Series 1957, No. 12

Issued January 1962

SOIL SURVEY

Hall County Nebraska

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF NEBRASKA
Conservation and Survey Division

HOW TO USE THIS SOIL SURVEY REPORT

THIS SURVEY of Hall County will serve several groups of readers, particularly farmers and ranchers who want information to help them plan the kind of management that will protect their soils and provide good yields. The survey describes the soils, shows their location on a map, and tells what they will do under different kinds of management.

Locating the soils

To find what kind of soils you have on your farm, first locate your farm on the Index to Map Sheets at the back of the report. To find your farm, you need to know the section, range, and township in which your farm is located. After finding the location of your farm, note the number of the rectangle it is in. Now turn to the map sheet with the corresponding number. On this map, locate your farm by section or part of the section. This map will show you the symbols used to designate the soils mapped on your farm. Use the Soil Legend to find the name of your soil or soils. Then turn to the Guide for Mapping Units near the back of the report to find the pages where your soils are described in detail.

Suppose, for example, an area located on the map has the symbol Hs. The legend for the detailed map shows that this symbol identifies the soil as Hastings silt loam, 0 to 1 percent slopes. This soil is described in the section, Soils of Hall County, beginning on the page listed for the soil in the Guide for Mapping Units.

Finding information

Few readers will be interested in all of the report, for it has special parts for different groups. The section, General Nature of the County, which discusses climate, early history, natural resources, agriculture, and other subjects, will be of interest mainly to those not familiar with the county.

Farmers and those who work with farmers will want to learn about the soils in the subsection, Descriptions of the Soils, and then turn to the section, Use and Management of Soils. In this way, they first learn how these soils can be managed and what yields can be expected. The soils are grouped by capability units; that is, groups of soils that need similar management and that respond to this management in about the same way. All the soils in the county are placed in dryland capability units, but only soils suited to irrigation are placed in irrigated units. For example, Hastings silt loam, 0 to 1 percent slopes, was placed both in dryland capability unit IIc-1 and in irrigated capability unit I-1. The management of dryland soils and irrigated soils are discussed in separate subsections. Table 2 tells how much a farmer can expect to harvest from Hastings silt loam, 0 to 1 percent slopes, under two levels of management, where the soil is dry farmed and where it is irrigated.

Ranchers will find helpful the subsection, Use and Management of Range Land. In table 3, soils are grouped in range sites and the dominant grasses that grow under excellent range conditions are listed. A range site is a management group of soils used for range.

Soil scientists and others interested in the scientific aspect of soils will find information about how the soils were formed and how they are classified in the section, Genesis, Classification, and Morphology of Soils.

Students, teachers, and other users can learn about the soils and their management in various parts of this report, depending on their particular interests. Those interested in general soil areas will want to read the section, General Soil Map. This section tells about the principal kinds of soils and where they are found.

At the back of this report is a Guide for Mapping Units that will guide you to practically everything in this report that is written about each soil. In this guide the map symbols for the soils of the county are in alphabetic order. Listed for each soil are the page numbers of its soil description and the discussions of its capability unit or units, range site, and woodland site.

* * * * *

This soil survey was made as a part of the technical assistance furnished by the Soil Conservation Service to the Hall County Soil Conservation District. Help in farm planning can be obtained from members of the SCS in the district, the county agricultural agent, or the staff of the State Agricultural Experiment Station. Fieldwork for this survey was completed in 1957. Unless otherwise stated, the statements in this report refer to the conditions in the county at that time.

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SOIL SURVEY OF HALL COUNTY, NEBRASKA

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United States Department of Agriculture in Cooperation with University of Nebraska Conservation and Survey Division

HALL COUNTY, located in south-central Nebraska (fig. 1), has a land area of 540 square miles, or 345,000 acres. It extends 24 miles from north to south and 23 miles from east to west. Grand Island, the county seat and largest town, is in the northeastern part of the county. Physiographically, the county consists of the valley of the Platte River, loessal uplands, and sandhills. The subhumid, continental climate has wide seasonal and day-to-day variations; it is very cold in winter and very hot in summer. About two-thirds of the land in the county is cropland, almost one-fourth is in grass, and a small part is woodland. Since 1945, irrigation has become increasingly important. Corn is the principal crop, but there are also large acreages in wheat, alfalfa, and oats. Sorghum, soybeans, sugar beets, and hay are planted in smaller acreages. Sweetclover, tame grasses, rye, and vetch are grown for forage and as soil building crops. Cattle are raised for beef and for their dairy products. A few farms sell milk to large local dairies. In recent years the production of turkeys for sale has grown in the area around Grand Island.

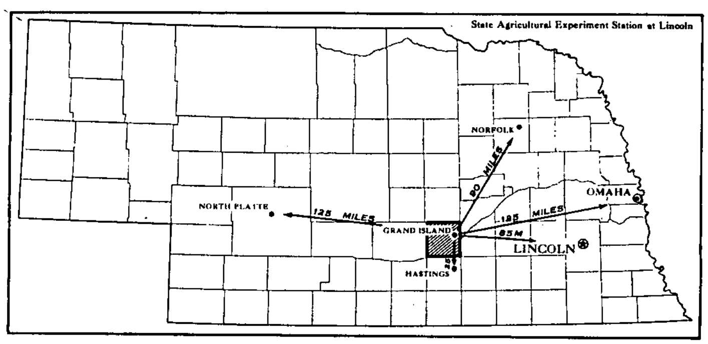

Figure 1.—Location of Hall County in Nebraska.

General Soil Map

A general soil map that has been made from the data on the detailed soil map is at the back of this report. This general map shows 11 general soil areas, or soil associations, each identified by a different color and number.

A soil association consists of different soils that occur together in a fairly uniform pattern. Within an association, the pattern may be intricate or simple and the soils do not necessarily occur in equal proportions. But the soils in an association tend to be located in the same kind of topographic positions.

The general soil map and the discussion of the soil associations are intended only as a general guide to the characteristics or relative physical capabilities of the soils in different parts of the county. These parts of the report can be used in community or county planning or for other general or overall use. They cannot be used as a basis for planning management of farms or fields because they are too general for these uses. To learn about the soils and agriculture of a specific farm or ranch, use the detailed soil map and soil descriptions.

Silty Uplands: Kenesaw-Holdrege Association

This association consists of deep, silty soils that developed on uplands in loess. Loess in Hall County is a yellowish, silty, windblown material. The soils in this association are level to steep and in places are hummocky. They occur in two general areas—one west and southwest of Cairo and the other extending in a band northeast and southwest of Doniphan. The total area of this association is 37,160 acres, or 11 percent of the county.

These soils are well drained and are moderately to rapidly permeable. Their surface soils are medium acid to neutral, and their subsoils and substrata are slightly acid to slightly alkaline.

The Kenesaw soils have a light-colored, thin to moderately thick, silt loam surface soil. These soils are young and have had little or no structural development in the subsoil. At depths of 10 to 36 inches is a calcareous silt loam parent material. Kenesaw soils make up 53 percent of this association.

The Holdrege soils have a thick, dark, silt loam surface soil over a subsoil of brownish silt loam or light silty clay loam. Their substrata are undeveloped, pale-yellow, wind-deposited silt (Peorian loess). These soils occupy about 37 percent of this association.

Smaller acreages of several other soils occur in the Kenesaw-Holdrege association. Colby soils make up about 6 percent of this association and Hobbs soils about 4 percent. The Hobbs soils occur in the widest upland draws. They have a dark-colored silty profile that developed from soil material washed down from the hills.

Most of this association is cultivated. The soils respond well to irrigation. The Holdrege soils are some of the best agricultural soils of the county. Most of the steep slopes of the Kenesaw soils are in permanent pasture. Grain, which is sold, is grown on most farms, and a few cows, hogs, and chickens are raised for home use. Some farmers fatten cattle in small feed lots. Practically all farms have access to gravel roads.

Loamy and Clayey Uplands: Hastings-Butler Association

This soil association is on uplands and consists of soils with moderately heavy to heavy subsoils that developed in Peorian loess. Most areas of these soils are nearly level, but next to drains some areas are gently sloping (3 to 7 percent) where erosion is moderate to severe. This association is in the southeastern part of the county. It has a total area of 23,960 acres and makes up 7 percent of the county.

The main soils in this association have a surface soil of dark, friable, weak, granular silt loam that is 6 to 14 inches thick. Slightly lighter colored than the surface soil, their subsoils are firm to very firm when moist and range from silty clay loam to clay. They are 16 to 30 inches thick. The parent material is pale-yellow loess of silt loam texture.

These soils are moderately slow to slow in permeability. Their surface soils are slightly acid to medium acid, and their subsoils are slightly acid to neutral. The substrata are slightly alkaline and contain moderate amounts of free lime.

The Hastings soils have dark-colored silt loam surface soils that are 6 to 14 inches thick. Their subsoils are firm, grayish-brown or yellowish-brown silty clay loam with subangular blocky structure. These soils occupy about 65 percent of this association.

The surface soils of the Butler soils are similar to those of the Hastings soils except that they have slightly gray subsurface layers. Butler soils have subsoils of a very firm, dark grayish-brown, prismatic silty clay or clay (claypan). These soils occupy about 26 percent of the association.

Some areas of Scott and Fillmore soils are also in this association. The Scott soils occupy the lowest depressions, where water stands much of the year. Fillmore soils are also in depressions but are slightly higher than Scott soils and, when in native pasture, support a better growth of grasses. The Scott soils have thinner surface soils than the Fillmore soils, but the subsoils of the soils in both series are heavy clay. The Scott soils make up about 1 percent of this association and the Fillmore soils about 4 percent. In the remaining 4 percent of the association are the Hobbs soils, which occur in upland draws that are occasionally flooded after rains. Figure 2 shows the relationship of the soils in the Hastings-Butler association as they occur in the southeastern part of the county.

Most of this association is cultivated, and yields of all crops commonly grown in the area are good. The crops respond well to irrigation. The farms are mainly of the cash-grain type although most farmers raise a few cows, hogs, and chickens for home use. Good gravel roads are on most all section lines.

Sandy Uplands: Valentine-Thurman Association

This association consists of soils that developed on uplands from sandy materials deposited by wind. In some places, the sandy materials are underlain with loess. The sandhills of Hall County are in this association. This association is in two general areas. The larger area is a band along the northwestern and north-central part of the county. The smaller area is along the south break to the valley of the Platte River. This association has a total area of 33,920 acres and makes up about 10 percent of the county.

Most of the soils in this association have surface soils and subsoils of sandy loam, loamy sand, or fine sand. The subsoil normally is lighter colored than the surface soils. The substrata are variable in texture. These soils are slightly acid to medium acid. Because they are sandy, they absorb water readily.

The main soils in this association are in the Valentine, Thurman, and Ortello series. The Valentine soils make up about 65 percent of this association. These soils are rolling and undulating. They have thin surface soils of loose, gray, fine sand that overlie loose, pale-brown subsoils. The Thurman soils are nearly level to undulating. They have surface soils of dark sandy loam or loamy sand that are 5 to 12 inches thick and subsoils of light brownish-gray loamy sand. The substrata commonly are stratified sandy loam, loamy sand, and fine sand. Thurman soils occupy about 25 percent of this association.

The Ortello soils have 20 to 36 inches of fine sandy loam over buried, medium to moderately fine textured layers. They make up about 10 percent of the association. Ortello soils are the best soils for farming in this association. They produce good yields under both dryland and irrigated management. The largest areas occur northeast and southwest of Doniphan.

About 80 percent of this association is in permanent pasture. The Valentine soils are too sandy, unstable, and droughty for successful cultivation. Some areas of Thurman soils are cultivated and produce fair to poor

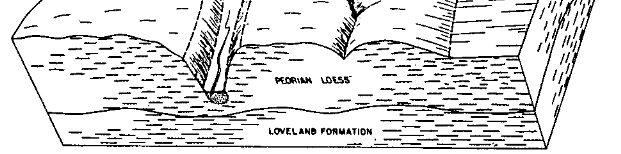

Figure 2.—**Topography, soils, and parent materials in the southeastern part of Hall County.**

crops. Fair to good stands of native grasses are grown on this land. The sandhills can produce an abundance of good forage. Large herds of beef cattle are pastured on these areas, especially in the northern part of the county. Some grazing is available throughout the year. Average farms and ranches are considerably larger than anywhere else in the county. Farmsteads are fewer. Some gravel roads are available, but many section lines are only trails and are not used for travel.

Deep Silty Terraces: Hord-Hall Association

This association consists of deep soils on stream terraces. These soils have dark, medium-textured surface soils and silty to moderately heavy subsoils. The soils developed in loess on high terrace levels and in a mixture of alluvium and loess on the lower terrace levels. Most of these soils are nearly level. The largest areas are on terraces of the Platte River Valley. They are also on side slopes along drains and on low ridges where erosion is moderate to severe. This association has a total area of about 54,750 acres and makes up 16 percent of the total area of the county.

The surface soils range from 6 to 16 inches in thickness. The substrata materials are loess, sand, or mixed sand and gravel. The surface soils are slightly acid to medium acid, the subsoils are slightly acid, the substrata are neutral to slightly alkaline. All soils of this association are well drained.

The principal soils in this association are Hord and Hall soils. The Hall soils have dark, silt loam surface soils over moderately heavy, subangular blocky subsoils. They occupy about 11 percent of this association. Hord soils are similar to Hall soils, but have medium-textured or loamy subsoils. Included with the Hord soils are numerous areas with subsoils and substrata of loam and sand. Hord soils occupy about 84 percent of this association.

Included in this association are a few areas of the depressional Scott and Fillmore soils which make up 1 percent of the association. Broken land makes up 3 percent. It occurs along stream banks and terrace edges. Hobbs soils occupy about 1 percent of the association. They have deep, dark, silty profiles and are on colluvial-alluvial slopes at the base of loessal uplands.

Soils of the Hord-Hall association are among the best agricultural soils of the county. They have medium internal drainage and sufficient depth to store a good supply of moisture. The soils respond well to irrigation in most places with little land leveling. They are high in natural fertility. Nearly all the soils are cultivated.

Most farms are of the cash-grain type. Some dairy and general livestock farms are in this association north of Grand Island. A few farmers fatten cattle in small feed lots. Good gravel or hard surface roads are on all section lines.

Claypan Terraces: Wood River Association

The soils in this association occur on the terraces in the valley of the Platte River. The soils generally developed on nearly flat areas of less than 1 percent slope but are also on areas that slope to drains where erosion is moderate to severe. They are mainly in the west-central part of the county. This association occupies 41,845 acres, or about 12 percent of the county.

The soils in the Wood River association have thick, dark surface soils and grayish-brown to very dark grayish-brown claypan subsoils. The parent materials are loess on loess-covered high terraces, a mixture of loess and alluvium, or alluvium on the lower terrace levels. Mixed sand and gravel occur at depths of 4 to 10 feet on the lower terraces.

All soils of this association have very slow internal drainage because of the fine-textured, claypan subsoil. The surface soils are slightly acid to medium acid, and the subsoils are neutral to slightly alkaline. Free carbonates normally are in the lower subsoils at depths of 2½ to 4 feet.

The soils of the Wood River series make up 94 percent of this association. These soils have surface soils of dark-colored silt loam, 12 to 16 inches thick, over subsoils of dark grayish-brown, prismatic and blocky silty clay or clay. Where Wood River soils occur on the higher terrace levels, the subsoils have certain alkali characteristics and may have a saline layer in the lower part. Crop growth is not affected unless the saline layer is exposed. A few areas of the depressional Scott and Fillmore soils occupy 2 percent of this association. Hall soils occupy about 3 percent of the area and Broken land, silty eroded terrace breaks, the remaining 1 percent.

Nearly all areas of the Wood River association are cultivated. Under dryland farming, crop yields are relatively poor compared to yields on soils that have a more friable subsoil. This is partly because the claypan impairs the penetration of roots. Effective storage of water is limited mainly to the upper 12 or 14 inches of soil. Under irrigation, however, the claypan is kept moist and the roots of many crops can grow into this layer. At the same time, the top 14 inches are moist and supply the crop with sufficient water. The effect of the pan layer in limiting water movement and root penetration is thus greatly reduced on irrigated crops.

As many irrigation wells are concentrated in this area as anywhere else in Hall County. Crop response to irrigation is excellent, and some of the best yields are obtained on these soils. Nearly all farms are the cash-grain type. Most farmers keep a few cows, hogs, and chickens for home use. Nearly every section line has a good gravel or hard surface road.

Sandy Terraces: Ortello-Thurman Association

This association consists of deep sandy soils on terraces that are not affected by excess water and a unit that is made up of both deep and moderately deep soils on terraces. Most of these soils are nearly level and hummocky. They occur mainly in the northeastern and central parts of the county. The association covers 29,075 acres, or about 9 percent of the county.

The parent materials from which the soils formed are wind-deposited or wind-sorted sandy material, silty alluvium or loess beneath an overblow of sandy material, and a mixture of loess and alluvium.

Soils of the Ortello-Thurman association vary from well drained to excessively drained. Permeability ranges from moderately rapid to very rapid. Because the sandy surface soil absorbs most of the rainfall, there is very little runoff except on the steeper slopes. Erosion is slight except on a few of the hummocky areas where it is moderate or severe.

In this association are Ortello and Thurman soils, the Hord-O'Neill complex, and the Hall-O'Neill complex. Thurman soils have dark, sandy loam or loamy sand surface soils, 6 to 14 inches thick. Their subsoils are lighter colored loamy fine sand. These soils may grade into loamy sand or fine sand at depths of 3 to 5 feet. A loamy substratum phase is mapped where these soils are underlain by a silty or clayey layer below 5 feet. Thurman soils occupy about 33 percent of this association. Ortello soils are less sandy than Thurman soils. They have surface soils of dark loam and fine sandy loam and subsoils of lighter colored fine sandy loam. A loamy substratum phase of the Ortello soils is also included with this association. Ortello soils occupy about 57 percent of this association.

Soils of the Hall-O'Neill and the Hord-O'Neill complexes are in a general area just west of Grand Island. About 65 percent of the area in these complexes consists of deep soils that have loamy to sandy surface soils and upper subsoils. At depths of 24 to 30 inches, a dense clay loam layer occurs. This layer lies abruptly on a sand and gravel substratum. About 25 percent of the area in the complexes has loamy surface soils and clay loam subsoils that have a combined thickness of 20 to 36 inches and overlie mixed sand and gravel. The remaining 10 percent of the area in these complexes is made up of shallow soils, 10 to 20 inches thick over mixed sand and gravel. The soils in these complexes occupy about 7 percent of this association.

A few areas of Valentine, Thurman, and O'Neill soils are scattered throughout this association. These soils make up the remaining 3 percent of the association.

Soils of this association are somewhat droughty under dryland farming. Many areas of Thurman soils are still in native grass. The Ortello soils and other soils in the association are good soils and well suited to irrigation.

This is an area of cash-grain farms. Hogs, cattle, and chickens are raised primarily for home use. A few farmers have small feed lots where they fatten beef cattle and hogs for market. Practically all farms have access to gravel or hard surface roads.

Imperfectly Drained Sandy Terraces: Ovina-Elsmere Association

This association consists of soils on stream terraces in the valley of the Platte River. These soils are nearly level to hummocky. They occur in the north-central and northeastern parts of the county. There are 9,000 acres in this association, which is 2 percent of the county.

These soils have sandy loam or loamy sand surface soils. The subsoils and substrata range from clay loam to loamy sand. Permeability is rapid or very rapid and surface runoff is slow. These are imperfectly drained soils, and they have a high ground-water level or a perched water table. The relationship of the imperfectly drained sandy terraces to the sandy uplands and the saline-alkali terraces is shown in figure 3.

The soils in this association are commonly mottled. The colors are generally dull browns and grays, indicating slow internal drainage or a fluctuating water table. Free lime is at various depths, and the surface soils and subsoils are slightly acid to slightly alkaline.

The Ovina soils have sandy loam profiles, 36 to 60 inches thick. Some areas have heavy substrata. These soils occupy about 65 percent of this association. The Elsmere soils have very sandy (loamy sand) profiles, 36 to 60 inches thick, both with and without heavy substrata. They occupy about 35 percent of this association.

Most soils in this association are cultivated, but many areas adjacent to the sandhills are in native pasture. During wet years, these soils often cannot be cultivated for several days after rains because they are in low positions and have slow internal drainage. Seedbed preparation is often delayed because the soils are wet. Normally, crop yields are not so high as on the better drained soils, but during dry seasons, the crops benefit from the water table. A small part of these soils is irrigated. Irrigation has not developed so rapidly as in other parts of the county.

The farms in this association are primarily cash-grain farms, but considerable livestock is raised in feed lots on the larger pasture areas. The livestock is mainly beef cattle. Good gravel roads are available to all farms.

Shallow and Moderately Deep Terraces: O'Neill-Meadin Association

This association occurs as a band of soils ½ to 2 miles wide along the southern edge of the terraces where they break to the bottom lands in the Platte Valley. These soils are nearly level except for the actual break to the bottom lands that has slopes of 3 to 50 percent. The largest area contains much of the City of Grand Island and the Grand Island Airport area. Also in this association is that area of the county locally known as Pov-

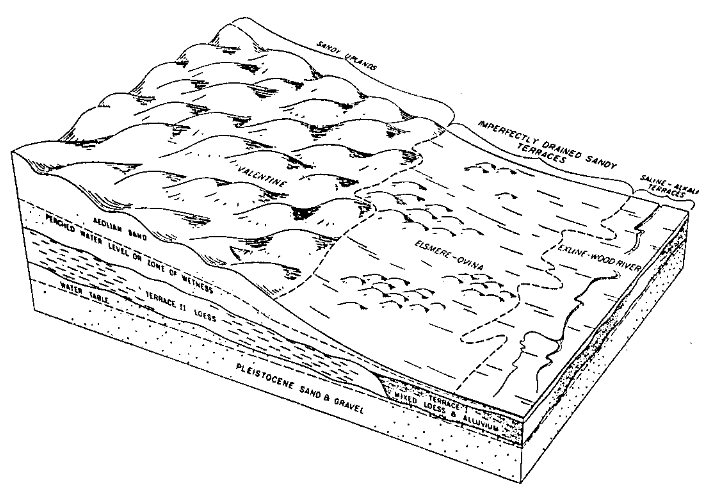

Figure 3.—**Ovina-Elsmere association in the north-central part of Hall County.**

erty Ridge. A total of 13,375 acres, or 4 percent of the county, is in this association.

These soils are 10 to 36 inches thick over mixed sand and gravel. They have loam or sandy loam surface soils. They are noncalcareous throughout their profiles and are slightly acid to medium acid. The percentage of gravel in the substrata varies considerably from place to place.

O'Neill soils have thick, dark loam and sandy loam surface soils. Their subsoils are mostly sandy loam. They are 20 to 36 inches thick over mixed sand and gravel. These soils make up about 92 percent of this association.

Meadin soils have only 10 to 20 inches of soil material over mixed sand and gravel. In most areas their surface soils are sandy loam, but there are a few areas of loam. Meadin soils occupy about 8 percent of this association.

Most of the acreage in this association is used to produce crops. Crops grown on these soils respond well to irrigation. Some areas of Meadin soils are in permanent pasture. Under dryland farming, the soils are droughty and crop yields are poor. Most farms are of the cash-grain type. Some cattle, hogs, and chickens are raised for home use on most farms. Practically all section lines have a good gravel road.

Saline-Alkali Terraces: Exline-Wood River-Silver Creek Association

This association consists of soils on stream terraces. These soils have a moderately and strongly saline-alkali layer or a calcareous clayey subsoil. A high water table has influenced their development. Their parent materials consist of loess on the high terrace levels and of alluvium or mixed alluvium and loess on the lower terrace levels. Some of the alkali areas have a 2- to 12-inch layer of wind-deposited sandy material on the surface. These soils occur in broad flats or basins that are slightly lower than the surrounding soils. They are mainly in the northeastern and north-central parts of the county. About 16,050 acres, or 4 percent of the county, is in this association.

These soils have surface soils of friable silt loam or fine sandy loam that range from 0 to 14 inches in thickness. The surface soils are light gray to dark gray and have crumb or weak granular structure. The well-developed, columnar, and blocky upper subsoils were formed in clay loam to clay materials. The lower subsoils are moderately fine or fine-textured and may contain large amounts of free lime carbonate. Buried soils are common.

Included in this association are the Exline and Silver Creek soils, the Wood River-Exline silt loams, and the Exline-Wood River silt loams. Areas of the Exline-Wood River silt loams are moderately to strongly affected by saline and alkali. The strongly affected areas have thin silt loam or sandy loam surface soils and strong, columnar, claypan subsoils. The areas occur as slight depressions, commonly called buffalo wallows, in native pastures and as light-colored, cloddy, alkali spots in cultivated fields. These spots are 15 to 100 feet apart in the strongly saline areas and 50 to 400 feet apart in the moderately saline areas. In some of the alkali spots, the original surface soils have been blown away and the subsoils are exposed.

Wood River-Exline silt loams have silt loam surface soils everywhere. Alkali spots are common but are not especially close together. The soils between the spots have 10 to 18 inches of dark-colored silt loam over claypan subsoils and resemble the soils of the Wood River series. Small areas of Hall and Hord soils occur within larger areas of Wood River-Exline silt loams.

The Silver Creek soils have dark, thick, friable silty surface soils over fine-textured clayey subsoils that contain large amounts of free lime. Although the Silver Creek soils are not saline-alkali, they occur in close association with the Exline and Wood River soils and, therefore, are included in this association.

The Exline-Wood River silt loams that are strongly affected by saline and alkali make up 56 percent of this association; the moderately affected areas of the Wood River-Exline silt loams make up 40 percent; and Silver Creek soils make up the remaining 4 percent.

These soils are not so productive as the better drained soils on terraces. About 25 percent of the area is in native pasture and is fair for this purpose. Some areas are mowed for hay. Alfalfa, sorghum, and wheat do better than other cultivated crops. The alkali spots are difficult to cultivate. They dry out last after rains, have a cloddy surface when dry, and their heavy, sticky subsoils are hard to plow. But these soils can be improved by lowering the water table. The results of some irrigation developments indicate that this is possible and profitable. Land leveling and drainage improve these soils.

There are few farmsteads in this association; the soils are in relatively low areas where crop productivity is limited. The farms are the cash-grain or general type. Some livestock is raised on nearly all farms. Good gravel or hard-surfaced roads are available throughout the area.

Deep and Moderately Deep Bottom Lands: Wann-Leshara-Cass Association

This association consists of all soils on bottom lands that are thicker than 20 inches over sand and gravel except those with loamy sand or sand profiles. The areas are nearly level with few drains. A small amount of hummocks are included. This association occurs on the bottom lands in the valleys of the Platte and South Loup Rivers. It covers 48,450 acres, or about 15 percent of the county.

The soils in this association have naturally well drained and imperfectly drained profiles and profiles in which the natural drainage has been changed or altered. The textures of the surface soils range from moderately fine to moderately coarse. The textures of the subsoils range from fine to moderately coarse.

The Cass soils are well drained. They have loam or sandy loam surface soils and sandy loam subsoils. These soils are at least 20 inches thick over mixed sand and gravel. They make up 15 percent of the association. Wann soils are similar to the Cass soils but developed under somewhat poor or imperfect natural drainage.

They have a higher ground-water level than Cass soils. Wann soils make up 43 percent of the association. Leshara soils are deep, silty soils that developed under somewhat poor drainage and are calcareous at the surface. They occupy 21 percent of the association.

The Volin soils are well-drained, noncalcareous, deep, silty soils. They make up 8 percent of the association. Lamoure soils are deep, calcareous soils that have silt loam surface soils and fine-textured subsoils. They occupy 13 percent of the association. A few areas of Sarpy loamy fine sand are included in this association.

Most of this area is in crops. Many fields are irrigated. Because they benefit from the moderately high ground-water level, the imperfectly drained soils commonly produce more than the soils on terraces and uplands during periods of drought. Corn, sorghum, wheat, and alfalfa are the main crops.

Most farms raise a few cows, hogs, and chickens for home use. Good gravel roads are available to most farmers. On islands of the Platte River, the roads are usually trails and do not follow section lines.

Very Sandy and Shallow Bottom Lands: Platte-Sarpy Association

This association consists of soils formed from recent alluvium and wind-deposited sands. Most areas are abandoned channels in the lowest elevations in the county; the association is crossed by many drains that range from 5 to 30 feet in width and 1 to 6 feet in depth. The soils in this association are on the bottom lands along the Platte River. This association consists of 28,940 acres, or 8 percent of the county.

Platte soils are shallow and very shallow, 6 to 20 inches thick over coarse sand or mixed sand and gravel. Their surface soils range from silty clay loam to sandy loam. The Platte complex includes soils of both the Platte and Wann series. Most of the Wann soils in this complex are moderately thick over gravel. Soils of the Platte-Sarpy complex are also in this association. The Platte soils mapped separately, Platte-Wann complex, and Platte-Sarpy complex make up about 80 percent of this association.

The Sarpy soils are on many discontinuous sand ridges, 3 to 10 feet high. They are excessively drained and occupy about 8 percent of the association.

A few small areas of other soils are also in this association. Barney soils are poorly drained and consist of 10 to 20 inches of loam and sandy loam over a substratum of mixed sand and gravel. They make up 5 percent of the association. Barney soils have a higher water table than any other soil in the Platte Valley. Riverwash, which occupies 6 percent of the association, consists of sand bars and some small sand islands along the Platte River. Loup soils occur in the valley of the South Loup River. They have a high water table throughout the year. Their surface soils and subsoils are silty clay loam to sandy loam. Their substrata are fine sand and medium sand. Loup soils occupy less than 1 percent of this association.

The largest acreage in this association is in permanent pasture. Many areas are mown for native hay and are normally excellent for this purpose. A few of the more level areas are cultivated. Most of the acreage in this association, however, is either too shallow, too sandy, or too wet for successful cultivation. The channeled areas are difficult to cross with farm machinery. Many trees occur, mainly along the river channels. But some fields containing soils of the Platte-Wann complex have been leveled and produce fair to good yields under irrigation. Corn and sorghum are the most commonly grown crops.

Very few farmsteads are in this association. Gravel roads are common but are not available to all areas. Some of the islands are inaccessible by ordinary means of travel, because the channels of the Platte River break up the network of roads. The road system is adequate for the type of agriculture sustained.

Soils of Hall County

In this section, first the general nature of the soils in the county is discussed. Then, the mapping of soils is described and some technical terms are explained. Finally, the soil series in the county and each soil in the series are described.

General Nature of the Soils

Practically all the soils in Hall County have formed under grass vegetation. Their parent materials are loess, a silty wind-blown deposit; alluvium, or a water-transported deposit; mixtures of loess and alluvium; and eolian, or wind-deposited, sands. The soils vary widely in texture, color, consistence, and content of organic matter. Practically all the soils have surface horizons of medium texture or coarser. The only soils with clayey surface horizons are on bottom lands or in local areas where erosion has removed the original surface soils. The texture of the subsoil ranges from clay to mixed sand and gravel. Buried soils are common in some areas.

A large part of the soils on bottom lands and many of the imperfectly drained soils on terraces are calcareous at the surface. In most soils on silty terraces and uplands, free lime is present in the substrata. In the young loessal soils, lime may be present at depths of 10 to 20 inches. The sandy soils on uplands are noncalcareous. The surface layers of most soils on terraces and uplands are slightly acid to medium acid, and the subsoil layers are slightly acid to neutral. Normally, acidity decreases as depth in the profile increases.

Poorly drained and very poorly drained soils make up about 3 percent of the county, imperfectly drained soils 38 percent, well-drained soils 35 percent, somewhat excessively drained soils 17 percent, and excessively drained soils 7 percent.

Texture, slope, depth, and natural drainage of the soils largely determine how the soils are used. Deep, medium-textured, well-drained soils are generally the most productive. If soils are irrigated, however, those having a claypan do almost as well as the deep, well-drained soils. The moderately sandy and moderately deep soils are droughty under dryland management, but their response to irrigation is excellent. Practically all of the poorly drained soils and a large part of the imperfectly drained soils are used for pasture. Under dryland management, the imperfectly drained soils generally yield more than the well-drained soils. This is because the crops on the imperfectly drained soils benefit from the high water table. The excessively drained soils on sandhills are too droughty and unstable for successful cultivation; they are used almost entirely for pasture.

How Soils are Mapped and Described

The scientist who makes a soil map works mostly on foot. He walks over the land and digs or bores many holes so that he can examine the material in the different layers that make up each soil. He measures steepness of slope with a hand level. The scientist observes the lay of the land, the crops and wild plants and how they grow, the underlying material wherever it is exposed, and any other feature about the nature and extent of the soil that he can. On an aerial photograph, which is used as a map, he draws boundary lines between the different soils, or mapping units.

