. It is in the Silty Lowland range site and windbreak suitability group 1.

Sv—Shell Variant silty clay loam, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on bottom lands. It is subject to occasional flooding. Areas range from 10 to 80 acres.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 6 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 11 inches thick. The underlying material is brown and dark grayish brown silty clay loam. Below this is a buried soil of silty clay. It is very dark gray in the upper part and dark gray in the lower part. In a few small areas, silty clay is below a depth of 40 inches. In other small areas the underlying material is silt loam.

Included with this soil in mapping are small areas of somewhat poorly drained Colo and Lamo soils on bottom lands. Both of these soils are in slightly lower positions on the landscape than Shell Variant soil. The included soils make up about 3 to 10 percent of the map unit.

The permeability of this Shell Variant soil is moderate in the upper part of the profile and slow in the lower part. The available water capacity is high. The organic matter content is moderate, and natural fertility is high. This soil has a perched seasonal high water table that ranges from a depth of 2 feet in most wet years to a depth of 3.5 feet in most dry years. Runoff is slow. The soil is easy to till if it is dry but tends to clod if it is wet. Moisture is released slowly to plants.

Most of the acreage of this soil is cultivated. A small acreage is seeded to introduced grasses and is used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, soybeans, oats, and grain sorghum. Alfalfa can be grown for hay and pasture. Wetness caused by the perched water table is the principal limitation. The water table occurs mainly in spring when rainfall is heaviest. Surface drainage is needed in places. Diversions help to prevent flooding from runoff from the higher lying soils. Conservation tillage practices, such as discing, chiseling, or no-till planting, keep crop residue on the surface and help to improve tilth and prevent evaporation of soil moisture.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn and alfalfa are the main crops. Surface drainage is needed in some areas. The slow permeability of the clayey material causes a perched water table, which results in minor problems associated with wetness. A small amount of land leveling is generally needed for gravity irrigation. Excessive application of water can result in ponding. Conservation tillage practices, such as discing and chiseling, keep crop residue on the surface and help to prevent the loss of soil moisture by evaporation.

This soil is suited to cool-season grasses for pasture. Smooth brome, orchardgrass, or tall fescue can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Pasture grasses can also be alternated with row crops as part of the cropping system. Overgrazing reduces the protective vegetative cover and causes deterioration of desired grasses. Grazing when the soil is wet causes compaction. Proper stocking and rotation grazing help to keep the grasses in good condition. Irrigated pastures generally respond to nitrogen fertilizer.

This soil is suited to trees and shrubs in windbreaks. Capability is good for the survival and growth of seedlings. Competition from weeds and undesirable grasses is the principal concern of management, but weeds can be controlled by cultivation between the rows and careful use of appropriate herbicides or by roto-tilling in the tree row.

This soil is not suited to septic tank absorption fields or the construction of dwellings because it is occasionally flooded. An alternate site is needed. Sewage lagoons should be diked as protection from flooding. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil.

Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance. Providing a gravel moisture barrier in the subgrade, crowning the roadbed by grading, and constructing adequate side ditches can provide needed surface drainage and reduce the damage by frost action.

This soil is in capability units IIw-2, dryland, and IIw-3, irrigated. It is in the Silty Lowland range site and windbreak suitability group 1.

ThB—Thurman loamy fine sand, 1 to 3 percent slopes. This deep, somewhat excessively drained, very gently sloping soil is on low ridges and side slopes of sandy uplands (fig. 17). It formed in eolian sand. Areas range from 3 to several hundred acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 11 inches. Below this is a transitional layer of grayish brown, very friable loamy fine sand about 5 inches thick. The underlying material is brown loamy fine sand in the upper part and light yellowish brown fine sand in the lower part to a depth of 60 inches. In places the plowed layer is grayish brown fine sand. In some small areas the surface layer is 20 to 26 inches thick. In other areas the surface layer is 6 to 10 inches thick. In some small areas the soil is gently sloping. In a few small areas, a silty or loamy layer is below a depth of 40 inches.

Included with this soil in mapping are small areas of Boelus, Elsmere, Hadar, Loretto, and Valentine soils. Boelus, Hadar, and Loretto soils are well drained. They are in slightly lower positions on the landscape than Thurman soil. Elsmere soils are somewhat poorly drained. They are on stream terraces. Valentine soils are excessively drained. They are in a higher position than Thurman soil. The included soils make up about 10 to 20 percent of the map unit.

The permeability of this Thurman soil is rapid, and the available water capacity is low. Runoff is slow. The organic matter content and natural fertility are low. The intake rate of water is very high. This soil is low in available phosphorus and calcium. It is easily tilled, moist or dry. Moisture is released readily to plants.

Most of the acreage of this soil is cultivated, but some areas are in native grass or seeded to introduced grasses. These areas are used for grazing or mowed for hay.

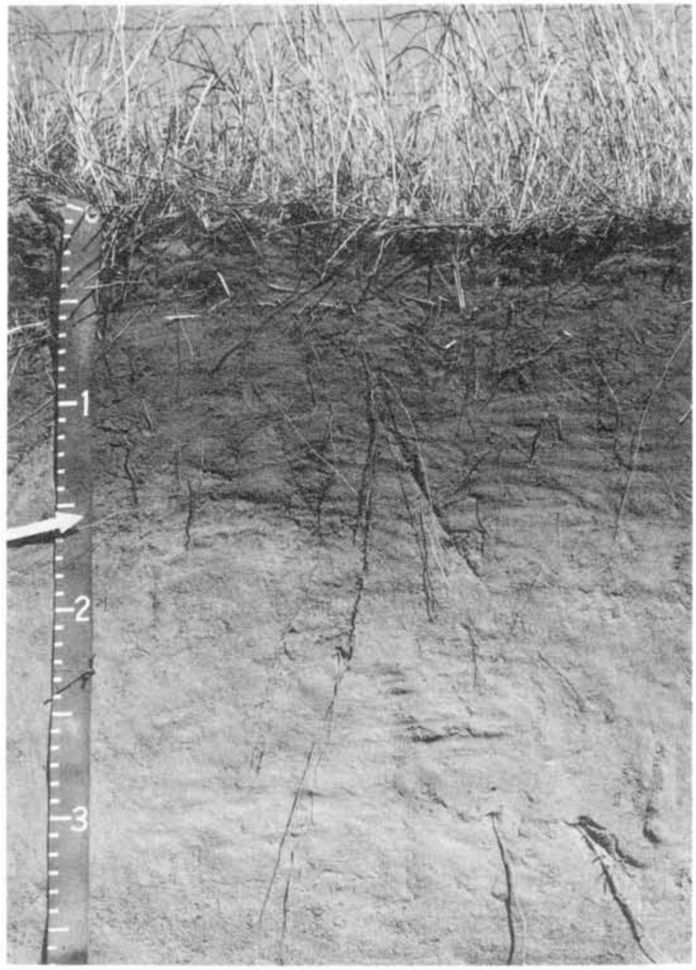

Figure 17.—Profile of Thurman loamy fine sand. This deep soil formed in eolian, sandy material and has a thick surface layer. Depth is marked in feet.

Under dryland farming, this soil is suited to corn, grain sorghum, rye, oats, and alfalfa. Soil blowing is the principal hazard. The low available water capacity, which causes droughtiness, is a limitation. Conservation tillage practices, such as discing, chiseling, or no-till planting, help to prevent soil blowing. The use of field windbreaks and cover crops also help to control soil blowing. Keeping crop residue on the surface helps to conserve soil moisture.

If irrigated, this soil is suited only to a sprinkler system of irrigation because of uneven slopes and the very high intake rate of water. Gravity irrigation is not suited. Corn and alfalfa are grown. Low fertility is a concern of management. Deep cuts during land leveling should be avoided because of the danger of exposing the underlying material of fine sand. Light, frequent applications of water are needed. Excessive amounts of water leach fertilizer and herbicides below the plant roots. A protective vegetative cover is needed to protect the soil from blowing. Conservation tillage practices, such as chiseling, keep crop residue on the surface and help to prevent soil blowing. Stripcropping and narrow field windbreaks also help to control soil blowing.

This soil is suited to introduced grasses for pasture. Use of this soil for pasture is an effective way to control soil blowing. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. In addition, introduced grasses can be used as part of a cropping sequence that is alternated with row crops. Overgrazing reduces the protective vegetative cover, causes deterioration of desired grasses, and results in severe losses by soil blowing. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of grasses.

This soil is suited to rangeland. Use of the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover, causes deterioration of desired grasses, and results in severe losses by soil blowing. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain or improve the range condition.

This soil generally provides a good site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Droughtiness is the main limitation, and soil blowing is the principal hazard. Soil blowing can be prevented by maintaining strips of sod or by planting a cover crop between the rows. Cultivation should be restricted to the tree row. Undesirable grasses and weeds in the row can be hoed by hand or controlled by careful use of appropriate herbicides.

This soil is suited to septic tank absorption fields, but extreme care needs to be taken to assure that pollution by seepage does not contaminate the underground water table. Lining or sealing the floor of the lagoon is needed to prevent seepage.

This soil is suited to the construction of dwellings and small commercial buildings and to roads and streets. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is in capability units IIIe-5, dryland, and IIIe-11, irrigated. It is in the Sandy range site and windbreak suitability group 5.

ThC—Thurman loamy fine sand, 3 to 6 percent slopes. This deep, somewhat excessively drained, gently sloping soil is on low ridges and side slopes of uplands. It formed in eolian sandy material. Areas range from 5 to 150 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 14 inches thick. Below this is a transitional layer of brown, very friable loamy fine sand about 4 inches thick. The underlying material is fine sand. It is pale brown in the upper part and light yellowish brown in the lower part to a depth of 60 inches. In some small areas, the surface layer is grayish brown fine sand. In a few small areas the soil is nearly level or very gently sloping. In some small areas the surface layer is grayish brown fine sand. In other small areas the dark surface layer is 20 to 26 inches thick.

Included with this soil in mapping are small areas of Boelus, Elsmere, and Hadar soils. Boelus and Hadar soils are well drained. They are in slightly lower positions on the landscape than Thurman soil. Elsmere soils are somewhat poorly drained. They are in a lower position. The included soils make up 10 to 20 percent of the map unit.

The permeability of this Thurman soil is rapid, and the available water capacity is low. Runoff is slow. The organic matter content and natural fertility are low. The intake rate of water is very high. This soil is low in available phosphorus and calcium. It is easily tilled, moist or dry. Moisture is released readily to plants.

About 60 percent of the acreage of this soil is cultivated. Most of the rest of the acreage is in native grass and is used for grazing or mowed for hay.

Although this soil is poorly suited to dryland farming because of droughtiness and the high risk of soil blowing, it is suited to corn, grain sorghum, rye, oats, and alfalfa. Conservation tillage practices, such as discing, chiseling, or no-till planting, help to prevent soil blowing. Cover crops and field windbreaks are also helpful. Keeping crop residue on the surface is important. Applications of feedlot manure and commercial fertilizers help to maintain and improve the fertility of the soil.

If irrigated, this soil is suited to a sprinkler system of irrigation. Corn and alfalfa can be grown. Soil blowing is the principal hazard. Low fertility is an important concern of management. Deep cuts during land leveling should be avoided because of the danger of exposing the underlying material of fine sand. Light, frequent applications of water are needed because excessive amounts of water leach fertilizers and herbicides below the plant roots. Conservation tillage practices, such as no-till planting, keep crop residue on the surface and help to prevent soil blowing. Applications of feedlot manure and commercial fertilizer help to maintain fertility.

This soil is suited to introduced grasses for pasture. Use of the soil for pasture is an effective way to control soil blowing. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa. Separate pastures of cool-season grasses and single species, warm-season grasses can be used to provide a long season of grazing. Introduced grasses can also be used as part of a cropping sequence that is alternated with row crops. Overgrazing reduces the protective vegetative cover, causes deterioration of desired grasses, and results in severe losses by soil blowing. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of introduced grasses.

This soil is suited to rangeland and can be used for either grazing or haying. Using the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, and mowing to improper heights reduces the protective cover, causes deterioration of desired grasses, and results in severe losses by soil blowing. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain or improve the native plants.

This soil generally provides a good planting site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Droughtiness is the main limitation, and soil blowing is the principal hazard. Soil blowing can be prevented by maintaining strips of sod or planting a cover crop between the rows. Cultivation should be restricted to the tree row. Undesirable grasses and weeds can be controlled by careful use of appropriate herbicides in the tree row or by hand hoeing or roto-tilling.

This soil is suited to septic tank absorption fields, but extreme care needs to be taken to assure that pollution by seepage does not contaminate the underground water table. The floor of sewage lagoons needs to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is suited to the construction of dwellings and roads and streets. Small commercial buildings need to be properly designed, or the slope of the soil can be graded to an acceptable level.

This soil is in capability units IVe-5, dryland, and IVe-11, irrigated. It is in the Sandy range site and windbreak suitability group 5.

ThD—Thurman loamy fine sand, 6 to 11 percent slopes. This deep, somewhat excessively drained, strongly sloping soil is on ridges and side slopes of uplands. It formed in eolian sandy material. Areas range from 5 to 25 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 10 inches thick. Below this is a transitional layer of grayish brown, very friable loamy fine sand about 6 inches thick. The underlying material is light yellowish brown fine sand to a depth of 60 inches. In places the dark surface layer is 20 to 26 inches thick. In a few places the soil is gently sloping.

Included with this soil in mapping are small areas of Boelus, Hadar, and Valentine soils. Boelus and Hadar soils are well drained. They are in slightly lower positions on the landscape than Thurman soil. Valentine soils are excessively drained. They are in a higher position. The included soils make up about 10 to 25 percent of the map unit.

The permeability of this Thurman soil is rapid, and the available water capacity is low. Runoff is slow. Natural fertility is low, and the organic matter content is moderately low. The intake rate of water is very high. Moisture is released readily to plants. This soil is low in nitrogen, available phosphorus, and calcium.

Most of the acreage of this soil is in native grass and is used for grazing or mowed for hay. Some areas are cultivated and are used for irrigated crops or seeded to introduced grasses.

This soil is not suited to dryland cultivated crops because of the strong slopes, droughtiness, and the high risk of soil blowing.

This soil is poorly suited to irrigation. A sprinkler system is the only method that can be used. Alfalfa is a suitable crop, and corn can be grown if the crop is carefully managed. Application of lime ensures a good stand of alfalfa. Water should be applied frequently in light applications to prevent the leaching of fertilizers and herbicides below the plant roots. Conservation tillage practices, such as no-till planting, keep crop residue on the surface and help to control soil blowing. Stripcropping and narrow field windbreaks also help to prevent soil blowing. Applications of nitrogen fertilizer and feedlot manure improve the fertility of the soil.

Use of this soil for pasture is an effective way to control soil blowing. Cool-season grasses, such as smooth brome, orchardgrass, or tall fescue, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide for a long season of grazing. Overgrazing reduces the protective vegetative cover, causes deterioration of the desired grasses, and results in losses by soil blowing. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of irrigation water and nitrogen fertilizer increase the growth and vigor of grasses.

This soil is suited to rangeland and can be used for either grazing or haying. Use of this soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. These practices can also cause severe losses by soil blowing and small blowouts. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain or improve the desired native plants.

This soil provides a fair site for trees and shrubs in windbreaks. Capability for the survival and growth of adapted species is fair. Trees need to be planted in shallow furrows and should not be cultivated. Sod can be maintained between the tree rows. Undesirable grasses and weeds in the row can be controlled by careful use of appropriate herbicides, roto-tilling, or hand hoeing.

Septic tank absorption fields can be constructed on the contour on this soil. Extreme care needs to be taken so that pollution by seepage does not contaminate the underground water table. For sewage lagoons, grading is required to modify the slope and shape the lagoon, and lining or sealing the floor is needed to prevent seepage. The wall or sides of shallow excavations can be shored to prevent sloughing or caving.

Dwellings and small commercial buildings need to be properly designed to accommodate the slope.

Cutting and filling is generally needed to provide a suitable grade for roads and streets.

This soil is in capability units VIe-5, dryland, and IVe-11, irrigated. It is in the Sandy range site and windbreak suitability group 5.

Tm—Thurman loamy fine sand, thick, 0 to 2 percent slopes. This deep, somewhat excessively drained, nearly level soil is on uplands and stream terraces. It formed in eolian sandy material. Areas range from 3 to 50 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 10 inches thick. The subsurface layer is dark gray, very friable loamy fine sand about 18 inches thick. Below this is a transitional layer of dark grayish brown, very friable loamy fine sand about 11 inches thick. The underlying material is loamy fine sand. It is brown in the upper part and pale brown in the lower part to a depth of 60 inches. In a few small areas the underlying material is fine sand. In cultivated areas, the plowed layer is slightly lighter colored than is typical, or it is the texture of fine sand because of winnowing. In a few small areas the surface layer is thinner.

Included with this soil in mapping are small areas of Blendon, Boelus, Elsmere, and Hadar soils. The well drained Blendon soils are in a slightly lower position on the landscape than Thurman soil. The well drained Boelus and Hadar soils are in slightly higher positions. The somewhat poorly drained Elsmere soils are in a lower position. The included soils make up about 10 to 15 percent of the mapped area.

The permeability of this Thurman soil is rapid, and the available water capacity is low. Runoff is slow. The organic matter content is moderately low, and natural fertility is low. The intake rate of water is very high. The surface layer is easily tilled, moist or dry. Moisture is released readily to plants. This soil is generally low in available phosphorus and calcium.

Most of the acreage of this soil is cultivated. Some areas are in native grasses or seeded to introduced grasses and used for grazing or mowed for hay. Some areas support field windbreaks.

Under dryland farming, this soil is suited to corn, grain sorghum, rye, and alfalfa. Soil blowing and droughtiness are the principal hazards. Conservation tillage practices, such as chiseling, discing, and stubble mulching, help to prevent soil blowing. Cover crops and field windbreaks are also helpful. Keeping crop residue on the surface is important.

This soil is suited to a sprinkler system of irrigation, but it is not suited to gravity irrigation because of the very high intake rate. Deep cuts during land leveling should be avoided. Light, frequent applications of water are needed. Excessive amounts of water leach fertilizers and herbicides below the plant roots. Soil blowing is a serious hazard if a protective vegetative cover is not maintained. Low fertility is a concern of management. Conservation tillage practices that keep crop residue on the surface help to prevent soil blowing and conserve soil moisture. Stripcropping and field windbreaks also help to prevent soil blowing. Applications of feedlot manure and commercial fertilizer help to maintain fertility.

This soil is suited to introduced grasses for pasture. Use of the soil for pasture is an effective way to control soil blowing. Cool-season grasses, such smooth brome or orchardgrass, can be mixed with alfalfa or other legumes; or single species, warm-season grasses can be grown. Separate pastures of cool-season grasses and warm-season grasses can be used to provide a long season of grazing. Introduced grasses can also be used as part of a cropping sequence with row crops. Overgrazing reduces the protective vegetative cover, causes deterioration of desired grasses, and results in severe losses by soil blowing. Proper stocking and rotation grazing help to keep the grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of grasses.

This soil is suited to native grasses for range. Use of the soil for range is an effective way to control soil blowing. Overgrazing, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired grasses. These practices can also cause severe soil losses by soil blowing and small blowouts. A planned grazing system, proper grazing use, and timely deferment from grazing or haying help to maintain or improve the native plants.

This soil generally provides a good site for the planting of trees. Capability for the survival and growth of adapted species is fair. Lack of adequate moisture and soil blowing are the main limitations. Soil blowing can be prevented by maintaining strips of sod or planting a cover crop between the rows. Cultivation should be restricted to the tree row. Undesirable grasses and weeds in the tree row can be controlled by careful use of appropriate herbicides, roto-tilling, or hand hoeing.

This soil is suited to septic tank absorption fields, but extreme care is needed to assure that effluent from the septic tank absorption fields does not contaminate the underground water table. The floor of sewage lagoons needs to be sealed or lined to prevent seepage. Walls or sides of shallow excavations can be shored to prevent sloughing or caving. This soil is suited to the construction of dwellings, buildings, and roads and streets.

This soil is in capability units IIIe-5, dryland, and IIIe-11, irrigated. It is in the Sandy range site and windbreak suitability group 5.

VaD—Valentine fine sand, 3 to 9 percent slopes. This deep, excessively drained, gently sloping and strongly sloping soil is on uplands. It formed in eolian sandy material. Areas range from 3 to several hundred acres.

Typically, the surface layer is dark grayish brown, very friable fine sand about 5 inches thick. Below this is a transitional layer of brown, very friable fine sand about 3 inches thick. The underlying material is pale brown fine sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Boelus, Elsmere, and Thurman soils. All of these soils are in lower positions on the landscape than Valentine soil. Boelus soils have less sand in the lower part of the profile, and Thurman soils have a thicker surface layer than Valentine soils. The somewhat poorly drained Elsmere soils are on stream terraces and in depressional areas. In a few small areas, the soils are moderately steep or steep. The included soils make up about 10 to 15 percent of the map unit.

The permeability of this Valentine soil is rapid, and the available water capacity is low. Runoff is slow. This soil is low in organic matter content, natural fertility, nitrogen, available phosphorus, and calcium. The intake rate of water is very high. Moisture is released readily to plants. This soil is loose if dry and workability is only fair, but it is easy to till if the soil is moist.

Most of the acreage of this soil is in native grass and is used as rangeland. A small acreage is irrigated.

This soil is not suited to dryland farming because of the sandy texture, droughtiness, and high risk of soil blowing.

This soil is poorly suited to sprinkler systems of irrigation, and it is not suited to gravity systems. If irrigated, corn, alfalfa, and oats are the most suitable crops. Soil blowing, low fertility, and the very high intake rate are major concerns of management. Light, frequent applications of irrigation water maintain soil moisture and reduce the leaching of nutrients below the root zone. Conservation tillage practices keep crop residue on the surface and help to control soil blowing. Stripcropping and windbreaks also help to control soil blowing. Application of feedlot manure or commercial fertilizer improves the fertility of the soil.

This soil is suited to rangeland. Use of the soil for range is an effective way to control soil blowing. Overgrazing by livestock, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired plants. A planned grazing system, proper grazing use, and deferred grazing help to keep the native plants in good condition and control soil blowing.

This soil generally provides a fair site for planting trees and shrubs in farmstead and feedlot windbreaks. It generally is not suited, however, to field windbreaks. It is best suited to drought resistant species. Trees should be planted in shallow furrows and should not be cultivated because the soil is sandy. Young seedlings tend to suffer from sand blasting during high winds and may be covered with drifting sand if they are not protected. Wooden barriers can be used to protect the seedlings from moving sand.

This soil is suited to septic tank absorption fields, but extreme care needs to be taken to assure that pollution by seepage does not contaminate the underground water table. The floor of sewage lagoons needs to be lined or sealed to prevent seepage. Walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is suited to the construction of dwellings and roads and streets. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable slope.

This soil is in capability units VIe-5, dryland, and IVe-12, irrigated. It is in the Sands range site and windbreak suitability group 7.

VaF—Valentine fine sand, 9 to 20 percent slopes. This deep, excessively drained, strongly sloping to steep soil is on uplands. It formed in eolian sandy material. Areas range from 3 to several hundred acres.

Typically, the surface layer is grayish brown, loose fine sand about 7 inches thick. Below this is a transitional layer of brown, loose fine sand about 7 inches thick. The underlying material is fine sand. It is brown in the upper part and pale brown in the lower part to a depth of 60 inches. In some small areas the soil is gently sloping.

Included with this soil in mapping are small areas of Elsmere and Thurman soils. The somewhat poorly drained Elsmere soils are in a lower position on the landscape than Valentine soil. Thurman soils are also in a lower position. A few small blowouts are in this area. The included soils make up about 10 to 15 percent of the map unit.

The permeability of this Valentine soil is rapid, and the available water capacity is low. Runoff is slow. The soil is low in organic matter content, natural fertility, nitrogen, available phosphorus, and calcium. Moisture is released readily to plants.

Most of the acreage of this soil is in native grass and is used for grazing.

This soil is not suited to cultivated crops, either dryland or irrigated, because of uneven steep slopes, droughtiness, and the high risk of soil blowing.

This soil is suited to rangeland. Use of the soil for range is an excellent way to control soil blowing. Overgrazing by livestock, improper timing of haying, or mowing to improper heights reduces the protective vegetative cover and causes deterioration of desired plants. If the protective cover is reduced, severe losses by soil blowing and small blowouts can occur. A planned grazing system, proper grazing use, and deferred grazing help to keep the grasses in good condition.

This soil generally provides a fair site for trees and shrubs in farmstead and feedlot windbreaks. It generally is not suited, however, to field windbreaks. It is better suited to drought resistant conifers than to other trees. Seedlings should be planted in shallow furrows and should not be cultivated because the soil is sandy and susceptible to blowing. Young seedlings tend to suffer from sand blasting during high winds and can be covered with drifting sand if they are not protected. Wooden barriers can be used to protect the plants.

This soil is suited to septic tank absorption fields if they are constructed on the contour, and if extreme care is taken to assure that pollution by seepage does not contaminate the underground water table or nearby streams. For sewage lagoons, extensive grading is required to modify the slope and shape the lagoon, and the floor of the lagoon should be lined or sealed to prevent seepage. Walls or sides of shallow excavations can be shored to prevent sloughing or caving.

Dwellings and small commercial buildings constructed on this soil need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable level. Cuts and fills are generally needed to provide a suitable grade for roads and streets.