The soil scientist describes soils and designates each soil layer, or horizon, with a letter symbol. The horizon at the surface, designated as the A horizon, is the layer from which soluble material and clay particles have been removed by percolating water as the water moved downward. The A horizon may be subdivided into the A_1 horizon, A_2 horizon, and so on. The depth of the soil horizons are measured from the surface downward. The subsoil of many soils, or the B horizon, is one in which clay and soluble material have accumulated. The B horizon may be divided into horizons B_1, B_2, B_3, and so on. Material immediately under the true soil is called the C horizon, or parent material, if the material appears to be about the same as that from which the soil was formed. If it is different, or nonconforming, it is called the D horizon.

The color of a horizon may be described by descriptive words or by Munsell notations for each color. Munsell color notations consist of a combination of letters and numbers such as 10YR 3/2. In addition to standing for the descriptive name very dark grayish brown, which is the name of the hue, this symbol tells us the value and the chroma of the color. The use of Munsell notations for describing the color of soils is explained more fully in the Soil Survey Manual (*9*).[1]

In descriptions of soils, the term texture refers to the relative proportions of the different sizes of mineral grains—sand, silt, and clay—that make up the soil. Loamy sand is the name for a soil that contains mostly sand and a small proportion of grains finer than sand. A clay contains enough fine material to make it plastic and sticky when wet. Most of the other textures lie between sand and clay.

Structure refers to the arrangement of the soil grains into lumps, granules, or other aggregates. If a horizon has structure, we need to know three things about the aggregates: their strength or grade (*weak*, *moderate*, or *strong*); their size (*very fine*, *fine*, *medium*, *coarse*, or *very coarse*); and their shape (*platy*, *prismatic*, *columnar*, *blocky*, *subangular blocky*, *granular*, or *crumb*). An example of a term for structure consisting of these three parts is *moderate*, *fine*, *granular*. Soils without definite structure are *single grain* if they are sand and are *massive* if they are clay. Consistence refers to the feel of the soil and the ease with which a lump can be crushed.

The type of boundary that separates each horizon from the one below is also given in soil descriptions. Boundaries can be *abrupt*, *clear*, *gradual*, or *diffuse*, and at the same time *smooth*, *wavy*, *irregular*, or *broken*. A *clear*, *wavy* horizon boundary is one that is 1 to 2½ inches wide and has pockets wider than their depth.

Some soil features that occur in areas too small to map, or areas less than 5 acres in size, are shown by special symbols on the soil map. These symbols are defined in the legend on the soil map.

Soils are placed in the categories series, type, and phase on the basis of the characteristics observed in the field by the survey team and determined in a laboratory by tests. The soil type is the basic unit of classification. It may consist of several subdivisions, or phases. Soil types that resemble each other in most of their characteristics are grouped in soil series.

Soil series.—Two or more soil types are placed in the same soil series if they differ in texture of the surface soil but are otherwise similar in kind, thickness, and arrangement of soil layers. In some areas, however, only one soil type of a particular series may occur. Each series is named for a place near where it was first mapped.

Soil type.—Soils similar in kind, thickness, and arrangement of layers in the profile, including the texture of the surface soil, are classified as a soil type.

Soil phase.—Because of differences other than those of kind, thickness, and arrangement of layers, some soil types are divided into two or more phases. Variation in slope, degree of erosion, and depth of the soil over the substratum are examples suggesting dividing a soil type into phases.

As an example of soil classification, consider the Wann series and the soils in this series that occur in Hall County. This series has two soil types in the county that are divided into phases as follows:

Series—
  Wann.
Types—
  Wann fine sandy loam.
  Wann loam.
Phases—
  Wann fine sandy loam, deep.
  Wann loam, deep.
  Wann loam, deep, saline.

Miscellaneous land types.—These land types are not placed in soil series but are identified by a descriptive name. In Hall County, the miscellaneous land types are Alluvial land, Broken land, and Riverwash.

Soil complex.—When two or more soils are so intricately associated that it is not feasible to show them separately on the soil map, they are mapped together and called a soil complex. Platte-Sarpy complex is an example of a soil complex mapped in this county.

Soil variant.—A soil is called a soil variant if it is closely related to the soils in an established series but differs from the soils in that series in at least one characteristic. Actually a soil variant ought to be in a soil series that differs from the one named, but it is of such

[1] Italicized numbers in parentheses refer to Literature Cited, p. 132.

small extent or has not been studied sufficiently to justify the establishment of a new series. A soil, therefore, may be recognized and defined as a variant in one survey area and later be designated as a separate series if found to be of large extent. Hord silt loam, thin solum variant, is an example of a variant mapped in this county.

Descriptions of the Soils

This subsection is provided for those who want detailed information about the soils in the county. It describes the single soils, or mapping units; that is, the areas on the detailed soil map that are bounded by lines and are identified by a symbol. For more general information about the soils, the reader can refer to the section, General Soil Map, in which the broad patterns of soils in the county are described.

In the descriptions that follow, the soils in a series are first discussed as a group by describing important features that apply to all the soils in the series. The location of the soils in the county is given as well as the position of the soils in the landscape. Some of the nearby or similar soils are named and compared with the soils in the series being described. The general description of the series is ended with a broad statement that tells how the soils are used.

Following the description of each series are descriptions of each soil in the series. Generally these descriptions tell how the profile of the soil described differs from the one described as representative of the series. They also tell about the use and suitability of the soil described and something about its management needs.

Block descriptions of profiles, which give details layer by layer, are not given in this subsection. A profile representative of each soil series is described in the section, Genesis, Classification, and Morphology of Soils.

Some of the terms used in the soil descriptions are defined in the preceding subsection, How Soils Are Mapped and Described. Other terms are described in the Glossary at the back of this report. Table 1 lists the acreage and proportionate extent of each soil mapped. The location and extent of the soils in the county are shown on the soil map.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Alluvial land	1, 159	0. 3
Barney loam	1, 450	. 4
Broken land	2, 284	. 7
Butler silt loam	6, 354	1. 8
Cass fine sandy loam, deep	4, 686	1. 4
Cass fine sandy loam	1, 266	. 4
Cass loam, deep	907	. 3
Cass loam	3, 943	1. 1
Colby silt loam, 7 to 11 percent slopes	1, 762	. 5
Colby silt loam, 11 to 30 percent slopes	2, 589	. 8
Elsmere fine sandy loam	103	(1)
Elsmere loamy fine sand	3, 409	1. 0
Exline-Wood River fine sandy loams	1, 910	. 6
Exline-Wood River silt loams	6, 645	1. 9
Fillmore silt loam	2, 282	. 7
Hall silt loam, 0 to 1 percent slopes	16, 953	4. 9
Hall silt loam, 1 to 3 percent slopes	519	. 2
Hall silt loam, 3 to 7 percent slopes, eroded	339	. 1
Hall-O'Neill complex, 0 to 1 percent slopes	820	. 2
Hastings silt loam, 0 to 1 percent slopes	9, 172	2. 7
Hastings silt loam, 1 to 3 percent slopes	4, 425	1. 3
Hastings silt loam, 3 to 7 percent slopes, eroded	1, 471	. 4
Hastings complex, severely eroded	161	(1)
Hobbs silt loam, 0 to 1 percent slopes	3, 324	1. 0
Hobbs silt loam, 1 to 3 percent slopes	516	. 2
Holdrege silt loam, 0 to 1 percent slopes	1, 836	. 5
Holdrege silt loam, 1 to 3 percent slopes	4, 070	1. 2
Holdrege silt loam, 3 to 7 percent slopes	2, 068	. 6
Holdrege silt loam, 3 to 7 percent slopes, eroded	995	. 3
Holdrege silt loam, 7 to 11 percent slopes	483	. 1
Holdrege silt loam, 7 to 11 percent slopes, eroded	1, 133	. 3
Holdrege-Colby complex, severely eroded	3, 246	. 9
Hord silt loam, 0 to 1 percent slopes	24, 259	7. 0
Hord silt loam, 1 to 3 percent slopes	537	. 2
Hord silt loam, 3 to 7 percent slopes, eroded	2, 113	. 6
Hord silt loam, thin solum variant, 0 to 3 percent slopes	6, 290	1. 8
Hord silt loam, thin solum variant, 3 to 7 percent slopes	238	. 1
Hord-O'Neill complex, 0 to 1 percent slopes	1, 205	0. 3
Kenesaw silt loam, 0 to 1 percent slopes	3, 509	1. 0
Kenesaw silt loam, 1 to 3 percent slopes	10, 159	2. 9
Kenesaw silt loam, 3 to 7 percent slopes	3, 892	1. 1
Lamoure silt loam	1, 808	. 5
Lamoure silt loam, saline	739	. 2
Leshara fine sandy loam	656	. 2
Leshara silt loam	9, 832	2. 8
Leshara silt loam, saline	467	. 1
Loup loam	162	(1)
Meadin loamy sand, 3 to 11 percent slopes	329	. 1
Meadin sandy loam, 0 to 1 percent slopes	1, 178	. 3
O'Neill loam, 0 to 1 percent slopes	10, 210	3. 0
O'Neill loam, 3 to 5 percent slopes, eroded	675	. 2
O'Neill sandy loam, 0 to 1 percent slopes	901	. 3
O'Neill sandy loam, 3 to 7 percent slopes, eroded	200	. 1
Ortello fine sandy loam, 0 to 3 percent slopes	2, 394	. 7
Ortello fine sandy loam, 3 to 7 percent slopes	1, 205	. 3
Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes	10, 453	3. 0
Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes	2, 031	. 6
Ortello loam, 0 to 1 percent slopes	4, 055	1. 2
Ovina fine sandy loam	3, 663	1. 1
Ovina loamy fine sand	2, 420	. 7
Platte loam	12, 361	3. 6
Platte-Sarpy complex	697	. 2
Platte-Sarpy complex, channeled	2, 728	. 8
Platte-Wann complex	7, 167	2. 1
Platte-Wann complex, channeled	545	. 2
Riverwash	1, 872	. 5
Sarpy fine sand	979	. 3
Sarpy loamy fine sand, 0 to 3 percent slopes	941	. 3
Sarpy loamy fine sand, 3 to 7 percent slopes	300	. 1
Scott silt loam	624	. 2
Silver Creek silt loam	823	. 2
Thurman fine sandy loam, 0 to 3 percent slopes	2, 644	. 8
Thurman fine sandy loam, 3 to 7 percent slopes	1, 184	. 3
Thurman loamy fine sand, 0 to 3 percent slopes	3, 026	. 9

[1] Less than 0.1 percent.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Thurman loamy fine sand, 3 to 7 percent slopes	5, 056	1. 5	Wann loam, deep, saline	357	0. 1
Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes	3, 031	. 9	Wann loam	5, 297	1. 5
Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes	1, 341	. 4	Wood River silt loam, 0 to 1 percent slopes	37, 251	10. 8
Thurman loamy fine sand, wind eroded	918	. 3	Wood River silt loam, 1 to 3 percent slopes	1, 037	. 3
Valentine fine sand	21, 488	6. 2	Wood River silt loam, 3 to 7 percent slopes, eroded	2, 437	. 7
Volin silt loam	6, 625	1. 9	Wood River-Exline fine sandy loams	1, 870	. 5
Wann fine sandy loam, deep	3, 548	1. 0	Wood River-Exline silt loams	3, 975	1. 2
Wann fine sandy loam	824	. 2	Streams and stream channels	9, 080	2. 6
Wann loam, deep	7, 714	2. 2	Total	345, 600	100. 0

Alluvial land

Alluvial land (Sy).—Mapped together in this land type are soils that occur in the lowest bottom-land areas adjacent to the Wood River and Dry Creek. Deposits of fresh alluvium are added by floods each time waters rise above their channels.

Where these soils occur along Dry Creek, they consist mainly of a dark loamy surface horizon over a slightly colored loam or sandy loam subsoil. A sand substratum is at depths of 24 to 42 inches. The upper horizon is stratified in many places.

Along the Wood River these soils occupy 100- to 500-foot wide strips. The fresh alluvium is dominantly loamy, but it is stratified with clayey and sandy materials.

Alluvial land has a gradual slope downstream. The areas are too small for profitable cultivation. Along the Wood River, they are covered with a dense growth of trees and brush. The soils mapped as Alluvial land are not tillable. Along Dry Creek they support a fair growth of grasses. Practically all these areas are used for pasture. A few small patches along Dry Creek are cultivated and produce fair crops of corn and sorghum when they are not flooded.

The soils of this land type are in dryland capability unit VIw–1, the Overflow range site, and the Moderately wet woodland site. They are not suitable for irrigation.

Barney series

The Barney series is made up of poorly drained bottom-land soils in the valley of the Platte River. They consist of 10 to 20 inches of medium and moderately coarse textured recent alluvium that overlies a substratum of mixed sand and gravel. The ground-water level is above the surface during the wettest seasons of the year, and at depths of 3 to 4 feet during the driest. These soils receive runoff from higher areas. In some places, small drains cross these areas and carry surface water to larger drains and streams.

These soils have a gray to dark-gray loam or silt loam surface horizon, 5 to 10 inches thick. This horizon is of a moderate crumb structure and is friable when moist. The surface horizon grades to a lighter colored (grayish brown) stratified loam, silt loam, very fine sandy loam, or sandy loam. In this lower horizon, medium to coarse, yellowish stains are common. The structure is nearly massive but breaks to coarse irregular fragments. This horizon is friable when moist and slightly hard when dry. In some places it contains much lime, but in most places sampled it was noncalcareous. A coarse sand or mixed sand-gravel substratum is at depths of 10 to 20 inches. This material is strongly marked with brownish and reddish blotches in the upper 2 feet, but these blotches are less common with depth.

Barney soils have a higher ground-water level than the Elsmere, Wann, or Platte soils. They resemble the Loup soils in drainage. The Barney soils have a sand-gravel substratum; the Loup soils, in contrast, have a substratum that is sand and fine sand.

The Barney soils are in permanent pasture or native hay meadow. When pastured, these areas become boggy. Small mounds 4 to 18 inches in height and 4 to 12 inches in diameter form. Some areas have three or four of these mounds per square yard, and they lower the value of the land. If the soils remain in native meadow, the bog condition does not develop and the grasses produce good yields of hay.

The most common vegetation in pastured areas is prairie cordgrass, reedgrass, sedges, and cattails. A few small, slightly high areas produce bluestem, switchgrass, and Indiangrass. These soils are too wet for cultivation. One soil of this series was mapped in the county.

Barney loam (0 to 1 percent slopes) (Ba).—This soil is not suitable for irrigation and is too wet for cultivation. It is in dryland capability unit Vw–1, the Wetland range site, and the Wet woodland site.

Broken land

Broken land (Bl).—In this land type are soils on short side slopes along shallow, intermittent drains. They are on stream terraces along the Platte River and also on short, steep slope breaks along the Wood River and along Prairie, Silver, Dry, and Moores Creeks and some of their tributaries. The areas are long and narrow. These soils have moderate permeability and moderate water-holding capacity. Surface runoff is rapid.

The texture varies. The profiles are mostly silty but in places contain horizons of clayey or sandy materials. Coarse sand or mixed sand and gravel is at depths of 4 to 8 feet at the lower levels on the terraces. Higher on the terraces, this coarse material occurs at depths of 20 to 40 feet. In many places soil development is entirely lacking; raw alluvium or loess crops out on the slopes. North of Grand Island, small areas having a sandy loam surface soil or subsoil are included with this unit.

Generally, the soils of this mapping unit are cultivated where the slopes are not more than 16 percent. Crop yields are low, however, and erosion is difficult to control. Most areas with slopes of more than 16 percent are in permanent vegetation—grass, trees, brush, or annual weeds. Many tree roots are exposed by the cutting action of fast-moving waters when the streams are near flood stage.

As a unit, these soils are too steep for cultivation. They are in dryland capability unit VIe–1, the Silty range site, and the Silty to clayey woodland site. Irrigation is not suitable for these soils.

Butler series

The Butler series consists of claypan soils of the upland that developed in Peorian loess. They occur south and east of Doniphan, in the southeastern part of Hall County. The soils are in low, flat areas that lie between the poorly drained depressions and the well drained, very gently sloping ridges.

Butler soils have a medium to slightly acid, dark grayish-brown silt loam surface horizon that ranges from 10 to 18 inches in thickness. It is of weak granular structure and is friable when moist. The subsurface horizon is noticeably grayer in the lower part than in the upper part when the soils are dry. The subsurface layer grades abruptly to a neutral to moderately alkaline, gray to dark-gray silty clay subsoil having columnar-prismatic structure. The subsoil is called a "hardpan" or "gumbo layer" by farmers because it is sticky when wet and very hard when dry. It ranges from 18 to 30 inches in thickness. The lower part of the subsoil is olive-gray silty clay loam of subangular blocky structure. It grades to mildly alkaline and calcareous yellowish parent material, which is loess of silt loam texture.

The Butler soils occur with the Scott, Fillmore, Hastings, and Holdrege soils. They resemble the Fillmore soils but occupy level areas. Butler soils occur on higher elevations than the Scott soils and have a thicker surface horizon. They are at lower elevations than the Hastings and Holdrege soils and have a more clayey subsoil.

Most areas of the Butler soils are under cultivation. They respond well to irrigation. Where these soils are still in native pasture, the grasses are now chiefly big and little bluestem, buffalograss, and grama. One soil of this series was mapped in this county.

Butler silt loam (0 to 1 percent slopes) (Bu).—Most of this soil is on slopes of less than 1 percent. A few acres on slopes of 2 percent are included.

Dryland crops, particularly corn, may not yield well because the very slow permeability in the heavy subsoil makes the soil droughty. Winter wheat and alfalfa do better than corn. All irrigated crops, especially corn, respond well to additional water.

For the areas on slopes of 2 percent, terraces, contour farming, and bench leveling are desirable ways of reducing soil and water losses. The drought hazard is more serious than on the more nearly level areas.

This soil is in dryland capability unit IIs–2, irrigated capability unit IIs–2, the Silty range site, and the Silty to clayey woodland site.

Cass series

The Cass series consists of somewhat excessively drained, deep and moderately deep bottom-land soils that have a sandy subsoil. They are forming in recent sandy alluvium. Mainly they are nearly level, though in a few areas they are gently sloping. Internal drainage is moderately rapid. The ground water is at depths of 5 to 15 feet.

The surface soil is slightly acid to mildly alkaline, gray to dark grayish-brown loam to fine sandy loam, about 6 to 10 inches thick. It is of weak granular structure and is friable when moist. The subsoil is a neutral to moderately alkaline, very friable, grayish-brown sandy loam. In places it is stratified with silty material. It overlies a substratum of sand and gravel. Rust-brown streaks and spots are not common, but occasionally a few may be seen in the lower part. Generally, there is no free lime in the profile.

Cass soils occur with soils of the Wann, Lamoure, Leshara, and Volin series. In texture their subsoil is similar to that of the Wann soils, but Cass soils do not have the mottling in the subsoil or the high groundwater level of the Wann soils. In the subsoil, Cass soils are sandier than the Volin. They have a lower groundwater level than the Leshara and Lamoure soils, are sandier in the subsoil, and are at higher elevations. Cass soils have a thicker and darker surface layer than the Sarpy soils and are not so sandy throughout their profile.

There is little danger of flooding on Cass soils because large upstream dams have been built on the Platte River. Most of the Cass soils are cultivated; they respond well to irrigation. Corn and milo (grain sorghum) are the most commonly grown crops. Wheat and alfalfa are also grown on some of the acreage.

These soils are easily worked. They are medium in natural fertility. During dry years the soils are somewhat droughty because of their sandy lower horizons. Wind erosion is a hazard. Where these soils remain in native pasture, they are now producing blugrass, bluestem, sand dropseed, buffalograss, and blue grama.

Cass loam, deep (0 to 1 percent slopes) (3Cm).—This soil has a profile like that described for the Cass series. Mixed sand and gravel is at depths of 3 to 6 feet in most areas. The loam surface horizon ranges from 6 to 18 inches in thickness. Small areas of fine sandy loam may be found within larger areas of this soil. A few areas with slopes of 2 percent are included.

Most of this soil is cultivated and much is irrigated. It produces excellent yields of the crops commonly grown. It is in dryland capability unit I–1, irrigated capability unit I–1, the Silty range site, and the Silty to clayey woodland site.

Cass loam (0 to 1 percent slopes) (Cm).—This soil has a dark, medium-textured surface horizon over a lighter colored sandy loam subsoil. At 20 to 36 inches, sandy loam grades abruptly to coarse sand or mixed sand and gravel. In places the subsoil is fine sandy loam or silt loam.

This soil has a friable surface soil that is easy to work. It has a low water-storing capacity because it is only moderately deep to the coarse substratum. Crops on this soil are among the first to burn during dry seasons. During wet years, or under irrigation, crops produce fair to good yields. This soil is in dryland capability unit IIs–5, irrigated capability unit IIs–5, the Silty range site, and the Silty to clayey woodland site.

Cass fine sandy loam (0 to 1 percent slopes) (Cs).—This soil has 20 to 36 inches of fine sandy loam over coarse sand or mixed sand and gravel. The surface soil and subsoil are as described for the series. Because of sandy texture and medium depth, the water-holding capacity is low. Permeability is moderately rapid.

This soil is too droughty for dryland farming. During wet years, or under irrigation, it produces good crops of corn, small grains, and legumes. A high level of management is needed for successful irrigation. Wind erosion is a hazard if the soil is not protected by vegetation. This soil is in dryland capability unit IIe–3, irrigated capability unit IIe–3, the Sandy range site, and the Sandy woodland site.

Cass fine sandy loam, deep (0 to 3 percent slopes) (3Cs).—The profile of this soil is like that described for the series. The surface horizon is very friable when moist. The profile is coarser with increasing depth, and is coarse sand or mixed sand and gravel at depths of 3 to 6 feet. This soil has a moderately low water-holding capacity and is somewhat droughty during dry years.

About half of this soil is on gently sloping areas, usually long low-lying ridges. A few uneven, low hummocky areas are included. Wind erosion is a hazard. It can be controlled by stubble mulching or keeping the land covered with growing crops.

Most of the acreage is cultivated. Crops respond to irrigation. This soil is in dryland capability unit IIe–3, irrigated capability unit IIe–3, the Sandy range site, and the Sandy woodland site.

Colby series

The Colby series consists of thin, light-colored, friable, silty soils that developed in thick deposits of loess. They are on steep slopes of the uplands. Because they are on slopes of more than 7 percent, runoff is rapid. Their permeability is moderate.

In uneroded areas of Colby soils, the surface horizon is grayish-brown silt loam, 6 to 10 inches thick. It is friable when moist and has a weak, fine, granular structure. Lime carbonate is usually leached from this horizon but is present in all the lower horizons. The subsoil is slightly lighter colored than the surface soil, and contains more clay, but is still a silt loam. It is normally calcareous, is 5 to 10 inches thick, and grades rapidly to the massive, floury, calcareous silt loam parent material. Small concretions of lime are evident in the parent material.

Colby soils have a thinner surface soil and subsoil than the Holdrege and Hastings soils, and they lack the blocky structure of these soils.

Wheat, corn, and grain sorghum are grown on some of the smoother slopes. The rough areas are mostly in pasture. Many cultivated areas have been reseeded to bromegrass pasture. Erosion is difficult to prevent when these soils are cultivated. Most of the native pastures on these soils have been grazed so close that most of the tall grasses have been grazed out. Blue grama, buffalograss, and invading forbs are abundant.

Colby silt loam, 7 to 11 percent slopes (CbC).—Most of this soil is on short side slopes along intermittent drains. Because of erosion, nearly all the original dark-colored surface horizon has been lost. The light-colored parent material is exposed in some areas. Many areas are crossed by numerous small gullies, which are plowed in with each cultivation.

Most of this soil is cultivated, but some areas have been reseeded to grass. Yields of sorghum, corn, and alfalfa are fair. The soil is low in nitrogen and organic matter. It is in dryland capability unit IVe–1, irrigated capability unit IVe–1, the Silty range site, and the Silty to clayey woodland site.

Colby silt loam, 11 to 30 percent slopes (CbD).—This soil is on narrow side slopes along drainageways and on steep hills, bluffs, and canyon areas composed of loessal parent material. Some slopes of less than 15 percent have been cultivated. The surface horizon has been removed by erosion, and the undeveloped loess is exposed. Some cultivated areas have been reseeded to grass because steep slopes made farming difficult.

The steeper slopes are in native grass for pasture. Here, erosion has varied. As a result, the soil profile is not uniform and the surface horizon is very thin and only slightly darkened. In other places the surface horizon is 6 to 8 inches thick and grayish brown. The subsoil is seldom developed. Irregular "cat-step" slopes are common (fig. 4).

The native vegetation consists of thin to thick stands of buffalograss, blue grama, and small amounts of little and big bluestem. Some small shrubs, yucca, and annual weeds are normally present. This soil is in dryland capability unit VIe–1, the Silty range site, and the Silty to clayey woodland site. Irrigation is not suitable.

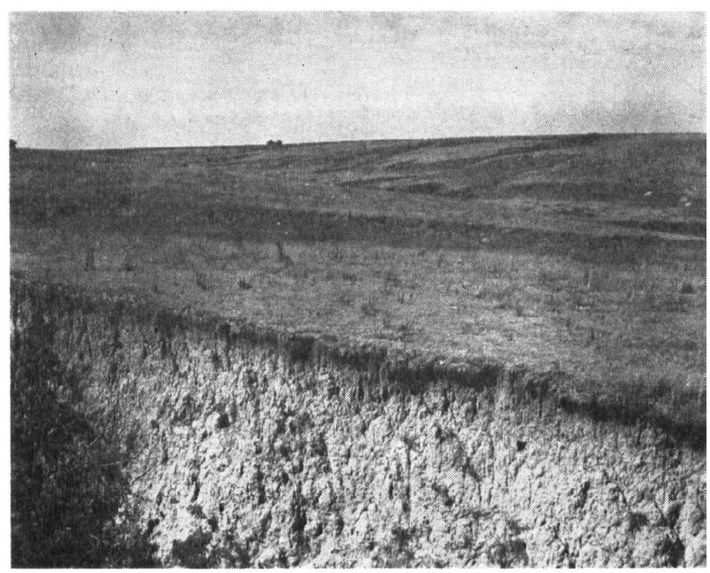

Figure 4.—Colby silt loam, 11 to 30 percent slopes, occupies the steeper slopes of this native pasture southwest of Cairo. Kenesaw silt loam is on the higher, gently rolling hillsides and forms the exposed ditchbank in the foreground.

Elsmere series

The Elsmere series consists of nearly level, imperfectly drained soils of the bottom lands and stream terraces. They are in the valley along the South Loup River, in the extreme northwestern part of Hall County, and south of the sandhills north of Grand Island. Their dark-colored sandy surface soil overlies lighter colored, incoherent, fine- and medium-sized sand. The ground-water level fluctuates between depths of 4 and 8 feet. There is little surface runoff. Permeability is rapid, and the water-holding capacity is low. These soils are not flooded to any great extent.

Elsmere soils have a gray to very dark gray fine sandy loam or loamy fine sand surface horizon, 8 to 14 inches thick. It is of crumb structure and is very friable when moist. The surface horizon grades to a transitional layer of light brownish-gray loamy fine sand. The substratum of fine and medium sand begins at depths of 20 to 30 inches. Yellowish and brownish blotches are common and distinct in the upper part of the substratum but are fewer with increase in depth. The entire profile is normally noncalcareous, but in scattered areas it contains some lime.

Elsmere soils differ from the Loup soils in having a lower ground-water level and fewer mottlings. They have a sandier and less stratified subsoil than the Wann soils. From the Cass soils the Elsmere soils differ in having a higher ground-water level and a sandier, more mottled subsoil.

Most of the Elsmere soils are in permanent pasture or hay meadow. A few areas are cultivated, though wind erosion is a severe hazard. Yields of corn and grain sorghum are fair. Where these soils are in native vegetation, the principal grasses are big and little bluestem, switchgrass, and Indiangrass. This vegetation has high carrying capacity and produces good yields when mowed for hay.

Elsmere fine sandy loam (0 to 1 percent slopes) (Es).—This soil has a profile like the one described for the Elsmere series. It is in dryland capability unit IIIw–5, irrigated capability unit IIw–6, the Subirrigated range site, and the Sandy woodland site.

Elsmere loamy fine sand (0 to 3 percent slopes) (Ea).—This soil has surface and subsoil horizons similar to those described for this series. In most places, a silty to clayey horizon is between 3 and 6 feet from the surface. Seepage water is held at a high level in the lower heavy horizons; natural drainage is imperfect.

During years of normal or above-normal rainfall, this soil produces lower crop yields than better drained soils. During years of drought, however, it outyields the better drained soils. This soil is in dryland capability unit IIIw–5, irrigated capability unit IIw–6, the Subirrigated range site, and the Moderately wet woodland site.

Exline series

The Exline series consists of soils on stream terraces along the valley of the Platte River in the northeastern and north-central parts of Hall County. The soils are in nearly level positions within broad, shallow basins. They are on the higher silt-covered terraces, and on the lower terraces where the parent material is old alluvium or a mixture of alluvium and loess. On the lower terraces, where the water table fluctuates much of the year, buried soils are present in many of the soil profiles. On the higher terraces, the water table is far from the surface. Exline soils on the higher terraces probably were formed when the water level was higher.

Exline soils are affected by soluble salts and alkali. Laboratory analyses indicate that high alkalinity is a more uniform characteristic of Exline soils than high content of soluble salts. The accumulation of soluble salts and alkalinity is greatest at depths of 10 to 36 inches. Soluble salts have been leached to greater depths in the Exline soils with a sandy surface layer than in those with a silty surface layer.

The thickness of the surface horizon, density and thickness of the subsoil, and salinity all vary in many areas of Exline soils. In the typical profile, the surface horizon is 1 to 10 inches of gray silt loam or fine sandy loam (fig. 5). This horizon is friable and is of crumb structure. The 1- to 5-inch subsurface layer is light-gray, platy silt loam. The upper subsoil is grayish-brown silty clay loam or silty clay. In some places it is strongly alkaline, saline, or both. It is sticky when wet and very hard when dry. The upper subsoil is of well-developed columnar structure. It grades to medium and coarse, strong blocky structure with increase in depth.

The Exline soils are associated with the Silver Creek and Wood River soils, but have a thinner surface horizon, as well as a more strongly developed subsoil containing larger amounts of soluble salts and alkali. Soils of the Exline series lack the high lime content of Silver Creek soils. They developed in areas having a higher water table than Wood River soils.

Exline soils that are in native pasture have numerous microdepressions (buffalo wallows) where the surface horizon is thin. Saltgrass and western wheatgrass are the dominant vegetation. Some buffalograss, blue grama, and bluegrass grow between the microdepressions, or wallows.

Exline soils have slow internal drainage. Water stands in the buffalo wallows for weeks after rains. Surface runoff is slow.

Exline soils are mapped in soil complexes with Wood River soils.

Exline-Wood River fine sandy loams (0 to 1 percent slopes) (E–Ws).—This mapping unit consists of areas of Exline and Wood River fine sandy loams too small to map separately. From 20 to 50 percent of the mapping unit is Exline, and the rest is mainly Wood River. Included, however, are some areas that have profiles resembling those of Ovina fine sandy loam.

The Exline soil is in small, slightly depressed areas surrounded by Wood River soil. Because the Exline areas are affected by salts and alkali, they are difficult to manage and limit the use of the Wood River soil.

About 75 percent of this unit is in permanent pasture. Careful management is necessary if it is cultivated. The areas of Exline soils contain buffalo wallows, or slick spots, that are irregularly shaped and 10 to 30 feet in diameter. These light-colored spots are difficult to till unless surface drainage is used. Cultivated areas are cloddy when dry. After a rain, they dry slowly and are soft and plastic underneath, though baked at the surface. Tractors get stuck in these slick spots.