This soil is in capability unit VIe-5, dryland. It is not assigned to an irrigated capability unit. It is in the Sands range site and windbreak suitability group 7.

Zo—Zook silty clay loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on bottom lands of major stream valleys. It is subject to occasional flooding. Areas range from 3 to several hundred acres.

Typically, the surface layer is very dark gray, firm silty clay loam about 7 inches thick. The subsurface layer is very dark gray, firm silty clay loam and silty clay about 28 inches thick. The subsoil is dark gray, firm silty clay about 13 inches thick. The underlying material is gray silty clay loam to a depth of 60 inches. In some small areas the surface layer is silty clay. In a few areas the underlying material is calcareous.

Included with this soil in mapping are small areas of Colo, Gibbon, and Muir soils. The somewhat poorly drained Colo and Gibbon soils are in positions on the landscape similar to Zook soil. The well drained Muir soil is on low stream terraces. It is in a slightly higher position. The included soils make up about 5 to 10 percent of the map unit.

The permeability of this Zook soil is slow, and the available water capacity is high. The organic matter content and natural fertility are high. This soil has a seasonal high water table that fluctuates from a depth of about 1 foot in most wet years to a depth of about 3 feet in most dry years. The intake rate of water is very low. Runoff is very slow. This soil warms more slowly in spring than well drained soils. It can be tilled only within a narrow range of moisture conditions. Moisture is absorbed slowly and released slowly to plants.

Most of the acreage of this soil is used for cultivated crops. A few areas are seeded to introduced grasses and are used for grazing or mowed for hay.

Under dryland farming, this soil is suited to corn, grain sorghum, soybeans, and alfalfa. Spring-sown small grain is not well suited because of soil wetness, which commonly delays tillage in spring. If suitable outlets are available, tile drains can be installed to help control wetness. Shallow surface drains also can be used or V-ditches constructed to control soil wetness and improve runoff. Diversion ditches help to control flooding. Conservation tillage practices that keep crop residue on the surface help to improve tilth and prevent soil blowing. Soil blowing is a hazard in winter if this soil is plowed in the fall. Application of feedlot manure helps to maintain the fertility of the soil.

If irrigated, this soil is suited to both gravity and sprinkler systems of irrigation. Corn, soybeans, and alfalfa can be grown. Wetness is the principal limitation. A small amount of land leveling is generally needed to improve the surface drainage and efficiency of the irrigation system. Because the soil absorbs water at a very slow rate, the proper rate of water application is needed to keep the plants from drowning. Applying feedlot manure helps to maintain fertility. Keeping crop residue on the surface by discing or chiseling is preferred to plowing this soil.

This soil is suited to introduced grasses for pasture. Cool-season grasses, such as creeping foxtail or reed canarygrass, can be mixed with alfalfa; or single species, warm-season grasses can be grown. Separate pastures of warm-season grasses and cool-season grasses can be used to provide a long season of grazing. Pasture grasses can be used as part of a cropping sequence with row crops. Overgrazing, grazing when the soil is wet, or improper timing of haying reduces the protective vegetative cover and causes deterioration of desired grasses. Proper stocking and rotation grazing help to keep the desired grasses in good condition. Applications of nitrogen fertilizer and irrigation water increase the growth and vigor of pasture grasses.

This soil provides a good site for the planting of trees and shrubs in windbreaks. Capability for the survival and growth of seedlings is good if the species selected can tolerate wetness. The establishment of seedlings can be difficult during wet years. Competition from weeds and grasses is a limitation. Occasional flooding is the main hazard. Cultivation between the rows is needed to help control weeds and grasses. Proper use of appropriate herbicides and roto-tilling also help to control weeds and grasses in the rows.

This soil is not suited to septic tank filter fields because of slow permeability, occasional flooding, and wetness caused by the seasonal high water table. An alternate site is needed. Sewage lagoons need to be diked as protection from flooding and constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table.

This soil is generally not suitable for the construction of buildings because of occasional flooding, wetness from the seasonal high water table, and the high shrink-swell potential of the soil. An alternate site is needed.

Constructing roads on suitable, compacted fill material above the flood level and providing adequate side ditches and culverts help to protect roads from flood damage and wetness. The surface pavement and subbase of roads need to be thick enough to compensate for low strength of the soil material. Using coarser-grained material for the subgrade or base material ensures better performance. Providing a gravel moisture barrier in the subgrade, crowning the roadbed by grading, and constructing adequate side ditches can ensure good surface drainage and reduce the damage by frost action.

This soil is in capability units IIw-4, dryland, and IIw-1, irrigated. It is in the Clayey Overflow range site and windbreak suitability group 2W.

prime farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing short- and long-range needs of food and fiber for the nation. The supply of high quality farmland is limited and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our Nation's prime farmland with wisdom and foresight.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to produce food, feed, forage, fiber, and oilseed crops. It has the quality of soil, length of growing season, and supply of moisture needed to provide a sustained high yield of crops if it is treated and managed in accordance with acceptable farming methods. Prime farmland produces the highest yields with the least inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland may now be used for crops, pasture, woodland, or other land use, but it may not be urban and built-up land or water areas. It must be used for either the production of food or fiber or be available for these uses.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. It also has favorable temperature and growing season and acceptable acidity or alkalinity. It has few or no rocks and is permeable to water and air. Prime farmland is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

About 95,910 acres or nearly 35 percent of the total acreage in Stanton County meets the soil requirements for prime farmland.

A recent trend in land use in some parts of the county has been the loss of some areas of prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate and are usually less productive.

The map units that make up prime farmland in Stanton County are listed in this section. This list does not constitute a recommendation for a particular land use. The extent of each map unit is listed in table 4. The location is shown on the detailed soils maps at the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, flooding, or inadequate rainfall, may qualify as prime farmland if these limitations are overcome by such measures as drainage, flood control, or irrigation. In the following list the measures needed to overcome these limitations are shown in parentheses after the name of some of the map units. Onsite evaluation is necessary to determine if these limitations have been overcome by corrective measures.

The map units that meet the soil requirements for prime farmland are listed in table 5.

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 avoid 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 behavior 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 windbreaks; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation 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 in all or part of the survey area. 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 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

Prepared by William E. Reinsch, conservation agronomist, Soil Conservation Service.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some plants not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil 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 "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to 1976 Nebraska Agriculture Statistics, 76 percent of the farmland in Stanton County is planted to crops. The largest acreage is in corn and soybeans, followed by alfalfa, oats, grain sorghum, and wheat. The potential is good for increased production of food.

dryland management

Good management practices on soils that are farmed dryland are those that reduce runoff and the risk of erosion, conserve moisture, and improve tilth. Most of the soils in Stanton County are suitable for crop production. In many places, however, suitable conservation practices are needed to reduce or correct the severe hazard of erosion.

Terraces, contour farming, grassed waterways, (fig. 18), and conservation tillage practices that keep crop residue on the surface help to reduce water erosion, increase water intake rate, and provide additional soil moisture for crops. Keeping crop residue on the surface or maintaining a protective vegetative cover reduces runoff and sealing and crusting of the soil during and after heavy rainfall. In winter, the stubble catches drifting snow that can provide additional moisture.

Soil blowing is a major hazard in parts of Stanton County. The same management practices that control water erosion can be used to control soil blowing. Crop residue management, conservation tillage practices, contour stripcropping, and narrow field windbreaks can be used. The hazards of both water and wind erosion can be reduced if the areas of more productive soils are used for row crops, and the areas of steeper, more erosive soils are used for close-grown crops, such as small grain, alfalfa, or grasses for hay and pasture. In many places, proper land use alone can reduce the hazard for erosion.

In Stanton County, insufficient rainfall commonly is a limiting factor in crop production. Water and wind are the active erosion agents on most soils. A cropping system and management practices to control erosion need to be planned to fit the soils in each field.

The sequence of crops grown on a field together with the combination of practices needed for the management and conservation of the soil is known as a conservation cropping system. Under dryland farming, the management practices and cropping system should preserve tilth and fertility; maintain a vegetative cover that protects the soil from erosion; and control weeds, insects, and diseases. Cropping systems vary according to the soils on which they are used. For example, the cropping system on Crofton silt loam, 11 to 15 percent slopes, eroded, should include a high percentage of grass and legume crops, whereas on Belfore silty clay loam, 0 to 2 percent slopes, a higher percentage of row crops can be grown in the crop rotation without adversely affecting the fertility and tilth of the soil.

The management practices that are best suited to protect the soil and reduce erosion on Class I soils, such as Belfore soils, are proper use of crop residue, the addition of nutrients by the application of fertilizers or feedlot manure, and good agronomic practices. On Class IIe soils, such as Moody silty clay loam, 2 to 6 percent slopes, the practices best suited are those that permit crop residue to remain on the soil over winter, contour farming, grassed waterways, and a conservation tillage system that leaves 3,000 pounds per acre of corn or sorghum residue or l,500 pounds of small grain residue on the surface after planting the crop. On Class IIIe and IVe soils the most desirable management practices are those that leave crop residue standing on the soil over winter, contour farming, terraces, grassed waterways, and a conservation tillage system that leaves 3,000 pounds per acre of corn or sorghum residue or 1,500 pounds per acre of small grain residue on the soil surface after planting the crop. On soils that have slopes of 11 to 15 percent, grasses and legumes are needed in the cropping sequence together with terraces, grassed waterways, and a conservation tillage system for row crops that leaves more than 3,000 pounds of corn or

Figure 18.—Parallel terraces, grassed waterways, and contour farming are used to help control erosion on this farm. Nora and Crofton soils are the main soils on the side slopes, and Hobbs soils are in the narrow drainageways.

sorghum residue per acre on the surface after planting. These management practices are needed to reduce water erosion to an acceptable level.

At the time of planting, the soils need to be worked to prepare a seedbed, control weeds, and provide a favorable place for the plants to grow. Excessive tillage, however, breaks down the granular structure in the surface layer. Such structure is needed for good tilth. Steps in the tillage process should be limited to those that are essential. Various conservation tillage practices can be used in Stanton County. The no-tilling, till-planting, or discing or chiseling and planting practices are well suited to row crops. Grasses can be established by drilling into a cover or stubble without further seedbed preparation.

All soils that are used for cultivated crops or for pasture should be tested to determine their need for additional nutrients. Under dryland farming, the kind and amount of fertilizer to be applied should be based on results of soil tests and on the moisture content of the soil at the time the fertilizer is applied. If the subsoil is dry or rainfall is below normal, the amount of nitrogen fertilizer applied should be slightly less than the recommended amount. Nitrogen fertilizer benefits nonlegume crops on all soils. Phosphorus and zinc are needed on the more eroded soils and in cut areas after construction of terraces or diversions. Soils that are farmed dryland require smaller amounts of fertilizer than irrigated soils because the plant population is generally lower.

Some soils in Stanton County are somewhat poorly drained because of a seasonal high water table. Open drainage ditches and underground tile systems can be used to help lower the water table if suitable outlets at low elevations can be located. Where the water table cannot be lowered sufficiently for good crop growth, crops that tolerate wet conditions can be planted.

Herbicides can be used to control weeds. Care needs to be taken that the correct kind of herbicide is applied at the proper rate to correspond with the soil conditions. The colloidal clay and humus fraction of the soil is responsible for the greatest part of the chemical activity in the soil. Therefore, crop damage from herbicides is more likely to occur on the coarse and moderately coarse soils that are low in colloidal clay, and on areas where the organic matter content is moderately low or low. The application rate of herbicides needs to be correspondingly lower on these soils and applied in accordance with instructions on the label. Keeping field boundaries on the contour helps provide for uniformity of soils in a field, thereby lessening the danger of damage from herbicides.

irrigation management

According to Nebraska Agriculture Statistics, about 12 percent of the cropland in Stanton County had been irrigated by 1976. Corn was grown on about 75 percent of the irrigated cropland, and a smaller acreage was in soybeans and alfalfa. Water for irrigation is almost entirely from wells.

Corn and soybeans are suited to either furrow or sprinkler systems of irrigation. Alfalfa can be irrigated by border, contour ditch, corrugations, or sprinkler systems.

Row crops are raised mostly on soils that are well suited to irrigation. Changing the crop from corn to soybeans or alfalfa and grass helps to control the plant diseases and insects that become common if the same crop is grown year after year. Gently sloping soils, such as Moody silty clay loam, 2 to 6 percent slopes, are subject to water erosion if they are irrigated by water in furrows that are constructed up and down the slope. For furrow irrigation, the soils should be contour bench leveled, or the soils should be irrigated with contour furrows in combination with parallel terraces. Sufficient amounts of residue should be maintained on the surface to control erosion to tolerable levels.

Land leveling increases the efficiency of irrigation because an even distribution of water can be obtained. The efficiency of a furrow system of irrigation can be improved if a tailwater recovery system is added. Sprinkler systems of irrigation are satisfactory on coarse-textured soils if an adequate amount of water is available. Terracing, contour bench leveling, and contour furrowing with terraces can be used on irrigated land. Grassed waterways and a conservation tillage system that keeps crop residue on the surface can be used to help control water erosion on soils irrigated by a sprinkler system.

If a sprinkler irrigation system is developed on soils such as Moody silty clay loam, 2 to 6 percent slopes, and Nora silty clay loam, 6 to 11 percent slopes, the same conservation practices that control water erosion on dryland crops should be used. Terraces, contour farming, and conservation tillage practices that leave a protective cover of crop residue on the soil after the row crop is planted help to conserve the supply of irrigation water by reducing evaporation and increasing the intake of rainfall as well as protecting the soil from erosion.

If a sprinkler irrigation method is used, water should be applied at a rate that allows the soil to absorb the water but will not produce runoff. Sprinklers can be used on more sloping soils as well as on nearly level soils. Some coarse textured soils, such as Thurman loamy fine sand, 3 to 6 percent slopes, are suited to sprinkler irrigation if conservation practices are used to control erosion. Because the water can be controlled, sprinklers have special use in conservation, for example, in establishing new pastures on moderately steep slopes. In summer, much water is lost through evaporation. In addition, water tends to be applied unevenly under some sprinkler irrigation systems because of wind drift. Watering at night when the temperatures are lower and wind velocities are lowest reduces evaporation and improves distribution.

Two kinds of sprinkler systems are commonly used in Stanton County. One is set at a location, left until a specified amount of water is applied, and then moved. The other is a moving system that revolves on a central pivot.

Because soil holds only a limited amount of water, regular intervals of irrigation water or precipitation are needed to keep the soil moist. The application interval varies according to the crop, the soil, and the amount of moisture already in the soil. The water should be applied only as fast as the soil can absorb it.

Irrigated silty soils in Stanton County hold about 2 inches of available water per foot of soil depth. A soil that is 4 feet deep and planted to a crop that sends its roots to a depth of 4 feet can hold about 8 inches of available water for the crop. For maximum efficiency, irrigation should be started when about one-half of the stored water has been used by the plants. If a soil holds 8 inches of available water, irrigation should be started when about 4 inches has been removed by the crop. An irrigation system should be planned to replace water at a rate that will provide a stable water supply for the crop.

A tailwater recovery pit can be installed at the end of a field irrigated by the furrow or border system to trap excess irrigation water. The water can then be pumped to the upper end of the field and used again. This practice increases the efficiency of the irrigation system and helps to conserve the supply of underground water.

Irrigated soils generally produce higher yields than dryfarmed soils. Consequently, more plant nutrients, particularly nitrogen and phosphorus, are removed by the harvested, irrigated crops. Returning all crop residue to the soil and adding feedlot manure and commercial fertilizer help to maintain the needed plant nutrients. Most grain crops in Stanton County respond to nitrogen fertilizer. Soils disturbed during land leveling, particularly in areas where the surface soil has been removed, respond to phosphorus, zinc, and iron. The kinds and amounts of fertilizer needed for specific crops should be determined by soil tests.

The soils in Stanton County that are suited to irrigation are assigned to an irrigation design group. These design groups are described in the Nebraska Irrigation Guide (*8*), which is part of the technical specifications for conservation in Nebraska. The arabic numbers in the irrigation capability unit at the end of the detailed map units indicate the design group to which a soil belongs. Assistance in planning and designing an irrigation system is available through the local office of the Soil Conservation Service or the county agricultural agent.

pasture and hayland management

Areas of soils that are used for hay or pasture should be managed for maximum production. Once the pasture is established, the grasses need to be kept productive. A planned system of grazing that meets the needs of the plants and promotes uniform utilization of forage is important if high returns are expected. Most forage plants are a good source of minerals, vitamins, proteins, and other nutrients. A well managed pasture can provide a balanced ration for livestock throughout the growing season. Irrigated pastures need a high level of management for maximum returns.

A mixture of adapted grasses and legumes can be profitably grown on many kinds of soils if it is properly managed. Grasses and legumes are compatible with grain crops in a crop rotation and are beneficial in promoting soil building. Because grasses and legumes help to improve tilth, add organic matter, and reduce erosion, they are an ideal crop for use in a conservation cropping system.

Grasses and legumes that are used for pasture and hayland, either irrigated or nonirrigated, require additional plant nutrients to obtain maximum vigor and growth. The kinds and amounts of fertilizer needed should be determined by soil test. Smooth brome and orchardgrass are the most commonly grown grasses for irrigated pastures. Intermediate wheatgrass, meadow brome, and creeping foxtail are also adapted to irrigation. Legumes that have potential for irrigated or nonirrigated pastures are birdsfoot trefoil and cicer milkvetch.

Irrigated pastures in Stanton County can provide for 750 to 900 pounds of beef per acre with a high level of management. They are an economic alternative to irrigated cropland when a resource management system is chosen.

Grasses that have potential for use as pasture without irrigation are smooth brome, intermediate wheatgrass, meadow brome, tall fescue, and orchardgrass. Some native, warm-season grasses, if planted as a single species on nonirrigated land, are compatible with cool-season pastures and improve the forage quality during the grazing season. Switchgrass, indiangrass, and big bluestem are native, warm-season grasses that can be used in a planned system of grazing to provide high quality forage during the summer months for grazing animals.

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 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 insures 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 Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider 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, and 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 slight 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 limitation is 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-1 or IIIw-5.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Prepared by Peter N. Jensen, range conservationist, Soil Conservation Service.

Rangeland makes up approximately 12 percent of the total farmland in Stanton County. It is scattered throughout the county, with the greatest concentration in the Sandy and Loamy Uplands in the northwestern part of the county; the Sandy Uplands; and the high water tablelands associated with the Elkhorn River. Rangeland is common in the Thurman-Nora-Crofton, the Valentine-Thurman, and the Inavale-Boel-Ord soil associations.

The majority of the rangeland is in the Sands, Sandy, Sandy Lowland, Subirrigated, Limy Upland, and Thin Loess range sites. The rest is in the Wet Land, Clayey, Silty, Silty Lowland, Silty Overflow, and Clayey Overflow range sites. The livestock farms or ranches in Stanton County average about 320 acres.

The raising of livestock, mainly cow-calf herds, in which calves are sold in the fall as feeders, is the

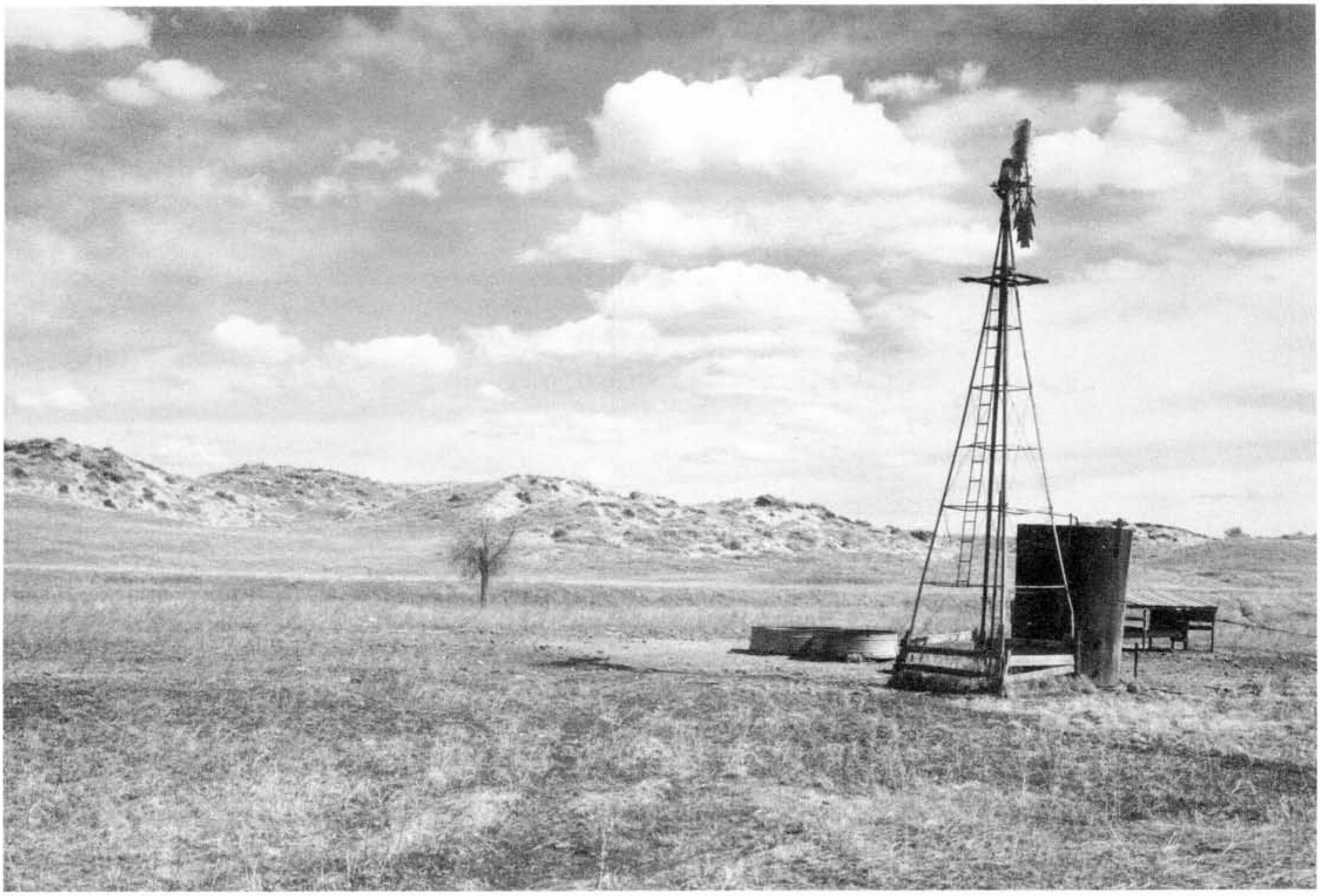

Figure 19.—Properly spaced water facilities and salt blocks are good management practices. Thurman soils are in the foreground, and Valentine soils are on the more rolling landscape in the background.

second largest farming industry in the county. Livestock generally graze the range from late in spring to early in fall and graze smooth brome pastures in spring and corn or grain sorghum aftermath from fall to early in winter. The rest of the winter they are fed hay, alfalfa, and silage.

At the end of each map unit description, the soil or soils in that unit are placed in an appropriate range site according to the kind and amount of vegetation that is grown on the soil when the site is in excellent range condition. The interpretations for each range site (fig. 19) in Stanton County are in the Technical Guide, which is in the local office of the Soil Conservation Service. Livestock farmers and ranchers or other users who want technical assistance with reseeding cropland to rangeland, developing a planned grazing system, or with other aspects of a sound range program can obtain help from the local office of the Soil Conservation Service.

woodland

Prepared by Keith A. Ticknor, forester, Soil Conservation Service.

Stanton County has approximately 4,000 acres of woodland. These areas are mostly along the major streams of Union Creek, Butterfly Creek, the Elkhorn River, and in many of the narrow upland drainageways. In addition, wooded areas are on the steep slopes south of Union Creek, in the Valentine-Thurman soil association south of the Elkhorn River, and on some areas of the poorly drained Loup soils.

Trees and shrubs in the drainageways and along the streams consist primarily of American elm, Siberian elm, green ash, silver maple, eastern cottonwood, redosier dogwood, Russian mulberry, common hackberry, black willow, boxelder, and American plum.

The wooded areas of the uplands consist mostly of bur oak, with a small percentage of green ash, common hackberry, and eastern redcedar. Gooseberry, sumac, and seedlings of bur oak trees make up a large part of the understory.

Many species, especially bur oak, eastern cottonwood, green ash, common hackberry, and silver maple trees have commercial value; however, very few wooded areas are managed for commercial production. Most of these areas are privately owned and occupy only a small acreage of the farm unit.

Since 1955, the acreage of woodland in Stanton County has declined approximately 50 percent. Most of this decline has been the result of clearing the woodland and converting it to cropland.

Bottom land soils along drainageways have potential for the production of sawtimber, firewood, Christmas trees, and other wood uses. Most of these soils, however, are used as cropland, and they are not likely to be converted to wood production.

windbreaks and environmental plantings

Prepared by Keith A. Ticknor, forester, Soil Conservation Service.

Most farmsteads in Stanton County have windbreaks that were planted by the landowners. Siberian elm and eastern cottonwood are the most common trees used in the older windbreaks. Eastern redcedar, ponderosa pine, green ash, honeylocust, and hackberry are commonly used in more recently planted windbreaks.

Tree plantings around the farmstead are a continuing process. Older trees pass maturity and deteriorate; some trees are lost because of insects or disease; new windbreaks are needed for expanding farmsteads.

Field windbreaks (fig. 20) are numerous in Stanton County. Many of the older field windbreaks consist of eight to ten rows of trees and shrubs, but some field windbreaks are made up of one and two rows of trees. Common species in the older plantings are eastern cottonwood, green ash, honeylocust, common hackberry, Russian mulberry, Russian-olive, ponderosa pine, Siberian elm, boxelder, Siberian peashrub, black locust, American plum, northern catalpa, and eastern redcedar.

The species of trees or shrubs selected for windbreaks need to be adapted to the soils in which they are to be planted. Matching the proper trees with the soil type is the first step towards ensuring survival and a maximum rate of growth. Permeability, available water capacity, and fertility greatly affect the rate of growth of trees and shrubs in windbreaks.

Generally, trees can be easily established in Stanton County, but controlling the competition from weeds and grasses after planting is an important concern in establishing and managing windbreaks.

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, keep know from blowing off 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,

Figure 20.—A field windbreak helps to control soil blowing on this area of Moody silty clay loam.

mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 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 local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

Prepared by Robert O. Koerner, biologist, Soil Conservation Service.

The results of a study concerning the potential for recreational development in Stanton County are published in "An Appraisal of Potentials for Outdoor Recreational Development, Stanton County," Soil Conservation Service, August 1967 (*7*). In this publication, eleven kinds of recreation are evaluated and appraised by representatives of county, state, and federal agencies, and various local private organizations.

The potential for hunting small game, such as pheasants, bobwhite quail, cottontail rabbits, and squirrels, rated especially high, and potential for hunting big game and waterfowl rated medium. Ten other recreational enterprises, including vacation cabins; cottages and homesites; camping grounds; picnic and field sports areas; water areas for fishing; golf courses; natural, scenic, and historic areas; riding stables; shooting reserves; vacation farms; and water sports areas, rated medium in potential for development.

At the Wood Duck Special Use Area, public recreation facilities are maintained by the Nebraska Game and Parks Commission. This recreational area comprises about 342 acres of land and 47 acres of water. Fishing; nonpower boating; and hunting for big game, small game, and waterfowl during the regular season are recreational activities. Hiking, birdwatching, and photography are also practiced. One acre of the area is used for campsites.

The Pilger Watershed Structure, 1 mile northeast of Pilger, is operated and maintained by the Lower Elkhorn Natural Resources District. It makes up 110 acres. The 52-acre lake is equipped with boat ramp and provisions for nonpower boating. Trees and grass have been planted next to this structure. Basic public facilities are provided, and there are parking areas for automobiles and self-contained camper vehicles. Campsites are not available, but tent camping is permitted. Fishing for bullheads is popular.

The Maskenthine Reservoir (fig. 21) north of Stanton provides flood control for the area as well as recreational opportunities for local residents. This area is operated and maintained by the Lower Elkhorn Natural Resouces District and comprises 240 acres. The 95-acre lake is used for swimming, fishing, and nonpower boating. Plantings of trees and shrubs provide habitat for wildlife and shade for picnickers and campers. Basic public facilities are provided, and roads, picnic tables, a swimming beach, a boat dock, and hiking trails are accessible.

Where permission is granted, the hunting of doves and deer is common on privately owned lands during the regular hunting season. Fishing for catfish, bass, and bluegills in farm ponds and the Elkhorn River is another recreational activity.

Community parks in the county include Stanton City Park, Pilger City Park, and Woodland Park. Stanton City Park has picnicking facilities, tennis courts, a swimming pool, and a nine-hole golf course. Pilger City Park has facilities for picnicking, baseball, and softball. It also has a swimming pool. Woodland Park, two miles northeast of Norfolk, provides picnic and play areas.

Stanton County has many scenic attractions. Hills and valleys and the many species of trees, shrubs, and vines along roadsides and fence rows provide a variety of natural beauty.

The soils of the survey area are rated in table 9 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 sewerlines. 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 recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, 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 by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads

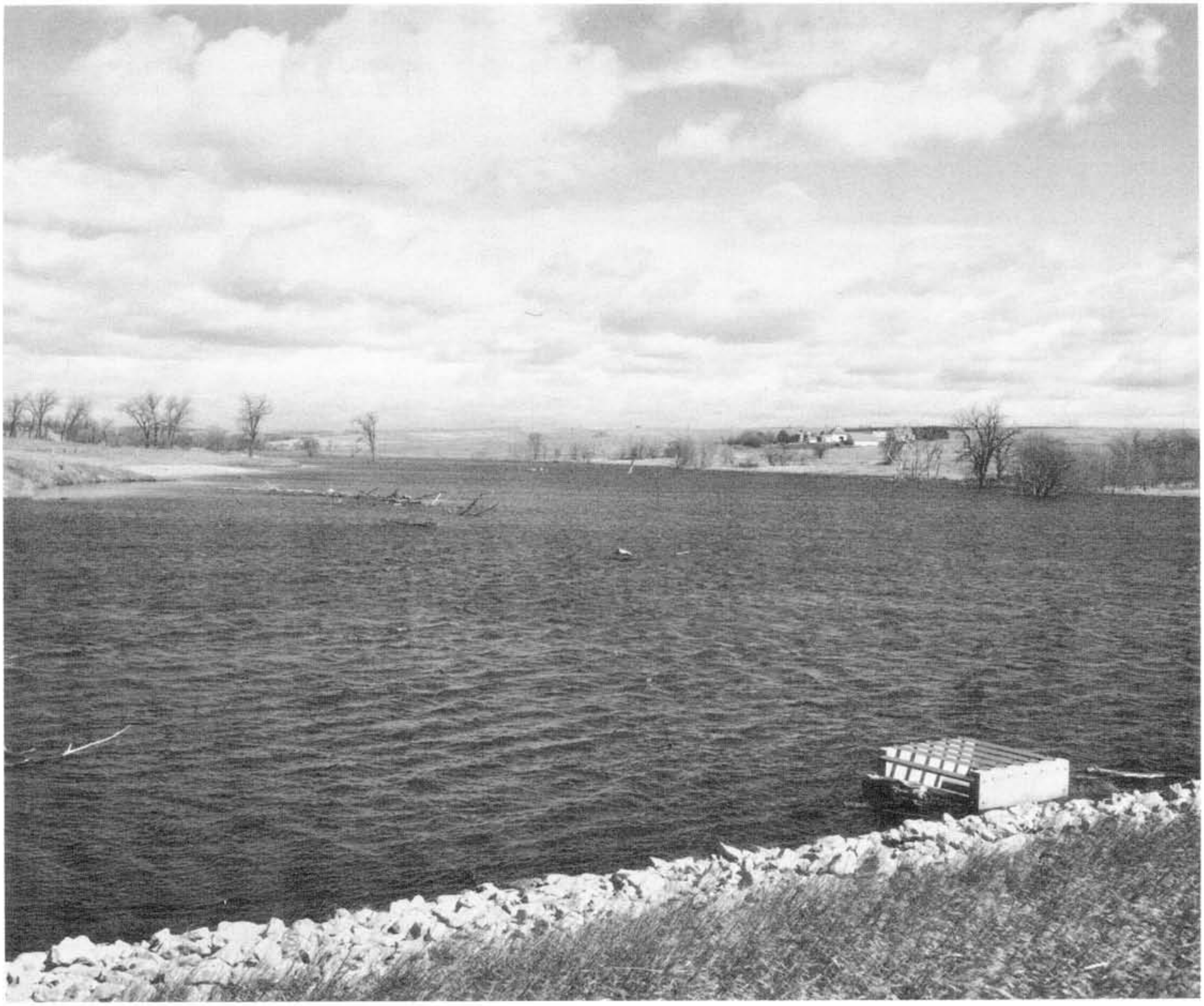

Figure 21.—The Meskenthine Reservoir provides both flood control and recreation facilities.

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 have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders 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 or stones or boulders 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 free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling 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.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Technical assistance is available for designing installations to improve habitat for wildlife and facilities for recreation within Stanton County. The Soil Conservation Service has a field office in Stanton that can provide this assistance or suggest an appropriate agency for help.

wildlife habitat

Prepared by Robert O. Koerner, biologist, Soil Conservation Service

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, 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 intensity of management needed for each element of the habitat.

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, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and grain sorghum.

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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, intermediate wheatgrass, smooth brome, clover, 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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big and little bluestem, giant ragweed, goldenrod, western wheatgrass, and blue grama.

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, the available water capacity, and wetness. Examples of these plants are oak, green ash, hackberry, apple, Washington hawthorn, Russian mulberry, and honeylocust. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are native plum, common lilac, cotoneaster, and skunkbush sumac.

Coniferous plants furnish browse, seeds, and cones. 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 Scotch pine, Austrian pine, ponderosa pine, and redcedar.

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 shrubs are native plum, cotoneaster, lilac, roses, and aromatic sumac.

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, wild millet, prairie cordgrass, rushes, sedges, and reedgrasses.

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. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, ring-necked pheasants, meadowlarks, field sparrows, cottontail rabbits, and skunks.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include cottontail rabbits, bobwhite quail, opossums, thrushes, woodpeckers, squirrels, raccoons, and deer.

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, shore birds, muskrats, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include badgers, antelopes, deer, prairie grouse, meadowlarks, and lark buntings.

In the following paragraphs, the ten soil associations on the general soil map of Stanton County in the back of this publication are discussed in relation to their use by wildlife.

The Thurman-Hadar-Larno association, the Thurman-Nora-Crofton association, the Crofton-Nora association, and the Nora-Crofton-Alcester association are used as openland habitat by a variety of openland wildlife, such as bobwhite quail, pheasants and cottontail rabbits. The topography of these associations is mostly strongly sloping and dissected with drainageways. Cottonwood and willow trees grow in the areas where the water table is near the surface. Growing in the drier parts of the drainageways are native grasses, such as big and little bluestem, switchgrass, indiangrass, sideoats grama; and trees and shrubs, such as common chokecherry, green ash, Siberian elm, eastern redcedar, common hackberry, American plum, and redosier dogwood. Many shelterbelts near the farmsteads provide escape cover and winter protection for pheasants, bobwhite quail, and white-tailed deer. Songbirds nest in the shelterbelts and can be attracted to the farmyard if supplementary grain or sunflower seeds are provided. Conservation practices, such as contour farming and terracing, and conservation tillage practices add to the diversity of cover type used by wildlife on the cropland areas. Rotation grazing, proper stocking, fertilization, proper timing of mowing, and weed control are other management practices that improve the cover on the grassland areas.

The Thurman-Boelus-Loretto association is used as habitat by such openland wildlife as bobwhite quail, pheasants, and white-tailed deer. This association is a transition area between the loess uplands and the sandhills. Center-pivot irrigation systems are common where underground water is available. Farmstead and field windbreaks offer winter protection for small game and songbirds and occasionally for white-tailed deer.

Narrow field windbreaks of eastern redcedar, Austrian pine, Russian-olive, common hackberry, honeylocust, and Amur honeysuckle provide food, cover, and travel lanes for wildlife, in addition to protecting the crops from soil blowing. Roadside ditches provide habitat for nesting for pheasants and quail. In areas where roadside ditches are ponded, large eastern cottonwood trees are common. These trees harbor eastern fox squirrels and raccoons, hawks, owls, woodpeckers, and occasionally eagles.

The Valentine-Thurman association provides rangeland habitat for prairie grouse, white-tailed deer, badgers, coyotes, and foxes. The most common grasses are big and little bluestem, prairie sandreed, switchgrass, indiangrass, sideoats grama, and blue grama. In areas where roadside ditches (fig. 22) are ponded after rainfall, woody vegetation grows along with the grasses. Eastern redcedar, American plum, common chokecherry, green ash, common hackberry, eastern cottonwood, and willow are common. In Stanton County, the native rangeland area provides a wider diversity of cover types than the general sandhills farther to the west. Consequently, this area is capable of a higher carrying capacity for wildlife on an acre basis than the area known as the Nebraska sandhills. Wetlands mostly occur where the high water table is ponded. These areas provide good resting places for waterfowl. The close proximity of grassland provides nesting habitat for waterfowl, pheasants, and shore birds.

The Muir-Shell-Hobbs association provides excellent habitat for wildlife in areas along and adjacent to the feeder streams that drain into the Elkhorn River in the northern part of the county and into the Platte River in the southern part. In these areas, there is diversity of cover types, including native range and pasture and many acres of excellent cultivated cropland, both

Figure 22.—Many roadside areas in the Valentine and Thurman soils are excellent habitat for pheasants and quail.

irrigated and nonirrigated. Woody species, such as green ash, American plum, and eastern redcedar grow in the drainageways. Corn, soybeans, and alfalfa are the principal crops.

The Inavale-Boel-Ord association, the Gibbon-Ord-Cass association, and the Elsmere-Ovina-Loup association are on bottom lands and stream terraces of the Elkhorn River valley and provide the greatest diversity of cover types for wildlife habitat in Stanton County. Russian-olive, common chokecherry, Russian mulberry, common hackberry, and Amur honeysuckle grow along roadsides and in drainageways. The diversity of cover types provides for a variety of wildlife, such as foxes, coyotes, cottontails, jackrabbits, white-tailed deer, squirrels, songbirds, hawks, owls, eagles, skunks, raccoons, and mink, along with muskrats and beaver. Ring-necked pheasants and bobwhite quail also live in this area. Mourning doves are throughout the county. Wetland wildlife, such as mink, muskrat, and beaver, along with waterfowl and shore birds, are common. Upland game birds, such as pheasants and bobwhite quail, together with white-tailed deer find cover along the river and food on the adjacent bottom lands. The riparian habitat offers cover for squirrels, cottontail rabbits, and songbirds. Hawks, owls, eagles, woodpeckers and raccoons live in the larger trees.

Throughout Stanton County, adequate winter cover and nesting cover are the predominant factors that control the population of wildlife.

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. The ratings are given in the following tables: 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 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 need to 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 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 (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) 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 11 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 the 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, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 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 12 shows the degree and the 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 12 also shows the suitability of the soils for use as daily cover for landfills. 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 60 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 effectively filter the effluent. 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 12 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 due to rapid permeability of 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 ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 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 type 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 type 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 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 13 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 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 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 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, 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 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 the depth to the water table is 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. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, 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 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 14 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 for 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 potential 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, or 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 reduce 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 wind 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 wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or 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 18.

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 characterize key soils.

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

engineering index properties

Table 15 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 "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. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, 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, SP-SM.

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 18.

Rock fragments larger than 3 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 oven-dry 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.

physical and chemical properties

Table 16 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, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving 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, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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.

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 change is based on the soil fraction less than 2 millimeters in diameter. 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 wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse 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 sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, 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 wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of 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 17 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 intake 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, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 17 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, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information 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 absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is 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 depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, 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 17.

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. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. 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.

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 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 creates a severe corrosion environment. 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.

physical and chemical analyses of selected soils

Samples from soil profiles were collected for physical and chemical analyses by the Soil Conservation Service, Soil Survey Laboratory in Lincoln, Nebraska. Soils of the Belfore and Clarno series were sampled in Stanton County. These data are available at the Soil Survey Laboratory. Soils of the Belfore, Crofton, Moody, Nora, Thurman, and Valentine series were sampled in nearby counties. These data are recorded in Soil Survey Investigations Report Number 5 (*6*). Data of the Zook series are recorded in Soil Survey Investigations Report Number 31 (*10*). Data of the Muir series are recorded in Soil Survey Investigations Report Number 4 (*5*).

This information helps soil scientists in classifying soils and developing concepts of soil genesis. It is also helpful in estimating available water capacity, susceptibility to soil blowing, fertility, tilth, and other aspects of soil management.

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and 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), D2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM). The group index number that is part of the AASHTO classification is computed by using the Nebraska modification system.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*9*). 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. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten 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 Mollisol.

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 Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

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 Haplustoll (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that have an ustic 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 *Udic* for example, identifies the subgroup that has a greater supply of moisture than is typical for the great group. An example is Udic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly 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-silty, mixed, mesic Udic Haplustolls.

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 substratum 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 (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*9*). Unless otherwise stated, matrix colors in the descriptions are for dry 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."

Alcester series

The Alcester series consists of deep, well drained soils on foot slopes mainly along intermittent drainageways in the loess uplands. Permeability is moderate. These soils formed in silty colluvium-alluvium. Slopes range from 2 to 6 percent.

The Alcester soils are near Colo, Hobbs, Kezan, Nora, and Shell soils in the landscape. Colo soils are somewhat poorly drained and are in a lower position in the landscape than Alcester soils. Hobbs soils do not have a B horizon or a cumulic epipedon. They are on bottom lands of narrow upland drainageways and are occasionally flooded. Kezan soils are poorly drained. They are on bottom lands of upland drainageways and are frequently flooded. Nora soils have a thinner A horizon than Alcester soils, and they have lime higher in the profile. They are on loess uplands and are in a higher position than Alcester soils. Shell soils do not have a B horizon and are on bottom lands.

Typical pedon of Alcester silty clay loam, 2 to 6 percent slopes, 1,825 feet south and 60 feet east of the northwest corner of sec. 1, T. 24 N., R. 2 E.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—8 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; neutral; gradual smooth boundary.

B1—22 to 28 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; neutral; clear smooth boundary.

B2—28 to 37 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; neutral; gradual smooth boundary.

B3—37 to 58 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; neutral; clear smooth boundary.

C—58 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; very fine soft accumulations of lime; few fine soft dark brown accumulations of iron and manganese; strong effervescence; moderately alkaline.

The solum ranges from 36 to 56 inches in thickness. The mollic epipedon ranges from 24 to 48 inches in thickness. Free carbonates are absent above a depth of 48 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is typically silty clay loam but ranges to silt loam and loam. Reaction is medium acid to neutral. The B horizon has value of 4 or 5 (2 through 4 moist) and chroma of 1 through 3. It is typically silty clay loam, but some pedons are silt loam. Reaction is slightly acid or neutral. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is typically silt loam, but some pedons are loam. Reaction ranges from neutral through moderately alkaline.

Barney series

The Barney series consists of poorly drained, rapidly permeable soils on bottom lands of the Elkhorn River valley. These soils formed in loamy and sandy material that is shallow over coarse sand with a small amount of gravel. Slopes range from 0 to 2 percent.

The Barney soils in Stanton County have a thinner A horizon than is defined for the Barney series, but this difference does not alter the usefulness or behavior of the soils.

The Barney soils are near Boel, Inavale, and Marlake Variant soils in the landscape. Boel soils are somewhat poorly drained and are in a slightly higher position than Barney soils. Inavale soils are somewhat excessively drained and are in a higher position. Marlake Variant soils are very poorly drained, have a silty control section, and are in a slightly lower position in the landscape than Barney soils.

Typical pedon of Barney loam, 0 to 2 percent slopes, 1,100 feet east and 800 feet north of the southwest corner of sec. 8, T. 23 N., R. 3 E.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; mildly alkaline; abrupt smooth boundary.

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

IIC1—10 to 30 inches; light gray (10YR 7/2) coarse sand with about 3 percent gravel, grayish brown (10YR 5/2) moist; few fine faint dark yellowish brown (10YR 4/4 moist) mottles; single grain; loose; mildly alkaline; abrupt smooth boundary.

IIC2—30 to 35 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few fine distinct yellowish brown (10YR 5/6 moist) mottles; massive; soft, very friable; mildly alkaline; abrupt smooth boundary.

IIC3—35 to 60 inches; very pale brown (10YR 7/3) coarse sand, pale brown (10YR 6/3) moist; single grain; loose; mildly alkaline.

The solum is from 7 to 10 inches thick. Depth to coarse sand ranges from 6 to 20 inches. Some pedons are calcareous above a depth of 15 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam but ranges to silt loam and fine sandy loam. Reaction is neutral to moderately alkaline. The AC horizon has value of 5 or 6 (2 through 4 moist) and chroma of 2 or 3. It is typically loamy fine sand but ranges to fine sandy loam and loamy sand. Reaction is neutral to moderately alkaline. The IIC horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3. It is typically coarse sand with thin, stratified layers of fine sandy loam and loam. Reaction is neutral to mildly alkaline.

Belfore series

The Belfore series consists of deep, well drained soils on uplands. Permeability is moderately slow. These soils formed in loess on broad ridgetops. Slopes range from 0 to 2 percent.

The Belfore soils are similar to Moody soils and are near Crofton, Moody, and Nora soils. Crofton soils do not have a mollic epipedon or a B horizon. They have free carbonates at a depth of less than 8 inches and are in a lower position in the landscape than Belfore soils. Moody soils have less clay in the B horizon and are also in a lower position. Nora soils have free carbonates at a depth of less than 30 inches, have less clay in the B horizon, and are in a lower position in the landscape than Belfore soils.

Typical pedon of Belfore silty clay loam, 0 to 2 percent slopes, 75 feet north and 2,500 feet east of the southwest corner of sec. 11, T. 21 N., R. 1 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; medium acid; abrupt smooth boundary.

B21t—7 to 13 inches; brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; weak fine prismatic structure parting to moderate fine subangular blocky; hard, firm; medium acid; clear wavy boundary.

B22t—13 to 21 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm; slightly acid; gradual wavy boundary.

B23—21 to 31 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; slightly acid; gradual wavy boundary.

B3—31 to 43 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; common fine faint brownish yellow (10YR 6/8 moist) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

C—43 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; common fine and medium faint brownish yellow (10YR 6/8 moist) mottles; massive; soft, very friable; neutral.

The solum ranges from 35 to 54 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Carbonates are leached to below a depth of 60 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. Reaction is slightly acid or medium acid. The B2t horizon has value of 4 through 6 (3 through 5 moist) and chroma of 2 or 3. It is silty clay loam or silty clay and averages between 35 and 43 percent clay. Reaction is slightly acid or neutral. The B23 and B3 horizons have value of 4 through 6 (3 through 5 moist) and chroma of 3 or 4. Reaction is slightly acid or neutral. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 through 4. It is silty clay loam or silt loam. Reaction is slightly acid or neutral.

Blendon series

The Blendon series consists of deep, well drained soils on stream terraces. Permeability is moderately rapid in the subsoil and rapid in the underlying material. These soils formed in mixed eolian sands and alluvium. Slopes range from 0 to 2 percent.

The Blendon soils are near Boelus, Elsmere, Loretto, and Thurman soils in the landscape. Boelus and Loretto soils have a finer textured B and C horizon and are in a higher position than Blendon soils. Elsmere soils are somewhat poorly drained and are on low stream terraces. Thurman soils have more sand in the control section, are somewhat excessively drained, and are in a higher position in the landscape than Blendon soils.

Typical pedon of Blendon fine sandy loam, 0 to 2 percent slopes, 900 feet west and 485 feet south of the northeast corner of sec. 5, T. 22 N., R. 2 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A12—9 to 16 inches; dark gray (10YR 4/1) fine sandy loam; very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; clear smooth boundary.

B2—16 to 30 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

B3—30 to 36 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; soft, very friable; neutral; gradual smooth boundary.

C1—36 to 47 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; neutral; gradual smooth boundary.

C2—47 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

The solum ranges from 30 to 40 inches in thickness. The mollic epipedon ranges from 24 to 40 inches in thickness. Depth to carbonates is typically below 60 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is typically fine sandy loam but ranges to sandy loam and loam. Reaction ranges from medium acid through neutral. The B2 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. Reaction is slightly acid or neutral. The B3 horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. This horizon is absent in some pedons. Reaction is slightly acid or neutral. The C horizon has value of 5 or 6 (3 through 5 moist) and chroma of 2 through 4. It is typically loamy fine sand, but some pedons are fine sand. Reaction is neutral or mildly alkaline.

Boel series

The Boel series consists of deep, somewhat poorly drained, rapidly permeable soils on bottom lands of major streams. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 2 percent.

The Boel soils are near Gibbon, Inavale, and Ord soils in the landscape. Gibbon soils are finer textured in the control section than Boel soils. Inavale soils are somewhat excessively drained, do not have a mollic epipedon, and are in a slightly higher position in the landscape. Ord soils have fine sand deeper in the profile than Boel soils.

Typical pedon of Boel loam, 0 to 2 percent slopes, 2,350 feet west and 1,200 feet south of the northeast corner of sec. 35, T. 23 N., R. 1 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

AC—8 to 16 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium to fine subangular blocky structure; soft, very friable; mildly alkaline; clear smooth boundary.

C1—16 to 32 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; few medium distinct reddish yellow (7.5YR 6/6 moist) mottles; single grain; loose; slightly alkaline; gradual wavy boundary.

C2—32 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; many medium distinct reddish yellow (7.5YR 6/8 moist) mottles; single grain; loose, thin strata of grayish brown loamy fine sand; neutral.

The solum ranges from 10 to 20 inches in thickness and is commonly the same thickness as the mollic epipedon.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam but ranges to fine sandy loam, loamy fine sand, and loamy sand. Reaction is slightly acid through moderately alkaline. The AC horizon has value of 3 through 5 (2 or 3 moist) and chroma of 2. It is typically fine sandy loam, but some pedons are loamy fine sand. Reaction is slightly acid through moderately alkaline. The C horizon has value of 6 through 8 (5 through 7 moist) and chroma of 2 or 3. It is typically fine sand but ranges to loamy fine sand and sand. The C horizon is stratified with thin layers of material that are darker and slightly finer textured. Reaction is neutral through moderately alkaline.

Boelus series

The Boelus series consists of deep, well drained soils on uplands. Permeability is rapid in the upper part of the profile and moderate in the lower part. These soils formed in a layer of eolian sand and the underlying loess. Slopes range from 2 to 6 percent.