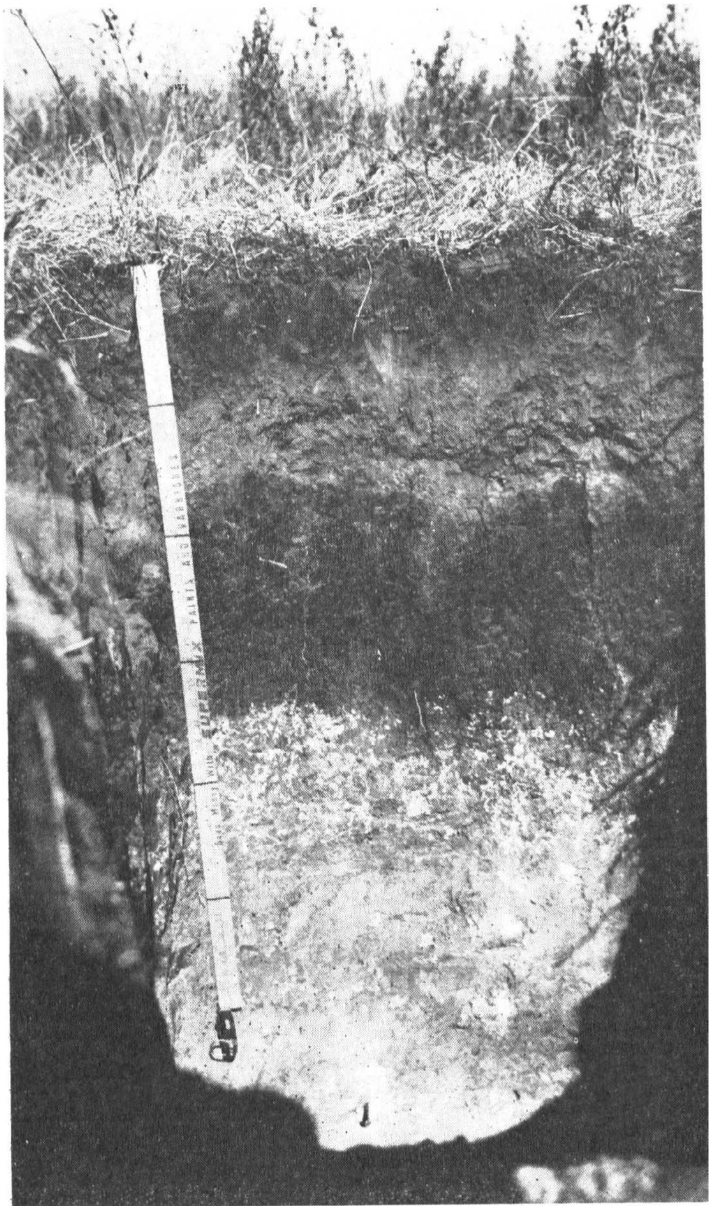

Figure 5.—Exline soils have a thin surface horizon, columnar and blocky subsoil, and saline-alkali characteristics. A leached, gray A_2 horizon is just above the dark-colored subsoil. Underlying the claypan is a horizon of mixed salts and lime.

Crops are spotty on the Exline soil. Yields on the mapping unit are lowered in proportion to the number and size of the slick spots. Alfalfa, sorghum, and sugar beets are best suited. Potatoes are not suited. Under a high level of management, yields of corn are fair if the soils are irrigated. For best yields, use nitrogen fertilizer. Tilth can be improved by adding organic matter, particularly barnyard manure. Sulfur and gypsum lower the alkalinity, and generous amounts of water help leach the salts to lower levels.

This mapping unit is in dryland capability unit VIs–1, irrigated capability unit IVs–1, and the Saline lowland range site. It is not suited to trees.

Exline-Wood River silt loams (0 to 1 percent slopes) (E-W).—This mapping unit is made up of 20 to 50 percent Exline silt loam and 50 to 80 percent Wood River silt loam. The areas of Exline soil contain slick spots that affect the use of the surrounding Wood River soil. Most of the complex is on slopes of less than 1 percent, but about 100 acres is on steeper slopes along drains.

About 75 percent of this mapping unit is used for native pasture. The acreage on steeper slopes is also in pasture. Crops are spotty and of poor quality if grown under dryland farming. Under irrigation, yields are fair if management is good. Yields are lower on the slick spots than on the surrounding areas, but irrigation will increase yields enough to be profitable. Cultivation is difficult during wet spring months unless surface drainage is adequate.

This mapping unit is in dryland capability unit VIs–1, irrigated capability unit IVs–1, and the Saline lowland range site. It is not suited to trees.

Fillmore series

The Fillmore series consists of soils developed in shallow basins or depressions on the terraces and uplands. On the higher silt-covered terraces and on the loessal uplands, these soils have a gray to very dark gray silty surface horizon, 10 to 16 inches thick. The light-gray subsurface horizon normally present changes abruptly to a prismatic-blocky silty clay or clay subsoil. The subsoil grades to the yellowish silty parent material at depths of 36 to 60 inches. On the lower terraces, especially in the area north of Grand Island, the subsoil is less strongly developed and more variable in texture and structure. It may be a clay loam that grades to sandy material in the lower part. In some places there is a mottled, olive-gray, silty clay lower subsoil.

Fillmore soils are slightly acid to medium acid in their surface horizon. The subsoil is slightly acid to neutral. The substratum is neutral to moderately alkaline and contains free lime in most places. The Fillmore soils are poorly drained. They receive runoff from higher areas. The water disappears slowly by seepage or evaporation, or it is carried away by drainage ditches.

The Fillmore soils resemble the Scott soils but have a thicker surface horizon. They lack the saline horizon of the Wood River soils, and in addition receive run-in water. Soils of the Fillmore series have a heavier subsoil and are at lower elevations than the Hastings, Holdrege, Hall, and Hord soils. The soils of the Fillmore series have a thicker surface horizon and lack the saline-alkali characteristics of Exline soils.

One soil of Fillmore series was mapped in this county.

Fillmore silt loam (Fm).—This soil has a profile like that described for the Fillmore series. Many areas are artificially drained and produce good crops of corn, wheat, and grain sorghum. Potatoes and alfalfa are not suitable. Some areas are irrigated. When they are properly managed, yields compare with those on Wood River soils. Nitrogen fertilizer will increase the yields of crops other than legumes.

This soil is in dryland capability unit IIIw–2, irrigated capability unit IIIw–2, the Overflow range site, and the Moderately wet woodland site.

Hall series

The Hall series consists of deep soils on stream terraces in the western and central parts of the county. These soils developed in wind-deposited silt on the high terraces, and in a mixture of alluvium and loess on the lower terraces. Most of the Hall soils are nearly level, but some are on side slopes along drains and on low ridges where erosion is moderate to severe. These soils have a thick, dark, silt loam surface horizon that overlies a lighter colored silty clay loam subsoil. They are well drained and have moderately slow permeability.

In level areas, the weak, granular surface horizon of these soils is dark grayish-brown to very dark grayish-brown silt loam, 10 to 18 inches thick. The subsoil is medium, subangular blocky, grayish-brown silty clay loam, 10 to 24 inches thick. It is firm when moist and moderately compact.

South of Cairo, the subsoil of Hall soils is slightly heavier than typical for the series. On the higher terraces, these soils have a yellowish silt loam substratum. This horizon varies on the lower terraces. In places there is a buried dark-colored soil or light-colored stratified layers of silt and very fine sandy loam.

The surface horizon of the Hall soils is slightly acid to medium acid, the upper subsoil is slightly acid, and the lower subsoil and substratum are neutral in reaction. Free lime carbonate is between depths of 3 and 5 feet.

Hall soils are associated with the Hord and Wood River soils. They differ from the Hord soils mainly in having a finer textured, more compact subsoil. Hall soils lack the coarse, blocky claypan subsoil of the Wood River soils. Their permeability is more rapid.

The soils of the Hall series are excellent for either dryland or irrigated agriculture. Most of these soils are cultivated. Where they are still in native pasture, buffalograss, blue grama, and some big and little bluestem occur.

Hall silt loam, 0 to 1 percent slopes (Ha).—This soil has a profile like that described for the Hall series. It is nearly level. Excellent yields of corn, wheat, sorghum, soybeans, and alfalfa are obtained. Sugar beets and potatoes do well. This soil is well suited to irrigation and is one of the best agricultural soils of the county. It is in dryland capability unit IIc–1, irrigated capability unit I–1, the Silty range site, and the Silty to clayey woodland site.

Hall silt loam, 1 to 3 percent slopes (HaA).—Most of this soil occurs on very gently sloping, low ridges. A few areas are on gentle side slopes along shallow, intermittent drains. The surface horizon is slightly thinner than in Hall silt loam, 0 to 1 percent slopes, and surface runoff is slightly more rapid. This soil is in dryland capability unit IIe–1, irrigated capability unit IIe–1, the Silty range site, and the Silty to clayey woodland site.

Hall silt loam, 3 to 7 percent slopes, eroded (HaB2).—Most areas of this soil are on short side slopes along shallow, intermittent drains. A few areas are on low, gently sloping ridges or on the break from a higher terrace level to a lower one. Such an area runs in a southwest-northeast direction about 3 miles south of Cairo.

This soil has lost much of its original dark surface horizon because of erosion. The present surface layer is 6 to 12 inches thick, and in places it is grayish brown because the original surface layer has been mixed with subsoil during tillage.

Terracing and contour farming are desirable ways of controlling loss of soil and water. This soil is in dryland capability unit IIIe–1, irrigated capability unit IIIe–1, the Silty range site, and the Silty to clayey woodland site.

Hall-O'Neill complex, 0 to 1 percent slopes (H–O).—This complex occurs on a terrace along the Platte River, mainly in the lower elevations and sags between hummocky areas of Ortello and Thurman soils. The largest area is west and southwest of Grand Island.

This complex consists of 40 to 60 percent Hall silt loam, 30 to 50 percent O'Neill loam, and 5 to 15 percent Meadin sandy loam. The soils have slow surface runoff, moderately slow permeability, and a medium to low water-holding capacity.

Many areas of this complex cannot be farmed separately because they form an intricate pattern with other soils. A few areas as large as 30 acres can be farmed as a unit.

Most of this complex is cultivated, but some is in permanent pasture. Corn and sorghum are the tilled crops most commonly grown. During dry weather, some of the shallowest areas are droughty. When they are leveled for irrigation, the profiles are thickened, since soil from adjacent higher areas is used as fill. Crop response to irrigation is good. Use nitrogen and lime for highest yields.

Areas of this complex in permanent pasture produce fair to good stands of buffalograss and blue grama. Sand dropseed and prairie triple-awn also occur.

This complex is in dryland capability unit IIc–1, irrigated capability unit I–1, the Silty range site, and the Silty to clayey woodland site.

Hastings series

The Hastings series consists of upland soils that have a dark, silty surface soil and a lighter colored silty clay loam subsoil. They are in the southeastern part of the county and are among the more extensive soils. Some areas of Hastings soils are on side slopes along drains and on gently sloping hillsides, but the largest acreages are nearly level. Erosion is moderate to severe on the more sloping areas.

In uneroded areas, Hastings soils have a dark grayish-brown to very dark grayish-brown, friable silt loam surface horizon, 10 to 18 inches thick. Northeast of Doniphan, however, the surface horizon is only 5 to 10 inches thick. The subsoil is moderately slowly permeable grayish-brown silty clay loam of medium and fine, subangular blocky structure. This horizon is sticky when wet, firm when moist, and hard when dry. Friable, grayish-yellow loess (silt loam) is at depths of 28 to 48 inches.

Hastings soils have a slightly acid to medium acid surface soil, a slightly acid to neutral subsoil, and a slightly alkaline (calcareous) substratum.

The Hastings soils occur with the Holdrege, Butler, Fillmore, and Scott soils. They are similar to the Holdrege soils but have a heavier (finer textured), more blocky subsoil, and, therefore, are somewhat less permeable. Hastings soils are at higher elevations than the Butler soils and do not have a claypan. Consequently, they have better external and internal drainage than the Butler soils and are more readily penetrated by roots.

The Scott and Fillmore soils occupy the depressions of this general area and have a darker, finer textured subsoil than soils of the Hastings series.

Hastings soils are among the best agricultural soils of the county. They retain a good supply of moisture for plant use during dry weather. Their tilth is easily maintained, and they have moderate to high natural fertility. Where these soils are in native pasture, the principal grasses are buffalograss and blue grama with some bluestem.

Hastings silt loam, 0 to 1 percent slopes (Hs).—This soil has a profile like that described for the Hastings series. It produces excellent crops of corn, wheat, sorghum, and alfalfa. Soybeans, sugar beets, and potatoes are also suited but are not grown extensively. Nitrogen fertilizer improves yields of crops other than legumes. This soil is in dryland capability unit IIc–1, irrigated capability unit I–1, the Silty range site, and the Silty to clayey woodland site.

Hastings silt loam, 1 to 3 percent slopes (HsA).—This soil has a profile like the one described for the Hastings series, but it is on stronger slopes. The surface horizon in cultivated fields is slightly thinner than in areas of native pasture. This soil is in dryland capability unit IIe–1, irrigated capability unit IIe–1, the Silty range site, and the Silty to clayey woodland site.

Hastings silt loam, 3 to 7 percent slopes, eroded (HsB2).—This soil occurs mainly on short slopes bordering some of the shallow intermittent drains, but partly on gently sloping ridges. Much of the original dark surface horizon has been removed by erosion. It is now 4 to 12 inches thick in most places, but in a few areas all of the dark-colored surface layer is gone and the brownish subsoil is exposed. The eroded areas are moderately low in organic matter and in fertility. Fertility and tilth can be improved by adding barnyard manure and crop residues. This soil is in dryland capability unit IIIe–1, irrigated capability unit IIIe–1, the Silty range site, and the Silty to clayey woodland site.

Hastings complex, severely eroded (3 to 6 percent slopes) (Hs3).—The soils of this complex are on short slopes bordering intermittent drains. They have lost nearly all of the surface horizon through erosion. In some places much of the subsoil has also been removed. Areas that have lost the original surface layer are light colored because the subsoil and substratum are exposed.

These soils are low in organic matter and in fertility. Crop residues and barnyard manure can be applied to increase their fertility and improve tilth. Terracing, contour farming, and bench leveling will reduce loss of soil and water.

Under dryland farming, crop yields are lower than on similar slopes where the surface horizon is thicker. This complex is in dryland capability unit IVe–1, irrigated capability unit IIIe–1, the Silty range site, and the Silty to clayey woodland site.

Hobbs series

Soils of the Hobbs series are dark-colored, silty soils that formed on colluvial slopes and alluvial fans. They occur southwest of Cairo along the base of the loessal hills, and, west of Cairo, there are a few areas in a small valley formed by the tributaries of Dry Creek. These soils are also in the bottoms of some of the wider draws of the loessal uplands.

These soils formed in light- and dark-colored silty material that was washed from the adjacent hills. The surface horizon is slightly acid to neutral, noncalcareous, stratified silt loam. The lower horizon is dark-colored silt loam to a depth of 3 to 5 or more feet. It has weak, coarse, blocky or subangular blocky structure, is friable, and is noncalcareous. Some stratification is evident in all of the profile.

Hobbs soils are darker colored and more stratified than soils of the Hord series.

Soils of the Hobbs series are subject to flooding during and following heavy rains, but there is little or no ponding of water. Most of the acreage is cultivated, and some is irrigated. Crops of corn and small grains may be damaged by the force of the floodwaters.

Hobbs silt loam, 0 to 1 percent slopes (Hb).—The profile of this soil is like the one described for the Hobbs series. This soil is in dryland capability unit IIw–3, irrigated capability unit IIe–1, the Overflow range site, and the Moderately wet woodland site.

Hobbs silt loam, 1 to 3 percent slopes (HbA).—This soil occurs on some of the more nearly level alluvial fan terraces. A few acres on steeper slopes are included. This soil is in dryland capability unit IIe–1, irrigated capability unit IIe–1, the Silty range site, and the Silty to clayey woodland site.

Holdrege series

The Holdrege series consists of dark soils of the uplands that developed in thick deposits of Peorian loess, a yellowish, windblown silty material. They are on the hills southwest of Cairo; on the uplands in the south-central part of the county; and on slopes bordering drains, where gradients range up to 16 percent.

The most typical profile is in nearly level areas with slopes of 1 to 2 percent. In such areas the surface horizon is a weak, granular, dark grayish-brown to very dark grayish-brown, friable silt loam, 10 to 18 inches thick. The surface layer grades to a subsoil of friable, heavy silt loam or light silty clay loam. It is grayish brown, or slightly lighter colored than the surface soil, and has weak subangular blocky structure (fig. 6). The yellowish parent material (loess) begins at depths of 30 to 42 inches and may continue for many feet. The entire profile is well drained.

On the uplands southwest of Cairo, the surface soil is slightly thicker because dark buried soils are present at depths of 18 to 30 inches.

Holdrege soils have a medium acid to slightly acid surface soil, a slightly acid subsoil, and a neutral to slightly alkaline substratum. Free lime is normally at depths of 42 to 60 inches.

Holdrege soils occur with the Kenesaw, Hastings, and Butler soils. They have a siltier, more friable subsoil than the Hastings soils and have more strongly developed, thicker, and darker horizons than the Kenesaw soils. They lack the claypan subsoil of the Butler soils and are at higher elevations.

The Holdrege soils are among the most productive in the county. They absorb water readily, are easy to work, and have a moderate water-holding capacity. Per-

Figure 6.—Thick surface and subsoil horizons characteristic of Holdrege soils. The lighter colored parent material is Peorian loess, a yellowish, silty windblown deposit common in the uplands of Hall County.

meability is moderate. The soils are susceptible to wind erosion only if the steeper slopes are cultivated.

These soils produce good yields of corn, wheat, sorghum, alfalfa, and soybeans. Potatoes and sugar beets are suitable but are not grown extensively. Tame and native pastures do well. The main plants in the native pastures are buffalograss, blue grama, and big and little bluestem.

Holdrege silt loam, 0 to 1 percent slopes (Ho).—This soil has a profile like that described for the Holdrege series. The main requirement is maintenance of fertility. Nearly all the crops commonly grown in the county are suited to this soil. It is well suited to irrigation. This soil is in dryland capability unit IIc-1, irrigated capability unit I-1, the Silty range site, and the Silty to clayey woodland site.

Holdrege solt loam, 1 to 3 percent slopes (HoA).—This very gently rolling soil is one of the best agricultural soils of the uplands. Tilth is easily maintained, and the organic-matter content is high. Most of this soil is under cultivation, and much of it is irrigated. It produces good yields of corn, sorghum, soybeans, wheat, alfalfa, sugar beets, potatoes, and tame pasture. This soil is in dryland capability unit IIe-1, irrigated capability unit IIe-1, the Silty range site, and the Silty to clayey woodland site.

Holdrege silt loam, 3 to 7 percent slopes (HoB).—This soil has a profile similar to that described for the Holdrege series. The soil is mainly gently sloping, but there are some short side slopes along drains, as well as some very gently rolling areas.

The areas near drains are in native pasture. Most of the rest of the soil is cultivated. Where the soil has been under cultivation, the surface layer is slightly thinner than it is in areas under native pasture.

This soil is suited to irrigation. It is in dryland capability unit IIIe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

Holdrege silt loam, 3 to 7 percent slopes, eroded (HoB2).—This soil has a profile similar to the one described for the Holdrege series, but its surface horizon, which is 4 to 12 inches thick, is thinner. In some places all of the original surface soil has been removed and the brownish subsoil is exposed.

Most areas are cultivated. During years of well-distributed rainfall or when irrigated, this soil produces fair to good yields. It is in dryland capability unit IIIe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

Holdrege silt loam, 7 to 11 percent slopes (HoC).—This soil is on short side slopes along drains. The surface soil and subsoil are slightly thinner than in uneroded Holdrege soils that are on milder slopes. Surface runoff varies from moderate to rapid because of differences in slope and in the quality of the grass cover.

This soil is in native pasture. The principal problem in management—control of water and erosion—can be solved by maintaining a vigorous stand of grasses. This soil is in dryland capability unit IVe-1, irrigated capability unit IVe-1, the Silty range site, and the Silty to clayey woodland site.

Holdrege silt loam, 7 to 11 percent slopes, eroded (HoC2).—This is a sloping loessal soil that eroded under cultivation. It would be more eroded if soil-conserving practices had not been applied. Surface runoff is rapid because of the slope.

This soil generally has a dark surface horizon, but the degree of erosion varies. Consequently, there are a few light-colored spots where erosion has exposed the subsoil or substratum.

Grass, alfalfa, and most other common crops can be grown under dryland management if control of water and erosion is adequate. The soil is suitable for grass and alfalfa grown under irrigation. It is in dryland capability unit IVe-1, irrigated capability unit IVe-1, the Silty range site, and the Silty to clayey woodland site.

Holdrege-Colby complex, severely eroded (3 to 7 percent slopes) (H-C3).—The soils of this mapping unit occupy short slopes along some of the shallow intermittent draws. Erosion has removed practically all of the surface soil and much of the subsoil, and in many places the yellowish parent material is exposed. When cultivated, the soils appear patchy because of differences in the amount of soil material removed by erosion. In some places the dark original surface soil has been mixed with the subsoil, and in others the subsoil and substratum have been mixed. In a few areas protected from severe erosion, the Holdrege profile is present, though the horizons are slightly thinner than those described for the Holdrege series. Small crossable gullies are numerous.

Most of this mapping unit has been cultivated. The soils are low in fertility and in content of organic matter. The moderately rapid surface runoff does not allow good penetration of moisture.

The areas are long and narrow, and separate management of them is difficult. Barnyard manure and crop residues will build up the supply of organic matter and increase the water-holding capacity. These soils are in dryland capability unit IVe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

Hord series

The Hord series consists of deep soils of the stream terraces that have a thick, dark, silt loam surface horizon and a slightly lighter colored silt loam subsoil. A broad belt of these soils runs northeast to southwest across the central part of the county. The soils are mostly on nearly level to gently sloping terraces (benches) and on gently sloping fanlike terraces that are adjacent to the uplands. Small areas are on slopes alongside some of the shallow drains.

In level areas Hord soils have a dark grayish-brown to very dark grayish-brown, friable silt loam surface horizon that is of weak, medium to coarse, granular structure and is 12 to 18 inches thick. This horizon grades abruptly to the subsoil, a grayish-brown, heavy silt loam to very fine sandy loam of weak, subangular blocky structure. The underlying material at these lower levels is silty to slightly sandy alluvium, which, at depths of 3 to 10 feet, is replaced by a deposit of coarse sand or mixed sand and gravel. Buried soils appear in the profile in some places. In others, the substratum is stratified silts and fine sandy loams.

On the higher terraces the profile is lighter colored than in the level areas and is siltier with depth. The soils on the terraces developed in yellowish silts.

Hord soils are well drained. They have a slightly acid to medium acid surface soil, a slightly acid subsoil, and a slightly acid to neutral substratum. In most of the Hord soils that have a coarse substratum at depths of 3 to 4 feet, free lime is not found in the profile. In many profiles, however, free lime is at depths of 4 to 5 feet.

Where Hord soils occur near the loessal uplands southwest of Cairo, they are sometimes reached by rapidly moving floodwaters following heavy local rains. In this area 6 to 18 inches of stratified silty alluvium has been deposited on the Hord profile. Diversion terraces and dams are needed to protect these areas from flooding.

Hord soils are associated with the Hall soils but have a siltier and more friable subsoil. The Hord soils occur on the lower parts of terraces with O'Neill soils but have a profile that is deeper to the substratum of coarse sand or mixed sand and gravel. Hord soils lack the gray subsurface layer and claypan subsoil that is characteristic of the Wood River soils.

Soils of the Hord series are among the best agricultural soils in the county. Most areas are cultivated. Corn, wheat, alfalfa, sorghum, soybeans, sugar beets, and potatoes are grown. Areas in native pasture support a mixed growth of tall and short grasses—buffalograss, blue grama, and big and little bluestem.

Hord silt loam, 0 to 1 percent slopes (Hd).—This soil has a profile similar to that described for the Hord series. It has moderate permeability, high water-holding capacity, and good tilth. Surface runoff is slow.

This is an excellent agricultural soil and is well suited to irrigation. It is in dryland capability unit IIc-1, irrigated capability unit I-1, the Silty range site, and the Silty to clayey woodland site.

Hord silt loam, 1 to 3 percent slopes (HdA).—This soil is on the crests and side slopes of very low, gently sloping ridges and on the narrow side slopes along shallow, intermittent drains.

In cultivated fields, the surface horizon of this soil is slightly thinner than in the profile described for the series. The main hazards are rapid surface runoff and erosion. This soil is in dryland capability unit IIe-1, irrigated capability unit IIe-1, the Silty range site, and the Silty to clayey woodland site.

Hord silt loam, 3 to 7 percent slopes, eroded (HdB2).—This soil is on side slopes along intermittent drains and on the crests and side slopes of gently rolling ridges. It is moderately eroded. The present surface horizon is dark colored for the most part, but there are some light-colored spots where erosion has been severe. For the soil as a whole, the surface horizon ranges from 4 to 12 inches in thickness. The rest of the profile is like that described for the Hord series.

Most of this soil is cultivated. The soil needs practices that will control water and erosion. This soil is in dryland capability unit IIIe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

Hord silt loam, thin solum variant, 0 to 3 percent slopes (2HdA).—This soil is made up of young alluvium that was deposited on older stream terraces when the Wood River and Prairie Creek overflowed their banks. It is along both sides of these streams in narrow bands 100 to 800 feet wide. It has a light brownish-gray to dark grayish-brown, friable silt loam surface horizon. This horizon has a weak, medium, granular structure and is 4 to 10 inches thick. It grades abruptly to a light brownish-gray upper subsoil of nearly massive, strongly calcareous silt loam. At depths of 2 to 5 feet are dark, buried soils that have a clay loam subsoil.

This soil has more free lime in its profile and is more alkaline than the normal soils of the Hord series. Lime concretions are at depths of 4 to 5 feet.

Farming is suitable on this soil. Alfalfa does well because of the lime content. This soil is in dryland capability unit IIc-1, irrigated capability unit I-1, the Silty range site, and the Silty to clayey woodland site.

Hord silt loam, thin solum variant, 3 to 7 percent slopes (2HdB).—Except for stronger slopes, this soil is the same as Hord silt loam, thin solum variant, 0 to 3 percent slopes. The stronger slopes make erosion a greater hazard. This soil is in dryland capability unit IIIe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

Hord-O'Neill complex, 0 to 1 percent slopes (H-N).—This complex is made up of soils of several series that occur in a pattern that prohibits mapping them separately. It consists of about 40 percent Hall and Hord sandy loams, 50 percent O'Neill sandy loam, and about 10 percent Meadin sandy loam. Sandy material from adjacent higher lying Ortello and Thurman soils has blown over these areas. The thickness of the sandy material ranges from 6 to 14 inches. This complex is in dryland capability unit IIe-3, irrigated capability unit IIe-3, the Sandy range site, and the Sandy woodland site.

Kenesaw series

The Kenesaw series consists of young, light-colored soils on uplands. They developed in thick deposits of loess, a yellowish, wind-deposited silty material. These soils are in three general areas: (1) west and north of Cairo; (2) west and north of the Rosedale community; and (3) between Doniphan and the point where Hall, Hamilton, and Merrick Counties meet. Some areas are hummocky.

In pasture areas, Kenesaw soils have a weak granular, grayish-brown silt loam surface horizon, 4 to 10 inches thick. This surface soil is friable when moist and slightly hard when dry; it is noncalcareous. The subsoil is weakly developed, friable, noncalcareous, grayish-brown to pale-brown silt loam; it is 8 to 24 inches thick. The unaltered calcareous parent material is at depths of 10 to 26 inches (fig. 7). This material (loess) is massive and has a few faint yellowish or reddish stains in the upper part. The lime is usually scattered throughout the material, but there are some small, soft to hard concretions.

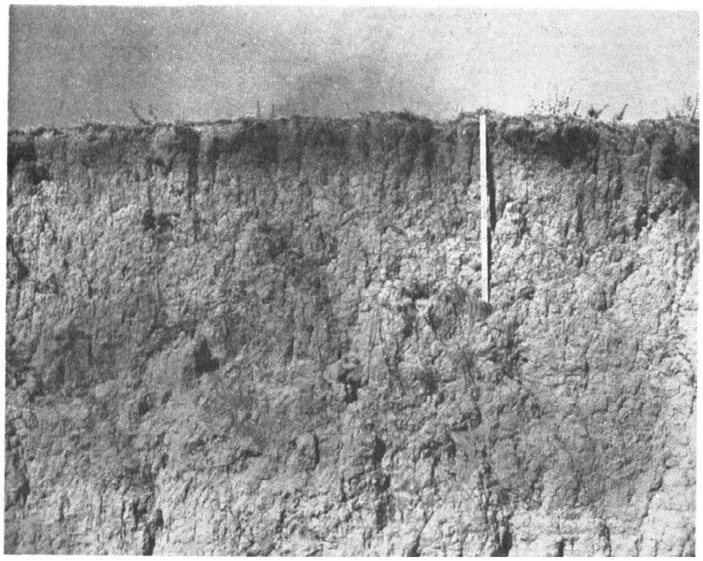

***Figure 7.*—Loess parent materials are at a depth of about 12 inches in this ditchbank in Kenesaw soils.**

In a few areas of Kenesaw soils the surface layer is thicker than normal, and the subsoil is more strongly developed than that described for the series. Ordinarily, the Kenesaw surface soil is not very deep; consequently, the surface horizon in a cultivated field has been mixed with some subsoil and is lighter colored (grayish brown) than in pastures. A dark, buried profile is at depths of 3 to 5 feet in some areas of Kenesaw soils. Included with the Kenesaw soils are some that have a stratified silty and sandy subsoil.

Kenesaw soils are well drained and have good water-holding capacity. Their permeability is moderate.

The Kenesaw soils have a lighter colored, thinner surface layer than Holdrege soils, lack their well developed subsoil, and contain lime higher in the profile. Kenesaw soils resemble the thin solum variants of the Hord series but were formed on loessal uplands rather than on alluvial terraces.

Most areas of Kenesaw soils are cultivated. They produce fair to good yields of corn, wheat, alfalfa, sorghum, potatoes, and tame grasses. Soybeans and sugar beets are also suitable but are seldom grown. Kenesaw soils are easily worked, and crops respond well when irrigated. The principal vegetation in native pastures is buffalograss and blue grama, with some big and little bluestem.

Kenesaw silt loam, 0 to 1 percent slopes (Ks).—The profile of this soil is the one described for the Kenesaw series. In an area south of the Rosedale community this soil is slightly sandier throughout. The texture of the horizons resembles a loam more closely than a silt loam. There is a thin stratum of fine sandy loam or loamy sand in some profiles. Dark, buried soils occur at depths of 2½ to 5 feet. These buried soils have a silt loam, silty clay loam, or silty clay horizon.

Some areas of this unit occur in pockets, or small basins, in the sandhill region in the northwestern part of the county. Individual areas range from 4 to 20 acres in size. In places the texture of the surface horizon is a loam. Near the edge of the basins it is fine sandy loam. A few of these areas are, or have been, cultivated. Generally, they are too small to cultivate; they are included with the rangeland on the surrounding areas of Valentine or Thurman soils.

This soil is well suited to crops grown in the county. It is in dryland capability unit IIc-1, irrigated capability unit I-1, the Silty range site, and the Silty to clayey woodland site.

Kenesaw silt loam, 1 to 3 percent slopes (KsA).—The profile of this soil is like that described for the Kenesaw series. This soil is gently sloping. The range in slope is 1 to 3 percent, but slopes of 2 percent are dominant.

About one-fourth of this soil is slightly sandier throughout the profile. In these sandier areas the horizons resemble loam more closely than silt loam. Thin layers of fine sandy loam or loamy sand occur in the profile. These sandier areas are on low, uneven hummocks. Some of the areas between the hummocks have a silty subsoil.

Most of this soil is cultivated. The surface is light colored when cultivated, and the soil is low in fertility and in organic matter. The sandier part is slightly more susceptible to wind erosion than the rest. Conservation measures are necessary in all areas to conserve water and soil material. A few of the sandier areas have been leveled for irrigation, but the leveling is expensive because a large amount of soil must be moved. Some areas are irrigated by sprinkler systems.

This soil is in dryland capability unit IIIe-1, irrigated capability unit IIe-1, the Silty range site, and the Silty to clayey woodland site.

Kenesaw silt loam, 3 to 7 percent slopes (KsB).—Most of this soil occurs on short side slopes along intermittent drains. A few areas are on hillsides. Erosion has not been uniform on this soil. Where erosion has been severe, the light-colored subsoil is exposed. Many small gullies cross these areas but are ordinarily filled during tillage.

A little less than half of the acreage is slightly sandier than the rest and is on low hummocks. In these places about half of the original dark surface soil has been removed, largely by water erosion, and in some areas the light-colored silty or slightly sandy subsoil is exposed.

Most of this soil is cultivated. It is in dryland capability unit IIIe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

Lamoure series

The Lamoure series consists of deep soils of the bottom lands that developed in stream-deposited materials. These soils are well distributed throughout the bottom lands along the Platte River.

Lamoure soils have a moderate granular, dark-gray to black silt loam surface horizon, 8 to 16 inches thick. They are calcareous at the surface. The upper subsoil is dark-gray, prismatic to blocky silty clay. It is very sticky and plastic when wet and very hard when dry. Some lime is in the lower part. At depths of 24 to 36 inches, the soils are medium to moderately fine textured and are mottled. Mixed sand and gravel is at depths of 3 to 6 feet.

Soils of the Lamoure series have slow permeability because of a fine-textured subsoil. They have high water-holding capacity and slow surface runoff. The groundwater level fluctuates between 3 and 8 feet.

Lamoure soils have a heavier subsoil than soils of the Leshara or Wann series. They are more poorly drained, occur at lower elevations, and have a heavier subsoil than Volin or Cass soils.