The Boelus soils are near Loretto, Nora, and Thurman soils in the landscape. Loretto soils are adjacent to Boelus soils, but they have less sand in the surface layer and upper part of the B horizon than Boelus soils. Nora soils have more clay and less sand in the control section and are in a lower position in the landscape. Thurman soils have more sand and less clay in the control section and are in a slightly higher position.

Typical pedon of Boelus loamy fine sand, 2 to 6 percent slopes, 450 feet west and 600 feet south of the northeast corner of sec. 12, T. 22 N., R. 2 E.

A1—0 to 11 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

B2—11 to 24 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak coarse angular blocky structure; soft, very friable; slightly acid; abrupt wavy boundary.

IIB2—24 to 40 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; slightly acid; clear smooth boundary.

IIB3—40 to 50 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; slightly acid; clear smooth boundary.

IIC—50 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; few fine faint brownish yellow (10YR 6/8 moist) mottles; massive; slightly hard, very friable; neutral.

The solum ranges from 30 to 55 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Depth to the IIB horizon ranges from 20 to 36 inches. Depth to free carbonates ranges from 50 to below 60 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 through 3, dry or moist. It is typically loamy fine sand but ranges to loamy sand and fine sand.

Reaction ranges from medium acid through neutral. The IIB horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 through 4, dry or moist. It is typically silty clay loam but ranges to silt loam and loam. The content of clay ranges from 18 to 35 percent. Reaction ranges from slightly acid through mildly alkaline. The IIC horizon has value of 5 through 7 (4 through 6 moist) and chroma or 2 through 4, dry or moist. Reaction is neutral or mildly alkaline.

Cass series

The Cass series consists of deep, well drained soils on bottom lands of major stream valleys. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 2 percent.

The Cass soils are near Boel, Gibbon, Inavale, and Ord soils in the landscape. Boel soils are somewhat poorly drained, have more sand in the control section, and are in a slightly lower position in the landscape than Cass soils. Gibbon soils are somewhat poorly drained, have more clay in the control section, and are in a slightly lower position. Inavale soils are somewhat excessively drained, have more sand in the control section, and are also in a slightly lower position. Ord soils are somewhat poorly drained, have fine sand higher in the profile, and are in a slightly lower position than Cass soils.

Typical pedon of Cass fine sandy loam, 0 to 2 percent slopes, 1,400 feet east and 1,200 feet south of the northwest corner of sec. 26, T. 23 N., R. 1 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A12—7 to 16 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark gray (10YR 2/1) moist; weak coarse to fine granular structure; slightly hard, very friable; neutral; clear wavy boundary.

AC—16 to 30 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable; neutral; clear wavy boundary.

C—30 to 60 inches; pale brown (10YR 6/3) fine sand stratified with thin layers of silt loam, loam, and fine sandy loam, brown (10YR 5/3) moist; single grain; loose; neutral; clear wavy boundary.

The mollic epipedon ranges from 10 to 20 inches in thickness. The solum ranges from 20 to 40 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically fine sandy loam or loam but ranges to silt loam or very fine sandy loam. Reaction is slightly acid or neutral. The C horizon has value of 5 through 7 (4 or 5 moist) and chroma of 2 or 3. The C1 horizon is typically fine sand, but some pedons are loamy fine sand. Thin strata of darker, finer textured material are typical. Reaction is neutral or mildly alkaline.

Clarno series

The Clarno series consists of deep, well drained soils on uplands. These soils formed in glacial till. Permeability is moderately slow. Slopes range from 2 to 11 percent.

The Clarno soils are near Hadar, Lawet, and Thurman soils in the landscape. Hadar soils have a coarse textured surface layer and are in a slightly higher position in the landscape than Clarno soils. Lawet soils are poorly drained and are in a lower position. Thurman soils are somewhat excessively drained, are sandy throughout the profile, and are in a higher position than Clarno soils.

Typical pedon of Clarno loam, 2 to 6 percent slopes, 100 feet east and 1,320 feet north of the southwest corner of sec. 17, T. 24 N., R. 1 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21—8 to 16 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; mildly alkaline; clear smooth boundary.

B22—16 to 22 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak coarse blocky structure; hard, firm; mildly alkaline; clear wavy boundary.

B3ca—22 to 30 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; few fine distinct light olive brown (2.5Y 5/4 moist) mottles; weak medium prismatic structure; slightly hard, friable; many medium manganese accumulations; violent effervescence; strongly alkaline; gradual smooth boundary.

C—30 to 60 inches; light gray (10YR 7/2) clay loam, pale brown (10YR 6/3) moist; few faint olive yellow (2.5Y 6/6 moist) mottles; massive; slightly hard, friable; few pebbles and stones; many medium lime accumulations; violent effervescence; strongly alkaline.

The solum ranges from 20 to 40 inches in thickness. The mollic epipedon ranges from 8 to 20 inches in thickness. Depth to lime ranges from 12 to 26 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is typically loam but ranges to silt loam. Reaction is neutral or slightly acid. The B2 horizon has value of 4 or 5 (2 through 4 moist) and chroma of 2 or 3. It is typically clay loam but ranges to loam. The content of clay ranges from 25 to 34 percent. Reaction is neutral or mildly alkaline. The B3 and C horizons have hue of 10YR through 5Y, value of 5 through 7 (4 through 6 moist), and chroma of 2 through 4. Reaction is moderately alkaline to strongly alkaline.

Colo series

The Colo series consists of deep, somewhat poorly drained soils on bottom lands. Permeability is moderately slow. These soils formed in noncalcareous silty sediment. Slopes range from 0 to 1 percent.

The Colo soils are similar to Zook soils and are near Hobbs, Kezan, Lamo, Shell, and Zook soils in the landscape. Hobbs soils have a thinner A horizon than Colo soils. They are well drained, stratified, and are in narrow drainageways of the loess uplands. Kezan soils are poorly drained, stratified, and are adjacent to Colo soils. Lamo soils have free carbonates throughout the profile and are also adjacent to Colo soils. Shell soils are well drained and are in a slightly higher position. Zook soils are poorly drained, have more clay in the control section, and are adjacent to Colo soils in the landscape.

Typical pedon of Colo silty clay loam, 0 to 1 percent slopes, 60 feet south and 1,850 feet west of the northeast corner of sec. 11, T. 21 N., R. 3 E.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A12—8 to 18 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine subangular blocky structure; slightly hard, friable; neutral; clear wavy boundary.

A13—18 to 28 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine and very fine subangular blocky structure; hard, firm; neutral; clear smooth boundary.

AC—28 to 40 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium and fine subangular blocky structure; hard, firm; neutral; clear wavy boundary.

Cg—40 to 60 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; few, medium distinct brown (7.5YR 5/4 moist) mottles; massive; hard, firm; few accumulations of iron and manganese; neutral.

The solum and the mollic epipedon range from 36 to 50 inches in thickness. In most pedons, free carbonates are absent throughout the profile, but in some areas the soil has a stratified, silty, calcareous overwash of soil material ranging from 6 to 18 inches thick.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 0 or 1. It is typically silty clay loam. Reaction is slightly acid or neutral. The C horizon has value of 5 through 7 (3 through 5 moist) and chroma of 0 through 2. It is typically silty clay loam, but some pedons are loamy sand or fine sand below a depth of 48 inches. Reaction is slightly acid or neutral.

Crofton series

The Crofton series consists of deep, well drained to excessively drained, moderately permeable soils on ridgetops and side slopes of uplands. These soils formed in calcareous loess. Slopes range from 2 to 60 percent.

The Crofton soils are near Moody and Nora soils. Moody soils have a mollic epipedon, are more strongly developed than Crofton soils, and are on ridgetops and side slopes. Nora soils have a mollic epipedon and a B horizon that is more deeply leached of carbonates. They are adjacent to Colo soils on the landscape.

Typical pedon of Crofton silt loam, 15 to 30 percent slopes, 1,200 feet east and 750 feet north of the southwest corner of sec. 28, T. 24 N., R. 1 E.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

AC—5 to 11 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium acid fine subangular blocky structure; slightly hard, very friable; few medium accumulations of lime; violent effervescence; moderately alkaline; clear wavy boundary.

C1—11 to 22 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; few fine distinct gray (10YR 5/1 moist) relict mottles; weak coarse prismatic structure; slightly hard, very friable; few fine accumulations of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—22 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; few fine distinct gray (10YR 6/l moist) relict mottles; massive; few fine accumulations of iron and manganese; soft, very friable; violent effervescence; moderately alkaline.

The solum ranges from 6 to 15 inches in thickness. Depth to free carbonates ranges from 0 to 8 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 4 through 6 (3 or 4 moist) and chroma of 2 or 3. It is typically silt loam, but some pedons are light silty clay loam. The AC horizon is absent in some pedons. If present, it has value of 5 or 6 (4 or 5 moist) and chroma or 2 or 3. The C horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 through 4. Most pedons have relict mottles with values ranging from 5 through 7 (4 through 6 moist) and chroma of l through 6.

Elsmere series

The Elsmere series consists of deep, somewhat poorly drained, rapidly permeable soils. These soils formed in eolian sands deposited on stream terraces and in depressed valleys of the uplands. Slopes range from 0 to 2 percent.

The Elsmere soils are near Boelus, Loup, Ovina, and Thurman soils in the landscape. Boelus soils have more clay and silt in the control section, are well drained, and are in a higher position than Elsmere soils. Loup soils are poorly drained and in a lower position. Ovina soils have less sand and more clay in the control section and are in a slightly higher position. Thurman soils are somewhat excessively drained and are in a higher position in the landscape than Elsmere soils.

Typical pedon of Elsmere loamy fine sand, 0 to 2 percent slopes, 1,645 feet west and 970 feet south of the northeast corner of sec. 15, T. 24 N., R. 1 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak medium granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

A12—5 to 11 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; clear wavy boundary.

AC—11 to 25 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grain; soft, very friable; few soft segregations of iron and manganese; neutral; gradual smooth boundary.

C—25 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; many coarse distinct strong brown (10YR 5/6 moist) mottles; single grain; loose; neutral.

The solum ranges from 16 to 36 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon is typically loamy fine sand but ranges to fine sandy loam, loamy sand, and fine sand. It has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. Reaction ranges from medium acid through mildly alkaline. The C horizon is typically fine sand but ranges to loamy fine sand and loamy sand. It has value of 5 through 7 (4 or 5 moist) and chroma of 2. Reaction ranges from medium acid through neutral.

Gibbon series

The Gibbon series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands of major stream valleys. These soils formed in stratified alluvium. Slopes range from 0 to 1 percent.

The Gibbon soils are near Cass, Lamo, Ord, and Zook soils in the landscape. Cass soils are well drained, have more sand in the control section, and are in a higher position in the landscape than Gibbon soils. Lamo soils have a thicker mollic epipedon and are adjacent to Gibbon soils in the landscape. Ord soils have more sand in the control section and are also adjacent to Gibbon soils. Zook soils are poorly drained, have more clay in the control section, and are in a slightly lower position than Gibbon soils.

Typical pedon of Gibbon silty clay loam, 0 to 1 percent slopes, 2,700 feet east and 1,850 feet north of the southwest corner of sec. 35, T. 23 N., R. 1 E.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12—8 to 18 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

A3ca—18 to 28 inches; gray (2.5Y 5/1) silty clay loam, dark gray (2.5Y 4/1) moist; weak fine and medium subangular blocky structure; hard, friable; violent effervescence; strongly alkaline; clear smooth boundary.

C1ca—28 to 46 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; few fine distinct yellowish brown (10YR 5/6 moist) mottles; weak medium prismatic structure; slightly hard, friable; violent effervescence; strongly alkaline; clear smooth boundary.

C2—46 to 60 inches; light gray (2.5Y 7/2) fine sand stratified with thin layers of loamy fine sand; light brownish gray (2.5Y 6/2) moist; common medium distinct brownish yellow (10YR 6/6 moist) mottles; single grain; loose; strongly alkaline.

The solum ranges from 15 to 28 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Depth to carbonates is less than 10 inches.

The A horizon has hue of 10YR or 2.5Y, value of 3 through 5 (2 or 3 moist), and chroma of 1 or 2. It is typically silty clay loam but ranges to silt loam and loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 5 through 8 (4 through 6 moist) and chroma of 1 or 2. It is typically silt loam or loam and commonly becomes coarser below a depth of 40 inches. Thin, stratified layers of fine sandy loam or loam are common in some pedons. Reaction is moderately alkaline or strongly alkaline.

Hadar series

The Hadar series consists of deep, well drained soils on uplands. These soils are rapidly permeable in the upper part of the profile and moderately slow in the lower part. They formed in a thin layer of eolian sand and in the underlying glacial till. Slopes range from 2 to 6 percent.

The Hadar soils are near Clarno, Lawet, and Thurman soils in the landscape. Clarno soils do not have sandy material in the upper part of the profile and are in a lower position than Hadar soils. Lawet soils are poorly drained and are on bottom lands. Thurman soils are somewhat excessively drained, do not have glacial till in the lower part of the profile, and generally are in a higher position in the landscape than Hadar soils.

Typical pedon of Hadar loamy fine sand, 2 to 6 percent slopes, 300 feet north and 400 feet east of the southwest corner of sec. 8, T. 24 N., R. 1 E.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; medium acid; clear smooth boundary.

A12—8 to 14 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; medium acid; clear smooth boundary.

C1—14 to 20 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; very friable; slightly acid; abrupt smooth boundary.

IIB2—20 to 28 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; few medium distinct yellowish brown (10YR 5/6 moist) mottles; moderate medium and fine subangular blocky structure; hard, firm; common fine dark brown accumulations of iron and manganese; neutral; clear smooth boundary.

IIB3—28 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; many medium distinct yellowish brown (10YR 5/6 moist) mottles; weak coarse subangular blocky structure; hard, firm; common fine dark brown accumulations of iron and manganese; many soft accumulations of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

IIC—36 to 60 inches; light gray (2.5Y 7/2) clay loam, light olive brown (2.5Y 5/4) moist; many medium distinct yellowish brown (10YR 5/6 moist) mottles; weak medium prismatic structure; hard, firm; few medium dark brown accumulations of iron and manganese; violent effervescence; moderately alkaline.

The mollic epipedon ranges from 10 to 20 inches in thickness. Depth to the IIB horizon ranges from 20 to 40 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand but ranges to loamy sand or sand. Reaction is slightly acid or medium acid. The C1 horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 through 4. It is slightly acid or medium acid. The IIB horizon has hue of 10YR or 2.5Y, value of 5 through 7 (4 through 6 moist), and chroma of 2 through 4. Reaction is neutral through moderately alkaline. The IIB horizon is typically clay loam but ranges to loam and sandy clay loam. The IIC horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 through 4. Reaction is mildly alkaline or moderately alkaline.

Hobbs series

The Hobbs series consists of deep, well drained, moderately permeable soils. These soils formed in stratified, noncalcareous, silty alluvium on botton lands of narrow drainageways of uplands. Slopes range from 0 to 2 percent.

The Hobbs soils are near Alcester, Colo, Kezan, Nora, and Shell soils in the landscape. Alcester soils have a B horizon, do not have stratification above a depth of 10 inches, and are in a higher position. Colo soils are somewhat poorly drained and are in a lower position than Hobbs soils. Kezan soils are poorly drained and are in a lower position. Nora soils have a B horizon and do not have stratification. They formed in loess on the uplands. Shell soils are stratified between a depth of 20 to 40 inches and are adjacent to Hobbs soils on the landscape.

Typical pedon of Hobbs silt loam, 0 to 2 percent slopes, 350 feet south and 75 feet west of the northeast corner of sec. 6, T. 21 N., R. 2 E.

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

C1—9 to 28 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) and dark gray (10YR 4/1) moist; weak medium and fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

C2—28 to 40 inches; stratified dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) and dark grayish brown (10YR 4/2) moist; weak medium granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Ab—40 to 60 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; massive; hard, friable; neutral.

The solum is less than 10 inches thick. Carbonates are absent above a depth of 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam but ranges to silty clay loam. Reaction is neutral or mildly alkaline. The C horizon has value of 4 through 7 (3 through 6 moist) and chroma of 1 through 3. Thin strata with higher or lower value are in undisturbed areas. Reaction is neutral through moderately alkaline.

Inavale series

The Inavale series consists of deep, somewhat excessively drained, rapidly permeable soils on bottom lands of major stream valleys. These soils formed in recent sandy alluvium. Slopes range from 0 to 3 percent.

The Inavale soils are near Barney, Boel, Cass, Gibbon, and Ord soils in the landscape. Barney soils are poorly drained and are in a lower position than Inavale soils. Boel and Ord soils have a mollic epipedon, are somewhat poorly drained, and are also in a lower position. Cass soils have a mollic epipedon, are well drained, have less sand in the control section, and are in a slightly higher position. Gibbon soils have more silt and clay in the control section, are somewhat poorly drained, and are in a slightly lower position than Inavale soils.

Typical pedon of Inavale loamy fine sand, 0 to 3 percent slopes, 1,800 feet west and 1,200 feet north of the southeast corner of sec. 36, T. 24 N., R. 3 E.

Ap—0 to 7 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak medium granular structure; soft, very friable; neutral; abrupt smooth boundary.

AC—7 to 12 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grain; soft, very friable; neutral; clear wavy boundary.

C1—12 to 32 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; mildly alkaline; gradual wavy boundary.

C2—32 to 49 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; thin strata of fine sandy loam; single grain; loose; mildly alkaline; gradual wavy boundary.

C3—49 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; mildly alkaline.

The solum ranges from 10 to 30 inches in thickness. Typically, carbonates are absent to a depth of 60 inches.

The A horizon has value of 4 through 7 (3 through 5 moist) and chroma of 1 through 3. It does not have a mollic epipedon. The A horizon is typically loamy fine sand but ranges to fine sandy loam, fine sand, and sand. Reaction is neutral or mildly alkaline. The AC and C horizons have value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3. They are typically fine sand but range to loamy sand and sand. Thin strata of slightly finer textured material are in the C horizon. Reaction is neutral through moderately alkaline.

Kezan series

The Kezan series consists of deep, poorly drained, moderately permeable soils that formed in silty alluvium. These soils are on bottom lands of upland drainageways. Slopes range from 0 to 2 percent.

The Kezan soils in Stanton County lack mottling as defined in the range for the Kezan series, but this difference does not alter the usefulness or behavior of the soil.

The Kezan soils are similar to Hobbs soils and are near Colo, Hobbs, Lamo, Muir, and Shell soils in the landscape. Colo soils are somewhat poorly drained and have a mollic epipedon that is more than 36 inches thick. Hobbs soils are well drained. Lamo soils are cumulic and calcareous. Colo, Hobbs, and Lamo soils are in positions in the landscape similar to Kezan soils. Muir soils are cumulic and well drained and are on low stream terraces. Shell soils are well drained and are in a higher position on the bottom lands than Kezan soil.

Typical pedon of Kezan silt loam, 0 to 2 percent slopes, 120 feet south and 100 feet west of the northeast corner of sec. 34, T. 22 N., R. 3 E.

Ap—0 to 8 inches; mixed dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

C1—8 to 14 inches; stratified grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; weak bedding planes; mildly alkaline; clear wavy boundary.

C2—14 to 24 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

A11b—24 to 38 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; moderately alkaline; gradual wavy boundary.

A12b—38 to 48 inches; very dark gray (10YR 3/1) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; moderately alkaline; clear wavy boundary.

A13b—48 to 60 inches; very dark gray (2.5Y N3/0) silty clay loam, black (2.5Y N2/0) moist; massive; hard, friable; moderately alkaline.

The solum is 4 to 9 inches thick. Free carbonates are absent in the profile.

The A horizon has value of 4 through 6 (2 or 3 moist) and chroma of 1 or 2. Reaction is neutral or mildly alkaline. The C horizon has value of 4 through 6 (3 or 4 moist) and chroma of 1 or 2. It contains thin strata of higher or lower value. Reaction is neutral to moderately alkaline. The Ab horizon is below a depth of 20 inches. Reaction is neutral to moderately alkaline.

Lamo series

The Lamo series consists of deep, somewhat poorly drained and poorly drained soils on bottom lands. Permeability is moderately slow. These soils formed in calcareous silty alluvium. Slopes range from 0 to 2 percent.

The Lamo soils in Stanton County lack mottles as defined for the Lamo series, but this difference does not alter the usefulness or behavior of the soils.

The Lamo soils are near Alcester, Colo, Gibbon, and Zook soils in the landscape. Alcester soils are well drained and are on foot slopes. Colo soils do not have calcium carbonate and are adjacent to Lamo soils in the landscape. Gibbon soils are noncumulic and are also in a similar position. Zook soils have more clay in the control section and are in a slightly lower position than Lamo soils.

Typical pedon of Lamo silty clay loam, 0 to 1 percent slopes, 525 feet south and 2,400 feet west of the northeast corner of sec. 34, T. 22 N., R. 3 E.

Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium and fine granular structure; slightly hard, friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12—10 to 22 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; medium granular structure; slightly hard, friable; violent effervescence; moderately alkaline; clear wavy boundary.

AC—22 to 32 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; slightly hard, friable; many medium soft accumulations of lime; violent effervescence; moderately alkaline; clear wavy boundary.

C1—32 to 39 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, friable; few medium small accumulations of lime; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—39 to 60 inches; light gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, friable; few small soft accumulations of lime; violent effervescence; moderately alkaline.

The solum and mollic epipedon range from 24 to 39 inches in thickness. Depth to carbonates ranges from 0 to 10 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silty clay loam, but it has small areas of silt loam. The AC horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The control section typically averages 28 to 35 percent silty clay loam. The C horizon has value of 5 through 7 (3 through 6 moist) and chroma of 1 or 2. It is typically silty clay loam but ranges to silt loam. Fine sandy loam, loamy fine sand, and fine sand are below a depth of 40 inches in some places.

Lawet series

The Lawet series consists of deep, poorly drained soils. Permeability is moderate. These soils are on bottom lands. They formed in calcareous, loamy alluvium. Slopes range from 0 to 2 percent.

The Lawet soils in Stanton County have a thicker mollic epipedon and higher chroma in the matrix directly below the mollic epipedon than is described for the series, but this difference does not alter the usefulness or behavior of the soils.

The Lawet soils are near Clarno, Colo, Elsmere, Hadar, Loup, and Ord soils in the landscape. Clarno and Hadar soils are well drained soils on uplands and formed in glacial till. Colo, Elsmere, and Ord soils are somewhat poorly drained and are in a slightly higher position than Lawet soils. Elsmere, Loup, and Ord soils have more sand in the control section. Loup soils are in a slightly lower position than Lawet soils.

Typical pedon of Lawet silty clay loam, 0 to 1 percent slopes, 1,500 feet south and 250 feet west of the northeast corner of sec. 9, T. 24 N., R. I E.

A11—0 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine and very fine granular structure; slightly hard, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12ca—12 to 25 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; violent effervescence; moderately alkaline; abrupt smooth boundary.

B2—25 to 33 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak medium granular structure; slightly hard, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—33 to 46 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; many fine distinct yellowish brown (10YR 5/4 moist) mottles; massive; slightly hard, friable; few small accumulations of manganese or iron; violent effervescence; mildly alkaline; gradual wavy boundary.

Ab—46 to 60 inches; dark gray (10YR 4/1) sandy loam, very dark gray (10YR 3/1) moist; many fine faint reddish brown (5YR 4/4 moist) mottles; massive; slightly hard, firm; few small accumulations of manganese or iron; violent effervescence; moderately alkaline.

The mollic epipedon ranges from 24 to 40 inches in thickness and is of the same thickness as the solum. Free carbonates are throughout the solum.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 0 or 1. It is typically silty clay loam but ranges to loam and silt loam. Reaction is mildly alkaline or moderately alkaline. The B horizon has value of 4 or 5

(3 or 4 moist) and chroma of 0 or 1. It is typically loam but ranges to silt loam, very fine sandy loam, and sandy clay loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 3 through 6 (2 through 5 moist) and chroma of 0 through 2. It is typically sandy clay loam and sandy loam but ranges to silty clay loam, silt loam, and loam. Reaction is neutral through moderately alkaline.

Loretto series

The Loretto series consists of deep, well drained, moderately permeable soils on uplands and stream terraces. These soils formed in mixed eolian sand and loess. Slopes range from 0 to 6 percent.

The Loretto soils are near Blendon, Boelus, Nora, and Thurman soils in the landscape. Blendon soils have a B horizon of fine sandy loam and are in a slightly lower position than Loretto soils. Boelus soils have more sand in the upper part of the profile and are adjacent to Loretto soils. Nora soils have more clay in the subsoil, less sand in the control section, and are in a lower position in the landscape. Thurman soils have more sand in the control section and are in a higher position.

Typical pedon of Loretto fine sandy loam, 2 to 6 percent slopes, 500 feet east and 650 feet south of the northwest corner of sec. 19, T. 22 N., R. 1 E.

Ap—0 to 8 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; medium acid; abrupt smooth boundary.

A12—8 to 16 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable; medium acid; clear smooth boundary.

B2t—16 to 32 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

B3—32 to 41 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

C—41 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; neutral.

The solum ranges from 36 to 60 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Depth to carbonates ranges from 40 inches to below 60 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is fine sandy loam or loam. Reaction is slightly acid or medium acid. The B2t horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is typically loam or silt loam, but some pedons are light silty clay loam. Reaction is medium acid through neutral. The B3 and C horizons have value of 5 through 7 (4 through 6 moist) and chroma of 2 through 4. These horizons are typically loam or silt loam, but some pedons are silty clay loam. Some pedons are sandy loam or loamy fine sand below a depth of 40 inches. Reaction is neutral through moderately alkaline.