Lamoure soils that have not been leveled for irrigation are occasionally flooded during wet seasons. Under dryland farming these soils receive some benefit from the high water level. They produce good yields of corn, sorghum, and alfalfa under irrigation. Soybeans and sugar beets are also suited to these soils, but they are not so commonly grown. Potatoes are not suited. In native pasture there is a mixture of switchgrass, blue grama, big and little bluestem, buffalograss, and saltgrass, and some bluegrass and Indiangrass.

Lamoure silt loam (0 to 1 percent slopes) (La).—This soil has a profile like that described for the Lamoure series.[2] It is in dryland capability unit IIIw-2, irrigated capability unit IIIw-2, the Subirrigated range site, and the Moderately wet woodland site.

Lamoure silt loam, saline (0 to 1 percent slopes) (2La).—This soil has a profile similar to that described for the Lamoure series,[3] but the surface horizon is slightly thinner in microdepressional, or "slick spot," areas, and the percentage of soluble salts and alkali is higher. In pasture or meadow areas there is considerably more saltgrass than in the nonsaline Lamoure soil.

After leveling for irrigation, the alkali spots on this soil are not so noticeable as under dryland farming. This soil dries out slowly following rains. The tilth in the alkali spots is poor. It takes a lot of power to pull tillage implements through them because the clay subsoil is close to the surface. This soil is in dryland capability unit IVs-1, irrigated capability unit IIIs-1, the Saline lowland range site, and the Moderately saline or alkali woodland site.

[2] This soil is higher in clay in the deeper part of the profile than is characteristic for the series.

[3] See footnote 2.

Leshara series

The Leshara series consists of nearly level to very gently undulating soils of bottom lands that develop under a water table that fluctuates between 3 and 8 feet from the surface. The soils are well distributed throughout the bottom lands of the Platte River Valley. A few areas also occur in the South Loup River Valley.

Leshara soils have a silty profile. Their surface horizon is friable, gray to dark grayish-brown silt loam and fine sandy loam, 8 to 14 inches thick. This horizon has medium and coarse crumb structure and is ordinarily calcareous at the surface. The upper subsoil is a light-gray or grayish-brown, dark, coarse, blocky silt loam or very fine sandy loam. Mottlings or blotches are common throughout the subsoil. Large amounts of disseminated lime are present.

In the Platte River Valley, mixed sand and gravel is at depths of 36 to 60 inches. Where Leshara soils occur in the South Loup River Valley, the substratum is fine- and medium-grade sand and is at depths of 20 to 36 inches.

The Leshara soils have a siltier subsoil than that of the Wann soils. They are deeper over the sand-gravel substratum than soils of the Platte series.

The Leshara soils have moderate permeability. Surface runoff is slow to medium. Capillary action sometimes brings soluble salts to the surface, where they accumulate as a white crust. Late spring and summer rains wash and leach these salts away, and there is seldom any damage to crops.

Most areas of Leshara soils are cultivated. They produce good yields of corn, wheat, sorghum, and alfalfa. Soybeans, sugar beets, and tame pasture also do well, but they are not grown extensively on Leshara soils. Potatoes are not well suited, for the alkaline reaction of the soil encourages potato scab. The high water table may cause excessive wetness in some years, but frequently it provides subirrigation that benefits crops and improves yields. Crops on Leshara soils respond well to irrigation. Many areas are in permanent pasture and native hay. These produce a good growth of big and little bluestem, blue grama, buffalograss, switchgrass, Indiangrass, and bluegrass.

Leshara fine sandy loam (0 to 1 percent slopes) (Lf).—This soil has 8 to 16 inches of fine sandy loam that was deposited over the original silt loam surface soil. The sandy surface soil is very friable when moist, soft when dry, and noncalcareous. Water intake is more rapid than on the silty Leshara soils. Wind erosion is a hazard. This soil is in dryland capability unit IIw-6, irrigated capability unit IIw-6, the Subirrigated range site, and the Sandy woodland site.

Leshara silt loam (0 to 1 percent slopes) (Le).—This soil has a profile like the one described for the Leshara series. It is in dryland capability unit IIw-4, irrigated capability unit IIw-4, the Subirrigated range site, and the Moderately wet woodland site.

Leshara silt loam, saline (0 to 1 percent slopes) (2Le).—Most of the soil has a profile similar to the one described for the Leshara series. Many small depressions are in the pastured areas. In these areas the surface horizon is 4 to 10 inches thick. In cultivated fields there are light-colored, cloddy slick spots. Laboratory analyses usually show these spots to have a high content of soluble salt. Their alkalinity may also be high. The spots are 5 to 50 feet in diameter, are fringed or covered with saltgrass vegetation, and will hold water for days or weeks following rains. They yield poor crops when cultivated. The slick spots are hard to cultivate because they are wet for a longer time than the surrounding soils.

Most areas of this soil are in permanent pasture or hay. If overgrazed, saltgrass will take over much of the pasture. Hay meadows have a much larger percentage of the desirable forage grasses. Under dryland cultivation, crop response is spotty and, for the most part, poor. Irrigation under good management produces considerably better yields. This soil is in dryland capability unit IVs–1, irrigated capability unit IIIs–1, the Saline lowland range site, and the Moderately saline or alkali woodland site.

Loup series

The Loup series consists of dark-colored, poorly drained soils of the bottom lands in a small valley along Sweet Creek and in the valley along the South Loup River in the extreme northwestern corner of the county. They occupy a small acreage, are nearly level areas, and are lower than any of the surrounding soils. The soils formed from moderately fine to moderately coarse textured recent alluvium, 6 to 20 inches thick, that was deposited over fine and medium sands. Practically no gravel is in these soils. Ground water is at or near the surface during wet seasons but as much as 4 feet from the surface during the driest seasons. These soils have poor natural drainage. Surface runoff is very slow.

Loup soils have a gray to very dark gray surface horizon, 6 to 12 inches thick. This horizon has mainly a moderate crumb structure but in places it is platy, blocky, or granular. The surface horizon ranges from very firm to very friable when moist, depending somewhat on variation in texture. Normally, there is a 4- to 8-inch transition horizon of mottled sandy loam or loamy sand. Directly beneath this horizon is a substratum of fine and medium sands. This material is dull colored, or it may be brighter colored with numerous dark-brown stains and streaks. Loup soils are normally noncalcareous throughout their profile.

Loup soils occur on lower elevations and have a higher ground-water level than the Elsmere or Wann soils. Their natural drainage is similar to that of the Barney soils. The Loup soils have a substratum of fine and medium sands, whereas the Barney soils have a substratum of mixed sand and gravel.

The ground-water level in Loup soils is too high for successful cultivation. These soils are used for whatever pasture they will produce. Many areas are excellent wildlife refuges. The higher areas produce good bluestem, switchgrass, and Indiangrass for hay. Reeds, sedges, cattails, and prairie cordgrass grow in the lowest areas. Some areas are so wet that they are almost marshes. Willows are dominant where there are trees of any kind.

One soil of the Loup series is mapped in this county.

Loup loam (0 to 1 percent slopes) (Lm).—The profile of this soil is the one described for the Loup series. Some areas having a surface soil of silty clay loam or fine sandy loam are included. This soil is not suitable for irrigation. It is in dryland capability unit Vw–1, the Wetland range site, and the Wet woodland site.

Meadin series

The Meadin series consists of nearly level soils on stream terraces. They developed in sandy stream-deposited materials less than 20 inches thick, which overlie mixed sand and gravel. These soils are not extensive in the county.

Meadin soils have a gray to grayish-brown sandy loam surface horizon. This horizon ranges from 4 to 10 inches thick and has a moderate crumb structure. The subsoil is brown to dark-brown coarse sandy loam or loamy sand. It is 6 to 10 inches thick and has weak, coarse, crumb structure. At depths of 10 to 20 inches, there is an abrupt change to coarse sand or mixed sand and gravel. A few pebbles are on the surface of the soil and throughout the profile. Meadin soils are noncalcareous. They are excessively drained, with very rapid permeability and a low water-holding capacity.

Meadin soils have a shallower profile than the closely associated O'Neill soils.

Most of the Meadin soils are in permanent pasture, but small areas are cultivated as a part of larger units of deeper soils. Under dryland farming, these soils are droughty and are not suitable for cultivated crops. Under irrigation, yields of grass, small grains, and alfalfa are fair to good if the soils are managed intensively.

Meadin sandy loam, 0 to 1 percent slopes (Ms).—The profile of this soil is like the one described for the Meadin series. A few areas with a loam surface horizon are included. This soil is in dryland capability unit VIIs–4, irrigated capability unit IVs–4, the Shallow range site, and the Shallow woodland site.

Meadin loamy sand, 3 to 11 percent slopes (MdB).—This soil is on slopes that break from terraces to the bottom lands in the Platte River Valley. It forms a discontinuous band from a point southwest of Grand Island to the Hall-Buffalo County line southwest of the Wood River. In some places the band is too narrow to be shown as a soil area and is indicated by a wavy line.

This soil is variable in thickness and texture. Most of it has a grayish-brown sandy loam or gravelly loamy sand surface horizon, 2 to 8 inches thick. In places the slightly darkened surface layer has been removed by erosion. The subsoil horizon is commonly lacking. In some profiles there is a subsoil, 2 to 14 inches thick, that consists of coarse, weak, blocky, brown sandy loam. At depths of 6 to 20 inches the soil grades rapidly to a substratum of mixed sand and gravel. In many areas, the soil profile is entirely lacking and the coarse sand and gravel are exposed.

In some cultivated areas there is a large amount of gravel on the surface. These areas show evidence of erosion, even when in native pasture. Numerous small and large gullies cross the slopes. Diagonal cattle trails cross many of these areas and contribute to their susceptibility to water erosion.

This droughty soil has excessive natural drainage because of its shallow depth and coarse texture. Surface runoff is very rapid.

This soil is suited only to permanent pasture. It supports a poor to fair growth of native grasses and annual weeds. It is too steep, too shallow, and too gravelly for successful cultivation, and it is not suitable for irrigation. This soil is in dryland capability unit VIIs-4, the Shallow range site, and the Shallow woodland site.

O'Neill series

Soils of the O'Neill series developed in loamy to sandy stream-deposited materials that are 20 to 36 inches deep over coarse sand or mixed sand and gravel. These soils are on nearly level stream terraces in the Platte River Valley. They occur mainly as a discontinuous band along the southern edge of the terraces. They are in an area known locally as Poverty Ridge because of the numerous crop failures before irrigation became established.

O'Neill soils are excessively drained and have a low water-holding capacity. Permeability is moderately rapid. These soils are noncalcareous throughout their profile.

Soils of the O'Neill series have a friable, dark brownish-gray to very dark grayish-brown loam and sandy loam surface horizon that is of weak, granular structure. This horizon grades to a grayish-brown sandy loam subsoil. In some profiles a thin, 2- to 6-inch, blocky clay loam layer occurs just above the substratum of coarse sand or mixed sand and gravel. There is a sprinkling of fine gravel throughout the profile, but it is never abundant above the substratum.

O'Neill soils have a sand-gravel substratum, whereas soils of the Ortello series are sandy in that horizon. The profile of the O'Neill soils is thicker over the sand-gravel substratum than that of the Meadin soils. The O'Neill soils have a sandier subsoil and a shallower profile than the Hord soils.

Soils of the O'Neill series are droughty under dryland management. Their response to irrigation is good, but there are some limitations when water is applied. Because the soils have a low water-holding capacity, irrigated crops do best if the water is applied at frequent intervals. Irrigation is most efficient if the field laterals are not more than an eighth of a mile long.

These soils are easy to work. They are susceptible to wind erosion if they are not protected by growing crops or crop residues.

O'Neill soils produce good yields of corn, sorghum, potatoes, alfalfa, soybeans, sugar beets, and tame pasture. Nearly all the commercial potato production in Hall County is on O'Neill soils. The principal grasses in native pastures are buffalograss and blue grama, with some big and little bluestem.

O'Neill loam, 0 to 1 percent slopes (Ok).—The profile of this soil is much like the one described for the O'Neill series. The loam surface layer contains an abundance of organic matter. Surface runoff is slow. Drainage is largely internal. Small areas with a sandy loam and silt loam surface texture are included. This soil is in dryland capability unit IIs-5, irrigated capability unit IIs-5, the Silty range site, and the Silty to clayey woodland site.

O'Neill loam, 3 to 5 percent slopes, eroded (OkB2).—This soil is almost entirely on slopes that break from the stream terraces down to bottom lands in the Platte River Valley. The dark surface horizon is thinner than that described for the O'Neill series. In most areas it is 6 to 10 inches thick. The lighter colored subsoil is exposed in a few spots.

A few areas of this soil are in permanent pasture. Small crossable gullies are common in nearly all areas. This soil is in dryland capability unit IIIe-1, irrigated capability unit IIIe-1, the Silty range site, and the Silty to clayey woodland site.

O'Neill sandy loam, 0 to 1 percent slopes (Om).—This soil has a very friable sandy loam surface layer which is lighter colored (browner) than the corresponding layer in the soil described for the O'Neill series. This soil is slightly more droughty than the O'Neill loams. Irrigation is necessary for high yields. This soil is in dryland capability unit IIe-3, irrigated capability unit IIe-3, the Sandy range site, and the Sandy woodland site.

O'Neill sandy loam, 3 to 7 percent slopes, eroded (OmB2).—This soil occurs on slopes that break from stream terraces to the bottom lands in the Platte River Valley. Some erosion has exposed a lighter colored subsoil. There is more gravel on the surface than on areas of uneroded O'Neill soils. Small crossable gullies are common. This soil is in dryland capability unit IIIe-3, irrigated capability unit IIIe-3, the Sandy range site, and the Sandy woodland site.

Ortello series

The Ortello series consists of deep soils on stream terraces and uplands that have a moderately sandy subsoil. These soils formed from sandy alluvium. In some areas much of this material has been reworked by wind. Ortello soils occur at both low and high terrace levels in the Platte River Valley and on adjacent uplands. They are mainly nearly level, but hummocky areas with gradients up to 6 percent are included.

Ortello soils have a very dark gray to grayish-brown loam and fine sandy loam surface horizon, 8 to 20 inches thick. It is slightly acid to medium acid. This horizon has a weak granular or moderate crumb structure and is friable to very friable when moist. The slightly acid subsoil is light brownish-gray sandy loam with a weak, coarse, prismatic structure breaking to weak, coarse, crumb structure. It becomes coarser and a little lighter colored with depth. On stream terraces coarse sand or mixed sand and gravel are at depths of 4 to 6 feet. The substratum is nearly neutral. A loamy substratum phase of the Ortello soils is mapped where a silty to clayey layer occurs at a depth of 3 to 5 feet.

The normal Ortello soils are noncalcareous throughout their profile. These somewhat excessively drained soils have moderately rapid permeability and a medium water-holding capacity.

Ortello soils have a sandier subsoil than the Hord or the Holdredge soils. Their profile is not so sandy as that of the Thurman soils. Ortello soils have a sandy substratum, whereas O'Neill soils have a substratum consisting of mixed sand and gravel.

Most of the Ortello soils are cultivated. They are somewhat droughty under dryland farming, but crops respond well to irrigation. Wind erosion is a hazard on the phases that have a sandy surface soil. Corn, wheat, sorghum, and alfalfa are the most commonly grown crops. Soybeans, tame pasture, potatoes, and sugar beets are also grown successfully. In native pastures the principal grasses are blue grama, buffalograss, big and little bluestem, sand dropseed, and prairie sandreed.

Ortello fine sandy loam, 0 to 3 percent slopes (OrA).—This soil has a profile similar to that described for the Ortello series. The surface layer is fine sandy loam. This horizon is thinner and lighter colored (browner) than in Ortello loam, 0 to 1 percent slopes. This soil is in dryland capability unit IIe–3, irrigated capability unit IIe–3, the Sandy range site, and the Sandy woodland site.

Ortello fine sandy loam, 3 to 7 percent slopes (OrB).—The soil of this unit has a profile similar to that described for the Ortello series. In cultivated areas, however, the surface horizon is slightly thinner; it is 6 to 12 inches thick. Some areas occupy low-lying ridges, but, for the most part, this soil is on irregular, wind-formed hummocks. It is in dryland capability unit IIIe–3, irrigated capability unit IIIe–3, the Sandy range site, and the Sandy woodland site.

Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes (2Or).—This soil has a surface layer and subsoil similar to those described for the Ortello series. At depths of 3 to 5 feet, however, there are silty to clayey horizons that represent an older, buried soil. In some places the silty buried material is yellowish loess, in which no darkening or soil development has taken place.

This soil is less droughty under dryland farming than the normal Ortello fine sandy loams. When leveling for irrigation, it is possible to make deeper cuts without exposing coarse material.

Some of this soil occurs on low-lying ridges or on low hummocks. Other areas are nearly level. This soil is in dryland capability unit IIe–3, irrigated capability unit IIe–3, the Sandy range site, and the Sandy woodland site.

Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes (2OrB).—This soil has a surface soil and subsoil similar to those described for the Ortello series. The silty or clayey horizon occurs at depths of 3 to 5 feet.

This soil is on short side slopes along shallow intermittent drains, on ridges, or on low hummocks. In places all of the surface soil has been removed and the lighter colored sandy subsoil is exposed. Considering the acreage as a whole, from 25 to 50 percent of the surface soil is still present.

Surface runoff is rapid. The organic-matter supply is low; and natural fertility is fair. Under dryland farming, this soil is less droughty than the normal Ortello fine sandy loams. When leveling for irrigation, it is possible to make deeper cuts without exposing coarse material. This soil is in dryland capability unit IIIe–3, irrigated capability unit IIIe–3, the Sandy range site, and the Sandy woodland site.

Ortello loam, 0 to 1 percent slopes (Ot).—This soil has a profile like that described for the Ortello series. The surface layer is a loam. About two-thirds of this soil is underlain, at depths of 3 to 5 feet, by buried silty and clayey soils. These buried soils have a profile similar to that of the Hall, Hord, or Wood River soils.

This soil is in dryland capability unit IIc–1, irrigated capability I–1, the Silty range site, and the Silty to clayey woodland site.

Ovina series

The Ovina series consists of imperfectly drained, moderately dark colored, moderately sandy soils that have a loamy subsoil. They are in nearly level areas in valley positions that are within or that border sandhill areas. Slick spots occur in some areas. There is little surface runoff, and permeability is slow. The ground-water level fluctuates between depths of 2 and 8 feet.

Ovina soils have a dark-gray to dark grayish-brown fine sandy loam and loamy fine sand surface horizon, 5 to 15 inches thick. It is very friable when moist and is noncalcareous but mildly alkaline. The surface horizon grades to nearly massive, grayish-brown fine sandy loam. Buried dark-gray to pale-olive loams or silt loams, over light-gray to grayish-brown silty clay loams to clays, begin at an average depth of 24 inches. The grayish color is caused by the abundance of free lime. At about 5 feet, the profile changes to calcareous loam or sandy loam, and then to coarse sand or mixed sand and gravel.

Some profiles have been observed in which the coarse substratum was at depths of 8 to 10 feet. Mottlings or blotches of light olive-brown, strong-brown, greenish, and bluish colors are common in the lower horizons of these soils.

Ovina soils have a less sandy subsoil than Elsmere soils, and they are less clayey than Silver Creek soils. They differ from the Ortello soils in having a shallow water table, as well as a mottled subsoil and other evidence of subirrigation and recurrent wetness.

Most areas are in native meadow. The most common grasses in these meadows are big and little bluestem, switchgrass, Indiangrass, blue grama, and some prairie cordgrass. Hay yields are good. Some areas of Ovina soils are cultivated. Yields are fair during dry years. In years of normal rainfall, some areas are too wet for successful cultivation.

Ovina fine sandy loam (0 to 1 percent slopes) (Ov).—This soil occupies nearly level, fairly broad, areas bordering the sandy uplands. It is associated with sandy soils of the stream terraces. This soil is in dryland capability unit IIw–6, irrigated capability unit IIw–6, the Subirrigated range site, and the Moderately wet woodland site.

Ovina loamy fine sand (0 to 3 percent slopes) (Oa).—This soil has a profile similar to the one described for the Ovina series. Because of wetness, most of this soil is in native meadow. It is in dryland capability unit IIIw–5, irrigated capability unit IIIw–5, the Subirrigated range site, and the Moderately wet woodland site.

Platte series

The Platte series consists of shallow soils of the bottom lands that are forming in 10 to 20 inches of recent alluvium. The alluvium overlies coarse sand or mixed sand and gravel. These soils occur extensively throughout the Platte River Valley. They are at lower elevations than the surrounding, deeper soils. Most areas of the Platte soils are associated with scars left by the former channels of the Platte River.

Platte loam has a calcareous, gray to black loam surface horizon and is 3 to 12 inches thick. It is friable when moist. Below the surface soil, in most places, there is a 6- to 10-inch horizon of stratified, mottled, light-gray silt loam, loam, and very fine sandy loam. This is the parent material of the soil, and it rests directly on the coarse substratum. Where the dark surface horizon is deepest, however, the soil grades through a layer of sandy loam to the mixed sand and gravel of the substratum.

Included with the Platte soils are soils having less than 10 inches of soil material over coarse sand and gravel.

The Platte soils have a low water-holding capacity because they are shallow. The coarse substratum has very rapid permeability. The ground-water level fluctuates between depths of 2 and 6 feet. It is highest during winter and early in spring. When the water table is high, capillary action brings soluble salts to the surface, where they accumulate as a white crust. Most of the salts are leached or washed away by late spring or summer rains. There is little danger from salt accumulation during normal years.

Platte soils are shallower over the coarse substratum than the moderately deep Wann loams. They resemble the Meadin soils in depth but have a higher ground-water level and occur on bottom lands instead of terraces.

Most areas of Platte soils are in permanent pasture or hay. Under dryland management, the soils are too droughty to be farmed successfully. Most of the cultivated areas are irrigated. Under irrigation, the hazards are severe. Water runs must be short, and applications of water frequent. Sorghum and corn are best suited. Where the soils are in native meadow, yields of hay are good. Grasses in native pastures should not be overgrazed (fig. 8). In poor pastures, ironweed, vervain, goldenrod, and ragweed have replaced the native blue grama, buffalograss, switchgrass, Indiangrass, and bluestem.

***Figure 8.*—This area of Platte soils has a high carrying capacity when it is properly managed, but the proportion of undesirable weeds and grasses is high when it is overgrazed.**

Platte loam (0 to 3 percent slopes) (Pt).—The profile of this soil is like the one described for the Platte series. About a third of the acreage is in areas that have a network of small, crossable drains, 1 to 2 feet deep and 5 to 15 feet wide, that carry surface water to larger streams. This soil is in dryland capability unit VIIs-4, irrigated capability unit IVs-4, the Subirrigated range site, and the Shallow woodland site.

Platte-Sarpy complex (0 to 2 percent slopes) (P-S).—This complex consists of imperfectly drained, shallow, loamy Platte soils and excessively drained, deep, very sandy Sarpy soils. The two are so intermixed they could not be mapped separately. Numerous small channels cross the areas of this unit.

Platte loam and a Platte soil with a sandy loam surface soil occur at low elevations and occupy from 45 to 65 percent of the complex. Their profile is like that described for the Platte series. Sarpy fine sand and Sarpy loamy fine sand occupy from 30 to 40 percent of the complex, and they are on the higher ridges where slopes range from 3 to 8 percent. These ridges crest 2 to 6 feet above the level of the Platte soils. Sarpy soils have a profile like that described for the Sarpy series.

Some areas have soils resembling Wann loam, Wann fine sandy loam, and Wann fine sandy loam, deep. These soils are intermediate in elevation between the Platte and Sarpy soils and occupy from 0 to 15 percent of the complex. Their profile is like that described for the Wann series.

This complex differs from the Platte-Wann complex in having more sandy and very sandy Sarpy soils. Both complexes occur in abandoned channels of the Platte River.

The ground-water level fluctuates between 2 and 12 feet. Surface runoff is medium. Some water moves away in drainage channels. On the very sandy soils, much of the water is absorbed nearly as rapidly as it falls. Wind erosion is a hazard on some of the sandy ridges where there is not enough grass to hold the soil.

Soils of this complex are in permanent pasture. They are too rough for successful cultivation. Extensive leveling could produce irrigable soils, but this would be expensive. When properly managed, these soils produce a fair amount of good grasses. They have a moderately high carrying capacity. The Sarpy soils are suited to prairie sandreed, sand dropseed, big and little bluestem, and blue grama. The Wann soils produce a mixture of tall and short grasses, including some switchgrass and Indiangrass. Platte soils commonly produce the poorest stand of grasses. Povertygrass, needle-and-thread, prairie triple-awn, and sand dropseed are the more abundant grasses on this soil.

Soils of this complex are in dryland capability unit VIIe-5, irrigated capability unit IVe-5, the Sands range site, and the Very sandy woodland site.

Platte-Sarpy complex, channeled (0 to 6 percent slopes) (2P-S).—These soils are like those described for the Platte-Sarpy complex. The ridges of Sarpy soils are higher than in the Platte-Sarpy complex. They have side slopes of 5 to 15 percent, and the crest of the ridges is 6 to 12 feet above the level of the adjacent Platte or Wann soils. Because of the numerous high sand ridges, shallow soil areas, and deeply entrenched drains, the soils are not suitable for cultivation. Many of the drains and stream channels are noncrossable with farm machinery. The soils of this complex are in dryland capability unit VIIe-5, the Sands range site, and the Very sandy woodland site.

Platte-Wann complex (0 to 2 percent slopes) (P-W).—This unit is made up primarily of shallow, loamy Platte soils and moderately deep to deep, sandy Wann soils in such close association they could not be mapped separately. They occur in bottom-land areas that were once channels of the Platte River. The soils are forming in materials recently deposited in the old channels.

The shallow, loamy soils of this complex have a profile like that described for the Platte series. They occur at the lowest elevations and occupy 30 to 60 percent of the complex, depending on the particular area involved. The moderately deep to deep sandy soils have a profile like that described for the Wann series. These soils occur at the highest elevations and occupy 40 to 70 percent of the complex. Minor inclusions of deep, very sandy soils similar to those described for the Sarpy series occupy 5 to 10 percent of the complex.

Surface runoff is moderate to rapid because of a network of drains, varying from 1 to 3 feet in depth and from 3 to 15 feet in width, which carry rainwater to larger streams. Most of the drains can be crossed with farm machinery. Much of the water from gentle rains enters the soil almost as rapidly as it falls. The water-holding capacity is low to medium.

The ground-water level fluctuates between 2 and 8 feet. Early in spring when the water level is high, soluble salts form a white crust on the surface of these soils. It is not harmful to the native vegetation and is leached or washed away by spring and midsummer rains.

Most areas of this complex are in permanent pasture or native hay meadow. A high level of management is necessary if these soils are cultivated. Crop yields are fair under dryland cultivation. The shallow soils are too droughty for successful crop production. If leveled for irrigation, crop yields are good. If irrigation is not used, areas of this complex are more profitable if left in permanent pasture or hay meadow. Wind erosion is a hazard.

If properly managed, pastures have a high carrying capacity. The most common grasses are big and little bluestem, switchgrass, Indiangrass, and bluegrass. In overgrazed areas, annual weeds, povertygrass, prairie triple-awn, and sand dropseed are common. The soils of this unit are in dryland capability unit VIIs-4, irrigated capability unit IVs-4, the Subirrigated range site, and the Shallow woodland site.

Platte-Wann complex, channeled (0 to 2 percent slopes) (2P-W).—These soils are similar to those described for the Platte-Wann complex. In the channeled phase, many of the drains are not crossable with ordinary farm machinery. They vary from 3 to 6 feet in depth and 6 to 20 feet in width. A few areas have water in them much of the year.

All areas are in permanent pasture. They are too rough for successful cultivation. This unit is in dryland capability unit VIIs-4, the Subirrigated range site, and the Shallow woodland site.

Riverwash

Riverwash (Rw).—Mapped together in this land type are sand bars and sand flats and some smaller islands within and adjacent to the channels of the Platte and South Loup Rivers. These areas are 1 to 3 feet above the level of normal stream flow. Most areas are slightly channeled and are subject to cutting action of streams when they are flowing at high-water stage. Some areas along the South Loup River are flooded when stream flow is highest. The flow of water in the Platte River is controlled by large upstream dams, so there is little flooding along that stream.

Some of the more stabilized areas have a moderately dark surface horizon of coarse sand, 2 to 8 inches thick. Most areas, however, have a light-colored surface layer that contains little organic matter.

Wind erosion is active where vegetation is not established, and most areas of Riverwash are nearly bare. Cocklebur and small willows are the first plants to become established. On the most stabilized areas, there are dense stands of willows, cottonwood trees, brush, annual weeds, and common reedgrass.

Many areas adjacent to river channels are used for whatever pasture they will support. Most of the sand bars are idle. Areas of Riverwash make excellent wildlife habitats. This land type is in dryland capability class VIII. It is not suitable as a woodland site.

Sarpy series

The Sarpy series consists of noncalcareous loamy sands and fine sands on bottom lands in the valleys of the Platte and South Loup Rivers. These soils are on low ridges and adjacent to abandoned channels of the Platte River. They occupy higher elevations than the surrounding soils. Their alluvial parent material has been reworked and drifted into low ridges by wind. In some places the parent material was blown out of the abandoned channels by north and northwesterly winds to form natural levees on the banks of these channels.

The Sarpy soils have a loose, single-grain, grayish-brown to dark grayish-brown surface horizon of fine sand that is 4 to 14 inches thick. The subsoil is loose, single-grain, light brownish-gray to grayish-brown fine sand or loamy sand. Normally, mottlings are absent. Buried soils are not common in Sarpy soils, but in some areas there is a loamy horizon between depths of 4 and 6 feet. Coarse sand or mixed sand and gravel is at depths of 4 to 10 feet.

Sarpy soils are slightly acid to medium acid and are noncalcareous. They are excessively drained. Permeability is rapid. The water-holding capacity is low. Surface runoff is slow on the more nearly level areas because nearly all the water is absorbed as rapidly as it falls. Runoff is moderate on the steeper, sandy ridges. The ground-water level is at depths of 6 to 12 feet. Where these soils are cultivated, or where overgrazing has destroyed the pasture grasses, wind erosion is a serious hazard.

Soils of the Sarpy series are sandier and have a lighter colored surface horizon than the Cass soils. They have a sandier, lighter colored profile, a lower ground-water level, and better natural drainage than Wann soils.

Most areas are in native pasture of hay meadow. Where a high level of management is practiced, these soils produce fair to good stands of prairie sandreed and sand dropseed, with smaller stands of blue grama and bluestem. On overgrazed and wind-eroded areas, ragweed, ironweed, cocklebur, sandbur, and similar plants are common.

When cultivated, Sarpy soils are droughty, are low in natural fertility, and tend to be difficult to work because of excessive sandiness. Crops respond well to irrigation.

Sarpy fine sand (2 to 6 percent slopes) (Sa).—This is the soil considered typical of the Sarpy series. It occupies sandy ridges that are 4 to 8 feet higher than the adjacent soils. Some of the ridges crest at 10 to 15 feet. This soil is in permanent pasture. It is too sandy, too droughty, and too irregular for successful cultivation. Blow-out troughs are common in some areas that have been overgrazed. This soil is not suitable for irrigation. It is in dryland capability unit VIIe–5, the Sands range site, and the Very sandy woodland site.

Sarpy loamy fine sand, 0 to 3 percent slopes (SgA).—This soil has a loamy sand surface horizon, 6 to 14 inches thick. It is thicker, slightly darker, and more coherent than Sarpy fine sand. The subsoil is grayish-brown or light brownish-gray loamy sand that becomes coarser with depth.

This soil is mainly on natural levees along abandoned stream channels. Most areas are cultivated. Under dryland management, yields of corn, sorghum, and alfalfa are fair to poor, depending on the amount of moisture during the growing season. Many areas are irrigated, and, under a high level of management, crops respond well. This soil is in dryland capability unit IIIe–5, irrigated capability unit IVe–5, the Sandy range site, and the Sandy woodland site.

Sarpy loamy fine sand, 3 to 7 percent slopes (SgB).—This soil is similar to Sarpy loamy fine sand, 0 to 3 percent slopes. It occupies long, uneven, low ridges within large, broad areas of less well drained soils. A few of the less sloping areas are cultivated. During dry years, crop yields are poor. In wet years, yields of corn, sorghum, and alfalfa are fair. Most areas are in native pasture and produce a good growth of sand-loving grass. This soil is in dryland capability unit IVe–5, irrigated capability unit IVe–5, the Sands range site, and the Sandy woodland site.

Scott series

The Scott series consists of soils that occur in depressions on the uplands and stream terraces. The soils have a thin, silty surface horizon and a thick, dark, claypan subsoil. The parent material is loess, a yellowish, silty, windblown material. On the low terraces north of Grand Island, however, the Scott soils formed in a mixture of loess and stream-deposited material (alluvium).

In this county, typical Scott soils have a friable, weak, granular or platy, gray surface horizon 4 to 10 inches thick. The lower part may be slightly grayer than the upper part. It changes abruptly to the dark-gray clay subsoil, which is of strong, prismatic-blocky structure. The subsoil is sticky and plastic when wet and very hard when dry. It grades to yellowish parent material at depths of 40 to 52 inches.

Areas of the low terraces in the northeastern part of the county are less uniform in the subsoil and substratum. The upper subsoil ranges from clay loam to clay. The parent material consists of stratified clay loam, loam, and sandy loam. In places there is a 3- to 10-inch, mottled, sticky layer of light gray sandy clay loam. The substratum of mixed sand and gravel is at depths of 4 to 6 feet.

Most of the low areas are undrained and receive runoff from higher surrounding soils. The water disappears slowly by seepage or evaporation. During wet years the areas are covered with water most of the time. In dry years they produce a poor growth of annual weeds and poor quality grasses. Some areas are nearly bare.

Scott soils have very poor natural drainage, are very slowly permeable, and are frequently ponded. Their surface soil is slightly acid to medium acid, and their subsoil is slightly acid to neutral. Free lime commonly has been leached to depths below 60 inches.

Scott soils have a thinner surface soil than the Fillmore soils and occur at lower elevation than the Butler and Fillmore soils. They are not suited to buffalograss or grama, which normally grows on the Fillmore soils.

Most areas of the Scott soils are used for whatever pasture they will produce. Some areas are cultivated, but yields are poor. One soil of this series was mapped in the county.

Scott silt loam (0 to 1 percent slopes) (Sc).—This soil is mostly in pasture, but some areas are cultivated. Yields of corn and sorghum are poor. Unless they are protected by diversion ditches or by terraces, crops ordinarily drown out in years of normal rainfall. The soil can be irrigated if adequately protected from floods. If the soil is cultivated deeper than 6 inches, some of the clay subsoil is brought to the surface. This soil is in dryland capability unit IVw–2, irrigated capability unit IVw–2, the Overflow range site, and the Wet woodland site.

Silver Creek series

The Silver Creek series consists of nearly level, imperfectly drained, deep soils that contain an abundance of lime. In this county the areas are on the low and high stream terraces in the Platte River Valley. The Silver Creek soils formed in old alluvium on the lower terraces and in loess on the higher terraces. Permeability is slow because of the clayey subsoil. Surface runoff and internal drainage are slow. The water table fluctuates between depths of 3 and 10 feet.

Silver Creek soils have a calcareous, gray, silt loam surface soil, 8 to 14 inches thick, that is of weak, fine, granular structure. The subsoil, a dense, blocky silty clay or clay, is very plastic and sticky when wet and very hard when dry. It contains a heavy concentration of lime carbonate and is gray to light gray when dry. The lower part of the subsoil contains less lime than the upper and in many places is stained or blotched with brownish, bluish, or greenish colors. On the lower terraces this mottling marks the zone within which the water table fluctuates. On the higher terraces the subsoil grades rapidly to a substratum that consists of loess having a silt loam texture and mottles of light gray.

Silver Creek soils differ from the nearby Exline soils in having a thicker surface horizon, a blocky instead of columnar subsoil, a higher concentration of free lime, and a lower concentration of soluble salts and alkali. Silver Creek soils contain more lime, are at lower elevations, and are more poorly drained than the Wood River soils.

Crops yield fairly well on Silver Creek soils, though they sometimes drown out in wet years. The soils can be irrigated successfully if adequate surface drainage is established. One soil of this series was mapped in the county.

Silver Creek silt loam (0 to 1 percent slopes) (Si).—This soil has a profile like the one described for the series. Crops yield fairly well but may drown out in wet years. Areas in pasture or hay meadows yield very well. Where the soil has not been cultivated, the plant cover is a mixture of tall and short grasses—buffalograss, western wheatgrass, saltgrass, bluestem, and some Indiangrass and switchgrass.

Irrigation can be practiced where adequate surface drainage can be established. This soil is in dryland capability unit IIIw–2, irrigated capability unit IIIw–2, the Subirrigated range site, and the Moderately wet woodland site.

Thurman series

The Thurman series consists of dark-colored soils of the uplands and stream terraces that developed in very sandy materials deposited by wind or water. These soils occur in nearly level to hummocky positions in the north-central part of the county and also in a discontinuous band along the south break to the Platte River Valley.

These soils have a dark-gray or dark grayish-brown surface soil of fine sandy loam or loamy fine sand. This horizon is 10 to 20 inches thick, is very friable when moist, and is slightly acid to medium acid. The subsoil is slightly acid, brown to grayish-brown loamy sand or loamy fine sand that commonly becomes coarser with depth. It is very friable when moist and weakly coherent when dry. Thurman soils are noncalcareous.

Soils of the Thurman series have a thicker and darker colored surface horizon than the closely associated Valentine soils.

Thurman soils are very rapidly permeable. Surface runoff is slow because most of the rainfall is absorbed as rapidly as it falls. Wind erosion is a severe hazard if these soils are not properly managed. In the cultivated areas, corn and sorghum are the most commonly grown crops. Some wheat is also grown. These soils are droughty under dryland management, but produce fair to good crops in years of above-normal rainfall. Areas in permanent pasture support a mixed growth of blue grama, little and big bluestem, prairie sandreed, and sand dropseed.

Thurman fine sandy loam, 0 to 3 percent slopes (TsA).—Some of this soil is on low ridges or irregular, low hummocks with slopes of about 2 percent. Other areas are in low pockets or sags between higher lying areas of Valentine soils. These areas vary from 5 to 30 acres in size. A few areas having a loam or silt loam surface horizon are included.

This soil is slightly droughty for dryland crops. Crop response to irrigation is excellent. This soil is in dryland capability unit IIe–3, irrigated capability unit IIe–3, the Sandy range site, and the Sandy woodland site.

Thurman fine sandy loam, 3 to 7 percent slopes (TsB).—Most of this soil is hummocky, but some areas are on short side slopes along intermittent drains in the sandy uplands. A few areas having a loam surface horizon are included.

Erosion has not been uniform. In places the original dark surface soil has been removed and the lighter colored sandy subsoil is exposed. In most areas, however, 25 to 50 percent of the dark surface soil remains and the soil is generally dark colored. In many places the remaining surface soil has been mixed with the subsoil during tillage.

Most of this soil is cultivated, but crop yields are only fair because of rapid surface runoff and low natural fertility. This soil is low in organic matter and nitrogen. It is in dryland capability unit IIIe–3, irrigated capability unit IIIe–3, the Sandy range site, and the Sandy woodland site.

Thurman loamy fine sand, 0 to 3 percent slopes (ThA).—This soil occurs in wind-formed, very gently undulating positions. In a few areas dark, buried silty soils are at depths of 3 to 5 feet.

Wind erosion is a hazard on this soil when it is cultivated. There are no surface drainage channels, because the rainfall is absorbed nearly as rapidly as it falls. Internal drainage is rapid.

Most of this soil is cultivated. Corn, wheat, sorghum, and alfalfa are the main crops grown. During dry years, this soil is droughty, but it produces fair to good yields when rainfall is normal or above normal. A few areas are irrigated by sprinklers. Leveling for gravity irrigation can be done, but large amounts of soil must be moved.

This soil is in dryland capability unit IIIe–5, irrigated capability unit IVe–5, the Sandy range site, and the Sandy woodland site.

Thurman loamy fine sand, 3 to 7 percent slopes (ThB).—The profile of this soil is like that described for the Thurman series. A few areas subject to severe wind erosion have lost most of their dark-colored surface horizon. Slopes are complex and the surface is hummocky. Some of the soil is cultivated, but most of it is in permanent pasture. It is in dryland capability unit IVe–5, irrigated capability unit IVe–5, the Sands range site, and the Sandy woodland site.

Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes (2ThA).—This soil has a surface layer and subsoil horizon similar to those described for the Thurman series. At depths of 3 to 5 feet, there is a buried silty to clayey horizon. The silty or clayey lower horizon makes this soil less droughty than the other Thurman soils. If it is leveled for irrigation, there is little chance of exposing coarse material. This soil is in dryland capability unit IIIe–5, irrigated capability unit IVe–5, the Sandy range site, and the Sandy woodland site.

Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes (2ThB).—This soil has a profile similar to that described for the Thurman series, but it has a buried silty to clayey horizon at depths of 3 to 5 feet. The lower horizon makes the soil less droughty than other Thurman soils, as it holds moisture within the reach of many crop roots. In a few areas most of the original dark-colored surface horizon has been removed by severe wind erosion. Most of this soil is cultivated, but very little is irrigated. This soil is in dryland capability unit IVe–5, irrigated capability unit IVe–5, the Sands range site, and the Sandy woodland site.

Thurman loamy fine sand, wind eroded (0 to 7 percent slopes) (Th3).—This soil occurs mainly in low hummocky positions, and its profile is similar to the one described for the Thurman series. The surface layer is light colored.

This soil contains very little organic matter, and its fertility is low. Permeability is rapid, and the water-holding capacity is low. Most of this soil is cultivated. It is not suited to irrigation, and farmers consider it droughty.

Severe wind erosion is a hazard on this soil. Because of erosion, it is unstable during periods of high winds. Areas of this soil are small because wind erosion has not been uniform. Much of the loamy fine sand surface horizon has been completely removed from the crests of the hummocks (fig. 9). Erosion is not so severe on the side slopes. Some "blow sand" has accumulated in the low-lying areas between the hummocks.

It is in dryland capability unit VIe–5, the Sands range site, and the Very sandy woodland site.

Valentine series

The Valentine series consists of young, hummocky soils that formed in wind-deposited sands. There are two general areas of Valentine soils. The most extensive area is located north of Cairo and Abbott in the northwestern and north-central parts of the county. A smaller area is in the south-central part, south of the Platte River Valley. Slopes range from 3 to 15 percent but are dominantly not more than 10 percent.

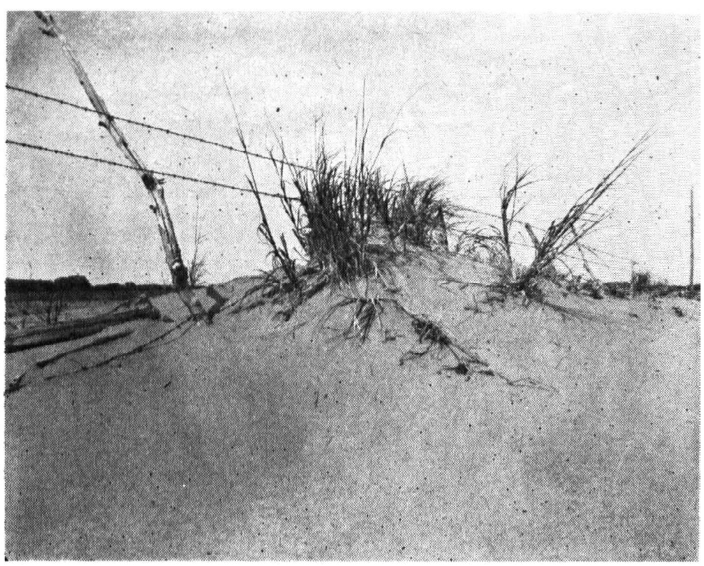

***Figure 9.*—Sand drifting from an unprotected field of Thurman loamy fine sand, wind eroded, has accumulated in a fence row. This soil needs a good cover crop or stubble mulch.**

Valentine soils have a dark-gray to light brownish-gray surface horizon of fine sand or loamy fine sand that is 4 to 12 inches thick. Normally, there is enough organic matter and silt mixed with the sand to give it weak coherence. This horizon grades rapidly to a loose, pale-brown fine sand or loamy fine sand that continues downward for at least 5 feet, and in places to 20 feet or more. A thin, slightly darkened horizon that indicates short periods of a former stabilization and formation of a surface layer occurs frequently in these soils.

The soils of the Valentine series are slightly acid to medium acid. No lime carbonate is present. They are rapidly permeable and have a low water-holding capacity. Surface runoff is very slow because the rainfall is absorbed by the porous sands. Blowouts are common.

Valentine soils have a lighter colored, thinner surface horizon and a sandier subsoil than the closely associated Thurman soils.

Nearly all areas of Valentine soils are in permanent pasture. They are too sandy and unstable for successful cultivation. Wind erosion is a serious hazard when the grass cover is destroyed. The native vegetation consists of fair to good stands of prairie sandreed, sand dropseed, blue grama, sand bluestem, and big and little bluestem. Only one soil of this series was mapped in the county.

Valentine fine sand (Va).—This soil is described as typical of the Valentine series. It produces fair to good stands of native grasses and is considered good grazing land when properly managed. Blowout troughs are common. This soil is in dryland capability unit VIIe–5, the Sands range site, and the Very sandy woodland site. It is not suitable for irrigation.

Volin series

The Volin series consists of silty alluvial soils of the Platte River Valley. They are underlain at 3 to 6 feet by coarse sand or mixed sand and gravel.

The surface horizon, 8 to 18 inches thick, is a calcareous, dark grayish-brown silt loam or very fine sandy loam of medium granular structure. It is friable when moist and slightly hard when dry. Normally, there is a medium-textured transitional horizon that is slightly lighter colored than the surface horizon. The upper substratum, or C horizon, at depths of 12 to 24 inches, is a light-gray to grayish-brown silt loam or very fine sandy loam of weak, coarse, prismatic structure. This horizon is friable when moist and slightly hard when dry. In places it is calcareous. The lower C horizon is stratified, light-colored, friable silt loam. Coarse sand or mixed sand and gravel occur at depths of 3 to 6 feet. In a few places there is a dark, buried, loamy layer in the lower substratum.

These well-drained soils are seldom flooded. Surface runoff is medium, and permeability is moderate. Erosion by wind and water is seldom a hazard if good management is used.

Volin soils have a slightly finer textured, more coherent subsoil than Cass soils. They are better drained and have a coarser textured subsoil than the Lamoure soils. One soil of the Volin series was mapped in the county.

Volin silt loam (0 to 1 percent slopes) (Vo).—This is one of the best agricultural soils of the county. Most of it is cultivated. Crop yields are fair to good under dryland management. The soil responds well to irrigation. It is easy to work. Natural fertility and the water-holding capacity are high. Areas in native pasture produce excellent stands of grasses, mainly bluestem, blue grama, buffalograss, and bluegrass. This soil is in dryland capability unit I–1, irrigated capability unit I–1, the Silty range site, and the Silty to clayey woodland site.

Wann series

The Wann soils are nearly level to very gently rolling, deep and moderately deep soils on bottom lands in the valleys of the Platte and South Loup Rivers. They formed in recent alluvium under the influence of a moderately high water table. Wann soils are at lower elevations than the surrounding well-drained soils but are higher than the associated shallow soils. These soils have a sandy subsoil.

Wann loam, deep, is the central, or typical, soil of this series. It has a very friable, calcareous, dark-gray to very dark grayish-brown loam surface horizon, 6 to 14 inches thick. It is of moderate crumb structure. The subsoil is light-gray or light brownish-gray fine sandy loam that breaks to coarse, weak, irregular fragments. Brownish and yellowish stains or blotches are present in this horizon. The subsoil is commonly stratified with thin layers of medium and moderately coarse alluvial material. The sandy texture continues to depths of 36 inches, or beyond 60 inches, to the substratum of coarse sand or mixed sand and gravel. Lime carbonates are usually at the surface and at varying levels in the profile.

Surface runoff is slow. Since most areas are nearly level, water enters the soils as rapidly as it falls. Internal drainage is moderately rapid. The water-holding capacity is medium to low. The ground-water fluctuates between depths of 3 and 8 feet. Capillary action brings some soluble salts to the surface during winter and early in spring, but summer rains tend to leach and wash away these salts.

Wann soils are more poorly drained and occupy lower positions than Cass soils. They have a sandier subsoil than the Leshara soils. They are not so sandy as the Sarpy soils and their surface horizon is thicker and darker.

The Wann soils in this county differ in depth to sand and gravel. Those that are deeper than 36 inches are identified by the word "deep." Those that have sand and gravel 20 to 36 inches from the surface do not have the word "deep" in their name.

Most of the areas of Wann soils are under dryland cultivation. In some seasons wetness limits crop production, but in drier seasons the water table provides subirrigation. Corn, sorghum, and alfalfa are most commonly grown. Some areas are irrigated. Response to irrigation is good. Some areas of Wann soils are in native pasture and hay meadow (fig. 10). Excellent stands of big and little bluestem, switchgrass, Indiangrass, and blue grama grow on these soils. Commonly there is some reedgrass and sand dropseed.

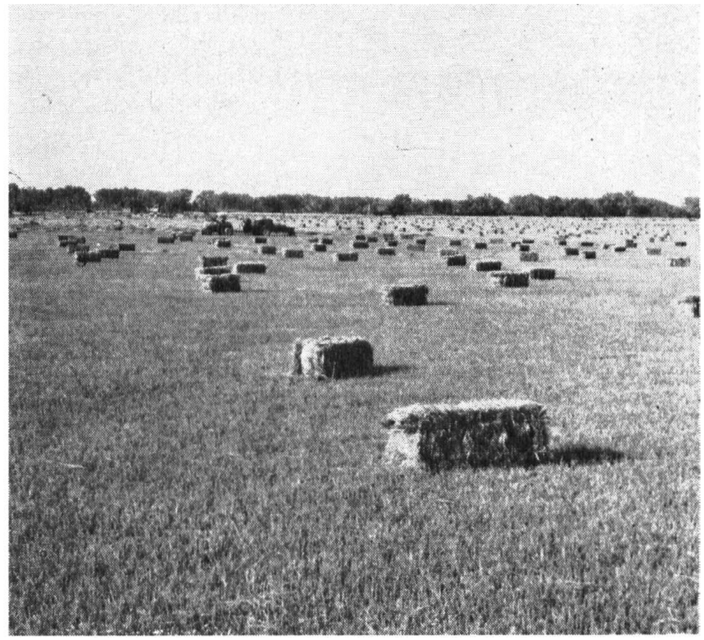

Figure 10.—**Wann soils produce some of the best yields of native hay in Hall County.**

Wann fine sandy loam, deep (0 to 2 percent slopes) (3Wb).—The profile of this soil is like that described for the Wann series. Most areas are nearly level, but a few are in low, hummocky positions.

About one-fourth of the areas are crossed by many drains and small channels from 1 to 3 feet deep and 3 to 15 feet wide. Most of these channels can be crossed with farm machinery, but, because it is difficult to cultivate the channeled areas, most of them are in native pasture. Leveling for irrigation is expensive.

This soil is in dryland capability unit IIw–6, irrigated capability unit IIw–6, the Subirrigated range site, and the Moderately wet woodland site.

Wann fine sandy loam (0 to 1 percent slopes) (Wb).—This soil has a profile similar to that described for the Wann series, but the coarse sand and gravel is at depths of only 20 to 36 inches. Most of this soil is in permanent pasture. If cultivated, it will produce fair to good crops, especially during years of above-normal rainfall. During dry years, it is droughty. Crops respond well to irrigation. This soil is in dryland capability unit IIw–6, irrigated capability unit IIw–6, the Subirrigated range site, and the Moderately wet woodland site.

Wann loam, deep (0 to 3 percent slopes) (3Wm).—The profile of this soil is similar to that described for the Wann series. It has a loam surface horizon.

About 15 percent of this soil is in areas cut by numerous drains and channels that carry surface water to larger streams. These drains are from 1 to 3 feet deep and from 3 to 15 feet wide and can be crossed by farm machinery. The soil in the drains is slightly shallower, darker, and more silty than the normal Wann loam. This soil is difficult to farm because of the numerous drains. It is in dryland capibility unit IIw–4, irrigated capability unit IIw-4, the Subirrigated range site, and the Moderately wet woodland site.

Wann loam, deep, saline (0 to 1 percent slopes) (2Wm).—This soil has a profile similar to that described for the Wann series. It has a loam surface horizon and is saline. White crystals are common in the surface layer and upper subsoil. Because of salinity, most areas are in permanent pasture or hay meadow. If these areas are overgrazed, saltgrass quickly replaces the more palatable grasses. Small depressions, covered with a dense growth of saltgrass, cover from 10 to 30 percent of the pasture areas. This soil is in dryland capability unit IVs-1, irrigated capability unit IIIs-1, the Saline lowland range site, and the Moderately saline or alkali woodland site.

Wann loam (0 to 1 percent slopes) (Wm).—This soil is similar to Wann loam, deep, but its sand-gravel substratum is only 20 to 36 inches from the surface. The water-holding capacity is low. During dry seasons crops tend to burn quicker than on deeper soils of the Wann series. This soil is in dryland capability unit IIw-4, irrigated capability unit IIw-4, the Subirrigated range site, and the Moderately wet woodland site.

Wood River series

The Wood River series consists mainly of deep, nearly level soils on stream terraces. They have a dark, thick silt loam surface horizon over a prismatic-blocky claypan subsoil. The most extensive areas are in the west-central part of the county, between Cairo and Wood River, but some are on side slopes along shallow, intermittent drains where erosion is moderate. The soils formed on the high stream terraces in yellowish, wind-deposited silts and in mixed alluvium and loess, underlain by mixed sand and gravel, on the lower terraces north of Grand Island.

Wood River soils have a friable, slightly acid to medium acid, gray to very dark grayish-brown surface horizon, 10 to 20 inches thick. The slightly alkaline, slowly permeable subsoil is grayish-brown to dark grayish-brown silty clay. It is very firm when moist and is 15 to 24 inches thick (fig. 11). This horizon is commonly referred to as a hardpan or claypan because of its silty clay texture and prismatic-blocky structure. The hardpan limits the effective root zone of many crops, particularly under dryland farming. Soluble salts occur beneath the hardpan in the areas on the higher terraces. These salts are too far from the surface to be harmful to crops. Free lime normally occurs in the substratum. Wood River soils are imperfectly drained.

Wood River soils are closely associated with Exline, Hall, and Hord soils. They have a thicker surface layer and subsoil than the Exline soils, and the soluble salts, where present, are deeper in the profile. Wood River soils have a finer textured subsoil and more strongly developed blocky structure (claypan) than the Hord and Hall soils. They lack the calcareous surface layer, the high-lime subsoil, and the high ground-water level of the Silver Creek soils.

Wood River soils are suited to most crops commonly grown in the county. Crops respond well to irrigation. Where the soil is leveled, the areas of exposed subsoil respond like alkali spots; they are difficult to farm, respond slowly to treatment, and produce poor crops.

Nearly all the acreage of Wood River soils is cultivated. In native pastures the vegetation is a mixture of tall and short grasses, mostly buffalograss, blue grama, and big and little bluestem.

Wood River silt loam, 0 to 1 percent slopes (Wr).—This soil, one of the most extensive in the county, has a profile like that described for the Wood River series. A few areas adjacent to the silty uplands southwest of Cairo are occasionally flooded following heavy rains. This soil is in dryland capability unit IIs-2, irrigated capability unit IIs-2, the Silty range site, and the Silty to clayey woodland site.

Wood River silt loam, 1 to 3 percent slopes (WrA).—This soil is similar to Wood River silt loam, 0 to 1 percent slopes. The range in slope is 1 to 3 percent, but slopes of about 2 percent are dominant. This soil is in dryland capability unit IIs-2, irrigated capability unit IIIe-2, the Silty range site, and the Silty to clayey woodland site.

Wood River silt loam, 3 to 7 percent slopes, eroded (WrB2).—This soil occurs on short side slopes along natural intermittent drains in the west-central part of the county.

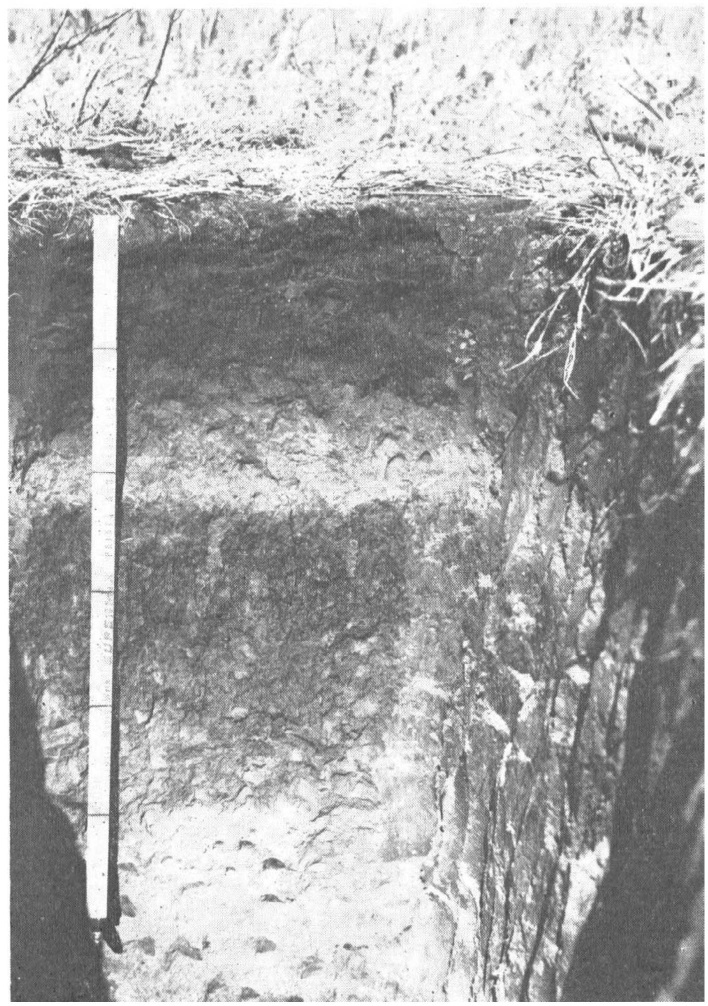

Figure 11.—Note the 14-inch surface horizon in this Wood River soil underlain by a weak subsurface horizon (A_2) of a grayish color. The blocky claypan slows root development and effective water movement.

It is more sloping than the adjoining, nearly level Wood River soils and has a thinner surface horizon. In many places tillage has mixed the original surface layer with the subsoil. The surface soil is thickest on the upper part of the slope and thinnest on the lower part, where the volume of moving water is greatest.

This soil has a spotty, dark- and light-colored appearance because erosion has not been uniform. Surface runoff is rapid. Fertility and the supply of organic matter are moderately low. Where the subsoil is exposed, crop response is poor. This soil is in dryland capability unit IIIe–2, irrigated capability unit IIIe–2, the Silty range site, and the Silty to clayey woodland site.

Wood River-Exline fine sandy loams (0 to 3 percent slopes) (W–Es).—About 80 percent of this complex is Wood River fine sandy loam, and about 20 percent is Exline fine sandy loam. The Exline fine sandy loam occurs as buffalo wallows in pastures or as slick spots in cultivated fields. These small depressions are 100 to 300 feet apart.

The soils of this complex produce fair to good yields of corn, wheat, alfalfa, and sorghum. Crops respond well to irrigation. This complex is in dryland capability unit IVs–1, irrigated capability unit IIIs–1, the Saline lowland range site, and the Moderately saline or alkali woodland site.

Wood River-Exline silt loams (0 to 1 percent slopes) (W–E).—This complex is about 80 to 85 percent Wood River silt loam and 15 to 20 percent Exline silt loam. The Exline soil occurs as buffalo wallows in pastures or as alkali spots in cultivated fields. The alkali spots are similar to other alkali areas in Exline-Wood River silt loams. The soil between these spots is similar to that described for the Wood River series. The areas of Exline soil, 50 to 400 feet apart, are too numerous to be mapped separately. A few minor areas of Hall and Hord soils are included in this complex.

Fair to good yields of corn, wheat, sorghum, and alfalfa are grown. Yields are considerably higher under irrigation. Barnyard manure and other organic matter will make the alkali spots more friable. Gypsum or sulfur will lower the alkalinity and salinity and make them more productive and thus improve yields. This complex is in dryland capability unit IVs–1, irrigated capability unit IIIs–1, the Saline lowland range site, and the Moderately saline or alkali woodland site.

Use and Management of Soils

This section consists of eight main parts. The first part explains the land capability classification used by the Soil Conservation Service. It also lists and briefly defines the capability units grouped for dryland farming in Hall County.

The second part discusses each dryland capability unit. Suitable uses of the soils in the units are suggested and certain practices of management are given.

The general management of irrigated soils is discussed in the third main part, and in the fourth part is a discussion of the management of each capability unit of irrigated soils.

The fifth part consists of a table listing, for principal crops, the estimated yields that can be expected under two levels of management on each soil in the county. These estimated yields are listed for both dryland and irrigated farming.

The sixth part discusses the use and management of rangeland, and the seventh part describes the use and management of woodland. The eighth part discusses the engineering uses of soils.

Capability Groups

Capability grouping is a system of classification used to show the suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs and limitations of the soils, the risk of damage to them, and their response to management. There are three levels above the soil mapping unit. These are the capability unit, the subclass, and the class.

Unit.—The capability unit, which also can be called a management group of soils, is the lowest level of the capability grouping. A capability unit is made up of soils that are similar in the management they need, in the risk of damage, and in general suitability for use.

Subclass.—The next broader grouping, the subclass, is used to indicate the dominant kind of limitation. The letter symbol "e" indicates that the main limiting factor is risk of erosion; "w" means that there is excess water or poor drainage; "s" means that the soils are shallow, droughty, or low in fertility; and "c" means that climate is so cold or dry it limits use of the soils. In this county all subclasses are used.

Class.—The broadest grouping, the land class, is identified by Roman numerals. All the soils in one class have limitations and management problems of about the same degree, but of different kinds as shown by the subclass. All of the land classes except classes I and VIII may have one or more subclasses.

Eight broad classes are provided in the national capability classification.

Class I soils are those that have the widest range of use and the least risk of damage. They are level or nearly level, productive, well drained, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly but do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping; consequently, they need moderate care to prevent erosion. Other soils in class II may be slightly droughty, or slightly wet, or somewhat limited in depth.

Class III soils can be cropped regularly but have a narrower range of use than those in class II. They need even more careful management.

In class IV are soils that should be cultivated only occasionally or only under very careful management.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops, but they can be used for pasture or range, for woodland, or for wildlife.

Class V soils are nearly level and gently sloping but are droughty, wet, low in fertility, or otherwise not suitable for cultivation.

Class VI soils are not suitable for crops because they are steep or droughty or otherwise limited, but they give fair yields of forage or forest products. Some soils in class VI can, without damage, be cultivated enough so that fruit trees or forest trees can be set out or pasture crops seeded.

Class VII soils provide only poor to fair yields of forage and have characteristics that limit them severely for this use. Fair to good yields of forest products may be obtained.

Class VIII soils have practically no agricultural use. Some of them have value as watersheds, as wildlife habitats, or for scenery.

The capability classification of a dry-farmed soil in Hall County may differ from the capability classification of the same soil if the soil is irrigated. Therefore two sets of classification must be made—one for the soils in the county if they are dry farmed and the other for the soils if they are irrigated.

In the following outline, the capability classes, subclasses, and units of dry-farmed soils in Hall County are given, along with a brief description of the kind of soils in the classes, subclasses, and units.

Class I.—Soils with few limitations that restrict their use. These soils are suitable for intensive cultivation over long periods without special practices other than those used for good farming.
- Unit I–1: Deep, nearly level, easily worked soils.

Class II.—Soils with some limitations that reduce the choice of plants or require some conservation practices. They are suitable to tilled crops, pasture, or woodland.
- Subclass IIc: Deep and moderately deep soils on which climate is the principal hazard.
  - Unit IIc–1: Nearly level, easily worked soils on which limited rainfall is the principal hazard.
- Subclass IIe: Soils subject to moderate erosion.
  - Unit IIe–1: Deep, very gently sloping, easily worked soils.
  - Unit IIe–3: Nearly level to very gently sloping, slightly sandy soils.
- Subclass IIs: Deep and moderately deep, nearly level soils with soil limitations.
  - Unit IIs–2: Nearly level claypan soils.
  - Unit IIs–5: Nearly level, moderately deep, moderately sandy soils.
- Subclass IIw: Deep and moderately deep soils limited by excess water.
  - Unit IIw–3: Deep and moderately deep soils of the bottom lands that are occasionally flooded.
  - Unit IIw–4: Deep and moderately deep, easily worked soils of the bottom lands that are occasionally wet due to a high water table.
  - Unit IIw–6: Deep and moderately deep, slightly sandy soils that are occasionally wet due to a high water table.

Class III.—Soils with severe limitations that reduce the choice of plants or require special conservation practices or both. These soils are suitable to tilled crops, pasture, woodland, or wildlife.
- Subclass IIIe: Nearly level to gently sloping soils where erosion is the main hazard.
  - Unit IIIe–1: Deep and moderately deep, easily worked soils on gentle slopes. Erosion is slight to moderate.
  - Unit IIIe–2: Deep claypan soils on gentle slopes.
  - Unit IIIe–3: Deep and moderately deep, slightly sandy soils on gentle slopes.
  - Unit IIIe–5: Deep, very sandy soils on nearly level to very gentle slopes.
- Subclass IIIw: Deep soils limited by excess water.
  - Unit IIIw–2: Moderately wet claypan soils in depressions or bottom lands.
  - Unit IIIw–5: Very sandy soils of the terraces and bottom lands that are moderately wet due to a high water table.