Loup series

The Loup series consists of deep, poorly drained, rapidly permeable soils on stream terraces and in a few areas, on bottom lands in the Elkhorn River Valley. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 2 percent.

The Loup soils are near Elsmere, Lawet, Ovina, and Thurman soils in the landscape. Elsmere soils are somewhat poorly drained and are in a slightly higher position than Loup soils. Lawet soils have more clay in the control section and are adjacent to Loup soils. Ovina soils are somewhat poorly drained, have more clay in the control section, and are in a slightly higher position. Thurman soils are somewhat excessively drained and are in a higher position than Loup soils.

Typical pedon of Loup fine sandy loam, 0 to 1 percent slopes, 1,450 feet south and 100 feet east of the northwest corner of sec. 10, T. 24 N., R. 1 E.

A11—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—10 to 16 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

AC—16 to 20 inches; gray (10YR 5/1) fine sandy loam, dark gray (10YR 4/1) moist; weak medium blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C1—20 to 36 inches; light gray (10YR 7/2) loamy fine sand, light brownish gray (10YR 6/2) moist; common medium faint dark yellowish brown (10YR 4/4 moist) mottles; single grain; loose; mildly alkaline; clear smooth boundary.

C2—36 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2 moist) common medium distinct yellowish brown (10YR 5/6 moist) mottles; single grain; loose; mildly alkaline.

The solum ranges from 10 to 20 inches in thickness. The mollic epipedon ranges from 7 to 20 inches in thickness. Loup soils have free carbonates above a depth of 15 inches and typically do not have free carbonates below this depth.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is typically fine sandy loam but ranges to loamy fine sand. Reaction is neutral through moderately alkaline. The AC horizon has values intermediate between the A and C horizon. It is typically fine sandy loam but ranges to loamy fine sand. Reaction is neutral through moderately alkaline. Some pedons do not have an AC horizon. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 1 or 2. Reaction ranges from mildly alkaline to moderately alkaline.

Marlake Variant

The Marlake Variant consists of deep, very poorly drained, moderately permeable soils on bottom lands of major streams. These soils formed in silty alluvium. Slopes range from 0 to 1 percent.

The Marlake Variant soils are near Barney, Boel, Inavale, and Riverwash soils in the landscape. Barney and Boel soils have more sand in the control section, are better drained, and are in a slightly higher position than Marlake Variant soils. Inavale soils have more sand in the control section, are somewhat excessively drained, and are in a higher position. Riverwash is sandy, and it is in a lower position in the landscape than Marlake Variant soils.

Typical pedon of Marlake Variant silt loam, 0 to 1 percent slopes, 100 feet west and 1,000 feet south of the northeast corner of sec. 10, T. 23 N., R. 3 E.

O1—3 inches to 0 partially decayed organic matter made up of leaves and stems.

A1—0 to 12 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; massive; hard, very friable; mildly alkaline; clear wavy boundary.

C—12 to 60 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; few fine distinct yellowish brown (10YR 5/6 moist) mottles; massive; hard, friable; mildly alkaline.

The solum ranges from 10 to 20 inches in thickness. The mollic epipedon is 6 to 18 inches thick.

A layer of decayed leaves and stems 1 inch to 3 inches thick is typically on the surface. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2, dry or moist. It is commonly silt loam, but thin strata of fine sandy loam and loam are common. Reaction is neutral through moderately alkaline. The C horizon has hue of 10YR through 5Y, value of 5 through 7 (4 through 6 moist), and chroma of 1 or 2, dry or moist. It is typically silt loam but ranges to loam. The C horizon is commonly stratified with coarser material. Mottles range from few to common, faint to prominent, and yellowish brown to reddish brown. Reaction is neutral to moderately alkaline.

Moody series

The Moody series consists of deep, well drained soils on uplands and terraces. Permeability is moderately slow. These soils formed in loess. Slopes range from 0 to 6 percent.

The Moody soils are near Belfore, Crofton, and Nora soils in the landscape. Belfore soils have more clay in the control section and are in a higher position than Moody soils. Crofton soils do not have a mollic epipedon, are calcareous at or near the surface, have less clay in the control section, and are in a similar position on the landscape. Nora soils have a thinner B horizon, have carbonates higher in the profile, and are in a lower position than Moody soils.

Typical pedon of Moody silty clay loam, 2 to 6 percent slopes, 2,430 feet south and 150 feet west of the northeast corner of sec. 5, T. 21 N., R. 2 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; hard, friable; medium acid; abrupt smooth boundary.

A12—7 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

B21—11 to 17 inches; grayish brown (10YR 5/2) silty clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; slightly acid; clear wavy boundary.

B22—17 to 32 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm; slightly acid; clear wavy boundary.

B3—32 to 40 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure; slightly hard, friable; few fine faint strong brown iron stains; neutral; clear smooth boundary.

C—40 to 60 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure; soft, very friable; common fine strong brown iron stains; mildly alkaline.

The solum ranges from 30 to 55 inches in thickness. Depth to carbonates ranges from 40 inches to below 60 inches. The mollic epipedon ranges from 10 to 20 inches in thickness, and in places it includes part of the B horizon.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 2. It is typically silty clay loam but ranges to silt loam. Reaction is medium acid through neutral. The B horizon has value of 3 through 6 (3 through 5 moist) and chroma of 2 through 4. It is typically silty clay loam, but some pedons are silt loam. In some pedons, the upper part of the B horizon is more than 35 percent clay but the control section averages less than 35 percent clay. Reaction is slightly acid through mildly alkaline. The C horizon has value of 5 or 6 (5 or 6 moist) and chroma of 2 through 4. It is mildly alkaline or moderately alkaline. The C horizon is typically silt loam, but some pedons are silty clay loam.

Muir series

The Muir series consists of deep, well drained soils on low stream terraces and bottom lands adjacent to larger streams. Permeability is moderate. The soils formed in silty alluvium. Slopes range from 0 to 1 percent.

The Muir soils are near Alcester, Gibbon, Hobbs, Nora, and Zook soils in the landscape. Alcester soils are on foot slopes and are in a higher position than Muir soils. Gibbon soils are somewhat poorly drained and are in a lower position. Hobbs soils are stratified at a depth above 10 inches. They do not have a B horizon and are on bottom lands of narrow upland drainageways. Nora soils have a thinner A horizon than Muir soils and have lime higher in the profile. They are on loess uplands and are in a higher position in the landscape than Muir soils. Zook soils are poorly drained, have more clay in the control section, and are in a lower position.

Typical pedon of Muir silty clay loam, 0 to 1 percent slopes, 200 feet south and 2,450 feet east of the northwest corner of sec. 34, T. 24 N., R. 3 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A12—7 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

B1—17 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

B2—24 to 39 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium and fine subangular blocky structure; hard, friable; neutral; clear wavy boundary.

B3—39 to 51 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C—51 to 60 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; very fine soft accumulations of lime; strong effervescence; moderately alkaline.

The solum ranges from 24 to 55 inches in thickness. The mollic epipedon ranges from 20 to more than 40 inches in thickness. Free carbonates are absent above a depth of 50 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silty clay loam but ranges to silt loam and loam. Reaction is medium acid through neutral. The B horizon has value of 4 through 6 (2 through 4 moist) and chroma of 2 or 3. It is typically silty clay loam but ranges to silt loam. Reaction is slightly acid through mildly alkaline. The C horizon has value of 5 through 7 (3 through 5 moist) and chroma of 2 through 4. It is typically silt loam but ranges to loam. Reaction ranges from slightly acid to moderately alkaline. In places fine sand, loam, or loamy sand is below a depth of 40 inches.

Nora series

The Nora series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous loess. Slopes range from 2 to 15 percent.

The Nora soils are near Alcester, Crofton, and Moody soils. Alcester soils have a thicker surface layer and are on foot slopes. Crofton soils do not have a mollic epipedon or a B horizon and have free carbonates at or near the surface. They are adjacent to Nora soils on the landscape. Moody soils have a thicker B horizon, have free carbonates leached to a greater depth, and are in a higher position than Nora soils.

Typical pedon of Nora silty clay loam, 6 to 11 percent slopes, 200 feet south and 1,400 feet east of the northwest corner of sec. 15, T. 24 N., R. 2 E.

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

B21—7 to 11 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, friable; neutral; clear wavy boundary.

B22—11 to 18 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable; neutral; clear wavy boundary.

B3ca—18 to 27 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; moderate coarse prismatic structure; slightly hard, friable; few fine lime concretions; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—27 to 38 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure; soft, very friable; few medium lime concretions; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—38 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The solum ranges from 20 to 36 inches in thickness. Carbonates are typically at a depth of 18 to 24 inches but range to a depth of 14 to 30 inches. The mollic epipedon ranges from 7 to 15 inches in thickness and extends into the B horizon.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 2. It is typically silty clay loam but ranges to silt loam. Reaction is slightly acid or neutral. The B2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 3 or 4. It is silty clay loam or silt loam but averages between 20 and 32 percent content of clay. Reaction ranges from slightly acid through mildly alkaline. The C horizon has value of 5 through 7 (5 or 6 moist) and chroma of 2 through 4. It is mildly alkaline or moderately alkaline.

The Nora soils in map units CuE2, NpC2, and NpD2 have a lighter colored surface layer than is defined as the range for the Nora series, but this difference does not alter the usefulness or behavior of the soils.

Ord series

The Ord series consists of deep, somewhat poorly drained soils on bottom lands. Permeability is moderately rapid. These soils formed in stratified alluvium. Slopes range from 0 to 2 percent.

The Ord soils are commonly near Blendon, Boel, Cass, and Inavale soils in the landscape. Blendon and Cass soils are well drained and are in a higher position than Ord soils. Boel soils have more sand in the control section and are adjacent in the landscape to Ord soils. Inavale soils do not have a mollic epipedon, are somewhat excessively drained, and are in a slightly higher position in the landscape.

Typical pedon of Ord silt loam, 0 to 1 percent slopes, 300 feet north and 900 feet west of the southeast corner of sec. 28, T. 23 N., R. 2 E.

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

A12—9 to 19 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak medium subangular structure; slightly hard, very friable; moderately alkaline; clear wavy boundary.

AC—19 to 26 inches; gray (10YR 5/1) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; moderately alkaline; clear wavy boundary.

C1—26 to 34 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; few fine distinct reddish yellow (7.5YR 6/6 moist) mottles; single grain; loose; moderately alkaline; gradual wavy boundary.

C2—34 to 42 inches; light gray (10YR 7/2) loamy fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; moderately alkaline; gradual wavy boundary.

C3—42 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; weak fine distinct brown (7.5YR 5/4 moist) mottles; single grain; loose; moderately alkaline.

The solum ranges from 20 to 35 inches in thickness and commonly corresponds to the depth to fine sand. Carbonates are typically absent in the profile, but, in a few places, carbonates are at or near the surface. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam but ranges to loam or fine sandy loam. Reaction ranges from slightly acid through moderately alkaline. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 or 2. It is commonly fine sandy loam, but in places it is loam. Reaction is neutral through moderately alkaline. The C horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3. It is typically fine sand that has strata of loamy fine sand and fine sandy loam. Reaction ranges from neutral through moderately alkaline.

Ortello series

The Ortello series consists of deep, well drained soils on uplands. Permeability is moderately rapid in the subsoil and rapid in the underlying material. These soils formed in mixed eolian sands and loess. Slopes range from 2 to 6 percent.

The Ortello soils are near Boelus, Loretto, Nora, and Thurman soils in the landscape. Boelus soils are coarser textured in the upper part of the control section than Ortello soils, and they are adjacent to Ortello soils in the landscape. Loretto and Nora soils have less sand in the B horizon and are in a similar position in the landscape. Thurman soils have a sandy control section and do not have a B horizon. They are somewhat excessively drained. Thurman soils are in a slightly higher position than Ortello soils.

Typical pedon of Ortello fine sandy loam, 2 to 6 percent slopes, 250 feet south and 1,700 feet east of the northwest corner of sec. 4, T. 24 N., R. 1 E.

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

A12—7 to 17 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; slightly hard, very friable; slightly acid; clear wavy boundary.

B2—17 to 26 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

C—26 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

The solum ranges from 22 to 36 inches in thickness. The mollic epipedon ranges from 8 to 20 inches in thickness. Ortello soils are generally noncalcareous to below a depth of 60 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 through 3. It is dominantly fine sandy loam but ranges to loam. Reaction is slightly acid or neutral. The B horizon has value of 4 through 6 (3 or 5 moist) and chroma of 2 through 4. It is dominantly fine sandy loam, but some pedons are sandy loam. Reaction is slightly acid or neutral. The C horizon has value of 6 through 8 (5 or 6 moist) and chroma of 2 through 4. Reaction is neutral or mildly alkaline. The C horizon is typically loamy fine sand but ranges to fine sand. In places, it is fine sandy loam in the upper part.

Ovina series

The Ovina series consists of deep, somewhat poorly drained soils on stream terraces. Permeability is moderate in the upper part of the control section and rapid in the lower part. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 3 percent.

The Ovina soils are near Boelus, Elsmere, Loretto, and Thurman soils in the landscape. Boelus and Loretto soils do not have mottles of low chroma above a depth of 40 inches. They are well drained and are in a slightly higher position in the landscape than Ovina soils. Elsmere soils have more sand in the control section and are in a lower position. Thurman soils have more sand in the control section and are somewhat excessively drained. They are in a higher position than Ovina soils.

Typical pedon of Ovina loamy fine sand, 0 to 3 percent slopes, 900 feet north and 100 feet east of the southwest corner of sec. 33, T. 23 N., R. 1 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A12—8 to 13 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

C1—13 to 19 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; weak medium fragments; soft, very friable; mildly alkaline; clear wavy boundary.

C2—19 to 35 inches; pale brown (10YR 6/3) loam, light olive brown (2.5Y 5/4) moist; weak fine and medium fragments; slightly hard, friable; slight effervescence; mildly alkaline; gradual wavy boundary.

C3—35 to 42 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 4/2) moist; common fine distinct reddish yellow (5YR 6/8 moist) mottles; weak fine and medium fragments; hard, firm; slight effervescence; mildly alkaline; abrupt smooth boundary.

C4—42 to 60 inches; light gray (2.5Y 7/3) fine sand, grayish brown (2.5Y 5/3) moist; common fine to medium distinct light olive brown (2.5Y 5/6 moist) mottles; single grain; soft, very friable; mildly alkaline.

The solum ranges from 10 to 20 inches in thickness. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand but ranges to loamy sand and fine sandy loam. Reaction ranges from neutral through moderately alkaline. The C1 horizon has value of 5 through 7 (4 through 6 moist) and chroma of 1 through 3. It is typically loamy fine sand but ranges to fine sandy loam. Reaction is mildly alkaline or moderately alkaline. The C2 and C3 horizons have value of 5 through 7 (4 through 6 moist) and chroma of 1 through 3. They are loam and clay loam. Reaction ranges from mildly alkaline to moderately alkaline. The C4 horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3. It is typically fine sand, but some pedons are loamy fine sand. Reaction is mildly alkaline or moderately alkaline.

Shell series

The Shell series consists of deep, well drained, moderately permeable soils on bottom lands of drainageways. These soils formed in stratified, silty alluvial sediment. Slopes range from 0 to 1 percent.

The Shell soils are near Alcester, Colo, Hobbs, and Nora soils in the landscape. Alcester soils have a regular decrease in content of organic matter. They have a B horizon and are on foot slopes. Colo soils are somewhat poorly drained and are in a slightly lower position in the landscape than Shell soils. Hobbs soils are stratified above a depth of 10 inches. They do not have a mollic epipedon and are on bottom lands of narrow upland drainageways. Nora soils have a thinner surface layer, a B horizon, and are in a higher position in the landscape than Shell soils.

Typical pedon of Shell silty clay loam, 0 to 1 percent slopes, 200 feet west and 2,400 feet south of the northeast corner of sec. 20, T. 24 N., R. 3 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A12—7 to 25 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C1—25 to 32 inches; stratified light brownish gray (10YR 6/2) and dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) moist; weak fine and medium fragments; slightly hard, friable; neutral; clear smooth boundary.

Ab—32 to 40 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; mildly alkaline; clear wavy boundary.

Cb—40 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable; mildly alkaline.

The solum and mollic epipedon range from 20 to 36 inches in thickness. In places, free carbonates are below a depth of 48 inches.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 2 or 3. It is typically silty clay loam but ranges to silt loam and loam. Reaction ranges from slightly acid through neutral. The C horizon has value of 3 through 6 (2 through 5 moist) and chroma of 2 or 3. It is typically silty clay loam but ranges to silt loam and loam. Reaction ranges from slightly acid through mildly alkaline. Some pedons have clayey material below a depth of 40 inches. Strata of various colors occur above a depth of 40 inches. Buried soils are typical of the Shell soils in Stanton County, but they are not in all areas.

Shell Variant

Shell Variant consists of deep, moderately well drained soils on bottom lands. Permeability is moderate in the upper part of the profile and slow in the lower part. These soils formed in silty alluvium. Slopes range from 0 to 1 percent.

The Shell Variant soils are near Colo, Hobbs, Kezan, Lamo, and Shell soils in the landscape. Colo and Lamo soils are somewhat poorly drained and are in a slightly lower position than Shell Variant soils. Hobbs soils are well drained. They are in a lower position and are stratified. Kezan soils are poorly drained. They have a thinner, dark surface layer and are in a slightly lower position. Shell soils are less clayey in the lower part of the profile than Shell Variant soils.

Typical pedon of Shell Variant silty clay loam, 0 to 1 percent slopes, 1,500 feet south and 75 feet east of the northwest corner of sec. 29, T. 21 W., R. 1 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; medium acid; abrupt smooth boundary.

A12—6 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark brown (10YR 2/2) moist; weak medium to fine subangular blocky structure; slightly hard, friable; medium acid; clear smooth boundary.

C1—17 to 24 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium to fine subangular blocky structure; slightly hard, friable; slightly acid; clear smooth boundary.

C2—24 to 31 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; abrupt smooth boundary.

Ab—31 to 45 inches; very dark gray (10YR 3/1) silty clay, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm; mildly alkaline; clear smooth boundary.

C—45 to 60 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; massive; hard, very firm; neutral.

The solum ranges from 24 to 36 inches in thickness and corresponds to the depth of the buried clayey soil. The mollic epipedon ranges from 20 to 40 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silty clay loam, but some pedons are silt loam. Reaction is medium acid through neutral. The B horizon has value of 4 through 6 (2 through 5 moist) and chroma of 2 or 3. It is typically silty clay loam, but some pedons are silt loam. Reaction is slightly acid or neutral. The Ab and C horizons have value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. They are typically silty clay but range to clay. Reaction is neutral or mildly alkaline.

Thurman series

The Thurman series consists of deep, somewhat excessively drained, rapidly permeable soils on uplands and stream terraces. These soils formed in eolian sand. Slopes range from 0 to 11 percent.

The Thurman soils are similar to Valentine soils and are near Boelus, Elsmere, Hadar, Loretto, and Valentine soils in the landscape. Boelus and Loretto soils have a loamy B horizon. Elsmere soils are somewhat poorly drained. Hadar soils are well drained and have more clay and less sand in the control section than Thurman soils. Boelus, Loretto, Elsmere, and Hadar soils are in lower positions than Thurman soils. Valentine soils have a thinner surface layer and are in a higher position on ridgetops.

Typical pedon of Thurman loamy fine sand, 6 to 11 percent slopes, 500 feet north and 900 feet west of the southeast corner of sec. 20, T. 24 N., R. 1 E.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, very friable; medium acid; clear smooth boundary.

AC—10 to 16 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; soft, very friable; slightly acid; clear smooth boundary.

C1—16 to 32 inches; light yellowish brown (10YR 6/4) fine sand, dark yellowish brown (10YR 4/4) moist; single grain; loose; neutral; gradual wavy boundary.

C2—32 to 60 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; neutral.

The solum ranges from 14 to 28 inches in thickness. Free carbonates are absent to a depth of 60 inches. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has value of 3 through 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand but ranges to fine sand. Reaction is medium acid or slightly acid. The AC horizon has value of 4 or 5 (3 or 4 moist) and chroma of 1 through 3. It is typically loamy fine sand but ranges to fine sand. Reaction is slightly acid or neutral. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 through 4. It is typically fine sand but ranges to loamy fine sand. Reaction is neutral or mildly alkaline.

The Thurman soils in map units ThB and ThC lack sufficient content of organic matter in the upper 11 inches to qualify for a mollic epipedon as defined in the range for the Thurman series, but this difference does not significantly alter the usefulness or behavior of the soils.

Valentine series

The Valentine series consists of deep, excessively drained, rapidly permeable soils. These soils formed in eolian sand on uplands. Slopes range from 0 to 20 percent.

The Valentine soils are similar to Thurman soils and are near Elsmere and Thurman soils in the landscape. Elsmere soils are somewhat poorly drained. They are in sandhill valleys and on stream terraces and are in a lower position than Valentine soils. Thurman soils are somewhat excessively drained. They have a mollic epipedon and are also in a lower position than Valentine soils.

Typical pedon of Valentine fine sand, 9 to 20 percent slopes, 2,600 feet north and 150 feet east of the southwest corner of sec. 35, T. 23 N., R. 2 E.

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; slightly acid; clear smooth boundary.

AC—7 to 14 inches; brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear wavy boundary.

C1—14 to 36 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grain; loose; neutral; clear gradual boundary.

C2—36 to 60 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grain; loose; neutral.

The solum ranges from 5 to 17 inches in thickness. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 through 6 (3 through 5 moist) and chroma of 2. It is typically fine sand but ranges to loamy fine sand. The AC horizon has value of 5 through 7 (4 through 6 moist) and chroma of 2 or 3. It is typically fine sand but ranges to loamy fine sand. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 through 4. It is typically fine sand but ranges to loamy fine sand.

Zook series

The Zook series consists of deep, poorly drained soils on bottom lands. Permeability is slow. These soils formed in alluvium. Slopes range from 0 to 1 percent.

The Zook soils are near Cass, Colo, Gibbon, and Muir soils on the landscape. Cass soils are well drained. They have more sand and less clay in the control section and are in a higher position than Zook soils. Colo and Gibbon soils are somewhat poorly drained. They have less clay in the control section and are in a position similar to Zook soils. Muir soils are well drained. They have less clay in the control section and are on low stream terraces.

Typical pedon of Zook silty clay loam, 0 to 1 percent slopes, 200 feet south and 2,250 feet west of the northeast corner of sec. 35, T. 24 N., R. 3 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine subangular blocky structure; hard, firm; neutral; abrupt smooth boundary.

A12—7 to 14 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; moderate fine subangular blocky structure; hard, firm; neutral; clear wavy boundary.

A13—14 to 20 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium subangular blocky structure; very hard, firm; neutral; gradual smooth boundary.

A3—20 to 35 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium blocky structure; very hard, firm; neutral; gradual smooth boundary.

Bg—35 to 48 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, firm; neutral; gradual smooth boundary.

Cg—48 to 60 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; massive; hard, friable; neutral.

The solum ranges from 36 to 60 inches in thickness. Free carbonates are absent above a depth of 50 inches. The mollic epipedon ranges from 36 to 50 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 0 or 1. It is typically silty clay loam but ranges to silty clay. The B and C horizons have hue of 10YR or 5Y and value of 4 through 6 (3 through 5 moist). The solum below a depth of about 14 inches is between 35 and 46 percent clay, and the content of clay commonly is constant to a depth of 48 inches or more. Reaction ranges from neutral to slightly acid throughout the solum. Some pedons have faint mottles of high chroma and value below a depth of 36 inches.

formation of the soils

This section tells how the factors of soil formation have affected the development of soils in Stanton County.

factors of soil formation

Soil is produced by soil-forming processes acting on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required 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. Many of the processes of soil development are unknown.

parent material

Parent material is the disintegrated and weathered rock from which a soil has formed. It determines the chemical and mineralogical composition of the soil. In Stanton County the soils formed in glacial till, loess, colluvium-alluvium, alluvium, and eolian sand.

Glacial till is the oldest material from which the soils of Stanton County were formed. It is mainly light gray clay loam and sandy clay that has a large content of segregated lime and many yellowish brown and dark brown mottles. Glacial till is at the surface in a small area in the northwestern part of Stanton County. The Clarno soils and the middle and lower horizons of the Hadar soils formed in glacial till.

Peorian Loess is the most extensive parent material in the county. It consists of pale brown or light grayish brown, calcareous, silty material deposited by the wind. This material covers most of the uplands in Stanton County. The loess is mainly of Peorian age and ranges from 30 to 70 feet in thickness. Belfore, Crofton, Moody, and Nora soils formed in loess.

Colluvium-alluvium is material that accumulates as a result of the combined forces of gravity and water. It is the parent material of soils on foot slopes at the base of hills in the loess uplands. The gently sloping Alcester soils formed in this material, which is friable and silty.

Alluvium is the most recently formed parent material. It is the parent material of soils on bottom lands and stream terraces. Alluvium is a mixture of sand, silt, and clay and has been deposited on the flood plains by overflowing streams. The flood plains continue to receive sediment from floodwaters. The material in these areas is relatively young, and soil development is slight. Sedimentation causes the textural differences in the development of soil horizons. The Boel, Cass, Colo, Gibbon, Inavale, Kezan, Lamo, Loup, Marlake Variant, Ord, Ovina, Riverwash, and Shell soils formed in alluvium on bottom lands. The oldest alluvium is on the stream terraces that are in a higher position than the present flood plain. The Muir soils formed in alluvium on low stream terraces that are seldom flooded.