Class IV.—Soils with very severe limitations that restrict the choice of plants, require very careful management, or both. They are suited to tilled crops, but need intensive treatment. They are also suited to pasture, woodland, or wildlife.
- Subclass IVe: Soils subject to severe erosion.
  - Unit IVe–1: Deep, easily worked soils on gentle to moderate slopes.
  - Unit IVe–5: Very sandy soils on gentle slopes.
- Subclass IVs: Shallow soils or soils with a saline or alkali condition.
  - Unit IVs–1: Nearly level to very gently sloping, moderate to strongly saline or alkali soils.
- Subclass IVw: Soils that are wet due to frequent overflow or an occasional high water table.
  - Unit IVw–2: Upland and terrace depressional soils that are subject to frequent overflow.

Class V.—Soils with limitations, other than erosion hazard, that are impractical to remove and that limit their use largely to pasture, range, woodland, or wildlife cover.
  - Unit Vw–1: Very wet lowlands.

Class VI.—Soils with severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture or range, woodland, or wildlife cover.
- Subclass VIe: Moderately steep to steep soils.
  - Unit VIe–1: Deep, silty soils on moderately steep to steep slopes. Erosion may be slight to severe.
  - Unit VIe–5: Deep, very sandy soils on strong slopes.
- Subclass VIs: Soils affected by strongly saline or alkali conditions.
  - Unit VIs–1: Nearly level to gently sloping soils affected by strongly saline or alkali conditions.
- Subclass VIw: Soils limited by excess water.
  - Unit VIw–1: Medium-textured and slightly sandy shallow soils that are wet because of a high water table.

Class VII.—Soils that are unsuited for cultivation and have very severe limitations that restrict their use largely to grazing, woodland, or wildlife.
- Subclass VIIe: Soils subject to severe erosion.
  - Unit VIIe–5: Loose, very sandy and sandy soils on nearly level slopes or on choppy dunes.
- Subclass VIIs: Shallow, dry soils.
  - Unit VIIs–4: Medium-textured to gravelly shallow soils on nearly level to steep slopes.

Class VIII.—Soils and land forms not suitable for commercial production of crops, grasses, or woody plants.

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Management of Dry-farmed Soils by Capability Units

Although the climate of Hall County is subhumid, most of the soils in the county can be cultivated without irrigation. But as much rainfall as possible must be retained and used efficiently. In dryland farming, attempts are made to prevent excessive evaporation, to slow runoff and increase infiltration, and to prevent excessive use of moisture by plants and the loss of soil through wind erosion.

In the following pages management of dry-farmed soils according to capability units is discussed. Important general characteristics of the soils in each capability unit are given, and the soils in the unit listed. Then suitable uses are named and effective management suggested.

CAPABILITY UNIT I-1 (DRYLAND)

These are deep, nearly level, easily worked soils. They have a dark, medium-textured surface horizon and are on the bottom lands. They absorb and store water well and readily release it to crops. Erosion is not a problem. Yields are high. The soils in this unit are:

Cass loam, deep.
Volin silt loam.

These soils are suited to corn, sorghum, wheat, oats, barley, sweetclover, alfalfa, and tame grasses. Row crops may be used for a maximum of 3 consecutive years in the crop rotation. Growing of legumes in the cropping system is advantageous to the farmer who raises livestock.

To maintain fertility and tilth, alfalfa and bromegrass can be seeded every 5 to 6 years and left for 3 or 4 years. Barnyard manure will help to maintain fertility and tilth. Fertility can be maintained by using large amounts of commercial fertilizer, but this is less desirable. More nitrogen will be needed during wet years than in dry years. All crop residues should be returned to the soil. Burning of wheat stubble is not desirable. Stubble mulching is a good means of controlling erosion, increasing moisture infiltration, and improving tilth. The main requirement is maintaining fertility and tilth.

Nitrogen is needed on all the soils. Soil tests will show the need for lime and the amount to apply.

CAPABILITY UNIT IIc-1 (DRYLAND)

These deep and moderately deep, nearly level, easily worked soils occur on uplands and stream terraces. They have a medium-textured surface soil and moderately fine to moderately coarse textured subsoil. They absorb and store water well and release it readily to plants. Erosion is a minor problem. The soils in this unit are:

Hall silt loam, 0 to 1 percent slopes.
Hall-O'Neill complex, 0 to 1 percent slopes.
Hastings silt loam, 0 to 1 percent slopes.
Hord silt loam, 0 to 1 percent slopes.
Hord silt loam, thin solum variant, 0 to 3 percent slopes.
Holdrege silt loam, 0 to 1 percent slopes.
Kenesaw silt loam, 0 to 1 percent slopes.
Ortello loam, 0 to 1 percent slopes.

These are some of the best agricultural soils in the county. They are suited to corn, wheat, sorghum, oats, barley, sweetclover, alfalfa, and tame grasses. Under dryland farming, all of the available rainfall is needed and practices should be followed that will use it efficiently.

Row crops can be grown for a maximum of 2 consecutive years. A legume sod crop, such as alfalfa or an alfalfa-bromegrass mixture, can be included in the cropping system once every 6 years and allowed to remain for 3 or 4 years. It will help to control erosion, to build up the supply of organic matter, and to increase fertility. Such management is particularly advantageous to farmers who raise livestock. A less desirable alternative is to maintain fertility by using large amounts of commercial fertilizer. Under such management, all crop residues must be returned to the soil. More nitrogen is needed during wet years than during dry years. Burning of wheat stubble is not desirable.

Stubble mulching will leave most of the crop residues on the surface and help to reduce evaporation. This is important on the O'Neill and Ortello soils. Green-manure crops, such as sweetclover, are useful on the Kenesaw soil, which is low in organic matter and in fertility.

The soils of this management unit need nitrogen. Soil tests will show the need for lime.

CAPABILITY UNIT IIe-1 (DRYLAND)

These are deep, easily worked, very gently sloping soils on uplands, stream terraces, and colluvial slopes. They have a medium-textured, dark-colored surface horizon over a moderately fine, medium, or moderately coarse subsoil. They absorb and store water well and release it readily to plants. If cultivated and not protected, they are subject to some sheet and wind erosion. The soils in this unit are:

Hall silt loam, 1 to 3 percent slopes.
Hastings silt loam, 1 to 3 percent slopes.
Hobbs silt loam, 1 to 3 percent slopes.
Holdrege silt loam, 1 to 3 percent slopes.
Hord silt loam, 1 to 3 percent slopes.

These soils are suited to corn, wheat, oats, barley, sweetclover, sorghum, alfalfa, and tame grasses. Row crops may be grown a maximum of 2 consecutive years.

Widely spaced terraces used with grassed waterways and contour farming is a desirable way of controlling erosion. These practices may be used together or individually but are more effective if used together. Stubble mulching increases infiltration of moisture, helps to control erosion, improves tilth, and enables the farmer to use the available moisture more efficiently. Green-manure crops and barnyard manure will increase organic-matter content and fertility.

A legume grown in the cropping system every 6 years will help to maintain fertility and to decrease erosion. For the farmer who uses legumes in feeding livestock, this system has particular advantages. A less desirable alternative for the cash-crop farmer is to maintain fertility by using large amounts of commercial fertilizer and returning all crop residues to the soil. Burning stubble is not desirable.

Nitrogen will increase the yields of most nonleguminous crops. Soil tests will show any need for lime. These are good agricultural soils if proper measures are taken to control erosion and to reduce loss of water.

CAPABILITY UNIT IIe-3 (DRYLAND)

These are deep and moderately deep, nearly level to very gently sloping sandy soils on bottom lands, stream terraces, and uplands. They have a surface horizon of dark-colored, fine sandy loam and a lighter colored subsoil ranging from sandy loam to silty clay loam. They are subject to wind erosion when not protected by crop residues or growing crops. Water erosion is active on some of the longer slopes.

The sandy surface layer makes these soils easy to cultivate. They absorb water well and readily release it to plants. Because of their coarse texture, they are somewhat droughty. The soils in this unit are:

- Cass fine sandy loam, deep.
- Cass fine sandy loam.
- Hord-O'Neill complex, 0 to 1 percent slopes.
- O'Neill sandy loam, 0 to 1 percent slopes.
- Ortello fine sandy loam, 0 to 3 percent slopes.
- Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.
- Thurman fine sandy loam, 0 to 3 percent slopes.

These soils are suited to corn, wheat, rye, sorghum, sweetclover, alfalfa, vetch, and tame grasses. Practices are needed to control both wind and water erosion. Cover crops of rye and vetch, wind stripping, shelterbelts, and stubble mulching will help control wind erosion. Where slopes are more than 1 percent, widely spaced terraces, together with contour farming and grassed waterways, will help control water erosion.

A legume may be included in the cropping system at least once every 6 years. Row crops are not desirable for a period longer than 2 consecutive years. The soils are normally low in organic matter. Use of legumes, green-manure crops, and barnyard manure will help to increase organic-matter content and to reduce the hazard of wind erosion.

Normally, the soils need nitrogen fertilizer for highest yields. They are low in lime and phosphorus, which should be applied in amounts indicated by soil tests.

CAPABILITY UNIT IIs-2 (DRYLAND)

This unit consists of deep, nearly level soils on stream terraces and uplands. They have a silty surface horizon and a claypan subsoil. The subsoil restricts penetration of roots and water. Slow infiltration and slow permeability make the soils somewhat droughty during dry weather. The soils are fertile and productive during years of above-normal rainfall. The soils in this unit are:

- Butler silt loam.
- Wood River silt loam, 0 to 1 percent slopes.
- Wood River silt loam, 1 to 3 percent slopes.

These soils are suitable for corn, wheat, sorghum, and alfalfa. They are particularly well suited to wheat because it matures before the hot, dry summer weather. These soils are better suited to small grains and sorghum than to corn.

Grasses and legumes are beneficial because they keep the soils more open, or porous, and thus allow better penetration of water. Legumes are needed in the cropping system about once every 6 years. Row crops may be used for a maximum of 2 years. Stubble mulching helps to improve tilth and to reduce evaporation. Barnyard manure increases the supply of organic matter and improves fertility. Where these soils occur on slopes of more than 1 percent, widely spaced terraces, together with contour farming, will intercept runoff and reduce soil erosion.

The soils are normally acid in their surface horizon and require lime for legumes. Nitrogen is needed for highest yields of crops other than legumes.

CAPABILITY UNIT IIs-5 (DRYLAND)

These are moderately deep, nearly level, easily worked soils of bottom lands and stream terraces. They have a dark, medium-textured surface horizon and a loamy subsoil, and they are underlain by coarse sands and gravel at depths of 20 to 36 inches. These soils absorb water well and readily release it to crops, but, because of the coarse substratum, cannot store large amounts of water for plant use. The hazard of erosion is slight. The soils in this unit are:

- Cass loam.
- O'Neill loam, 0 to 1 percent slopes.

Corn, sorghum, wheat, and tame grasses are suited to these soils. Alfalfa can also be grown, but stands do not last many years because the soils are droughty.

Row crops may be used for a maximum of 3 consecutive years in a crop rotation. Legumes and grass grown in the crop rotation are advantageous to the farmer who raises livestock. Barnyard manure will help to maintain fertility and tilth. A less desirable alternative program for the cash-crop farmer is to maintain fertility by using commercial fertilizer. All crop residues must be returned to the soil under such a program. Stubble mulching is a desirable way of reducing evaporation, improving tilth, and controlling erosion. The main needs of these soils are maintaining fertility and tilth and conserving moisture. Soil tests will indicate if lime is needed and the amount to apply.

CAPABILITY UNIT IIw-3 (DRYLAND)

Hobbs silt loam, 0 to 1 percent slopes, is the only soil in this capability unit. This is a deep soil on bottom lands that are occasionally flooded for short periods of time. At times, crops are damaged by scouring or deposits left by floods and planting is delayed. This soil is sometimes damaged by water from higher, adjacent uplands. During dry years, this additional water may be of some benefit to crops if it does not come too fast.

Corn, sorghum, wheat, sweetclover, alfalfa, and tame grasses are suitable crops for this soil. Alfalfa is damaged by excess water.

To conserve fertility, include a legume in the cropping system at least once every 6 years. Row crops should be limited to 3 consecutive years. In some fields, diversion terraces will intercept runoff that can cause soil erosion and damage crops. These diversions will carry excess water slowly to an outlet or spread it on native grass where erosion will not occur. Drainage ditches must be maintained to remove excess water and to prevent drowning of crops.

Nitrogen is required for all crops except legumes. Lime is ordinarily not needed.

CAPABILITY UNIT IIw-4 (DRYLAND)

This unit consists of deep and moderately deep, imperfectly drained soils that have a medium-textured surface horizon. They are in nearly level and channeled areas on the bottom lands. The ground-water level fluctuates between 2 and 8 feet from the surface. During normal or wet years, the water table is high enough to limit crop yields. During dry years, crops may obtain some benefit from the water table because it subirrigates the soils. These soils absorb water well and readily release it to plants. Erosion is not a problem. The soils in this unit are:

Leshara silt loam.
Wann loam, deep.
Wann loam.

The crops suited to these soils are corn, wheat, sorghum, alfalfa, sweetclover, and tame grasses. Many areas remain in native meadow. Yields of hay are good.

The principal problem is the wetness of the soils during some seasons. It is difficult to correct this, but in some areas surface ditches or tile drains may be used. Legumes or legume-grass mixtures can be included in the cropping system to increase the supply of organic matter, to improve tilth, and to maintain fertility. Limit row crops to 3 consecutive years.

These soils are high in lime. Alfalfa ordinarily shows increased yields following application of phosphate. On some of the soils, corn has shown good response to the application of zinc; sorghum responds to the application of iron. Nitrogen is necessary for high yields.

CAPABILITY UNIT IIw-6 (DRYLAND)

These are deep and moderately deep, imperfectly drained soils with a fine sandy loam surface horizon. They are level or nearly level and are on bottom lands and stream terraces. Their subsoil is a light-colored fine sandy loam. A substratum of medium to moderately fine texture is in a few of the soils. The ground-water level, or a perched water table, is sufficiently high to cause the soils to be wet for part or all of the year. This wetness frequently causes late spring planting. Poor aeration and cool soil temperatures cause slow growth. During most years, yields are lower on these soils than on the well-drained soils of similar texture. During seasons of drought, however, crops normally obtain some benefit from the additional moisture in these soils, and yields are higher than on the well-drained areas. Farmers refer to these soils as subirrigated. The soils in this unit are:

Leshara fine sandy loam.
Ovina fine sandy loam.
Wann fine sandy loam, deep.
Wann fine sandy loam.

Corn, wheat, sorghum, alfalfa, sweetclover, and tame grasses are suited to these soils. Alfalfa yields are lowered because of the high water table and may be drowned out in the lowest areas during wet years.

The principal problem is wetness during some seasons. If a legume or legume-grass mixture is included in the cropping system about once every 6 or 8 years, tilth and fertility will be maintained more easily. Barnyard manure will increase production.

Ordinarily, these soils have a sufficiently high content of lime. Nitrogen is needed; phosphate normally increases yields of alfalfa. Limited soil tests have shown zinc may be beneficial for corn.

CAPABILITY UNIT IIIe-1 (DRYLAND)

All the soils of this unit have a medium-textured (mostly silt loam) surface horizon and are only slightly to moderately eroded. The subsoil ranges from moderately fine to moderately coarse but in most of the soils is medium textured. Slopes range from 2 percent on young soils with thin surfaces to 3 to 6 percent on deep and moderately deep older soils of the stream terraces and uplands. Some areas are hummocky. Water is readily absorbed and is easily released for crops. Water erosion is the main problem. Most of these soils are low in organic matter. The soils in this unit are:

Hall silt loam, 3 to 7 percent slopes, eroded.
Hastings silt loam, 3 to 7 percent slopes, eroded.
Holdrege silt loam, 3 to 7 percent slopes.
Holdrege silt loam, 3 to 7 percent slopes, eroded.
Hord silt loam, 3 to 7 percent slopes, eroded.
Hord silt loam, thin solum variant, 3 to 7 percent slopes.
Kenesaw silt loam, 1 to 3 percent slopes.
Kenesaw silt loam, 3 to 7 percent slopes.
O'Neill loam, 3 to 5 percent slopes, eroded.

Corn, wheat, sorghum, alfalfa, sweetclover, and tame grasses are suited to these soils. A legume or a legume-grass mixture included in the cropping system once every 6 or 8 years will help maintain tilth and fertility. Row crops should not be grown for more than 2 consecutive years if maximum tilth and desirable structure are expected. Barnyard manure will increase organic-matter content. Water erosion is the main problem. Contour farming, along with terraces and grassed waterways, will slow runoff and control soil loss. Stubble mulching leaves most of the crop residues on the surface and controls erosion. It also increases infiltration of moisture and the supply of organic matter.

Nitrogen is needed for high yields on all crops other than legumes. Apply lime in amounts indicated by soil tests.

CAPABILITY UNIT IIIe-2 (DRYLAND)

This capability unit consists of one soil, Wood River silt loam, 3 to 7 percent slopes, eroded. This deep soil of the stream terraces has a silt loam surface horizon and a clayey (claypan) subsoil. It occurs on slopes of 3 to 7 percent and is moderately eroded. The subsoil is very hard when dry and very sticky when wet. It restricts penetration of roots and moisture and makes the soil droughty. Surface runoff is rapid. If left unprotected, this soil is subject to wind and water erosion.

This soil is suited to wheat, sorghum, alfalfa, sweetclover, and tame grasses. Wheat is suitable because it matures before the hot, dry weather of July and August. This soil is not suited to corn.

Because this soil occurs in long, narrow areas on short side slopes along drains, it will need to be handled as a separate unit. Soil and water losses can be minimized with contour farming. On longer slopes, one or more terraces can be established. Grassed waterways will prevent the formation of gullies and will carry water downslope to disposal areas, or to larger drainage channels, without causing erosion. Grow legumes in the cropping system once in every 5 or 6 years to allow their roots to penetrate, aerate, and keep the subsoil open. Grow row crops not more than 2 years in succession. Applying barnyard manure, growing of green-manure crops, and turning under of crop residues are desirable ways of making the more severely eroded areas more friable.

Nitrogen is required. Ordinarily, lime is not needed.

CAPABILITY UNIT IIIe-3 (DRYLAND)

These deep and moderately deep sandy soils occur on stream terraces and uplands. They are dominantly gently sloping, but some areas are hummocky. Most of these soils have a dark, fine sandy loam surface horizon and a lighter colored fine sandy loam subsoil. The substratum is variable. The soils absorb water well and readily release it to plants. They are easy to cultivate but are slightly to moderately susceptible to wind and water erosion. In content of organic matter and in fertility they range from low to medium. The soils in this unit are as follows:

O'Neill sandy loam, 3 to 7 percent slopes, eroded.
Ortello fine sandy loam, 3 to 7 percent slopes.
Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.
Thurman fine sandy loam, 3 to 7 percent slopes.

These soils are suitable for corn, wheat, rye, sorghum, alfalfa, vetch, sweetclover, and tame grasses. Rye and vetch are suitable as cover crops or green-manure crops.

Control of wind and water erosion is necessary to maintain productivity. Terracing, contour farming, stripcropping, grassed waterways, stubble-mulch tillage, and field shelterbelts are desirable where they can be used. Terracing, however, may not be feasible in the hummocky areas. Legumes or a legume-grass mixture included in the cropping system once in every 5 or 6 years will build up the supply of organic matter, improve fertility, and control wind erosion. Cropping systems in which row crop does not follow row crop are most useful in building up the soil and controlling erosion.

Nitrogen is normally required. Supplies of lime and phosphorus are normally low; fertilizer containing these can be applied in amounts indicated by soil tests.

CAPABILITY UNIT IIIe-5 (DRYLAND)

This unit consists of soils of the bottom lands, stream terraces, and uplands that have a very sandy surface layer and subsoil. They are nearly level to very gently sloping soils marked by low hummocks. The soils absorb water well and readily release it to plants. Water-holding capacity is low, and permeability is rapid. Erosion is normally slight, but a few areas may be moderately eroded. These soils are easy to cultivate; when the surface is dry, they must be protected from wind erosion. Conserving moisture, maintaining fertility, and preventing erosion are the main requirements for successful crop production. The soils in this unit are:

Sarpy loamy fine sand, 0 to 3 percent slopes.
Thurman loamy fine sand, 0 to 3 percent slopes.
Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.

Corn, wheat, sorghum, rye, vetch, sweetclover, alfalfa, and tame grasses are suited to these soils. Rye and vetch are used as cover crops or green-manure crops.

Legumes grown in the cropping system will help control erosion by keeping the soils covered throughout the year. They also improve the fertility and increase the supply of organic matter. Barnyard manure also increases the supply of organic matter and improves fertility. A year of a row crop may be followed by a legume or a small grain. It is difficult to terrace these soils because they are hummocky and very sandy. Contour farming is practiced where it is suitable to the soils. Field shelterbelts and stubble mulching are desirable in controlling wind erosion.

Nitrogen is necessary for high yields of crops other than legumes. Soil tests normally show a need for lime.

CAPABILITY UNIT IIIw-2 (DRYLAND)

This unit consists of imperfectly drained soils on bottom lands and stream terraces that have a fine-textured subsoil and of depressional soils on uplands that are occasionally flooded. The soils of this capability unit have a thick, dark, silt loam surface layer and a clayey subsoil. The surface soil is easily worked and absorbs water readily, but the subsoil does not absorb water well and releases it slowly to plants. The soils are fertile, but crops are sometimes lost because of flooding and lack of surface drainage. In wet years, these soils are occasionally too wet to cultivate. The soils in this unit are:

Fillmore silt loam.
Lamoure silt loam.
Silver Creek silt loam.

These soils are suitable for corn, sorghum, wheat, and tame grasses. They are better suited to sorghum and wheat than to corn or alfalfa. Alfalfa is seldom grown on the Fillmore soil because of the risk of its drowning out.

Terraces constructed on surrounding higher soils will control accumulation of runoff on these lower lying areas. Surface drainage by open ditches will remove much of the excess water. In some years, good crops are grown because they benefit from water draining onto these soils.

Nitrogen is needed for highest yields. Lime is not needed on the Silver Creek or the Lamoure soil; soil tests will indicate the need for lime on the Fillmore soil. Phosphate normally increases yields on the Lamoure soil.

CAPABILITY UNIT IIIw-5 (DRYLAND)

This unit consists of imperfectly drained soils on the stream terraces and bottom lands. They have a surface layer of loamy fine sand and a subsoil of stained or blotched loamy sand. The substratum of the soils in this capability unit is variable. The Elsmere soil in South Loup River Valley has a surface layer of fine sandy loam, which overlies a subsoil of blotched fine sand.

These soils have a fairly high, or perched, water table that keeps them wet part or all of the year. Above the water table, they absorb moisture well and readily release it to plants. The soils in this unit are:

Elsmere fine sandy loam.
Elsmere loamy fine sand.
Ovina loamy fine sand.

These soils are suitable for corn, sorghum, alfalfa, sweetclover, and tame grasses. Alfalfa yields are lowered because of the high water table. The main hazards on these soils are susceptibility to blowing and the high water table that sometimes causes extreme wetness, particularly in early spring. Drainage will correct the wetness, although in dry years, the water table is of value because it subirrigates crops. During normal years, poor soil aeration, cool temperatures, and wetness cause late spring planting and reduce yields. A good vegetative cover on the soils will control wind erosion. Rye and vetch are sometimes used as cover crops and green-manure crops.

A legume or a legume-grass mixture is needed in the cropping system every 5 or 6 years and it ought to remain for 2 or 3 years. One year of a row crop followed by legumes, small grain, or cover crops will control blowing, increase organic matter, and raise the level of fertility. Barnyard manure will have the same effect.

Nitrogen is needed for highest yields, but lime is seldom needed. Apply phosphate in amounts indicated by soil tests.

CAPABILITY UNIT IVe-1 (DRYLAND)

This unit consists of severely eroded silty soils with slopes of 3 to 6 percent and all silty soils with slopes of 7 to 11 percent. They occur on uplands, mainly on short side slopes along intermittent drains or draws. Their subsoils are medium or moderately fine textured. These soils are easily worked. All are well drained and moderately permeable. They absorb and store water well and readily release it to plants. Surface runoff is rapid. Sheet and gulley erosion are serious hazards. The soils in this unit are:

Colby silt loam, 7 to 11 percent slopes.
Hastings complex, severely eroded.
Holdrege silt loam, 7 to 11 percent slopes.
Holdrege silt loam, 7 to 11 percent slopes, eroded.
Holdrege-Colby complex, severely eroded.

Corn, sorghum, alfalfa, sweetclover, wheat, and tame grasses are suited to these soils. Grow legumes and grass about 75 percent of the time because of the severe erosion hazard. Cultivate the soils for only 2 or 3 years, including 1 year of a row crop, before returning to a legume or grass. These soils need terracing, contour farming, grassed waterways, and measures for control of gullies. Barnyard manure will increase soil fertility and decrease runoff. Stubble mulching will increase infiltration of moisture and add organic matter.

Nitrogen is needed for highest yields of crops other than legumes. The soils normally contain sufficient lime.

CAPABILITY UNIT IVe-5 (DRYLAND)

These very sandy soils occur on hummocky areas where the dominant range in slopes is between 4 and 6 percent. The soils are on bottom lands, stream terraces, and uplands. They have a surface layer and subsoil of loamy fine sand. The substratum is variable. The soils absorb and release water readily. The water-holding capacity is low, and permeability is rapid. These soils are easy to cultivate, but their surface must be protected from wind erosion, as they blow easily. Keeping the soils covered with grass most of the time will maintain fertility, conserve moisture, and control erosion. The soils can be cropped occasionally, but only for a year or two at a time, and then reseeded to grass or a long-term legume. The soils in this unit are:

Sarpy loamy fine sand, 3 to 7 percent slopes.
Thurman loamy fine sand, 3 to 7 percent slopes.
Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.

When these soils are cultivated, alfalfa, wheat, and tame grasses are the best crops because they keep the ground covered most of the year. Rye and vetch are well suited as cover crops or green-manure crops. Row crops are not suited, because of the severe hazard of wind erosion and the need for farming up and down the slopes. Ordinarily, terracing is not practical because the soils are hummocky and very sandy. Returning all crop residues to the soil and adding barnyard manure will improve the fertility and organic-matter content. Nitrogen will improve the yield of crops other than legumes. Lime is needed for legumes.

CAPABILITY UNIT IVs-1 (DRYLAND)

These are nearly level to very gently sloping, deep soils on stream terraces and bottom lands. They are moderately affected by salinity and alkalinity. The surface layer of these soils is silt loam, loam, or sandy loam. The subsoil ranges from sandy loam to clay.

The salinity and alkalinity are not uniform on these soils. Light-colored alkali spots, or "slick spots," occur in fields. In pastures, these spots occur in slightly depressed areas. The salinity and alkalinity are fully described for the individual soils. In cultivated fields, the surface soils are puddled where they are alkaline. Erosion is slight on these areas. The soils in this unit are:

Lamoure silt loam, saline.
Leshara silt loam, saline.
Wann loam, deep, saline.
Wood River-Exline fine sandy loams.
Wood River-Exline silt loams.

Most of the acreage in this capability unit is cultivated, but many areas are in native grass. Yields are low because of salinity and alkalinity. Sorghum, wheat, sweetclover, alfalfa, and tame grasses are the most suitable crops. Corn yields are fair on areas between alkali spots. Barnyard manure and crop residues will make these spots more friable. Sulfur or gypsum may be used on a trial basis to reduce the alkalinity and salinity. Legumes may be used in the cropping system about once every 5 or 6 years to improve tilth and fertility.

Nitrogen is needed for highest yields. Apply lime to the Wood River-Exline soil areas in amounts indicated by soil tests. Sufficient lime is available in the Lamoure, Leshara, and Wann soils. Do not overgraze pastures. Overgrazing allows saltgrass to crowd out the more palatable grasses. Rotation grazing is desirable. Control of weeds and brush is needed in most areas.

CAPABILITY UNIT IVw-2 (DRYLAND)

The only soil in this unit is Scott silt loam. It occurs in depressions on the stream terraces and uplands and is flooded frequently. The surface layer, a thin silt loam, overlies a dense, dark-colored claypan subsoil. The soil absorbs water slowly and slowly releases it to plants.

The main hazard is excess water for part or all of the year. If the soil is cultivated deeper than 6 inches, the sticky, clayey subsoil is exposed.

Where this soil can be drained, corn, sorghum, wheat, and tame grasses can be grown successfully. Alfalfa is sensitive to flooding and is not often grown. If satisfactory drainage cannot be established, this soil should be left in native grass and used for whatever pasture it will support.

Surface drainage is difficult in some places, for the areas are commonly in basins and there may be no satisfactory place to drain the water. Terraces on the adjacent higher land will control much of the runoff and reduce flooding of this soil. Surface drainage ditches can be used in some places.

Available crop residues and barnyard manure will make this soil more friable. Nitrogen is needed for highest crop yields.

CAPABILITY UNIT Vw-1 (DRYLAND)

In this capability unit are nearly level soils of the bottom lands that have a water table at or near the surface most of the year. These soils are too wet for cultivation. Their surface layer is mostly loam and fine sandy loam or silt loam. Their substratum is sand or mixed sand and gravel. The high water table determines the use and management of these soils. The soils in this unit are:

Barney loam.
Loup loam.

Most areas are in native pasture or hay. Loup soil is used only for the little pasture it will provide. Where the Barney and Loup soils are pastured, they develop boggy areas, which are indicated by small mounds 4 to 18 inches in height and 4 to 12 inches in diameter. In some places there are three or four of these mounds per square yard, and they lower the value of the land for pasture. When hay is spread on these areas, the cattle will trample the bogs and level the areas. The bogs develop only in pastured areas.

No special treatments are necessary. Apply phosphate in amounts indicated by soil tests. During some seasons, the soils are so wet that grazing may have to be limited. Proper stocking rates and rotation grazing will maintain the carrying capacity.

The vegetation on these soils consists mainly of tall sedges, sloughgrass, cattails, and wild ryegrass. In the native hay meadows, there normally is some big and little bluestem and switchgrass.

CAPABILITY UNIT VIe-1 (DRYLAND)

This unit consists of deep, silty soils on slopes of 10 to 30 percent. Where these soils have not been cultivated, they have a thin surface horizon, but in areas that have been farmed, most of the original darkened surface layer has been removed by erosion. Water is readily absorbed, but, because of the steep slopes, runoff is very rapid and gulley erosion may be severe. In the severely eroded areas, the supply of organic matter and the fertility are low. The mapping units are:

Broken land.
Colby silt loam, 11 to 30 percent slopes.

Because of slope and susceptibility to erosion, these soils are suitable only for grass or trees. Areas already cultivated ought to be reseeded to native grasses. This is best done by first planting sweetclover or sudangrass and then sowing a mixture of native grasses in the stubble. The grass mixture may include big and little bluestem, western wheatgrass, blue grama, and side-oats grama. Some switchgrass can be added, as it does well in the draws and drains at the base of the steep slopes. Good grazing practices are necessary to get maximum production. Terraces are needed to control gulley erosion and to give the grass seedings a chance to get started. Seeding of waterways to sod, shaping of gullies, and building structures to control gullies are needed. These soils offer some good sites for dams that will provide water for livestock or for recreation.

CAPABILITY UNIT VIe-5 (DRYLAND)

The only soil in this capability unit is Thurman loamy fine sand, wind eroded. This very sandy soil is strongly sloping or rolling. The surface layer is a thin or thick, loamy fine sand; the subsoil is a loamy fine sand that is lighter colored than the surface layer. This soil is severely eroded and susceptible to further wind erosion if a good grass cover is not maintained. Water is absorbed rapidly. Fertility is normally low.

This soil is not suited to cultivation; it is rolling, very sandy, susceptible to wind erosion, and low in fertility. Areas already used for crops ought to be planted to a mixture of native grasses or to trees. Big and little bluestem, blue grama, side-oats grama, and sand lovegrass are best suited. Sweetclover may be seeded with the grasses to provide nitrogen.

Areas in grass must not be overstocked. Rotate grazing and sometimes defer grazing to allow the grasses to go to seed. Control weeds and brush.

CAPABILITY UNIT VIs-1 (DRYLAND)

These strongly saline-alkali soils are on stream terraces along the Platte River Valley. They are moderately wet. The surface horizon is thin silt loam or sandy loam and the subsoil is clay loam to clay of prismatic to columnar-blocky structure. The substratum is variable. These soils absorb water slowly and release it slowly to plants. The saline-alkali condition is not uniform. The highest concentrations occur in the small depressions in pasture areas or the slick spots in cultivated fields. These spots are 30 to 100 feet or more apart. Areas between the spots are moderately saline or alkali or are not affected. Under dryland management these soils are not suitable for cultivated crops because of high soluble salt content, high exchangeable sodium content, and high alkalinity. The soils in this unit are:

Exline-Wood River fine sandy loams.
Exline-Wood River silt loams.

These soils are best suited to grass. Salt- and alkali-tolerant vegetation grows best. Tall wheatgrass and western wheatgrass can be used to reseed areas already under cultivation. Proper stocking rates should be maintained because overgrazing tends to allow saltgrass to crowd out the more desirable species. Mowing the pastures regularly will destroy gumweed, goldenrod, and other large weedy plants. Some of the larger depressions can be artificially drained by surface ditching.

CAPABILITY UNIT VIw-1 (DRYLAND)

One land type, Alluvial land, is in this capability unit. This land type consists of silty or sandy soils of bottom lands that are not suitable for cultivation because they are frequently flooded or are broken into small units by crooked stream channels. Along the Wood River, these areas are covered with trees, brush, and weeds. Along Dry Creek, these areas support a fair growth of pasture grasses but are badly dissected by the meandering, deeply entrenched stream channel.

This land type is suitable for grass or trees. Good range management, such as proper stocking, rotation grazing, and deferred grazing, are needed for maximum yields. On flooded areas some reseeding of grasses is needed at times. Structures that will control gullies are necessary in some places. Where these areas are cultivated, they should be reseeded to native grasses. Switchgrass, Canada ryegrass, and similar grasses may be used along the Wood River. Blue grama, side-oats grama, big and little bluestem, and switchgrass may be used along Dry Creek.

CAPABILITY UNIT VIIe-5 (DRYLAND)

These soils occur on bottom lands, stream terraces, and uplands. The surface horizon is loose, single-grained fine sand, 4 to 12 inches thick. The subsoil is lighter colored fine sand. These soils are very low in organic matter and in fertility. Water-holding capacity is low. The soils absorb and release water readily to plants. When not covered with grass, they are unstable and must be carefully managed to prevent serious wind erosion. Most areas are stabilized with grass, but many small blowout troughs are included. The sands shift and drift with the wind. The soils in this unit are:

Platte-Sarpy complex.
Platte-Sarpy complex, channeled.
Sarpy fine sand.
Valentine fine sand.

These soils are best suited to grass. They require intensive range management, such as proper stocking, deferred grazing, rotation grazing, and control of weeds and brush. Animals will graze more uniformly with proper distribution of salt. In the blowout areas, reseeding to grass is important. While these areas are being revegetated, they should be fenced to keep livestock out. Sand lovegrass, sand dropseed, and prairie sandreed are suited to these soils. Vetch may be seeded with the grasses.

CAPABILITY UNIT VIIs-4 (DRYLAND)

These shallow soils are 10 to 20 inches thick over coarse sand or mixed sand and gravel. They occur on bottom lands and terraces. These soils have a surface horizon of loam, sandy loam, or gravelly loam. In places this horizon changes rapidly to a thin, lighter colored horizon of stratified loam and sandy loam, or it grades directly to the sand and gravel of the substratum. Slopes range from nearly level to steep. The water table of the Platte and the Wann soils fluctuates between 2 and 8 feet; that of the Meadin soils is at about 30 feet. Water is readily absorbed, but the soils store very little for plants. The soils are droughty and, normally, low in fertility. The soils in this unit are:

Meadin loamy sand, 3 to 11 percent slopes.
Meadin sandy loam, 0 to 1 percent slopes.
Platte loam.
Platte-Wann complex.
Platte-Wann complex, channeled.

These soils are best suited to grass. With good conservation practices, the more desirable grasses will crowd out the annuals and poorer grasses. Proper stocking, deferred grazing, and rotation grazing are needed for the pastures. Mowing will help to prevent weeds from using the available moisture and going to seed. The pastures will need to be reseeded if native grasses are not left to produce seed.

CAPABILITY CLASS VIII (DRYLAND)

Riverwash is the only land type in capability class VIII, which is not subdivided into units. It consists of sand bars within and adjacent to the channels of the Platte and South Loup Rivers and Sweet Creek. These areas are 1 to 3 feet above the normal stream flow. They are coarse sand or mixed sand and gravel. Ordinarily, there is little darkening of this material, but in some of the more stabilized areas, a 2- to 8-inch surface horizon is darkened with organic matter.

Some areas are barren except for small willows and cocklebur. Cottonwood trees, brush, and common reedgrass grow in many places. Wind erosion is active where vegetation is not established. The land is subject to some change when streams are high, and it is frequently flooded.

This land is used for whatever pasture it will provide. It furnishes excellent wildlife habitats. Hunting "blinds" are common. Proper wildlife management is needed to preserve good hunting and fishing on this land.

General Management of Irrigated Soils

In this subsection general problems of management on irrigated soils are discussed. The next subsection discusses specific management of irrigated soils by capability units.

Conservation irrigation

Conservation irrigation is the using of irrigated soils and irrigation water in a way that insures high production without the waste of either water or soils. Practices of irrigation, cropping, and other management are used that will keep the land fit for continuous agriculture.

To the farmer, this can mean savings in water, control of erosion, higher crop yields, lower costs, and continued production. For many farmers, conservation irrigation may mean a start towards solving problems of alkalinity, waterlogging, and other adverse conditions that are common in Hall County.

Most of the problems on irrigated farms can be solved in practical ways. This requires an accurate knowledge of soil, topography, water needs, and of the capability of the land to be irrigated. An irrigator who practices conservation irrigation has control of the water from the time it enters the ditches or pipe until only a small part leaves his field as waste water. He is able to apply the water in such a way that it wets the rooting zones of the plants with the least possible loss from runoff or percolation.

Some farms may need a different method of irrigation, drainage control, or land leveling. The available water supply generally can be made to go farther if delivery schedules and soil management are improved. Soil-building crops can be grown in rotation with cash crops to add organic matter to the soil. Adequate fertilization according to crop needs helps maintain fertility.

Irrigation methods

Water is distributed to the field by furrows, corrugations, borders, controlled flooding, or sprinklers.

Furrow irrigation.—This is the most common method for irrigating row crops. Water is applied to furrows between the plant rows by gated pipe or by siphon tubes (fig. 12). If the land is nearly level, the furrows may be straight. On steeper soils, contour furrows are used to carry the water across rather than down the slope. Furrows may also be used where the land has been bench leveled.

Corrugation irrigation.—In this method, the water is applied to small furrows by gated pipe or siphon tubes. From the small furrows it moves laterally through the soil and wets the entire field. This method is suited to close-growing crops, particularly alfalfa (fig. 13).

Border irrigation.—This method uses the principle of controlled flooding. A sheet of water is advanced down a narrow strip between low ridges or borders, and the water is absorbed by the soil as it advances. To prevent ponding, the strip should be well leveled and the grade should be uniform. The ridges ought to be low and rounded so they can be planted with the strips.

Controlled flooding.—In this method, water is flooded downslope between closely spaced field ditches. Frequent openings in the ditches allow a uniform distribution of water over the field.

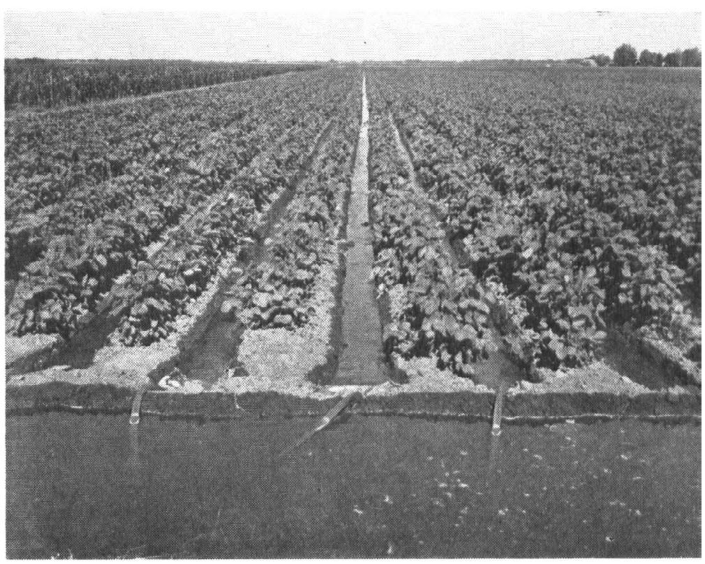

***Figure 12.*—Furrow irrigation of soybeans using siphon tubes. The soil is O'Neill loam, 0 to 1 percent slopes.**

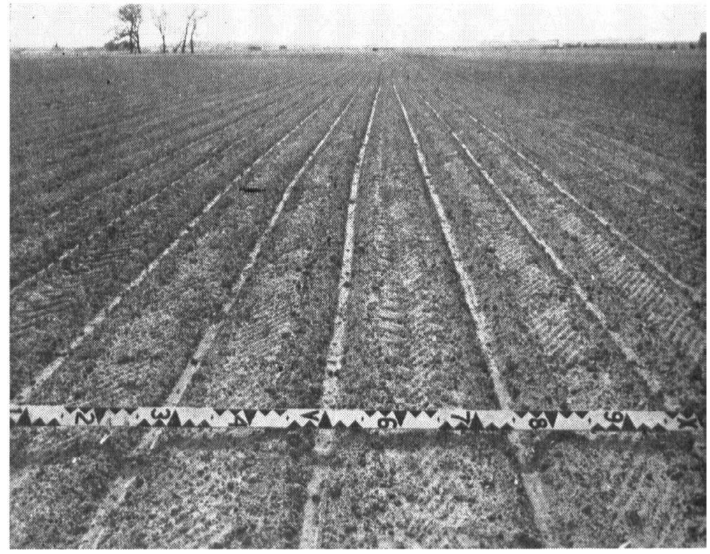

***Figure 13.*—These corrugations were installed immediately after planting of alfalfa in fall.**

Sprinkler irrigation.—Water is applied by sprinklers at a rate that the soil will absorb without runoff. Sprinklers can be used on the steeper slopes as well as on more level areas (fig. 14). Because the water can be carefully controlled, sprinklers have special uses in conservation irrigation, such as establishing pastures on steep slopes. In summer, however, much water is lost through evaporation. Wind drift causes uneven water application. In 1955, sprinkler type systems were used on only 3.5 percent of all irrigated land in Hall County.

Planning irrigation on your farm

Because conditions on no two farms are alike, each farm must be planned separately. The plan selected is affected by the desires, abilities, and financial status of the operator. Therefore, it is impossible to present any one plan that can be used for all irrigated farms. Most farmers will need some technical help to plan their irrigation system. The Soil Conservation Service furnishes specialists to the local Soil Conservation District who help

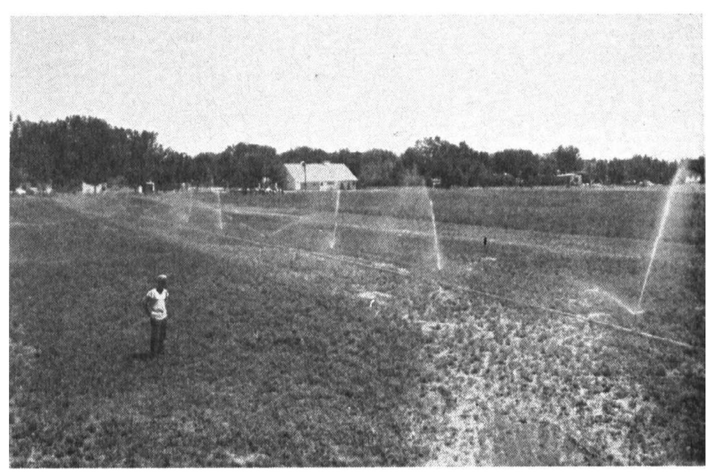

***Figure 14.*—Sprinklers irrigating a moderately deep Wann soil in pasture and hay. This soil is well suited to sprinkler irrigation. It is relatively shallow to sand and gravel.**

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farmers to plan the various phases of an irrigation system. The final decisions, however, must be those of the farmer. When a farmer and a conservationist work out an irrigation system, they take the following steps:

1. Take an inventory of the soil and water resources. The soil map and this report give the soil characteristics, but the amount of water available has to be determined.
2. Prepare a topographic map of the field or farm.
3. Using the topographic map and the soil map, they plan the irrigation system. This includes:
   a. Location of wells.
   b. Division of fields.
   c. Row direction.
   d. Length of run.
   e. Methods of distributing water.
   f. Location of irrigation ditches.
   g. System of drainage.
   h. Location of structures.
   i. Determining where leveling is needed and the approximate depth of cuts and fills.
   j. Choosing suitable crops.
   k. Determining where to take soil samples for fertility analysis.
4. Prepare the land. Water needs to be applied with maximum efficiency. The land may need to be leveled.
5. Make efficient use of the irrigation water. Adjust the size of the stream so that it will not cause erosion but will apply just enough water to satisfy crop demands.

Soil problems on irrigated soils

The addition of irrigation water to land presents some soil problems that are peculiar to this type of farming. In the following paragraphs, some of these problems are discussed in relation to the soils on which they are most likely to occur. Some general statements about how to overcome these problems are also given.

SOIL DEPTH AND TEXTURE

The depth and texture of the soil largely influence the amount of available moisture that a soil can store for plant use. This storage capacity influences the frequency of irrigation, size of streams, and size of farm laterals. In general, the inches of available moisture that can be stored in 1 foot of soil for the most common textures are as follows:

Sand	0.25 to 0.75
Loamy sand	0.75 to 1.25
Sandy loams	1.00 to 1.75
Silt loam and loam	1.50 to 2.00
Clay loams	1.75 to 2.25
Clays	2.00 to 3.00

The irrigable soils of Hall County that have the lowest moisture-holding capacity are those of the Meadin, Platte, O'Neill, Elsmere series, and the moderately deep soils of the Cass and Wann series. Ortello, Thurman, Valentine, and Sarpy soils are deep and sandy and have a fairly low water-holding capacity.

The roots of some plants are deep, while those of others are shallow. The depth of root penetration affects the frequency of irrigation and the amount of water applied in each irrigation. If the roots of a plant can extract water from as deep as 6 feet, it is more efficient to apply a greater amount of water at each irrigation than is applied for shallow-rooted crops and to irrigate less frequently. Irrigation runs can be longer when water is applied to soils planted to deeper rooted crops, or the size of the irrigation streams can be smaller.

Crops commonly grown in Hall County and the effective maximum depth of their roots are:

Alfalfa and sweetclover	6 feet.
Corn, sorghum, small grains, and sugar beets	4 feet.
Potatoes, soybeans, and pasture	3 feet.

The depth of water required in each irrigation depends on how much water the soil can hold, and on how nearly all of the available water is taken from the soil by plants between each irrigation. A medium-textured soil normally stores about 2 inches of usable water per foot of soil depth. Generally not more than 1 inch is removed before another irrigation if the crop is to grow rapidly. Thus, if the rooting zone of a crop is 3 feet, about 3 inches of water should be stored each irrigation. Assuming a farm efficiency of 75 percent and that the crop would use 0.2 inch of moisture per day, the 3 inches stored would last 15 days. The irrigation interval would be every 2 weeks.

Plants do not withdraw moisture at equal rates from all depths of the root zone. Soil texture and depth have little or no influence on the pattern of moisture extraction. In the first one-fourth of depth from the surface, a plant extracts 40 percent of the total moisture extracted. In the next lower one-fourth depth, the plant extracts 10 percent less, or 30 percent of the total. In the upper one-half of the root zone, therefore, a plant extracts 70 percent of the total moisture. In the third one-fourth of depth, the plant extracts 20 percent of the moisture; and in the lowest one-fourth of depth, the plant extracts only 10 percent of the total moisture.

In the management of irrigated crops, the effective rooting depth is considered, not maximum root development. Plants first take in the moisture nearest the surface and then that at lower depths.

TOPOGRAPHY

Topography, particularly slope, greatly influences the choice of irrigation methods. Although large earth-moving equipment can change many land surfaces, the cost of this change must be considered. The cost must be weighed against the improvement in soil conditions and the resulting increased crop yields.

Even though soil erosion may be reduced by proper management, the effect of slope is of major importance. But on soils in Hall County that are considered irrigable, normally, the disadvantages of unfavorable slope can be overcome by the proper choice of water distribution.

SOIL FERTILITY

Irrigation frequently increases crop yields two to six times those on the unirrigated soil. Producing the extra yields, however, causes larger amounts of nutrients to be removed from the soil. On irrigated soils, maintaining fertility is extremely important. The amounts of commercial fertilizer needed depend on the soil type, soil management, quality of irrigation, and the crop yield expected. The nutrient content of soils can be determined by soil tests, which ought to be taken before applying phosphate, lime, and potash. Imperfectly drained soils of bottom lands—Wann, Leshara, Lamoure, and Platte—may respond to zinc when it is applied to fields planted to corn. Zinc should be applied on a small test plot the first year to observe its effect on the crop. The county agent can tell you how much and in what form to apply the zinc.

Yields are reduced on Wood River soils where land-leveling cuts are deep and the subsoil is exposed. These areas react like alkali spots and are difficult to improve, but additions of organic matter in any form make them more friable and more receptive to water. Heavy fertilization improves the stalk growth of the crop. Gypsum or sulfur can neutralize the excessive amounts of sodium in some of these spots.

Where deep cuts are made on the more friable soils, such as Holdrege, Hastings, Hord, Hall, and Kenesaw, large additions of fertilizer and organic matter will normally improve these areas in a year or two. Zinc may also improve them, but it should be used on a trial basis.

DRAINAGE

Once the land is properly leveled for surface drainage, little extra effort or expense is needed to prepare it for any of the various methods of surface irrigation. Surface drainage is especially important on the saline-alkali soils and on all the imperfectly drained soils in the county if these soils are to be dry enough for seedbed preparation early in spring. Excess water normally must be removed from irrigated lands. This removal may be a problem on the claypan soils of the Wood River and Exline series. If the soils become waterlogged, subsurface drainage is required. Root development is restricted because aeration is poor. Also, the soils are slow to warm up in the spring. These problems may exist in the imperfectly drained Ovina, Silver Creek, Wann, Leshara, Lamoure, and Platte soils. Subsurface drainage can be by open ditches or tile drains.

The water table must be kept low enough to allow adequate water to be removed from the root zone and to prevent soluble salts from moving upward into the root zone. Control of the water table is difficult. Normally shallow-rooted crops are grown on areas that may be affected by a high water table. If alfalfa or another deep-rooted crop is grown, these crops may need to be replanted every 2 or 3 years or used in rotation with more shallow-rooted crops.

In draining the depressional soils of the Fillmore and Scott series, terraces can be constructed on the higher lying surrounding soils to protect the depressions from excess water. Surface ditches can be constructed if a good disposal area is available.

Excessive use of irrigation water will increase the drainage problem and reduce yields. Proper scheduling of irrigations is necessary.

EROSION CONTROL

Another serious problem is how to apply irrigation water without washing away the soil. Uncontrolled irrigation water can strip away the soil at an alarming rate. If the soil structure is improved, normally the rate that irrigation water is absorbed is increased. Soil erosion on irrigated land can be reduced by planting grass-legume mixtures in a long-time cropping system, plowing under green-manure crops and crop residues, stubble mulching, and adding barnyard manure.

On sloping lands, the proper choice of methods for distributing the water is most important. Terraces, along with contour furrows, are suggested for all row crops where the slope exceeds 1 percent. Careful maintenance is necessary on irrigated land that is cultivated on the contour. Overirrigation tends to wash away plant nutrients and small particles of soil. This type of erosion is controlled by the rate of application and the length of run. Bench leveling will also control erosion on deep soils where the slopes are 1 to 5 percent.

SALINITY AND ALKALINITY

Soils that have a high ground-water level commonly have saline and alkali problems. On the bottom lands, the problem is primarily salinity, and in winter and spring bottom-land soils are commonly covered with a white crust of soluble salts. Because rains late in spring and irrigation water tend to wash away and leach the salts, soils that receive water from these sources seldom have a serious crop loss resulting from salts.

On the stream terraces of the Platte River Valley the Exline soils are affected by both soluble salts and high alkalinity. The alkali problem may be one of high pH, high amounts of exchangeable sodium, or both. When the water table is low because of drought or excessive pumping from wells, the leaching caused by normal applications of irrigation water lowers the salinity and alkalinity. The use of barnyard manure and other forms of organic matter make the soils more friable and their intake of water more rapid. Sulfur and gypsum can be used to neutralize some of the salts and sodium in the soil. Salt-resistant crops do best on these soils. The saline and alkali soils need more frequent irrigations than areas of normal soils because the intake of water and the availability of moisture to plants is low. Careful land leveling will maintain adequate surface drainage.

In areas where the water table is continuously high and saline-alkali conditions are severe, the land can be planted to a grass such as tall wheatgrass.

Management of Irrigated Soils by Capability Units

A soil under irrigation generally needs management that differs from that needed by the same soil when it is dry farmed. For this reason, soils in the county that are suited to irrigation are usually placed in capability units that differ from the units in which they are placed if they are dry farmed.

In the outline that follows are the capability classes, subclasses, and units of soils in Hall County that are suitable for irrigated farming.

Class I.—Soils with few limitations that restrict their use for irrigation.
- Unit I-1: Deep, nearly level, easily worked soils.

Class II.—Soils with some limitations for irrigation. Some special practices may be required for efficient irrigation.
- Subclass IIe: Very gently sloping soils subject to moderate erosion.
  - Unit IIe-1: Deep, very gently sloping, easily worked soils.
  - Unit IIe-3: Nearly level to very gently sloping, slightly sandy soils.
- Subclass IIs: Soils with slight limitations due to soil properties.
  - Unit IIs-2: Nearly level claypan soils.
  - Unit IIs-5: Nearly level, moderately deep, easily worked soils.
- Subclass IIw: Soils with limitations due to excess water.
  - Unit IIw-4: Deep and moderately deep, easily worked soils of bottom lands.
  - Unit IIw-6: Deep and moderately deep, slightly sandy soils of bottom lands.

Class III.—Soils with severe limitations for irrigation. Special practices are necessary for efficient irrigation.
- Subclass IIIe: Gently sloping soils subject to severe erosion.
  - Unit IIIe-1: Deep and moderately deep, easily worked soils.
  - Unit IIIe-2: Deep claypan soils.
  - Unit IIIe-3: Deep and slightly sandy soils.
- Subclass IIIs: Soils with severe limitations due to soil properties.
  - Unit IIIs-1: Nearly level, moderately saline or alkali soils.
- Subclass IIIw: Soils with severe limitations due to excess water.
  - Unit IIIw-2: Moderately wet claypan soils.
  - Unit IIIw-5: Moderately wet very sandy soils.

Class IV.—Soils with very severe limitations for irrigation. Irrigation may be limited or special practices required.
- Subclass IVe: Soils subject to very severe erosion.
  - Unit IVe-1: Deep silty soils on moderately steep to steep slopes.
  - Unit IVe-5: Very sandy soils on very gentle to gentle slopes.
- Subclass IVs: Soils with very severe limitations due to soil properties.
  - Unit IVs-1: Strongly saline or alkali soils.
  - Unit IVs-4: Shallow, slightly sandy soils.
- Subclass IVw: Soils with very severe limitations due to excess water.
  - Unit IVw-2: Depressional soils subject to frequent flooding.

In the following pages, each irrigated capabilty unit is discussed separately. The soils are listed in each unit, and characteristics they have in common are described. Crops suited to the soils in the units are named and suitable management for the soils is suggested.

CAPABILITY UNIT I-1 (IRRIGATED)

These deep, nearly level soils occur on bottom lands, stream terraces, and uplands. They have a medium-textured surface horizon and a moderately fine, medium, or moderately coarse textured subsoil. The substratum varies from place to place. Erosion is slight. The soils absorb water well and release it readily to plants. Depending on the depth of the soil, water-holding capacity ranges from moderate to low. These soils are easily worked. They have few restrictions under irrigation (fig. 15).

***Figure 15.*—Immediately after leveling this class I land (Hord silt loam) in fall, it is irrigated. This practice insures sufficient moisture for spring planting.**

The soils in this unit are:

Cass loam, deep.
Hall silt loam, 0 to 1 percent slopes.
Hall-O'Neill complex, 0 to 1 percent slopes.
Hastings silt loam, 0 to 1 percent slopes.
Holdrege silt loam, 0 to 1 percent slopes.
Hord silt loam, 0 to 1 percent slopes.
Hord silt loam, thin solum variant, 0 to 3 percent slopes.
Kenesaw silt loam, 0 to 1 percent slopes.
Ortello loam, 0 to 1 percent slopes.
Volin silt loam.

These soils are well suited to irrigation and the production of corn, sorghum, alfalfa, soybeans, potatoes, sugar beets, and tame grasses.

If high fertility is maintained, alfalfa, grass, or a bromegrass-alfalfa mixture may be grown once every 6 or 8 years. Row crops should not be grown more than 4 consecutive years. Under such management, the livestock farmer can use the hay on the farm and return barnyard manure to the soil.

Legumes improve fertility, tilth, and water intake; they reduce erosion and help control weeds.

Recent experiments indicate that fertility also can be maintained by using large quantities of commercial fertilizer but no legumes in a rotation. Under this system, return all crop residues to the soil. In time organic matter, tilth, and fertility will be seriously reduced if corn is sold for fodder, livestock is allowed to feed on corn and sorghum stalks, or alfalfa is sold to dehydrating plants. If legumes are not used in the cropping system, a high level of management is needed to maintain fertility.

These soils need little land leveling to prepare them for gravity irrigation. Deep cuts and backfilling normally are not needed. Irrigation laterals and field runs are necessarily short on Hall-O'Neill complex, 0 to 1 percent slopes. While plants are growing, irrigation ought to be almost continuous if the highest yields are to be obtained.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are border dikes, corrugations, furrows, controlled flooding, and sprinklers. Sprinkling is the only method suitable for all crops.

All these soils normally need nitrogen. Apply lime as indicated by soil tests.

CAPABILITY UNIT IIe-1 (IRRIGATED)

These are deep soils on stream terraces and uplands. They are nearly level to very gently sloping and are only slightly eroded. Their surface horizon is silt loam or loam, and their subsoil is silty clay loam, silt loam, or fine sandy loam. The soils absorb water well and release it readily to plants; they have a moderate water-holding capacity. On most of these soils, the slope is sufficient to cause water to move downhill gradually. Simple conservation practices are necessary to control loss of soil and water. The soils in this unit are:

- Hall silt loam, 1 to 3 percent slopes.
- Hastings silt loam, 1 to 3 percent slopes.
- Holdredge silt loam, 1 to 3 percent slopes.
- Hobbs silt loam, 0 to 1 percent slopes.
- Hobbs silt loam, 1 to 3 percent slopes.
- Hord silt loam, 1 to 3 percent slopes.
- Kenesaw silt loam, 1 to 3 percent slopes.

These soils are suited to irrigation and the production of corn, sorghum, alfalfa, soybeans, potatoes, sugar beets, and tame grasses. A cropping system may be used that includes alfalfa or a bromegrass-alfalfa mixture every 6 to 8 years, but these plants should not remain for more than 4 years. Alfalfa helps maintain productivity, tilth, organic matter, and capacity to take in water. An alternative practice is to apply large quantities of commercial fertilizer and to return all crop residues to the soil. If this practice is used, however, management must be at a high level so that fertility, tilth, and organic-matter content are not reduced.

The application of barnyard manure adds available plant nutrients and reduces erosion.

Some land leveling normally is needed to prepare the soils for gravity irrigation. This provides an even distribution of water, uniform drainage, and stimulates an even growth of plants. Plant corn, sorghum, potatoes, soybeans, or other row crops on the contour so that erosion is controlled and irrigation water conserved. The contour furrows may be supplemented with terraces.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are border dikes, corrugations, contour furrows, controlled flooding, and sprinklers. Sprinkling is the only method suitable for use on all crops.

Although most of these soils are high in natural fertility, they need large amounts of commercial fertilizer if they are irrigated. All the soils need nitrogen. Lime may be applied for legumes if soil tests indicate a need.

CAPABILITY UNIT IIe-3 (IRRIGATED)

These deep and moderately deep, nearly level or gently sloping soils occur on bottom lands, stream terraces, and uplands. They have a surface horizon of fine sandy loam or sandy loam and a subsoil of fine sandy loam to loamy fine sand. The substratum varies widely from place to place. The soils absorb water readily and are easily penetrated by air and plant roots. They are very easy to work but require frequent irrigations where the coarse substratum is high in the profile. Wind erosion, leaching of plant food by excessive irrigation, and depletion of fertility are the main hazards. The soils in this unit are:

- Cass fine sandy loam, deep.
- Cass fine sandy loam.
- Hord-O'Neill complex, 0 to 1 percent slopes.
- O'Neill sandy loam, 0 to 1 percent slopes.
- Ortello fine sandy loam, 0 to 3 percent slopes.
- Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.
- Thurman fine sandy loam, 0 to 3 percent slopes.

These soils are suited to irrigation and the production of corn, sorghum, alfalfa, soybeans, potatoes, sugar beets, and tame grasses. One-fourth of this land in a cropping sequence may be in alfalfa, grass, or a bromegrass-alfalfa mixture. These plants help maintain fertility, tilth, and organic matter and help decrease erosion. Cropping systems that do not provide a legume are not suitable on these sandy soils unless a high level of management is maintained. All crop residues should be left on the surface during winter to control erosion; they should be plowed under the following spring. Barnyard manure and green-manure crops increase fertility and water intake and control erosion.

Some land leveling is required to prepare the soil for gravity irrigation. On slopes of 2 percent, row crops ought to be grown on the contour so that the loss of soil and water is prevented. Irrigation structures may be needed to control erosion and to convey proper amounts of water.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are border dikes, straight or contour furrows, corrugations, controlled flooding, and sprinklers. Sprinkling is the only method suitable for use on all crops. Where sugar beets are planted, do not use contour furrows. Where corn, soybeans, potatoes, or sorghum are grown, the contour furrows should be supplemented with terraces or they should be bench leveled. On Cass fine sandy loam, and O'Neill sandy loam, 0 to 1 percent slopes, it is necessary to shorten the length of runs and to irrigate more often, because these soils are only moderately deep and have a low water-holding capacity.

If yields are to be high and fertility maintained, large amounts of commercial fertilizer, especially nitrogen, must be added. Lime and phosphate also may be needed.

CAPABILITY UNIT IIs-2 (IRRIGATED)

These soils occur on nearly level areas of stream terraces and uplands. They have a dark-colored silt loam surface horizon and a clay or claypan subsoil. The surface horizon is easily worked and absorbs water well, but the fine-textured subsoil restricts the movement of air and water and the development of roots. Overirrigation occurs on the lower side of the field because the subsoil absorbs water slowly. The soils in this unit are:

Butler silt loam.
Wood River silt loam, 0 to 1 percent slopes.

Crops suitable for irrigated areas are corn, sorghum, alfalfa, soybeans, potatoes, sugar beets, and tame grasses (fig. 16).

Figure 16.—Irrigated hybrid sorghum on Wood River silt loam, 0 to 1 percent slopes.

Alfalfa, grass, or a grass-alfalfa mixture may be included in the cropping system every 4 to 6 years. These deep-rooted crops tend to keep the subsoil more open than shallow-rooted crops. They also maintain fertility and tilth by adding organic matter. Barnyard manure and green manure help to reduce erosion and to maintain fertility, tilth, and capacity to take in water.

Some land leveling is necessary to prepare these soils for gravity irrigation. Where the subsoil is cut in leveling, undercutting and backfilling with 6 inches of topsoil should be considered. Wood River soils that have an exposed subsoil have low crop yields. The exposed areas react like alkali spots, and it is difficult to pull tillage implements through them. Organic matter will make these spots more friable, and gypsum and sulfur may reduce some of the harmful effects.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are border dikes, corrugations, furrows, controlled flooding, and sprinklers. Sprinkling is the only method suitable for use on all crops. Drainage ditches are needed at the lower edge of the field to carry away excess water and to prevent the drowning of crops.

If yields are to be high, large amounts of nitrogen are needed. Apply lime as indicated by soil tests.

CAPABILITY UNIT IIs-5 (IRRIGATED)

These soils are moderately deep and occur in nearly level areas on stream terraces and bottom lands. They have a medium-textured surface soil and a moderately coarse textured subsoil. The substratum is very coarse mixed sand and gravel. Erosion is slight. Air and water move readily through the soil, but plant roots are hindered by the substratum of sand and gravel that is at depths of 20 to 36 inches. Surface runoff is slow. The soils have a low water-holding capacity because of their moderate depth. They are easily worked and respond well to commercial fertilizers. The main problems of management are the loss of irrigation water through seepage and the maintenance of fertility. The soils in this unit are:

Cass loam.
O'Neill loam.