Windblown sandy material occurs mainly south of the Elkhorn River in the central part of Stanton County. In places, sand is the only parent material, but in places, it is mixed with a thin mantle of loess. This eolian sand is alluvium of the Elkhorn River flood plain that was picked up by the wind and deposited on the uplands.

The eolian sand parent material consists of loose, single grain, pale brown, or very pale brown fine sand and loamy fine sand. The Thurman and Valentine soils formed in deep deposits of this material. The upper horizons of the Boelus and Hadar soils also formed in eolian sand.

climate

The subhumid temperature climate in Stanton County provides a moderate amount of moisture for soil development processes, but it has a temperature range that nearly precludes soil development for about 3 months during the winter season, intense rainstorms that result in runoff on the slopes and flooding in the valleys, and winds that shift the material of the sandy soils.

The average annual precipitation is about 28 inches. This is sufficient moisture for the development of the soils that have a dark surface layer with a moderate content of organic matter. In most silty soils the surface layer and the upper part of the subsoil have been leached of lime and an accumulation of lime is in the lower part of the subsoil or in the substratum. The sandy soils on the uplands have been leached of lime throughout the profile. In a few soils, such as Belfore soils, the processes of soil development have resulted in some of the clay content of the surface layer moving into the subsoil. Excessive rainfall or rapid snowmelt results in flooding and deposition of sediment on bottom lands.

The native grass vegetation, together with warm summers and cold winters in Stanton County, favored the development of soils with dark surface layers. Average frost penetration is to a depth of about 24 inches, and summer temperatures reach or exceed 100° F. a few days each year. Alternate freezing and thawing and wetting and drying contribute to the formation of a granular surface layer and a prismatic or blocky structure in the subsoil. Summer heat and moisture also speed chemical weathering. In winter, the prevailing northwesterly winds help to determine the distribution of the eolian sand and loessial parent material.

In many places in cultivated fields, runoff from hard rains has eroded the dark surface layer and reduced the fertility of the soils. In addition, wind has eroded or removed many of the coarse and moderately coarse soils. In some areas, all of the original dark surface layer has been removed from the original site and redeposited a short distance away. The material moved by water has moved down gradient to the lower slopes, foot slopes, and bottom lands; and the material moved by wind has blown about the field or into adjacent fields. Soil development is interrupted only temporarily.

The availability of plant nutrients is dependent upon decomposition of organic matter by micro-organisms and chemical weathering of the mineral soil material. Micro-organisms in the soil have a temperature and moisture range in which they are most active. Chemical reactions are slowed by decreasing temperatures and speeded by hot temperatures. Changes in temperature and moisture control the weathering of parent material and the decomposition of organic matter.

The humidity in Stanton County generally is low, and a fairly high loss of water takes place through evaporation and transpiration. This loss reduces the amount of water for leaching, vegetative growth, decomposition of organic matter, and chemical weathering.

plants and animals

Before settlement in Stanton County, vegetation was mainly mid and tall prairie grasses. These grasses have been an important factor in formation of the soils. The fibrous root system fills the surface layer with minute rootlets. When the plants die and decay, this root system produces organic matter and helps to promote the development of granular structure in the soil. Deeper roots improve the permeability of the subsoil and also add a small amount of organic matter. Most of the soils in Stanton County have a friable or very friable, dark surface layer due largely to the organic matter that is present.

Micro-organisms, worms, insects, gophers, and other small animals are important in the development of the soils in Stanton County. Micro-organisms decompose organic matter, changing it into humus from which growing plants obtain nutrients and through which minerals are returned to the soil. Earthworms and small burrowing animals help mix this humus with the soil. The decayed organic matter gives the upper part of the soil its dark color and influences its physical and chemical composition. The Lamo, Gibbon, and Muir soils have the highest content of organic matter in Stanton County. Such soils as the Valentine, Thurman, and Inavale soils have the lowest content.

Plant roots bring nutrients to the surface layer of the soil. Calcium, especially, helps to keep the soils porous. Decomposing organic matter forms organic acids that in solution hasten the leaching process and aid in soil formation.

Human activities also affect soil formation. Conservation tillage practices and terraces help to build and improve the soil. Additions of fertilizer and the use of irrigation water change the soil. Cultivation can contribute to soil loss unless care is taken to conserve the soils. The activities of man have an immediate effect on both the rate and direction of soil-forming processes.

relief

Relief affects soil formation mainly through its influence on runoff, erosion, aeration, and drainage. Runoff is more rapid on steep and very steep slopes than on more gentle slopes. Consequently, plant growth generally is less vigorous, less water penetrates the soil, soil horizons are thinner and less distinct, and lime is not so deeply leached in the steeper soils. Erosion is more severe on steeper slopes if all other soil formation factors are equal.

Even if the soils have the same parent material, the influence of relief is evident in the color, thickness, and horizonation of the soils. The gradient, shape, length, and direction of slope influence the amount of moisture in the soil. Steep and very steep soils, such as the Crofton soils, are weakly developed, have a thin surface layer, and have lime at or near the surface. In Moody soils, which are not quite so steep, the surface layer is thicker, lime is leached to a greater depth, and a subsoil has formed. In the nearly level Belfore soils, the surface layer is dark and thick, the subsoil is well developed, and lime is leached to a greater depth. The Crofton, Moody, Belfore, and Nora soils all formed in Peorian Loess under grass vegetation. Consequently, differences among these soils can be largely attributed to differences in relief.

The Boel, Cass, Colo, Gibbon, Hobbs, Inavale, Kezan, Lamo, Lawet, Loup, Marlake Variant, Ord, Ovina, Shell, and Zook soils are on bottom lands and have low relief. Soil formation is slight on bottom lands because the soil commonly receives new sediment from flooding. Each period of flooding provides new parent material and starts a new cycle of soil formation. Hobbs silt loam, channeled, is a soil that formed on bottom lands and is frequently flooded.

time

Time is needed to change parent material into a soil. Organic matter accumulates and darkens the surface layer in a short time. The leaching of carbonates begins almost immediately but progresses slowly. Horizons in the subsoil are slow in developing, and most horizons do not form until the carbonates have been leached and clay formation begins.

The soil at each site in the landscape has a zero point in its development. Time zero is the point at which deposition of the parent material is completed, a fresh land surface is provided by geologic erosion, or one or more of the factors controlling soil development changes.

Slopes are constantly being changed by the geomorphic process that alters the landscape. Vegetation may be wiped out or changed by natural hazards, fire, wind, erosion, or climatic change. Climate and organisms appear to be less subject to change than other factors. However, ice-ages and extreme drought have occurred in the past. Both of these climatic extremes have a strong influence on the number and kind of organisms and their rate of activity. Warm, moist climates speed soil formation, whereas cold and dry climates slow the formation of soils.

The rate of soil formation cannot be expressed in inches of soil formed per year. Neither can a soil be rated mature at some point in its development. It is, however, possible to rate soil development in terms of the depth of leaching, horizon development, clay movement, and other soil characteristics.

The concept of soil maturity is predicated upon time as it relates to characteristics of the soil profile. Soils that do not have well developed and distinct horizons are considered to be immature. These soils will undergo change and development with time. Soils with well developed horizons are considered to be more mature and stable.

The Belfore and Moody soils are soils in which development has progressed toward maturity over a long period of time. The dark surface indicates an accumulation of organic matter. Carbonates have been leached, distinct horizons have formed in the subsoil, and clay formation and clay movement are indicated by the content of clay in the subsoil. The steep Crofton soil, which does not have well developed horizons in the subsoil, may have progressed to the limit of formation in its particular landscape site and have stable profile characteristics, but it has undergone only slight soil development. Organic matter has darkened the surface layer, but leaching has scarcely removed the carbonates from the dark surface layer, the horizons in the subsoil are faint or nonexistent, and clay formation and clay movement have not begun.

Time implies age. Radiocarbon dating has been used to pinpoint the age of carbonates in some soils and to date the age of some parent material. These dates establish a maximum age limit for a soil developed on a dated parent material, but they do not assure that the soil is the oldest possible age. Radiocarbon dates indicate that the age of Peorian Loess ranges from 15,000 to 30,000 years "before the present." The reddish brown Loveland Formation, which occasionally crops out on hillsides in Stanton County, is much older than Peorian Loess. Upland sands are less than 10,000 years of age, whereas alluvium in the valleys varies from a few years to a few hundred years in age.

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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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by 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.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compact layers to depths below normal plow depth.

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.

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 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 slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

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 all or part of the 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.

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.

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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

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.

Depth, soil (classes.) The total thickness of soil material over coarse sand or mixed sand and gravel is as follows:

	Inches
Very shallow	0 to 10
Shallow	10 to 20
Moderately deep	20 to 40
Deep	more than 40

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.
Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.
Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.
Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

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 the activities of man or other animals 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 does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

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.

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, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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.

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.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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 7.5 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying 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.

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 upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

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, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A 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) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

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 A or B 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, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

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 the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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—

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.

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.

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 wind.

Low strength. The soil is not strong enough to support loads.

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. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and 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 the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic-matter content. The classes used in this survey are as follows:

	Organic matter present
Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent

Parent material. The unconsolidated organic and mineral material in which soil forms.

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.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting 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 0.20 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. For example, 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. The water can be removed only by percolation or evapotranspiration.

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.

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 degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly 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.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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.

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.

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.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

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.

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. In this survey, the classes of slope are as follows:

Nearly level	0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	2 to 6 percent
Strongly sloping	6 to 11 percent
Moderately steep	11 to 15 percent
Steep	15 to 30 percent
Very steep	30 to 60 percent

Slow intake (in tables). The slow movement of water into 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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
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 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 which provide vegetative barriers to wind 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 wind 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 profile below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

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."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

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.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

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.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-78 at Stanton, Nebraska]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- 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----	30.1	8.0	19.1	57	-22	0	.60	.21	.92	2	6.8
February---	37.3	14.7	26.0	66	-16	8	.99	.29	1.56	3	7.1
March------	46.8	23.8	35.3	80	-7	39	1.68	.60	2.56	5	7.2
April------	63.4	37.0	50.2	88	16	106	2.38	1.16	3.42	6	.7
May--------	74.3	48.2	61.3	94	26	358	4.20	2.52	5.69	8	.0
June-------	83.3	57.9	70.6	101	40	618	4.38	2.19	6.29	7	.0
July-------	88.1	62.8	75.5	103	47	791	3.16	1.54	4.55	6	.0
August-----	85.8	60.8	73.3	101	44	722	2.81	1.36	4.06	6	.0
September--	76.5	50.8	63.7	96	29	411	2.30	.98	3.41	5	.0
October----	66.4	39.5	53.0	89	19	175	1.39	.30	2.25	3	.3
November---	48.9	25.7	37.3	74	0	0	.87	.14	1.42	2	2.7
December---	35.5	14.4	25.0	63	-16	0	.75	.23	1.17	3	7.5
Yearly:											
Average--	61.4	37.0	49.2	---	---	---	---	---	---	---	---
Extreme--	---	---	---	103	-23	---	---	---	---	---	---
Total----	---	---	---	---	---	3,228	25.51	21.01	29.77	56	32.3

[1] 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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-78 at Stanton, 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--	April 28	May 13	May 19
2 years in 10 later than--	April 23	May 7	May 14
5 years in 10 later than--	April 14	April 26	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	October 11	September 28	September 22
2 years in 10 earlier than--	October 15	October 3	September 26
5 years in 10 earlier than--	October 23	October 12	October 5

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-78 at Stanton, 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	175	146	135
8 years in 10	180	153	141
5 years in 10	191	168	153
2 years in 10	202	182	164
1 year in 10	208	189	170

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AcC	Alcester silty clay loam, 2 to 6 percent slopes	18,000	6.5
Ba	Barney loam, 0 to 2 percent slopes	650	0.2
Be	Belfore silty clay loam, 0 to 2 percent slopes	4,200	1.5
Bn	Blendon fine sandy loam, 0 to 2 percent slopes	1,760	0.6
Bp	Boel loam, 0 to 2 percent slopes	1,000	0.4
BsC	Boelus loamy fine sand, 2 to 6 percent slopes	3,330	1.2
Cf	Cass fine sandy loam, 0 to 2 percent slopes	1,600	0.6
CnC	Clarno loam, 2 to 6 percent slopes	670	0.2
CnD	Clarno loam, 6 to 11 percent slopes	260	0.1
Co	Colo silty clay loam, 0 to 1 percent slopes	1,080	0.4
CrC2	Crofton silt loam, 2 to 6 percent slopes, eroded	1,060	0.4
CrD2	Crofton silt loam, 6 to 11 percent slopes, eroded	3,500	1.3
CrE2	Crofton silt loam, 11 to 15 percent slopes, eroded	2,510	0.9
CrF	Crofton silt loam, 15 to 30 percent slopes	6,400	2.3
CrG	Crofton silt loam, 30 to 60 percent slopes	240	0.1
CuE2	Crofton-Nora complex, 11 to 15 percent slopes, eroded	46,400	16.9
Eh	Elsmere loamy fine sand, 0 to 2 percent slopes	3,700	1.3
Gk	Gibbon silty clay loam, 0 to 1 percent slopes	2,780	1.0
HaC	Hadar loamy fine sand, 2 to 6 percent slopes	950	0.3
Hd	Hobbs silt loam, 0 to 2 percent slopes	15,000	5.5
He	Hobbs silt loam, channeled	3,840	1.3
InB	Inavale loamy fine sand, 0 to 3 percent slopes	1,055	0.4
Ip	Inavale-Boel complex, channeled	3,770	1.4
Kz	Kezan silt loam, 0 to 2 percent slopes	1,880	0.7
La	Lamo silty clay loam, 0 to 1 percent slopes	950	0.3
Lc	Lamo silty clay loam, wet, 0 to 1 percent slopes	380	0.1
Ld	Lawet silty clay loam, 0 to 1 percent slopes	880	0.3
Lo	Loretto fine sandy loam, 0 to 2 percent slopes	710	0.3
LoC	Loretto fine sandy loam, 2 to 6 percent slopes	1,410	0.5
LpC	Loretto loam, 2 to 6 percent slopes	1,270	0.5
Lv	Loup fine sandy loam, 0 to 1 percent slopes	660	0.2
Ma	Marlake Variant silt loam, 0 to 1 percent slopes	430	0.2
MoC	Moody silty clay loam, 2 to 6 percent slopes	17,950	6.5
Mp	Moody silty clay loam, terrace, 0 to 1 percent slopes	780	0.3
Mu	Muir silty clay loam, 0 to 1 percent slopes	7,155	2.6
NoD	Nora silty clay loam, 6 to 11 percent slopes	8,650	3.1
NoE	Nora silty clay loam, 11 to 15 percent slopes	6,360	2.3
NpC2	Nora-Crofton complex, 2 to 6 percent slopes, eroded	6,050	2.2
NpD2	Nora-Crofton complex, 6 to 11 percent slopes, eroded	47,700	17.4
Og	Ord fine sandy loam, 0 to 2 percent slopes	1,110	0.4
Oh	Ord silt loam, 0 to 1 percent slopes	1,960	0.7
OrC	Ortello fine sandy loam, 2 to 6 percent slopes	430	0.2
OvB	Ovina loamy fine sand, 0 to 3 percent slopes	660	0.2
Pb	Pits and Dumps	120	0.1
Rw	Riverwash	330	0.1
Sm	Shell loam, 0 to 1 percent slopes	4,920	1.8
Sn	Shell silty clay loam, 0 to 1 percent slopes	3,050	1.1
Sv	Shell Variant silty clay loam, 0 to 1 percent slopes	775	0.3
ThB	Thurman loamy fine sand, 1 to 3 percent slopes	5,570	2.0
ThC	Thurman loamy fine sand, 3 to 6 percent slopes	9,990	3.6
ThD	Thurman loamy fine sand, 6 to 11 percent slopes	1,500	0.5
Tm	Thurman loamy fine sand, thick, 0 to 2 percent slopes	5,100	1.9
VaD	Valentine fine sand, 3 to 9 percent slopes	7,700	2.8
VaF	Valentine fine sand, 9 to 20 percent slopes	3,070	1.1
Zo	Zook silty clay loam, 0 to 1 percent slopes	1,240	0.4
	Water areas less than 40 acres and flowing streams less than 1/8 mile wide	1,250	0.5
	Total land area	275,745	100.0
	Water areas, over 40 acres	95	
	Total area	275,840	

* 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
AcC	Alcester silty clay loam, 2 to 6 percent slopes
Be	Belfore silty clay loam, 0 to 2 percent slopes
Bn	Blendon fine sandy loam, 0 to 2 percent slopes
Cf	Cass fine sandy loam, 0 to 2 percent slopes
CnC	Clarno loam, 2 to 6 percent slopes
Co	Colo silty clay loam, 0 to 1 percent slopes (where drained)
CrC2	Crofton silt loam, 2 to 6 percent slopes, eroded
Gk	Gibbon silty clay loam, 0 to 1 percent slopes (where drained)
Hd	Hobbs silt loam, 0 to 2 percent slopes
La	Lamo silty clay loam, 0 to 1 percent slopes (where drained)
Lo	Loretto fine sandy loam, 0 to 2 percent slopes
LoC	Loretto fine sandy loam, 2 to 6 percent slopes
LpC	Loretto loam, 2 to 6 percent slopes
MoC	Moody silty clay loam, 2 to 6 percent slopes
Mp	Moody silty clay loam, terrace, 0 to 1 percent slopes
Mu	Muir silty clay loam, 0 to 1 percent slopes
NpC2	Nora-Crofton complex, 2 to 6 percent slopes, eroded
Og	Ord fine sandy loam, 0 to 2 percent slopes
Oh	Ord silt loam, 0 to 1 percent slopes
OrC	Ortello fine sandy loam, 2 to 6 percent slopes
Sm	Shell loam, 0 to 1 percent slopes
Sn	Shell silty clay loam, 0 to 1 percent slopes
Sv	Shell Variant silty clay loam, 0 to 1 percent slopes
Zo	Zook silty clay loam, 0 to 1 percent slopes (where drained)

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[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	Corn		Soybeans		Grain sorghum		Alfalfa hay		Cool-season grass	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
AcC----------------------- Alcester	90	140	33	42	95	125	4.5	6.5	5.0	12.0
Ba----------------------- Barney	---	---	---	---	---	---	---	---	---	---
Be----------------------- Belfore	85	140	35	45	85	120	3.9	6.0	4.5	10.0
Bn----------------------- Blendon	65	135	26	40	65	115	2.8	5.5	3.0	11.0
Bp----------------------- Boel	50	110	25	35	60	100	3.0	4.8	3.5	9.0
BsC----------------------- Boelus	60	130	25	40	75	115	3.5	5.2	2.5	9.0
Cf----------------------- Cass	65	135	25	40	70	120	3.5	5.5	3.6	11.0
CnC----------------------- Clarno	70	125	27	33	70	95	3.5	5.2	3.5	11.0
CnD----------------------- Clarno	60	110	24	30	65	90	3.0	5.0	3.2	9.0
Co----------------------- Colo	90	135	34	40	85	125	4.0	6.0	5.0	12.0
CrC2----------------------- Crofton	55	95	25	30	60	80	2.7	4.0	2.5	9.0
CrD2----------------------- Crofton	60	85	22	---	55	---	2.6	4.0	2.2	9.0
CrE2----------------------- Crofton	50	---	20	---	52	---	2.1	---	2.0	---
CrF----------------------- Crofton	---	---	---	---	---	---	---	---	---	---
CrG----------------------- Crofton	---	---	---	---	---	---	---	---	---	---
CuE2----------------------- Crofton-Nora	58	---	22	---	55	---	2.5	---	2.3	---
Eh----------------------- Elsmere	55	110	20	---	---	---	2.5	4.5	3.5	10.0
Gk----------------------- Gibbon	85	130	33	40	87	120	4.0	6.0	5.0	12.0
HaC----------------------- Hadar	57	120	25	38	70	115	3.5	5.0	2.5	9.0
Hd----------------------- Hobbs	80	135	33	40	83	115	4.0	6.0	5.0	12.0
He----------------------- Hobbs	---	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Soybeans		Grain sorghum		Alfalfa hay		Cool-season grass	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
InB----------------------- Inavale	35	90	20	---	40	80	2.0	4.0	2.0	7.0
Ip------------------------ Inavale-Boel	---	---	---	---	---	---	---	---	---	---
Kz------------------------ Kezan	40	---	25	---	40	---	3.0	---	4.7	---
La------------------------ Lamo	80	125	32	40	85	120	4.2	6.3	5.0	12.0
Lc------------------------ Lamo	---	---	---	---	---	---	---	---	---	---
Ld------------------------ Lawet	60	108	---	---	52	---	3.0	4.6	5.0	---
Lo------------------------ Loretto	80	140	30	38	90	125	4.5	6.5	4.0	11.0
LoC----------------------- Loretto	70	130	29	35	80	120	4.0	6.0	3.2	10.0
LpC----------------------- Loretto	75	132	30	40	85	125	4.5	6.5	4.0	11.0
Lv------------------------ Loup (drained)	50	---	20	---	55	---	2.5	---	4.5	---
Ma------------------------ Marlake Variant	---	---	---	---	---	---	---	---	---	---
MoC----------------------- Moody	80	130	30	40	82	120	4.0	6.0	4.0	11.0
Mp------------------------ Moody	85	140	32	40	90	130	4.5	6.5	4.3	13.0
Mu------------------------ Muir	90	150	35	45	92	130	4.5	6.5	4.5	13.0
NoD----------------------- Nora	70	115	25	32	72	110	3.2	5.2	3.5	10.0
NoE----------------------- Nora	60	---	20	---	70	---	3.0	---	3.0	9.0
NpC2---------------------- Nora-Crofton	72	120	27	35	70	115	3.5	5.0	4.0	10.0
NpD2---------------------- Nora-Crofton	68	100	25	---	65	95	3.0	4.5	3.0	9.0
Og------------------------ Ord	57	115	26	36	65	105	3.0	5.5	3.8	9.5
Oh------------------------ Ord	65	120	30	38	70	110	3.5	5.9	4.0	10.0
OrC----------------------- Ortello	60	120	28	34	70	110	3.0	5.5	3.0	9.5
OvB----------------------- Ovina	60	115	25	---	60	110	3.5	5.0	2.5	8.0

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn		Soybeans		Grain sorghum		Alfalfa hay		Cool-season grass	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton	AUM*	AUM*
Pb**. Pits and Dumps										
Rw**. Riverwash										
Sm----------------------- Shell	88	145	36	44	85	130	4.2	6.2	5.0	13.0
Sn----------------------- Shell	85	145	35	42	85	130	4.2	6.2	5.0	13.0
Sv----------------------- Shell Variant	83	140	35	42	80	125	4.2	6.0	5.0	12.5
ThB---------------------- Thurman	60	115	---	---	63	110	2.5	4.5	2.0	9.5
ThC---------------------- Thurman	55	100	---	---	58	95	2.0	4.0	1.8	6.5
ThD---------------------- Thurman	---	95	---	---	---	90	---	4.0	---	---
Tm----------------------- Thurman	65	120	---	---	68	115	2.8	5.0	2.5	10.0
VaD---------------------- Valentine	---	85	---	---	---	---	---	3.2	---	---
VaF---------------------- Valentine	---	---	---	---	---	---	---	---	---	---
Zo----------------------- Zook	80	120	32	40	80	115	4.2	5.8	4.5	10.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** 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 those potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I (N)	12,135	---	---	---
(I)	12,135	---	---	---
II (N)	74,865	38,640	32,865	3,360
(I)	36,935	2,470	32,865	1,600
III (N)	85,950	80,590	5,360	---
(I)	67,150	61,790	5,360	---
IV (N)	72,575	69,815	2,760	---
(I)	79,300	79,300	---	---
V (N)	1,690	---	1,690	---
VI (N)	26,280	18,670	7,610	---
VII (N)	240	240	---	---
VIII(N)	760	---	760	---

TABLE 8.--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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
AcC----------------- Alcester	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, blue spruce, common hackberry, Russian-olive, eastern redcedar.	Honeylocust, ponderosa pine, green ash.	---
Ba. Barney					
Be----------------- Belfore	---	Siberian peashrub, Tatarian honeysuckle, lilac, American plum.	Eastern redcedar, common hackberry, bur oak, Russian-olive, blue spruce.	Ponderosa pine, green ash, honeylocust.	---
Bn----------------- Blendon	Skunkbush sumac---	Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Honeylocust, green ash, common hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	Siberian elm.
Bp----------------- Boel	Redosier dogwood	Common chokecherry, American plum.	Eastern redcedar, common hackberry.	Austrian pine, northern red oak, green ash, golden willow, honeylocust, silver maple.	Eastern cottonwood.
BsC---------------- Boelus	Skunkbush sumac---	Lilac, Tatarian honeysuckle, American plum, Siberian peashrub.	Eastern redcedar, ponderosa pine, Russian-olive, green ash, honeylocust, common hackberry.	---	Siberian elm.
Cf----------------- Cass	---	Peking cotoneaster, Amur honeysuckle, lilac, American plum.	Eastern redcedar	Austrian pine, common hackberry, eastern white pine, honeylocust, bur oak, green ash.	Eastern cottonwood.
CnC, CnD---------- Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Co----------------- Colo	Redosier dogwood	Common chokecherry, American plum.	Eastern redcedar, common hackberry.	Silver maple, Austrian pine, golden willow, honeylocust, green ash, northern red oak.	Eastern cottonwood.
CrC2, CrD2, CrE2-- Crofton	Silver buffaloberry, American plum.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Russian-olive, common hackberry, Tatarian honeysuckle.	Ponderosa pine, honeylocust, Siberian elm, green ash.	---	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
CrF, CrG. Crofton					
CuE2*: Crofton	Silver buffaloberry, American plum.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Russian-olive, common hackberry, Tatarian honeysuckle.	Ponderosa pine, honeylocust, Siberian elm, green ash.	---	---
Nora	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, common hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Eh Elsmere	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, common hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
Gk Gibbon	American plum, redosier dogwood.	Common chokecherry	Eastern redcedar, common hackberry, Austrian pine, green ash, Russian mulberry.	Silver maple, golden willow, honeylocust.	Eastern cottonwood.
HaC Hadar	Skunkbush sumac	American plum, Siberian peashrub, Tatarian honeysuckle, lilac.	Eastern redcedar, ponderosa pine, green ash, honeylocust, common hackberry, Russian-olive.	---	Siberian elm.
Hd Hobbs	---	American plum, Peking cotoneaster, lilac, Amur honeysuckle.	Eastern redcedar	Green ash, common hackberry, Austrian pine, honeylocust, eastern white pine, bur oak.	Eastern cottonwood.
He. Hobbs					
InB Inavale	American plum	Amur honeysuckle, lilac, fragrant sumac.	Eastern redcedar, Russian mulberry, Russian-olive.	Honeylocust, Austrian pine, common hackberry, Scotch pine, green ash.	---
Ip*: Inavale	---	Eastern redcedar	Austrian pine, ponderosa pine, jack pine.	---	---
Boel.					
Kz Kezan	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
La----------------- Lamo	---	Siberian peashrub, Tatarian honeysuckle, lilac.	Common hackberry, blue spruce, ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, green ash, honeylocust.	Eastern cottonwood.
Lc. Lamo					
Ld----------------- Lawet	---	Lilac, Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, common hackberry, ponderosa pine, blue spruce.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
Lo, LoC----------- Loretto	Skunkbush sumac---	Siberian peashrub, Tatarian honeysuckle, American plum, lilac.	Eastern redcedar, honeylocust, Russian-olive, green ash, common hackberry, ponderosa pine.	---	Siberian elm.
LpC---------------- Loretto	---	American plum, Tatarian honeysuckle, lilac, Siberian peashrub.	Eastern redcedar, blue spruce, bur oak, Russian-olive, common hackberry.	Honeylocust, green ash, ponderosa pine.	---
Lv. Loup					
Ma. Marlake Variant					
MoC, Mp----------- Moody	---	Siberian peashrub, American plum, lilac, Tatarian honeysuckle.	Common hackberry, eastern redcedar, bur oak, Russian-olive, blue spruce.	Ponderosa pine, green ash, honeylocust.	---
Mu----------------- Muir	Peking cotoneaster	Amur honeysuckle, fragrant sumac, lilac, Russian-olive.	Bur oak, eastern redcedar, green ash, common hackberry.	Scotch pine, honeylocust, Austrian pine.	---
NoD, NoE---------- Nora	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, common hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
NpC2*, NpD2*:					
Nora-------------	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, common hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Crofton----------	Silver buffaloberry, American plum.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Russian-olive, common hackberry, Tatarian honeysuckle.	Ponderosa pine, honeylocust, Siberian elm, green ash.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Og, Oh------------ Ord	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, common hackberry.	Silver maple, Austrian pine, green ash, golden willow, honeylocust, northern red oak.	Eastern cottonwood.
OrC--------------- Ortello	Skunkbush sumac---	American plum, Siberian peashrub, Tatarian honeysuckle, lilac.	Eastern redcedar, honeylocust, ponderosa pine, Russian-olive, common hackberry, green ash.	---	Siberian elm.
OvB--------------- Ovina	Redosier dogwood	Common chokecherry, American plum.	Eastern redcedar, common hackberry.	Austrian pine, northern red oak, green ash, honeylocust, silver maple, golden willow.	Eastern cottonwood.
Pb*. Pits and Dumps					
Rw*. Riverwash					
Sm, Sn------------ Shell	---	American plum, autumn-olive, Amur honeysuckle, lilac, Peking cotoneaster.	Eastern redcedar, bur oak.	Austrian pine, green ash, honeylocust, common hackberry.	Eastern cottonwood.
Sv---------------- Shell Variant	---	American plum, autumn-olive, Amur honeysuckle, lilac, Peking cotoneaster.	Eastern redcedar, bur oak.	Austrian pine, green ash, common hackberry, honeylocust.	Eastern cottonwood.
ThB, ThC---------- Thurman	Amur honeysuckle, skunkbush sumac, lilac.	Eastern redcedar, Manchurian crabapple, Russian-olive, Siberian peashrub.	Ponderosa pine, green ash, honeylocust, common hackberry.	Siberian elm------	---
ThD--------------- Thurman	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, jack pine.	---	---
Tm---------------- Thurman	Amur honeysuckle, skunkbush sumac, lilac.	Eastern redcedar, Manchurian crabapple, Russian-olive, Siberian peashrub.	Ponderosa pine, green ash, honeylocust, common hackberry.	Siberian elm------	---
VaD, VaF---------- Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Austrian pine, ponderosa pine, jack pine.	---	---
Zo---------------- Zook	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, common hackberry.	Honeylocust, golden willow, green ash, northern red oak, silver maple, Austrian pine.	Eastern cottonwood.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AcC Alcester	Slight	Slight	Moderate: slope.	Slight	Slight.
Ba Barney	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Be Belfore	Slight	Slight	Slight	Slight	Slight.
Bn Blendon	Slight	Slight	Slight	Slight	Slight.
Bp Boel	Severe: flooding.	Moderate: flooding, wetness.	Moderate: wetness, flooding.	Moderate: wetness, flooding.	Moderate: wetness, droughty, flooding.
BsC Boelus	Slight	Slight	Moderate: slope.	Slight	Slight.
Cf Cass	Severe: flooding.	Slight	Slight	Slight	Slight.
CnC Clarno	Slight	Slight	Moderate: slope.	Slight	Slight.
CnD Clarno	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Co Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
CrC2 Crofton	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
CrD2, CrE2 Crofton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CrF Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
CrG Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
CuE2*:					
Crofton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Nora	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Eh Elsmere	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Gk Gibbon	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
HaC Hadar	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Hd: Hobbs	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
He: Hobbs	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
InB: Inavale	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty, flooding.
Ip*:					
Inavale	Severe: flooding, too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, flooding, slope.
Boel	Severe: flooding.	Moderate: flooding, wetness.	Slight	Moderate: wetness, flooding.	Severe: flooding.
Kz: Kezan	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
La: Lamo	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, flooding, percs slowly.	Moderate: wetness.	Moderate: flooding, wetness.
Lc: Lamo	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ld: Lawet	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, flooding.
Lo: Loretto	Slight	Slight	Slight	Slight	Slight.
LoC, LpC: Loretto	Slight	Slight	Moderate: slope.	Slight	Slight.
Lv: Loup	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ma: Marlake Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MoC: Moody	Slight	Slight	Moderate: slope.	Slight	Slight.
Mp: Moody	Slight	Slight	Slight	Slight	Slight.
Mu: Muir	Severe: flooding.	Slight	Slight	Slight	Slight.
NoD, NoE: Nora	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
NpC2*:					
Nora	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
NpC2*:					
Crofton	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
NpD2*:					
Nora	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Crofton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Og, Oh Ord	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, droughty, flooding.
OrC Ortello	Slight	Slight	Moderate: slope.	Slight	Slight.
OvB Ovina	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Pb*. Pits and Dumps					
Rw*. Riverwash					
Sm Shell	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Sn Shell	Severe: flooding.	Moderate: percs slowly.	Moderate: flooding, percs slowly.	Slight	Moderate: flooding.
Sv Shell Variant	Severe: flooding.	Moderate: percs slowly.	Moderate: flooding, percs slowly.	Slight	Moderate: flooding.
ThB, ThC Thurman	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
ThD Thurman	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Tm Thurman	Slight	Slight	Slight	Slight	Moderate: droughty.
VaD Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty.
VaF Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope.
Zo Zook	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AcC----------------- Alcester	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Ba------------------ Barney	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Be------------------ Belfore	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Bn------------------ Blendon	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Bp------------------ Boel	Fair	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Poor	Fair.
BsC----------------- Boelus	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Cf------------------ Cass	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
CnC----------------- Clarno	Good	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
CnD----------------- Clarno	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Co------------------ Colo	Good	Fair	Good	Fair	Poor	Good	Good	Good	Fair	Fair	Good	Good.
CrC2, CrD2, CrE2--- Crofton	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
CrF, CrG------------ Crofton	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
CuE2*:												
Crofton------------	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Nora---------------	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Eh------------------ Elsmere	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Gk------------------ Gibbon	Good	Good	Good	Good	Fair	Good	Fair	Good	Good	Good	Fair	Good.
HaC----------------- Hadar	Fair	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.	Good.
Hd------------------ Hobbs	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
He------------------ Hobbs	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
InB----------------- Inavale	Fair	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ip*:												
Inavale	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Boel	Fair	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Poor	Fair.
Kz: Kezan	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
La: Lamo	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Fair	Fair	Good.
Lc: Lamo	Very poor.	Poor	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	Fair.
Ld: Lawet	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Poor.
Lo, LoC, LpC: Loretto	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Lv: Loup	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ma: Marlake Variant	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
MoC: Moody	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Mp: Moody	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Mu: Muir	Good	Good	Good	Good	Fair	Good	Poor	Very poor.	Good	---	Very poor.	Good.
NoD: Nora	Poor	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
NoE: Nora	Poor	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
NpC2*:												
Nora	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Crofton	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
NpD2*:												
Nora	Poor	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Crofton	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Og, Oh: Ord	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
OrC: Ortello	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
OvB: Ovina	Fair	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Pb*. Pits and Dumps												
Rw*. Riverwash												
Sm, Sn: Shell	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Sv: Shell Variant	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
ThB, ThC: Thurman	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
ThD: Thurman	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Tm: Thurman	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
VaD, VaF: Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Zo: Zook	Good	Fair	Good	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AcC----------------Alcester	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Ba----------------Barney	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
Be----------------Belfore	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Bn----------------Blendon	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
Bp----------------Boel	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, droughty, flooding.
BsC---------------Boelus	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Cf----------------Cass	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
CnC---------------Clarno	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
CnD---------------Clarno	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Co----------------Colo	Severe: wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, shrink-swell, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.
CrC2--------------Crofton	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
CrD2, CrE2--------Crofton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
CrF, CrG----------Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CuE2*:						
Crofton----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Nora-------------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Eh----------------Elsmere	Severe: wetness, cutbanks cave.	Severe: flooding.	Severe: wetness, flooding.	Severe: flooding.	Moderate: wetness, frost action, flooding.	Moderate: wetness, droughty.
Gk----------------Gibbon	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.

See footnote at end of table.

TABLE 11.--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
HaC: Hadar	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Slight.
Hd: Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
He: Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
InB: Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Ip*:						
Inavale	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding, slope.	Severe: flooding.	Moderate: droughty, flooding, slope.
Boel	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Kz: Kezan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
La: Lamo	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, frost action.	Moderate: flooding.
Lc: Lamo	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness.
Ld: Lawet	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
Lo: Loretto	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
LoC, LpC: Loretto	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
Lv: Loup	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ma: Marlake Variant	Severe: ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding, flooding.
MoC: Moody	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Mp: Moody	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Mu: Muir	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 11.--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
NoD, NoE: Nora	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
NpC2*:						
Nora	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
Crofton	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
NpD2*:						
Nora	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
Crofton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Og, Oh: Ord	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, droughty, flooding.
OrC: Ortello	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
OvB: Ovina	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: wetness.
Pb*. Pits and Dumps						
Rw*. Riverwash						
Sm, Sn: Shell	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Sv: Shell Variant	Moderate: too clayey, wetness, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding.	Moderate: flooding.
ThB: Thurman	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
ThC: Thurman	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
ThD: Thurman	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Tm: Thurman	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VaD: Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaF: Valentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Zo: Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AcC: Alcester	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ba: Barney	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Be: Belfore	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Bn: Blendon	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Bp: Boel	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
BsC: Boelus	Slight	Moderate: slope.	Slight	Slight	Good.
Cf: Cass	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
CnC: Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
CnD: Clarno	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Co: Colo	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Poor: wetness, hard to pack.
CrC2: Crofton	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
CrD2, CrE2: Crofton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
CrF, CrG: Crofton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CuE2*:					
Crofton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Nora	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Eh: Elsmere	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: wetness, seepage.	Severe: wetness, seepage.	Poor: too sandy, seepage.

See footnote at end of table.

TABLE 12.--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
Gk: Gibbon	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
HaC: Hadar	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Poor: hard to pack.
Hd, He: Hobbs	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
InB: Inavale	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Ip*:					
Inavale	Severe: flooding, poor filter.	Severe: seepage, flooding, slope.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Boel	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
Kz: Kezan	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
La: Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
Lc: Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Ld: Lawet	Severe: flooding, wetness, percs slowly.	Severe: seepage, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Lo, LoC, LpC: Loretto	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
Lv: Loup	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Ma: Marlake Variant	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Poor: ponding.
MoC: Moody	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
Mp: Moody	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
Mu: Muir	Moderate: flooding.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--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
NoD, NoE: Nora	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
NpC2*:					
Nora	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Crofton	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
NpD2*:					
Nora	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Crofton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Og, Oh: Ord	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
OrC: Ortello	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
OvB: Ovina	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
Pb*. Pits and Dumps					
Rw*. Riverwash					
Sm, Sn: Shell	Severe: flooding.	Slight	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Sv: Shell	Severe: flooding, wetness.	Severe: wetness.	Severe: flooding, too clayey.	Severe: flooding.	Severe: too clayey.
ThB, ThC: Thurman	Severe: poor filter.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
ThD: Thurman	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
Tm: Thurman	Severe: poor filter.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy, seepage.
VaD: Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VaF: Valentine	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Zo: Zook	Severe: percs slowly, wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, too clayey, flooding.	Severe: wetness, flooding.	Poor: too clayey, wetness, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AcC------ Alcester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ba------ Barney	Poor: wetness.	Probable------	Improbable: too sandy.	Poor: thin layer, wetness.
Be------ Belfore	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Bn------ Blendon	Good------	Probable------	Improbable: too sandy.	Fair: thin layer.
Bp------ Boel	Fair: wetness.	Probable------	Improbable: too sandy.	Good.
BsC------ Boelus	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Cf------ Cass	Good------	Probable------	Improbable: too sandy.	Good.
CnC------ Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
CnD------ Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Co------ Colo	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CrC2------ Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CrD2, CrE2------ Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
CrF------ Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CrG------ Crofton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CuE2*:				
Crofton------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Nora------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
Eh------ Elsmere	Fair: wetness.	Probable------	Improbable: too sandy.	Poor: area reclaim.
Gk------ Gibbon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HaC: Hadar	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Hd, He: Hobbs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
InB: Inavale	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Ip*:				
Inavale	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Boel	Fair: wetness.	Probable	Improbable: too sandy.	Fair: area reclaim.
Kz: Kezan	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: wetness.
La: Lamo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lc: Lamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ld: Lawet	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lo, LoC, LpC: Loretto	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lv: Loup	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
Ma: Marlake Variant	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MoC, Mp: Moody	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Mu: Muir	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
NoD, NoE: Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
NpC2*:				
Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
NpD2*:				
Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Og, Oh Ord	Fair: wetness.	Probable	Improbable: too sandy.	Fair: thin layer.
OrC Ortello	Good	Probable	Improbable: too sandy.	Fair: thin layer.
OvB Ovina	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Pb*. Pits and Dumps				
Rw*. Riverwash				
Sm Shell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Sn Shell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Sv Shell Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ThB, ThC, ThD, Tm Thurman	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
VaD, VaF Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Zo Zook	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
AcC----------------- Alcester	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Ba----------------- Barney	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty, rooting depth.
Be----------------- Belfore	Slight---------	Moderate: hard to pack.	Deep to water	Favorable------	Favorable------	Favorable.
Bn----------------- Blendon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
Bp----------------- Boel	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Droughty, rooting depth.
BsC---------------- Boelus	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
Cf----------------- Cass	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
CnC---------------- Clarno	Moderate: seepage, slope.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
CnD---------------- Clarno	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Co----------------- Colo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Flooding, wetness.	Wetness--------	Wetness.
CrC2--------------- Crofton	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
CrD2, CrE2, CrF, CrG--------------- Crofton	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
CuE2*:						
Crofton----------	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Nora-------------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Eh----------------- Elsmere	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, fast intake, droughty.	Wetness, too sandy, soil blowing.	Droughty.
Gk----------------- Gibbon	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness--------	Favorable.
HaC---------------- Hadar	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Rooting depth.

See footnote at end of table.

TABLE 14.--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
Hd----- Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-----	Favorable-----	Favorable.
He----- Hobbs	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, flooding.	Favorable-----	Favorable.
InB----- Inavale	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Ip*:						
Inavale-----	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Boel-----	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Droughty, rooting depth.
Kz----- Kezan	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Wetness.
La----- Lamo	Slight-----	Moderate: piping, hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Favorable.
Lc----- Lamo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Wetness.
Ld----- Lawet	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness-----	Wetness.
Lo----- Loretto	Severe: seepage.	Moderate: piping.	Deep to water	Favorable-----	Soil blowing---	Favorable.
LoC----- Loretto	Severe: seepage.	Moderate: piping.	Deep to water	Slope-----	Soil blowing---	Favorable.
LpC----- Loretto	Severe: seepage.	Moderate: piping.	Deep to water	Slope-----	Favorable-----	Favorable.
Lv----- Loup	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Ma----- Marlake Variant	Moderate: seepage.	Severe: ponding.	Ponding, flooding.	Ponding, flooding.	Ponding-----	Wetness.
MoC----- Moody	Moderate: seepage, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Slope-----	Erodes easily	Erodes easily.
Mp----- Moody	Moderate: seepage.	Moderate: thin layer, piping, hard to pack.	Deep to water	Favorable-----	Erodes easily	Erodes easily.
Mu----- Muir	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable-----	Favorable-----	Favorable.
NoD, NoE----- Nora	Severe: slope.	Severe: piping.	Deep to water	Slope-----	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--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
NpC2*:						
Nora	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Crofton	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
NpD2*:						
Nora	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Crofton	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Og Ord	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Droughty.
Oh Ord	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Droughty.
OrC Ortello	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope	Too sandy, soil blowing.	Favorable.
OvB Ovina	Severe: seepage.	Severe: piping, wetness.	Frost action	Wetness, fast intake.	Wetness, soil blowing.	Wetness.
Pb*. Pits and Dumps						
Rw*. Riverwash						
Sm, Sn Shell	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.
Sv Shell Variant	Slight	Moderate: wetness.	Percs slowly, flooding.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Favorable.
ThB, ThC Thurman	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
ThD Thurman	Severe: slope, seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Droughty, slope.
Tm Thurman	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VaD Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VaF Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Zo Zook	Slight	Severe: hard to pack, wetness.	Flooding, percs slowly, frost action.	Wetness, percs slowly.	Not needed	Not needed.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
AcC-------------- Alcester	0-22	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	22-58	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
	58-60	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	100	95-100	85-100	30-50	10-20
Ba--------------- Barney	0-6	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	85-95	60-95	20-35	3-15
	6-10	Stratified loam to sand.	SM, ML	A-2, A-4	0	90-100	90-100	55-80	20-60	---	NP
	10-60	Coarse sand, fine sandy loam, sand, fine sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	90-100	85-100	30-70	3-15	---	NP
Be--------------- Belfore	0-7	Silty clay loam	CL, CH	A-6, A-7	0	100	100	100	95-100	35-55	15-30
	7-43	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	45-60	20-30
	43-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	35-55	15-30
Bn--------------- Blendon	0-16	Fine sandy loam	SM	A-4	0	100	90-100	60-100	35-50	20-30	NP-5
	16-36	Fine sandy loam, sandy loam.	SM	A-4	0	100	85-100	60-100	35-45	20-30	NP-5
	36-60	Fine sandy loam, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-4	0	85-100	65-100	50-100	10-45	<30	NP-5
Bp--------------- Boel	0-16	Loam, fine sandy loam.	ML, SM	A-4	0	100	100	85-95	70-95	24-35	2-10
	16-60	Fine sand, loamy fine sand, coarse sand.	SP, SM	A-2, A-3	0	100	95-100	85-95	0-25	---	NP
BsC-------------- Boelus	0-24	Loamy fine sand	SM, SP-SM	A-2	0	100	100	50-100	10-35	<20	NP
	24-50	Silt loam, loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	80-100	30-40	8-15
	50-60	Silt loam, loam, silty clay loam.	CL	A-4, A-6	0	100	100	100	90-100	30-40	8-18
Cf--------------- Cass	0-16	Fine sandy loam	SM, SM-SC	A-4, A-2	0	100	95-100	85-95	20-40	<20	NP-5
	16-30	Fine sandy loam, sandy loam, very fine sandy loam.	SM, SM-SC	A-4, A-2	0	100	95-100	85-95	20-50	<20	NP-5
	30-60	Loamy fine sand, fine sand, coarse sand.	SM, SP-SM	A-2, A-3	0	95-100	95-100	50-75	5-30	---	NP
CnC, CnD--------- Clarno	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	8-30	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	30-60	Loam, clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	50-80	30-45	10-20
Co--------------- Colo	0-18	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	18-40	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	20-30
CrC2, CrD2, CrE2- Crofton	0-4	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	4-60	Silt loam--------	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25
CrF, CrG--------- Crofton	0-5	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	5-60	Silt loam--------	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25
CuE2*:											
Crofton---------	0-5	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	5-60	Silt loam--------	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CuE2*:											
Nora-------------	0-5	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	12-25
	5-15	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	15-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
Eh--------------- Elsmere	0-11	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	11-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	100	60-100	5-30	---	NP
Gk--------------- Gibbon	0-18	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-55	20-35
	18-28	Silt loam, clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	55-90	25-38	12-20
	28-60	Stratified fine sandy loam to silt loam.	SM, SC, CL, ML	A-4	0	100	100	70-95	35-90	<25	NP-8
HaC-------------- Hadar	0-14	Loamy fine sand	SM	A-2	0	100	100	80-95	15-35	---	NP
	14-20	Loamy fine sand, sand, loamy sand.	SM, SP-SM	A-2, A-3, A-4	0	100	100	50-95	5-40	---	NP
	20-60	Loam, clay loam, sandy clay loam.	CL, CH, SC	A-6, A-7	0	95-100	95-100	80-95	35-75	25-55	10-30
Hd, He----------- Hobbs	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	9-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	95-100	80-100	25-52	5-25
InB-------------- Inavale	0-7	Loamy fine sand	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	85-95	5-35	<25	NP-5
	7-12	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	12-60	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
Ip*:											
Inavale---------	0-7	Fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	7-12	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	90-100	65-85	5-30	<25	NP-5
	12-60	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM, SM-SC	A-2, A-3	0	100	100	70-90	5-30	<25	NP-5
Boel------------	0-16	Loam------------	ML	A-4	0	100	100	85-95	70-95	24-35	2-10
	16-60	Fine sand, loamy fine sand, coarse sand.	SP, SM	A-2, A-3	0	100	95-100	85-95	0-25	---	NP
Kz--------------- Kezan	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-90	20-35	2-12
	8-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	80-95	25-40	4-19
La--------------- Lamo	0-22	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	85-95	40-65	14-35
	22-60	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-95	30-55	11-35
Lc--------------- Lamo	0-22	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-55	15-35
	22-60	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	85-95	35-55	15-35

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Ld--------------- Lawet	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	20-50	10-25
	12-46	Sandy clay loam, clay loam, loam.	CL, SC	A-6, A-4	0	100	100	70-100	35-75	20-35	8-20
	46-60	Stratified fine sandy loam to fine sand.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	60-100	20-60	<20	NP-5
Lo, LoC---------- Loretto	0-16	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	70-100	20-40	<25	NP-5
	16-41	Loam, silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	85-100	80-100	30-45	11-25
	41-60	Loam, silt loam, silty clay loam.	CL	A-6, A-7, A-4	0	100	100	80-100	80-100	30-47	8-25
LpC-------------- Loretto	0-14	Loam-------------	CL, CL-ML	A-6, A-4	0	100	100	85-100	60-90	25-40	5-15
	14-37	Loam, silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	85-100	80-100	30-45	11-25
	37-60	Loam, silt loam, silty clay loam.	CL	A-6, A-7, A-4	0	100	100	80-100	80-100	30-47	8-25
Lv--------------- Loup	0-20	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	70-85	30-45	<20	NP-6
	20-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-100	5-20	---	NP
Ma--------------- Marlake Variant	0-12	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-100	25-40	8-20
	12-60	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	80-100	25-40	8-20
MoC, Mp---------- Moody	0-11	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	13-25
	11-40	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	95-100	32-55	11-30
	40-60	Silt loam--------	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	5-25
Mu--------------- Muir	0-42	Silty clay loam	CL	A-6, A-7-6	0	100	100	95-100	85-100	35-45	15-25
	42-60	Silt loam, silty clay loam, loam.	CL, ML, CL-ML	A-4, A-6, A-7-6	0	100	100	95-100	85-100	20-45	4-20
NoD, NoE--------- Nora	0-7	Silty clay loam	CL, MH	A-6, A-7	0	100	100	95-100	95-100	35-55	12-25
	7-18	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	18-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
NpC2*, NpD2*:											
Nora------------	0-5	Silty clay loam	CL, MH	A-6, A-7	0	100	100	95-100	95-100	35-55	12-25
	5-15	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	15-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
Crofton---------	0-5	Silt loam--------	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	5-60	Silt loam--------	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25
Og--------------- Ord	0-16	Fine sandy loam	ML, SM	A-2, A-4	0	95-100	95-100	70-98	30-90	20-35	NP-10
	16-26	Fine sandy loam, loamy fine sand, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	70-100	30-85	20-35	NP-10
	26-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC	A-2, A-3	0	95-100	95-100	50-100	5-30	<20	NP-5
Oh--------------- Ord	0-19	Silt loam--------	ML	A-4	0	100	100	95-100	95-100	25-35	2-8
	19-26	Fine sandy loam, loamy fine sand, sandy loam.	ML, SM	A-2, A-4	0	95-100	95-100	70-100	30-85	20-35	NP-10
	26-60	Stratified sand to fine sandy loam.	SM, SP-SM, SM-SC	A-2, A-3	0	95-100	95-100	50-100	5-30	<20	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
OrC---------------- Ortello	0-17	Fine sandy loam	SM, ML	A-4	0	100	100	70-95	40-55	<20	NP
	17-26	Fine sandy loam, sandy loam.	SM, ML	A-4	0	100	100	70-95	40-55	<20	NP
	26-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-3, A-2	0	100	100	50-70	5-35	---	NP
OvB---------------- Ovina	0-19	Loamy fine sand	SM	A-2	0	100	100	70-90	15-30	---	NP
	19-42	Loam--------------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-80	20-35	2-15
	42-60	Fine sandy loam, fine sand.	SM, SP-SM	A-4, A-2	0	100	100	70-85	15-45	---	NP
Pb*. Pits and Dumps											
Rw*. Riverwash											
Sm---------------- Shell	0-17	Loam--------------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	6-18
	17-50	Silt loam---------	CL	A-4, A-6	0	100	100	95-100	90-100	25-40	10-25
	50-60	Fine sandy loam, silt loam.	SM, ML, SM-SC, CL-ML	A-4	0	100	100	70-85	40-55	<25	NP-5
Sn---------------- Shell	0-25	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	30-45	12-25
	25-60	Silty clay loam	CL	A-4, A-6	0	100	100	95-100	95-100	25-40	10-25
Sv---------------- Shell Variant	0-17	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	12-25
	17-31	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	25-40	10-25
	31-60	Silty clay--------	CH	A-7	0	100	100	95-100	90-100	50-70	27-45
ThB, ThC, ThD---- Thurman	0-16	Loamy fine sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	90-100	5-40	<20	NP
	16-60	Loamy fine sand, fine sand, very fine sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	---	NP
Tm---------------- Thurman	0-28	Loamy fine sand	SM, SP-SM	A-2, A-3, A-4	0	100	100	90-100	5-40	<20	NP
	28-60	Loamy fine sand, fine sand, very fine sand.	SM, SP-SM	A-2, A-3	0	100	100	85-100	5-25	---	NP
VaD, VaF--------- Valentine	0-7	Fine sand---------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	7-60	Fine sand, loamy fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Zo---------------- Zook	0-14	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
	14-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[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	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
AcC------------- Alcester	0-22	27-30	1.20-1.35	0.6-2.0	0.19-0.22	5.6-7.3	Moderate-----	0.28	5	7	2-4
	22-58	20-32	1.20-1.35	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.28			
	58-60	20-32	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
Ba-------------- Barney	0-6	10-20	1.40-1.50	0.6-2.0	0.20-0.24	6.6-8.4	Low----------	0.28	2	4L	2-4
	6-10	3-10	1.60-1.80	2.0-20	0.09-0.14	7.4-8.4	Low----------	0.17			
	10-60	0-5	1.70-1.90	6.0-20	0.02-0.04	6.6-7.8	Low----------	0.10			
Be-------------- Belfore	0-7	25-39	1.30-1.50	0.2-0.6	0.21-0.24	5.6-6.5	High---------	0.32	5	7	2-4
	7-42	35-42	1.20-1.40	0.2-0.6	0.11-0.18	5.6-7.8	High---------	0.32			
	42-60	25-35	1.30-1.50	0.2-0.6	0.18-0.22	6.1-8.4	High---------	0.32			
Bn-------------- Blendon	0-16	10-18	1.25-1.35	2.0-6.0	0.11-0.17	5.6-7.3	Low----------	0.20	5	3	2-4
	16-36	10-15	1.25-1.35	2.0-6.0	0.09-0.15	6.1-7.3	Low----------	0.20			
	36-60	5-18	1.30-1.45	2.0-20	0.08-0.15	6.6-8.4	Low----------	0.20			
Bp-------------- Boel	0-16	15-25	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	Low----------	0.28	5	4L	2-4
	16-60	0-6	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	Low----------	0.20			
BsC------------- Boelus	0-24	3-12	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-2
	24-50	18-35	1.40-1.60	0.6-2.0	0.20-0.22	6.1-8.4	Moderate-----	0.43			
	50-60	15-30	1.30-1.50	0.6-2.0	0.20-0.22	6.6-8.4	Moderate-----	0.43			
Cf-------------- Cass	0-16	7-17	1.40-1.60	2.0-6.0	0.16-0.18	5.6-7.3	Low----------	0.20	5	3	1-2
	16-30	5-15	1.40-1.60	2.0-6.0	0.15-0.17	6.1-8.4	Low----------	0.20			
	30-60	2-10	1.50-1.70	6.0-20	0.08-0.10	6.1-8.4	Low----------	0.20			
CnC, CnD--------- Clarno	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	Low----------	0.28	5	6	2-4
	8-30	20-30	1.25-1.40	0.6-2.0	0.16-0.20	6.6-8.4	Moderate-----	0.37			
	30-60	20-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	Moderate-----	0.37			
Co-------------- Colo	0-18	27-32	1.28-1.32	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.28	5	7	4-8
	18-40	30-35	1.25-1.35	0.6-2.0	0.18-0.20	6.1-7.3	High---------	0.28			
CrC2, CrD2, CrE2- Crofton	0-4	20-27	1.20-1.30	0.6-2.0	0.21-0.24	7.4-8.4	Low----------	0.43	5	4L	.5-1
	4-60	15-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.43			
CrF, CrG--------- Crofton	0-5	20-27	1.20-1.30	0.6-2.0	0.21-0.24	7.4-8.4	Low----------	0.43	5	4L	.5-2
	5-60	15-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.43			
CuE2*:											
Crofton---------	0-5	20-27	1.20-1.30	0.6-2.0	0.21-0.24	7.4-8.4	Low----------	0.43	5	4L	.5-1
	5-60	15-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low----------	0.43			
Nora------------	0-7	27-35	1.20-1.25	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	5	7	1-2
	7-18	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.3	Moderate-----	0.43			
	18-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
Eh-------------- Elsmere	0-11	3-10	1.90-2.10	6.0-20	0.10-0.12	5.6-7.8	Low----------	0.17	5	2	1-2
	11-60	0-8	1.90-2.10	6.0-20	0.06-0.11	5.6-7.8	Low----------	0.17			
Gk-------------- Gibbon	0-18	27-35	1.25-1.35	0.2-0.6	0.21-0.23	7.4-8.4	Moderate-----	0.32	5	4L	2-4
	18-28	20-32	1.30-1.50	0.6-2.0	0.18-0.22	7.9-8.4	Moderate-----	0.32			
	28-60	15-25	1.50-1.70	0.6-6.0	0.16-0.20	8.5-9.0	Low----------	0.32			
HaC------------- Hadar	0-14	4-12	1.50-1.70	6.0-20	0.10-0.12	5.6-6.5	Low----------	0.17	5	2	1-2
	14-20	4-12	1.50-1.90	6.0-20	0.06-0.11	5.6-6.5	Low----------	0.17			
	20-60	20-35	1.25-1.40	0.2-0.6	0.14-0.18	6.6-8.4	Moderate-----	0.32			
Hd, He----------- Hobbs	0-9	15-27	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	Low----------	0.32	5	6	2-4
	9-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	Low----------	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
InB----------------- Inavale	0-7	2-10	1.50-1.60	6.0-20	0.10-0.12	6.6-7.8	Low-----------	0.17	5	2	.5-1
	7-12	3-10	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	Low-----------	0.17			
	12-60	3-10	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	Low-----------	0.17			
Ip*:											
Inavale----------	0-7	1-5	1.50-1.60	6.0-20	0.07-0.09	6.6-7.8	Low-----------	0.17	5	1	.5-1
	7-12	3-10	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	Low-----------	0.17			
	12-60	3-10	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	Low-----------	0.17			
Boel-------------	0-16	15-25	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	Low-----------	0.28	5	4L	1-3
	16-60	0-6	1.50-1.60	6.0-20	0.05-0.10	6.6-8.4	Low-----------	0.20			
Kz----------------- Kezan	0-8	24-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	Moderate-----	0.32	5	6	2-4
	8-60	24-35	1.20-1.40	0.6-2.0	0.18-0.22	6.6-8.4	Moderate-----	0.32			
La----------------- Lamo	0-22	27-35	1.40-1.60	0.2-0.6	0.21-0.23	7.4-8.4	High----------	0.28	5	7	2-4
	22-60	25-35	1.30-1.50	0.2-0.6	0.18-0.22	7.4-8.4	High----------	0.32			
Lc----------------- Lamo	0-22	27-35	1.20-1.35	0.2-0.6	0.18-0.20	7.4-8.4	High----------	0.28	5	4L	2-4
	22-60	27-35	1.20-1.35	0.2-0.6	0.18-0.20	7.4-8.4	High----------	0.32			
Ld----------------- Lawet	0-12	27-30	1.20-1.40	0.6-2.0	0.21-0.23	7.4-8.4	Moderate-----	0.28	5	4L	2-4
	12-46	22-35	1.30-1.50	0.6-2.0	0.14-0.19	7.4-9.0	Moderate-----	0.28			
	46-60	0-15	1.50-1.80	2.0-20	0.05-0.13	6.6-8.4	Low-----------	0.17			
Lo, LoC----------- Loretto	0-16	8-18	1.40-1.60	2.0-6.0	0.13-0.18	5.1-6.5	Low-----------	0.20	5	3	1-2
	16-41	20-35	1.30-1.40	0.6-6.0	0.17-0.20	5.6-7.3	Low-----------	0.28			
	41-60	18-30	1.40-1.50	0.6-6.0	0.17-0.20	6.1-8.4	Low-----------	0.28			
LpC--------------- Loretto	0-14	10-20	1.30-1.50	0.6-2.0	0.20-0.22	5.1-6.5	Low-----------	0.28	5	6	2-4
	14-37	20-35	1.30-1.40	0.6-6.0	0.17-0.20	5.6-7.3	Low-----------	0.28			
	37-60	18-30	1.40-1.50	0.6-6.0	0.17-0.20	6.1-8.4	Low-----------	0.28			
Lv----------------- Loup	0-20	5-15	1.30-1.50	2.0-6.0	0.16-0.18	6.6-8.4	Low-----------	0.20	5	8	2-4
	20-60	2-7	1.60-1.80	6.0-20	0.06-0.08	6.6-8.4	Low-----------	0.17			
Ma----------------- Marlake Variant	0-12	18-27	1.25-1.35	0.6-2.0	0.22-0.24	6.6-7.8	Low-----------	0.28	5	8	4-8
	12-60	18-27	1.25-1.35	0.6-2.0	0.20-0.22	6.6-7.8	Low-----------	0.28			
MoC, Mp----------- Moody	0-11	27-35	1.20-1.30	0.2-0.6	0.21-0.23	5.6-7.3	Moderate-----	0.32	5	7	2-4
	11-40	27-35	1.20-1.30	0.2-0.6	0.18-0.20	6.1-7.3	Moderate-----	0.43			
	40-60	20-27	1.20-1.30	0.6-2.0	0.19-0.21	6.6-8.4	Moderate-----	0.43			
Mu----------------- Muir	0-42	28-35	1.30-1.45	0.6-2.0	0.21-0.23	5.6-7.8	Low-----------	0.32	5	7	2-4
	42-60	18-35	1.30-1.50	0.6-2.0	0.18-0.22	6.1-8.4	Low-----------	0.32			
NoD, NoE---------- Nora	0-7	27-35	1.20-1.25	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	5	7	2-4
	7-18	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.3	Moderate-----	0.43			
	18-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
NpC2*, NpD2*:											
Nora-------------	0-5	27-35	1.20-1.25	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	5	7	1-2
	5-15	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.3	Moderate-----	0.43			
	15-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	Moderate-----	0.43			
Crofton----------	0-5	20-27	1.20-1.30	0.6-2.0	0.21-0.24	7.4-8.4	Low-----------	0.43	5	4L	.5-1
	5-60	15-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	Low-----------	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
Og---------------- Ord	0-16	8-15	1.40-1.60	0.6-6.0	0.16-0.24	6.1-9.0	Low------------	0.20	5	3	1-2
	16-26	8-15	1.50-1.70	2.0-6.0	0.15-0.17	6.6-8.4	Low------------	0.20			
	26-60	3-12	1.60-1.80	2.0-20	0.02-0.04	6.6-8.4	Low------------	0.20			
Oh---------------- Ord	0-19	8-15	1.40-1.60	0.6-2.0	0.20-0.22	6.1-9.0	Low------------	0.24	5	5	2-4
	19-26	8-15	1.50-1.70	2.0-6.0	0.15-0.17	6.6-8.4	Low------------	0.20			
	26-60	3-12	1.60-1.80	2.0-20	0.02-0.04	6.6-8.4	Low------------	0.20			
OrC--------------- Ortello	0-17	5-15	1.40-1.60	2.0-6.0	0.13-0.18	6.1-7.3	Low------------	0.20	5	3	1-2
	17-26	5-15	1.40-1.60	2.0-6.0	0.12-0.17	6.1-7.3	Low------------	0.20			
	26-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.6-7.8	Low------------	0.15			
OvB--------------- Ovina	0-19	3-10	1.30-1.50	6.0-20	0.10-0.12	6.6-8.4	Low------------	0.17	5	2	1-2
	19-42	7-15	1.40-1.60	0.6-2.0	0.17-0.19	7.4-8.4	Low------------	0.28			
	42-60	5-15	1.40-1.60	2.0-6.0	0.14-0.16	7.4-8.4	Low------------	0.20			
Pb*. Pits and Dumps											
Rw*. Riverwash											
Sm---------------- Shell	0-17	15-27	1.20-1.30	0.6-2.0	0.22-0.23	5.6-7.3	Low------------	0.32	5	6	2-4
	17-50	20-30	1.20-1.30	0.6-2.0	0.20-0.22	5.6-7.3	Low------------	0.32			
	50-60	7-18	1.35-1.50	2.0-6.0	0.15-0.17	6.1-7.8	Low------------	0.24			
Sn---------------- Shell	0-25	27-32	1.15-1.25	0.2-0.6	0.21-0.23	5.6-7.3	Moderate-------	0.32	5	7	2-4
	25-32	20-30	1.20-1.30	0.6-2.0	0.20-0.22	5.6-7.3	Low------------	0.32			
	32-60	20-30	1.20-1.30	0.6-2.0	0.20-0.22	6.1-7.8	Low------------	0.32			
Sv---------------- Shell Variant	0-17	27-35	1.20-1.30	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-------	0.32	5	7	2-4
	17-31	27-35	1.15-1.25	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-------	0.32			
	31-60	35-55	1.15-1.30	0.06-0.2	0.10-0.13	6.6-8.4	High-----------	0.32			
ThB, ThC, ThD----- Thurman	0-16	5-12	1.60-1.80	6.0-20	0.10-0.12	6.1-7.3	Low------------	0.17	5	2	1-2
	16-60	2-10	1.60-1.80	6.0-20	0.06-0.11	6.1-7.3	Low------------	0.17			
Tm---------------- Thurman	0-28	5-12	1.60-1.80	6.0-20	0.10-0.12	6.1-7.3	Low------------	0.17	5	2	1-2
	28-60	2-10	1.60-1.80	6.0-20	0.06-0.11	6.1-7.3	Low------------	0.17			
VaD, VaF---------- Valentine	0-7	0-6	1.50-1.60	6.0-20	0.06-0.11	5.6-7.3	Low------------	0.15	5	1	.5-1
	7-60	0-8	1.50-1.60	6.0-20	0.06-0.08	5.6-7.3	Low------------	0.15			
Zo---------------- Zook	0-14	32-38	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High-----------	0.28	5	7	4-8
	14-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High-----------	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "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]

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
AcC---------------- Alcester	B	None---------	---	---	>6.0	---	---	High-----	Moderate	Low.
Ba----------------- Barney	D	Frequent----	Long------	Mar-Jun	0-2.0	Apparent	Nov-Jun	Moderate	High-----	Low.
Be----------------- Belfore	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
Bn----------------- Blendon	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Bp----------------- Boel	A	Occasional	Brief-----	Mar-Jun	1.5-3.5	Apparent	Nov-May	Moderate	High-----	Low.
BsC---------------- Boelus	A	None---------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Cf----------------- Cass	B	Rare---------	---	---	>6.0	---	---	Moderate	Moderate	Low.
CnC, CnD---------- Clarno	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Co----------------- Colo	B/D	Occasional	Very brief to long.	Feb-Nov	2.0-3.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
CrC2, CrD2, CrE2, CrF--------------- Crofton	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
CrG---------------- Crofton	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
CuE2*:										
Crofton-----------	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
Nora--------------	B	None---------	---	---	>6.0	---	---	High-----	Moderate	Low.
Eh----------------- Elsmere	A	Rare---------	---	---	1.5-2.5	Apparent	Nov-May	Moderate	Moderate	Low.
Gk----------------- Gibbon	B	Occasional	Very brief	Mar-Jul	1.5-3.0	Apparent	Nov-Jun	High-----	High-----	Low.
HaC---------------- Hadar	B	None---------	---	---	>6.0	---	---	Low------	Low------	Moderate.
Hd----------------- Hobbs	B	Occasional	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low------	Low.
He----------------- Hobbs	B	Frequent----	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low------	Low.
InB---------------- Inavale	A	Occasional	Very brief	Jan-Jul	>6.0	---	---	Low------	Moderate	Low.
Ip*:										
Inavale-----------	A	Occasional	Very brief	Jan-Jul	>6.0	---	---	Low------	Moderate	Low.
Boel--------------	A	Frequent----	Brief-----	Mar-Jun	1.5-3.5	Apparent	Nov-May	Moderate	High-----	Low.
Kz----------------- Kezan	B	Frequent----	Brief-----	Mar-Jul	1.0-3.0	Apparent	Nov-Jun	High-----	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
La----------------- Lamo	C	Occasional	Brief-----	Mar-Aug	1.5-3.0	Apparent	Nov-May	High-----	High-----	Low.
Lc----------------- Lamo	C	Occasional	Brief-----	Mar-May	0.5-1.5	Apparent	Nov-Jun	High-----	High-----	Low.
Ld----------------- Lawet	B/D	Occasional	Brief-----	Mar-Jun	1.0-2.0	Apparent	May-Nov	High-----	High-----	Moderate.
Lo, LoC, LpC------ Loretto	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
Lv----------------- Loup	D	Occasional	Brief-----	Jan-Jul	+.5-1.0	Apparent	Nov-May	Moderate	High-----	Low.
Ma----------------- Marlake Variant	D	Frequent----	Brief-----	Mar-Jun	+2-1.0	Apparent	Oct-Jun	Moderate	High-----	Low.
MoC, Mp----------- Moody	B	None---------	---	---	>6.0	---	---	High-----	Moderate	Low.
Mu----------------- Muir	B	Rare---------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
NoD, NoE---------- Nora	B	None---------	---	---	>6.0	---	---	High-----	Moderate	Low.
NpC2*, NpD2*:										
Nora--------------	B	None---------	---	---	>6.0	---	---	High-----	Moderate	Low.
Crofton-----------	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
Og, Oh------------ Ord	B	Occasional	Brief-----	Mar-May	1.5-3.5	Apparent	Nov-May	High-----	High-----	Low.
OrC--------------- Ortello	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Low.
OvB--------------- Ovina	B	Rare---------	---	---	2.0-4.0	Apparent	May-Nov	High-----	Moderate	Low.
Pb*. Pits and Dumps										
Rw*. Riverwash										
Sm, Sn------------ Shell	B	Occasional	Brief-----	Mar-Jun	>6.0	---	---	Moderate	Low------	Low.
Sv----------------- Shell Variant	B	Occasional	Brief-----	Mar-Jun	2.0-3.5	Perched	Nov-Jun	Moderate	Low------	Low.
ThB, ThC, ThD, Tm- Thurman	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
VaD, VaF---------- Valentine	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
Zo----------------- Zook	C/D	Occasional	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-May	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth to inches	Classification		Grain-size distribution: Percentage passing sieve--					Grain-size distribution: Percentage smaller than--			Liquid limit	Plasticity index	Moisture density
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm	Pct		G/cc
Crofton silt loam: (S76NE-167-021)													
Ap-------- 0 to 6	A-6(10)	CL	100	100	100	100	99	94	34	26	39	14	2.67
AC-------- 6 to 11	A-7-6(11)	CL	100	100	100	100	99	94	32	25	41	16	2.67
C2--------24 to 60	A-6(10)	CL	100	100	100	100	100	95	32	24	40	16	2.70
Hadar loamy fine sand: (S77NE-167-004)													
Ap-------- 0 to 8	A-2-4(00)	SM	100	100	100	92	17	13	5	5	--	NP	2.62
IIB2------20 to 28	A-7-6(11)	CL	100	100	100	94	63	60	35	31	43	23	2.67
IIC-------36 to 60	A-7-6(16)	CL	100	99	98	94	74	69	41	33	47	26	2.66
Hobbs silt loam: (S78NE-167-013)													
Ap-------- 0 to 9	A-6(10)	CL	100	100	100	100	97	88	25	22	37	14	2.64
C1-------- 9 to 28	A-6(11)	CL	100	100	100	100	99	92	26	22	40	17	2.66
Cb--------40 to 60	A-7-6(16)	MH	100	100	100	100	99	93	32	25	52	23	2.60
Moody silty clay loam: (S77NE-167-008)													
Ap-------- 0 to 7	A-6(9)	ML	100	100	100	100	98	92	35	28	38	13	2.61
B21-------11 to 17	A-7-6(17)	CH	100	100	100	100	99	94	42	37	51	26	2.68
C---------40 to 60	A-7-6(12)	CL	100	100	100	100	99	93	33	29	41	19	2.69
Nora silty clay loam: (S78NE-167-003)													
A1-------- 0 to 7	A-7-5(17)	MH	100	100	100	100	99	93	29	22	55	25	2.60
B22-------11 to 18	A-7-6(15)	CL	100	100	100	100	98	92	35	27	49	22	2.67
C1ca------27 to 38	A-7-6(13)	CL	100	100	99	98	97	90	32	26	43	21	2.68
Valentine fine sand: (S77NE-167-003)													
A1-------- 0 to 7	A-2-4(02)	SM	100	100	100	100	14	10	4	3	--	NP	2.63
AC-------- 7 to 14	A-3(02)	SP-SM	100	100	100	100	6	5	2	2	--	NP	2.63
C2--------36 to 60	A-3(02)	SP-SM	100	100	100	100	5	4	2	2	--	NP	2.62

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alcester	Fine-silty, mixed, mesic Cumulic Haplustolls
*Barney	Sandy, mixed, mesic Mollic Fluvaquents
Belfore	Fine, montmorillonitic, mesic Udic Haplustolls
Blendon	Coarse-loamy, mixed, mesic Pachic Haplustolls
Boel	Sandy, mixed, mesic Fluvaquentic Haplustolls
Boelus	Sandy over loamy, mixed, mesic Udic Haplustolls
Cass	Coarse-loamy, mixed, mesic Fluventic Haplustolls
Clarno	Fine-loamy, mixed, mesic Typic Haplustolls
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Crofton	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Elsmere	Sandy, mixed, mesic Aquic Haplustolls
Gibbon	Fine-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Hadar	Sandy over loamy, mixed, mesic Udic Haplustolls
Hobbs	Fine-silty, mixed, nonacid, mesic Mollic Ustifluvents
Inavale	Sandy, mixed, mesic Typic Ustifluvents
*Kezan	Fine-silty, mixed, nonacid, mesic Mollic Fluvaquents
*Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
*Lawet	Fine-loamy, mesic Typic Calciaquolls
Loretto	Fine-loamy, mixed, mesic Udic Argiustolls
Loup	Sandy, mixed, mesic Typic Haplaquolls
Marlake Variant	Fine-silty, mixed, mesic Mollic Fluvaquents
Moody	Fine-silty, mixed, mesic Udic Haplustolls
Muir	Fine-silty, mixed, mesic Cumulic Haplustolls
Nora	Fine-silty, mixed, mesic Udic Haplustolls
Ord	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Ortello	Coarse-loamy, mixed, mesic Udic Haplustolls
Ovina	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Shell	Fine-silty, mixed, mesic Cumulic Haplustolls
Shell Variant	Fine-silty, mixed, mesic Cumulic Haplustolls
Thurman	Sandy, mixed, mesic Udorthentic Haplustolls
Valentine	Mixed, mesic Typic Ustipsamments
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

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