Crops suitable for irrigation of these soils are corn, sorghum, alfalfa, potatoes, sugar beets, soybeans, and tame grasses. Most of the commercial production of potatoes in the county is on O'Neill loam. Tilth and organic matter can be maintained by a cropping system that provides a row crop for 3 years, a small grain with a legume or grass-legume mixture for 1 year, and leaving the legume or grass-legume mixture for 1 to 5 years. All crop residue should be left on the surface during winter and plowed under the following spring. Barnyard manure and green-manure crops increase fertility and help control erosion.

If legumes are not included in the rotation, fertility and tilth can be maintained by high fertilization and returning all crop residue to the soil. The organic matter, tilth, and fertility will be seriously reduced if all grain and forage is continually removed from the land. If legumes are not included in the cropping system, a high level of management is needed to maintain fertility.

These soils need only a small amount of land leveling to prepare them for irrigation, but competent advice should be obtained before establishing the layout system. Because of the moderate depth to sand and gravel, the irrigation runs and field laterals need to be shorter than in deeper soils and the periods of irrigation more frequent.

Water can be applied by spiles, gated pipes, or siphon tubes and then distributed to the fields by several methods. Border dikes, corrugations, furrows, controlled flooding, and sprinklers are suitable methods.

All these soils normally need nitrogen for highest yields. Apply lime and phosphorus as indicated by soil tests.

CAPABILITY UNIT IIw-4 (IRRIGATED)

These soils are deep and moderately deep and occur on nearly level or slightly channeled bottom lands. They have a surface layer of silty clay loam, loam, or silt loam and a subsoil of silty clay loam, silt loam, or fine sandy loam. At depths of 20 inches to 6 feet is a mixed sand and gravel substratum. A high water table that fluctuates between 2 and 8 feet makes wetness the main hazard. Deep-rooted crops normally are short-lived because of this wetness. Generally, drainage and seedbed preparations are difficult. The soils in this unit are:

Leshara silt loam.
Wann loam, deep.
Wann loam.

The soils are suited to irrigation and the production of corn, alfalfa, sorghum, soybeans, sugar beets, and tame grasses. Because the alkaline soil reaction causes potato scab, they are not well suited to potatoes.

Alfalfa, grass, or a mixture of grass and alfalfa included in the cropping system every 6 to 8 years helps to maintain fertility, tilth, and the content of organic matter. Green-manure crops and barnyard manure conserve moisture, improve fertility, and prevent erosion.

Most of the acreage needs only a small amount of land leveling to prepare them for gravity irrigation. Water can be applied by spiles, gated pipes, and siphon tubes (fig. 17) and then distributed on the field by one of several methods of distribution. These methods are border dikes, corrugations, furrows, controlled flooding, and sprinklers. Sprinkling is the only method that can be used on all crops commonly irrigated in the county. Drainage may be necessary to remove excess surface water and to prevent the drowning of crops. Erosion is seldom a problem.

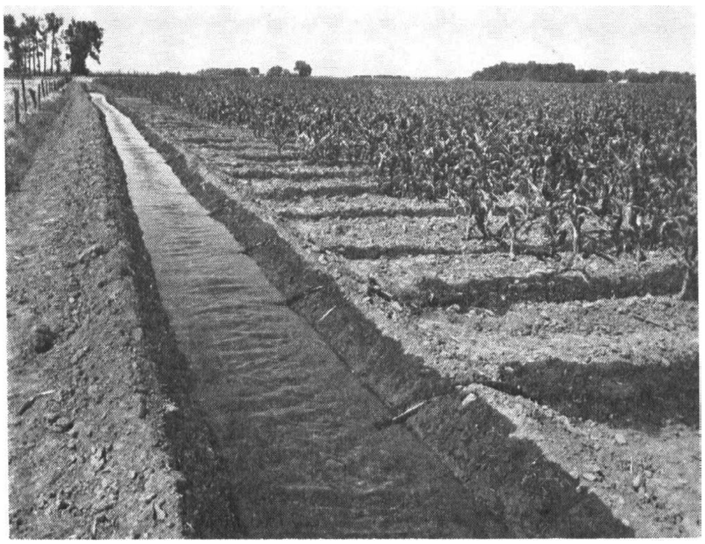

Figure 17.—Irrigating every other row of corn on Wann loam by using siphon tubes.

Nitrogen fertilizer is needed for highest yields and to maintain fertility. These soils have an adequate supply of lime. Phosphate fertilizer increases the yield of legumes, and zinc may increase the yield of corn.

CAPABILITY UNIT IIw-6 (IRRIGATED)

These soils occur on bottom lands and stream terraces. They are deep or moderately deep, nearly level, and sandy. Their surface layer and subsoil are fine sandy loam, and their substratum varies from place to place. They are affected by a water table that fluctuates between 2 and 8 feet. Because of wetness, deep-rooted crops normally do not last long. These soils are commonly too wet in spring for early seedbed preparation. Wind erosion is a hazard. The soils in this unit are:

Elsemere fine sandy loam.
Elsmere loamy fine sand.
Leshara fine sandy loam.
Ovina fine sandy loam.
Wann fine sandy loam, deep.
Wann fine sandy loam.

These soils are suited to irrigation and the production of corn, alfalfa, sorghum, sugar beets, soybeans, and tame grasses. Potatoes are not well suited because of the alkaline surface reaction.

Alfalfa, grass, or a grass-alfalfa mixture included in the cropping system every 6 to 8 years helps to maintain fertility, tilth, and organic matter, and to decrease erosion. Barnyard manure and green-manure crops help to control erosion, increase fertility, and improve tilth. By grazing tame pastures in rotation, grasses are permitted to meet their growth requirements and full use of the pastures is obtained.

These soils require only a little land leveling to prepare them for gravity irrigation. Water can be applied by siphon tubes, spiles, and gated pipes and then distributed on the field by one of several methods of distribution. These methods are border dikes, furrows, corrugations, contour ditches, controlled flooding, and sprinklers. Sprinkling is the only method that can be used on all crops.

Nitrogen fertilizer is needed if high yields are to be produced and fertility maintained. The soils contain an abundance of lime. Phosphate fertilizer on alfalfa increases yields. Zinc has produced some increased yields of corn.

CAPABILITY UNIT IIIe-1 (IRRIGATED)

These soils are deep or moderately deep and lie on gentle slopes on stream terraces and uplands. They have a medium-textured surface horizon and a moderately fine, medium, or moderately coarse textured subsoil. Their substratum varies from place to place. Surface runoff is rapid, and erosion is slight, moderate, or severe. Except for the O'Neill soils, these soils have good water-holding capacity and all are easily worked. They respond well to commercial fertilizers. Erosion, maintenance of fertility, and conservation of water are the main problems. The soils in this unit are:

Hall silt loam, 3 to 7 percent slopes, eroded.
Hastings silt loam, 3 to 7 percent slopes, eroded.
Hastings complex, severely eroded.
Holdrege silt loam, 3 to 7 percent slopes.
Holdrege silt loam, 3 to 7 percent slopes, eroded.
Holdrege-Colby complex, severely eroded.
Hord silt loam, 3 to 7 percent slopes, eroded.
Hord silt loam, thin solum variant, 3 to 7 percent slopes.
Kenesaw silt loam, 3 to 7 percent slopes.
O'Neill loam, 3 to 5 percent slopes, eroded.

Crops suitable on irrigated areas of these soils are corn, alfalfa, sorghum, potatoes, soybeans, sugar beets, and tame grasses. Plant row crops on the contour so that the loss of soil and water is lessened.

By limiting row crops to not more than 3 consecutive years and including alfalfa, grass, or a grass and alfalfa mixture in the cropping system every 4 to 6 years, fertility, tilth, and the capacity to take in water are maintained. When legumes or grass is not in the cropping system, return all crop residues to the soil and add large amounts of commercial fertilizer. Green-manure crops and barnyard manure increase organic matter, reduce erosion, and improve tilth. If they are grazed in rotation, tame pastures can be irrigated when the animals are off the pasture and the plants can meet their growth requirements.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are contour ditches, sprinklers, contour furrows, and corrugations. Sprinkling is the only method that is adapted for use on all crops commonly irrigated in the county. Contour furrows need to be supplemented with terraces, or the soils should be bench leveled. Sugar beets are not suited to contour furrow irrigation. Irrigation structures help to control erosion and convey water in proper amounts. These soils can be bench leveled.

Nitrogen fertilizer is needed if high yields are to be produced and fertility maintained. Soil tests will indicate the need for lime.

CAPABILITY UNIT IIIe-3 (IRRIGATED)

These deep and moderately deep, sandy soils occur on stream terraces and uplands on gentle slopes. Both the surface layer and subsoil horizon are moderately coarse textured. The substratum varies from place to place. Erosion is slight or moderate. Air, plant roots, and water move through the soils easily. These soils are easy to work but may need frequent irrigations. They are medium to low in organic matter. Wind erosion, leaching of plant food by excessive irrigation, and maintenance of fertility are the main hazards. The soils in this unit are:

- O'Neill sandy loam, 3 to 7 percent slopes, eroded.
- Ortello fine sandy loam, 3 to 7 percent slopes.
- Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.
- Thurman fine sandy loam, 3 to 7 percent slopes.

Crops suitable for irrigated areas of these soils are corn, sorghum, alfalfa, potatoes, sugar beets, and tame grasses. Row crops may be grown on the contour so that the loss of soil and water is lessened.

A cropping system that includes alfalfa, grass, or a grass-alfalfa mixture every 4 to 6 years improves and maintains productivity, tilth, and the supply of organic matter. It also decreases erosion. When a legume is not included in the cropping system, large amounts of fertilizer are needed to maintain fertility and all available crop residues should be returned to the soil. Barnyard manure and green-manure crops will build up the supply of organic matter. Stubble mulching will control rapid runoff, decrease evaporation, and help stabilize the soil against wind erosion. Rotation grazing of tame pastures is desirable because it permits irrigation while the livestock are off the field and also permits the plants to meet their growth requirements.

Except for sprinkler irrigation, some preparation of the soils is normally needed. Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are controlled flooding, sprinklers, contour furrows, and corrugations. The sprinkler method is the only system suited to all crops. Sugar beets are not suited to contour furrows. For corn, potatoes, soybeans, and sorghum, contour furrows may be supplemented by terraces or bench leveled. Irrigation structures may be necessary to adequately convey water and to control erosion.

Nitrogen fertilizer is needed to maintain fertility when these soils are irrigated. Soil tests will indicate the need for lime or phosphate.

CAPABILITY UNIT IIIs-1 (IRRIGATED)

This unit consists of deep soils that are moderately affected by saline or alkali conditions. These soils occur on bottom lands and stream terraces, generally in nearly level areas. Their surface horizon is sandy loam, loam, or silt loam, and their subsoil ranges from clay to clay loam. In many places there is a water table that fluctuates between depths of 3 and 8 feet. Erosion is slight. These soils normally take in water slowly, and tillage is difficult on the alkali spots. The salt or alkali accumulations reduce crop yields. The main problems on these soils are slow growth and poor stands of crops, accumulation of salt or alkali, and slow intake of irrigation water. Improvement of these soils is difficult. The soils in this unit are:

- Lamoure silt loam, saline.
- Leshara silt loam, saline.
- Wann loam, deep, saline.
- Wood River-Exline fine sandy loams.
- Wood River-Exline silt loams.

Crops suited to irrigation are corn, alfalfa, sorghum, soybeans, sugar beets, and tame grasses. Potatoes are not suited and soybeans do poorly.

Cropping systems that include the use of a legume or a grass-legume mixture help to maintain and improve productivity, tilth, and the capacity to take in water. They also add organic matter. Barnyard manure and green-manure crops also improve these soils. If legumes are not provided in the cropping system, a high level of management is needed to maintain productivity. All available organic matter should be returned to the soil, and adequate amounts of commercial fertilizer added.

Rotation grazing of tame pastures permits irrigation when the livestock are not on the land and also permits plants to meet their growth requirements.

The capacity of alkali spots to take in water can be increased by adding gypsum and sulfur. Tilth can be improved by adding corncobs, barnyard manure, and other forms of organic matter.

These soils need provisions for surface drainage if they are irrigated. Water stands on the alkali spots for weeks unless these areas are filled by land leveling or are drained artificially. Land leveling is normally desirable because it conserves water, stimulates an even growth of plants, helps regulate runoff, and provides uniform drainage. Because these soils have slow permeability, the rate water is applied must be slow. Frequent irrigations are necessary because plants cannot absorb water readily from saline or alkali soils.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by one of several methods of distribution. These methods are border dikes, corrugations, furrows, controlled flooding, and sprinklers. Sprinkling is the only method suited to all crops.

Nitrogen fertilizer is needed if yields are to be satisfactory and fertility maintained. Lime is not needed on the soils on the bottom lands. Soil tests will indicate the need for lime by soils on terraces.

CAPABILITY UNIT IIIe-2 (IRRIGATED)

These are deep soils on very gentle and gentle slopes on stream terraces and uplands. They have a silt loam surface horizon, a silty clay or clay (claypan) subsoil, and a substratum of various texture. Erosion ranges from slight to moderate. The surface horizon absorbs water readily, but the movement of water and the development of roots in the subsoil is restricted. Conservation measures should be used to control rapid surface runoff and erosion. Drainage is a problem unless provision is made to dispose of excess water. The soils in this unit are:

Wood River silt loam, 1 to 3 percent slopes.
Wood River silt loam, 3 to 7 percent slopes, eroded.

Crops suitable for irrigated areas are corn, alfalfa, soybeans, sorghum, potatoes, sugar beets, and tame grasses. Plant row crops on the contour to control loss of soil and water.

Every 4 to 6 years, plant alfalfa or a grass-alfalfa mixture to maintain and improve fertility, tilth, and the capacity to take in water. Where legumes are not included in the cropping system, all available crop residues should be returned to the soil. Apply adequate fertilizer. Barnyard manure and green-manure crops increase the supply of organic matter. Rotation grazing on tame pastures permits irrigation when the livestock are off the land and also gives plants time for unimpaired growth.

Some preparation of the soils is usually necessary for all types of irrigation except sprinkler. Water can be applied by spiles, gated pipes, siphon tubes and then distributed on the field by proper methods. Suitable methods are sprinklers, corrugations, contour furrows, and contour ditches. Sprinkling is suitable for all of the adapted crops. Contour furrows are not suitable for irrigating fields of sugar beets. Irrigation structures are used to control erosion and to transmit proper amounts of water. Drainage ditches may be needed to remove excess water from the lower end of the field and thus prevent the drowning of crops. Grassed waterways reduce erosion and carry away some of the excess water.

Nitrogen fertilizer normally is needed on these soils. Soil tests will determine the need for lime.

CAPABILITY UNIT IIIw-2 (IRRIGATED)

These nearly level soils are on bottom lands and stream terraces. They have a silt loam surface horizon and a clay subsoil. The water table fluctuates between 3 and 10 feet. Although the surface horizon absorbs water well, the movement of air and water is very slow in the clayey subsoil and the development of roots is poor. The response to fertilizer generally is not so good as on soils that permit air and water to move freely. Water from higher areas occasionally may drown some crops unless surface drainage is provided. Generally, irrigations should be light so that waterlogging is prevented. Spring planting is delayed in some years because of wetness. Because of the high water table, deep-rooted crops normally are short lived. Erosion is not a problem. The soils in this unit are:

Fillmore silt loam.
Lamoure silt loam.
Silver Creek silt loam.

Crops suited to irrigated areas of these soils are corn, alfalfa, soybeans, sorghum, sugar beets, and tame grasses. Potatoes are not well suited because of alkali surface soils and fine-textured subsoils.

Alfalfa or a grass-alfalfa mixture may be included every 4 to 6 years to maintain fertility, tilth, and capacity to take in water. If a legume is not planted, all available crop residues should be returned to the soil. Adequate additions of commercial fertilizer are needed to maintain fertility. Barnyard manure and green-manure crops will improve fertility, tilth, and capacity to take in water. On tame grasses, rotation grazing permits irrigation when the animals are off the pasture. At these times plants can grow without hindrance.

Only a little land leveling is needed to prepare these soils for gravity irrigation. The grade should be sufficient to provide adequate drainage.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by proper methods. These methods are sprinklers, border dikes, corrugations, furrows, and controlled flooding. Provide ditches or grassed waterways to carry away any excess water.

Nitrogen is normally needed if high yields are to be produced and fertility maintained. Lime is abundant in these soils. Phosphate fertilizer improves the yield of legumes and may improve yields of other crops.

CAPABILITY UNIT IIIw-5 (IRRIGATED)

This unit consists of only one soil, Ovina loamy fine sand. This soil is deep, very sandy, and imperfectly drained. It occurs on nearly level areas of stream terraces. It has a loamy fine sand surface layer that is dark colored, very friable, and noncalcareous. This layer grades to lighter colored fine sandy loam or loamy fine sand, which is underlain by buried profiles of medium- to fine-textured material at a depth of 24 to 48 inches. The subsoil contains much free lime and is stained with brownish and reddish colors. The water table occurs at depths of 2 to 8 feet, depending on the season of the year. Because of wetness, deep-rooted crops ordinarily do not last long. This soil is commonly too wet for early seedbed preparation. Wind erosion is a hazard.

This soil is suited to the irrigation and the production of corn, alfalfa, sorghum, and tame pasture. Because of the alkaline soil reaction, potatoes are not well suited. Alfalfa or a grass-legume mixture included in the cropping system helps to maintain fertility and organic matter and to decrease erosion. Plant a legume every 5 or 6 years and allow it to remain for 3 or 4 years. Do not grow row crops for more than 2 successive years. Corn or sorghum is a good crop to use following a grass-legume mixture. Barnyard manure, stubble mulching, and green manure crops help to control erosion and increase fertility. Rye and vetch are suitable cover crops. Grazing tame pastures in rotation allows the grasses to meet their growth requirements and the pastures to be fully used.

These soils need only a small amount of land leveling to prepare them for gravity irrigation. Irrigation water can be applied by spiles, gated pipe, or siphon tubes and then distributed on the field by proper methods. These methods are sprinklers, border dikes, and furrow. Contour ditches may be used for alfalfa and tame grasses where the slope of the land is between 0.5 and 1.0 percent. In some places, artificial drainage may be needed.

Nitrogen is needed for successful yields. The need for lime and phosphate may be indicated by soil tests.

CAPABILITY UNIT IVe-1 (IRRIGATED)

These soils are strongly sloping and occur on uplands. They have a medium-textured surface layer, subsoil, and substratum. They take in water at a moderate rate. Erosion, which is the greatest hazard, ranges from slight to severe. Surface runoff is rapid unless adequate measures of water conservation are applied. The soils in this unit are:

- Colby silt loam, 7 to 11 percent slopes.
- Holdrege silt loam, 7 to 11 percent slopes.
- Holdrege silt loam, 7 to 11 percent slopes, eroded.

These soils are suited to tame grasses and mixtures of grass and alfalfa. They can be irrigated by sprinklers. The slope of these soils is too steep for successful irrigation of row crops.

These soils should remain in grass or legumes most of the time. Occasionally it may be necessary to grow an annual crop to prepare the soils for reestablishing the stand of grass and legumes. Barnyard manure and green-manure crops help to maintain and improve fertility. Rotation grazing permits irrigation when the animals are off the pasture and, at these times, permits plants to grow unhindered and meet their growth requirements.

Grassed waterways may be needed to prevent serious gully erosion. Terracing will slow runoff and channel the water to nonerosive areas.

Tame grasses normally need nitrogen. Soil tests will indicate if lime is needed.

CAPABILITY UNIT IVe-5 (IRRIGATED)

This unit consists of nearly level to gently sloping soils on bottom lands, stream terraces, and uplands. Many areas are hummocky. These soils have a surface layer and subsoil of loamy fine sand or loamy sand. The substratum ranges from silt loam to mixed sand and gravel. Erosion normally is slight, but a few areas have moderate to severe wind erosion. These soils take in water very rapidly and need frequent irrigation. Fertility normally is low, but the response to fertilizer is generally good. Wind erosion and the maintenance of fertility are the main problems. The soils in this unit are:

- Platte-Sarpy complex.
- Sarpy loamy fine sand, 0 to 3 percent slopes.
- Sarpy loamy fine sand, 3 to 7 percent slopes.
- Thurman loamy fine sand, 0 to 3 percent slopes.
- Thurman loamy fine sand, 3 to 7 percent slopes.
- Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.
- Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.

Crops suited to irrigated areas of these soils are alfalfa, corn, sorghum, and tame grass. A cropping system that keeps the soils in legumes or a legume-grass mixture most of the time helps maintain fertility and control wind erosion. Row crops should not be planted more than 2 consecutive years. Rye and vetch are suitable cover crops. Barnyard manure helps to control wind erosion and improve fertility. Stubble mulching leaves crop residues on the surface to conserve moisture and control wind erosion. Alternating the use of tame pastures permits irrigation when the animals are off the pastures and gives plants a better chance to grow.

Some preparation normally is needed to prepare the land for gravity irrigation. Deep cuts may be necessary because of the uneven topography. Areas that have had their surface soil cut away should have their fertility restored by additions of barnyard manure, other forms of organic matter, and large amounts of commercial fertilizer, including zinc.

Irrigation water can be applied by spiles, gated pipes, siphon tubes and then distributed on the field by proper methods. These methods are sprinklers, contour ditches, and furrows. To control erosion, grow row crops on contour furrows where the slopes are more than 1 percent. Sprinkling is the only method suited to all crops. Irrigation structures may be necessary for conveying the proper amounts of water to the field and to help control erosion. In some places artificial drainage may be needed.

Nitrogen is needed for successful yields. Lime normally is needed for all soils in this unit except the imperfectly drained ones.

CAPABILITY UNIT IVs-1 (IRRIGATED)

These soils occur on stream terraces in the Platte River Valley, generally in level areas. They are strongly saline and alkali, and their water table is moderately high in most places. The soils in this unit are:

- Exline-Wood River silt loams.
- Exline-Wood River fine sandy loams.

Crops suitable for irrigated areas of these soils are alfalfa, sorghum, corn, sugar beets, and tame grasses. Although corn cannot withstand the effects of alkali, it produces fair yields.

These soils have a silt loam or fine sandy loam surface horizon. Their subsoil ranges from clay loam to clay and has a prismatic columnar-blocky structure. The substratum varies from place to place.

Areas of these soils have different degrees of salinity or alkalinity. The highest concentration of soluble salts and alkali is in depressions or slick spots that have the thinnest surface horizon. Between these spots the soil is moderately saline or alkali or is not affected. The slick spots, however, are relatively close and are the main factor to be considered in the use and management of these soils.

These soils absorb water slowly and release it slowly to plants. The slick spots have slow internal drainage and are sticky when wet. Where the subsoil and surface soil are mixed through tillage, these spots frequently puddle and tractors become stuck. Crops on these slick spots are poor.

Some areas have been leveled for irrigation and produce fair to good yields. These areas are commonly too wet to prepare properly for early spring planting, and late cultivation is difficult. Crops tolerant to salt and alkali are desirable. When these soils are irrigated the level of management ought to be high. Because of the slow permeability and high salt concentrations, frequent irrigations are necessary and the rate water is applied must be slow.

Adequate surface drainage, which is normally provided by land leveling, is necessary on these soils. Additions of barnyard manure and other organic matter in large quantities help make the slick spots more friable and more receptive to water. Irrigating with large quantities of water may leach the salts and alkali to lower levels, and gypsum or sulfur will neutralize some of these salts. Although the salts may have been reduced in preceding irrigation seasons, there is no sure way to prevent them from returning in areas that have a high water table. Lowering of the ground-water level is difficult.

The use of alfalfa or a grass-alfalfa mixture in the cropping system is desirable. Alfalfa is somewhat tolerant of soluble salts, and the roots of alfalfa tend to keep the subsoil more open than those of a more shallow rooted crop. These soils can be made more friable and fertile by adding large amounts of organic matter. Once every 4 to 6 years you can plant alfalfa, but do not plant row crops for more than 3 consecutive years. Sorghum and sugar beets do well. Where tame pasture is needed, tall wheatgrass is excellent.

Irrigation water can be applied by spiles, siphon tubes, and gated pipes and then distributed on the field by proper methods. These methods are sprinklers, furrows, corrugations, border dikes, and controlled flooding. Irrigation structures may be needed. Drainage must be provided to prevent drowning of crops in slick spots and on the lower edge of the field.

Nitrogen is needed if yields are to be high. Apply lime and phosphate as indicated by soil tests.

CAPABILITY UNIT IVs-4 (IRRIGATED)

These soils are shallow and occur on bottom lands and stream terraces on nearly level to channeled topography. Most areas are on the bottom lands in the Platte River Valley. Included within the larger areas of shallow soils are a few small areas of moderately deep and deep soils. The soils in this unit have a dark-colored surface horizon that ranges from loam to sandy loam. The subsoil ranges from silt to sand and, in most places, is lighter colored than the surface soil. At depths of 10 to 20 inches, there is coarse sand or mixed sand and gravel. The water table fluctuates between 2 and 8 feet except in drained areas of Platte loam, where it is slightly lower. The Meadin soils, which are on stream terraces, are excessively drained and have a low ground-water level. The soils of this unit are:

Meadin sandy loam, 0 to 1 percent slopes.
Platte loam.
Platte-Wann complex.

These soils may be irrigated and are best suited to grass and grass-alfalfa mixtures. Under a high level of management, satisfactory yields of corn and sorghum may be produced. If the soils are used for row crops, the rows ought to be short to avoid excessive loss of water.

Land leveling is difficult over large areas because of the shallow depth of the soils and the danger in exposing the sand and gravel substratum. Because permeability is very rapid, the soils require frequent irrigations. Because fertility is low, the soils need a high level of management. After leveling, the soils in the Platte-Wann complex normally are 20 to 26 inches thick. These soils are better suited to irrigation than Platte loam or the Meadin sandy loam.

All the soils in this unit need grass or a mixture of alfalfa and grass from time to time to maintain fertility and tilth and to control erosion. Barnyard manure will increase fertility.

If tame pastures are grazed in rotation, these soils can be irrigated when the animals are off the pasture. This will allow the plants to grow unhindered.

Water can be applied by spiles, gated pipes, and siphon tubes and then distributed on the field by proper methods. These methods are furrows, border dikes, corrugations, contour ditches, or sprinklers.

Add nitrogen to these soils to stimulate the growth of plants. Lime is not needed on soils of the bottom lands but should be applied to soils on stream terraces. Phosphate increases yields of the soils on bottom lands. Recent experiments indicate that applications of zinc on corn are profitable.

CAPABILITY UNIT IVw-2 (IRRIGATED)

The only soil in this unit is Scott silt loam. This deep soil occurs on stream terraces and uplands in depressions that are frequently flooded. It has a thin, dark-colored, silt loam surface horizon. The subsoil is very slowly permeable dark clay. On uplands, the substratum is a yellowish loess of silt loam texture. On stream terraces, the substratum varies from place to place.

Suitable crops on irrigated areas of this soil are alfalfa, corn, sorghum, sweetclover, and tame grass. Because a fine-textured subsoil is close to the surface, potatoes and sugar beets are not suitable.

If this soil is irrigated, the flooding hazard must be eliminated. This can be done by terracing the surrounding high-lying soils or by digging drainage ditches. When the soil is tilled more than 6 inches deep, the clay subsoil is exposed and the soil is sticky and difficult to work. The subsoil impairs the movement of water and the development of roots. If cultivation is delayed because the soil has to be drained, the control of weeds is a problem. Another problem on this low, wet soil is the preparation of a seedbed in spring.

Alfalfa or a grass-alfalfa mixture included in the cropping system every 4 to 6 years will help keep this soil friable and maintain its productivity. But if water stands on this soil, the alfalfa will drown. Row crops should not be grown for more than 3 consecutive years. Barnyard manure and green-manure crops will increase the supply of organic matter and help maintain fertility.

Irrigation water can be applied by spiles, gated pipes, siphon tubes and then distributed on the field by proper methods. These methods are border dikes, corrugations, contour ditches, furrows, and sprinklers. Not all of these methods, however, are suited to all crops. Soybeans, corn, and sorghum are suited only to furrow irrigation.

This soil normally needs nitrogen. A soil test will indicate the need for lime.

Estimated Yields

Estimated average yields for principal crops are given in table 2 under two levels of management. For most crops, yields under these two levels of management are listed for both irrigated soils and dry-farmed soils. Because the irrigated acreage of wheat is very small, only the estimated yields for dry-farmed soils are given. Soybeans, potatoes, and sugar beets are not dry farmed, and only yields for irrigated soils are given. Yields for both irrigated and dry-farmed soils are listed for corn, alfalfa, sorghum, and tame pasture.

The yields in columns B are those to be expected when management is at a high level. Those in columns A are to be expected when the farmer does not carry out all the practices that management at a high level requires.

TABLE 2.—*Estimated average acre*

[Yields in columns A are those expected when all practices required for a high level of management are *not* carried out; yields in columns in very small

Map Symbol	Soil	Corn				Wheat		Alfalfa			
		Irrigated		Dryland		Dryland		Irrigated		Dryland	
		A	B	A	B	A	B	A	B	A	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Sy	Alluvial land	----	----	----	----	----	----	----	----	----	----
Ba	Barney loam	----	----	----	----	----	----	----	----	----	----
Bl	Broken land	----	----	----	----	----	----	----	----	----	----
Bu	Butler silt loam	56	81	20	26	18	22	3. 1	4. 6	1. 5	2. 2
3Cs	Cass fine sandy loam, deep	57	70	15	20	11	14	3. 2	4. 1	1. 3	1. 9
Cs	Cass fine sandy loam	52	65	6	11	4	8	1. 6	2. 6	. 3	. 7
3Cm	Cass loam, deep	60	74	19	22	14	16	3. 4	4. 3	1. 5	1. 9
Cm	Cass loam	56	70	8	14	6	11	1. 9	3. 0	. 5	1. 0
CbC	Colby silt loam, 7 to 11 percent slopes	----	----	6	9	4	6	2. 0	2. 4	. 8	1. 0
CbD	Colby silt loam, 11 to 30 percent slopes	----	----	----	----	----	----	----	----	----	----
Es	Elsmere fine sandy loam	50	63	7	12	5	9	1. 4	2. 4	. 5	. 9
Ea	Elsmere loamy fine sand	39	51	14	19	9	12	1. 9	2. 5	1. 2	1. 5
E-Ws	Exline-Wood River fine sandy loams	30	40	----	----	----	----	1. 4	2. 8	----	----
E-W	Exline-Wood River silt loams	40	45	----	----	----	----	1. 4	2. 8	----	----
Fm	Fillmore silt loam	50	71	14	20	14	17	3. 0	4. 0	----	----
Ha	Hall silt loam, 0 to 1 percent slopes	63	90	24	30	18	22	3. 7	5. 5	2. 0	2. 5
HaA	Hall silt loam, 1 to 3 percent slopes	58	82	19	26	17	21	3. 2	5. 2	1. 7	2. 3
HaB2	Hall silt loam, 3 to 7 percent slopes, eroded	52	66	17	23	14	18	2. 6	4. 4	1. 6	2. 0
H-O	Hall-O'Neill complex, 0 to 1 percent slopes	56	70	8	14	6	11	1. 9	3. 0	. 5	1. 0
Hs	Hastings silt loam, 0 to 1 percent slopes	61	89	20	28	18	22	3. 5	5. 4	1. 8	2. 4
HsA	Hastings silt loam, 1 to 3 percent slopes	58	82	19	26	17	21	3. 2	5. 2	1. 7	2. 3
HsB2	Hastings silt loam, 3 to 7 percent slopes, eroded	52	66	17	23	14	18	2. 6	4. 4	1. 6	2. 0
Hs3	Hastings complex, severely eroded	34	48	11	17	10	13	2. 3	3. 5	1. 1	1. 6
Hb	Hobbs silt loam, 0 to 1 percent slopes	63	90	18	23	14	17	4. 0	5. 0	1. 7	2. 0
HbA	Hobbs silt loam, 1 to 3 percent slopes	63	90	18	23	14	17	4. 0	5. 0	1. 7	2. 0
Ho	Holdrege silt loam, 0 to 1 percent slopes	63	90	24	30	18	22	3. 7	5. 5	2. 0	2. 5
HoA	Holdrege silt loam, 1 to 3 percent slopes	61	85	22	28	17	21	3. 5	5. 3	1. 9	2. 4
HoB	Holdrege silt loam, 3 to 7 percent slopes	59	77	20	26	15	20	3. 0	4. 7	1. 8	2. 2
HoB2	Holdrege silt loam, 3 to 7 percent slopes, eroded	56	68	18	24	14	19	2. 8	4. 5	1. 7	2. 0
HoC	Holdrege silt loam, 7 to 11 percent slopes	----	----	14	21	9	13	2. 2	3. 0	1. 4	1. 9
HoC2	Holdrege silt loam, 7 to 11 percent slopes, eroded	----	----	13	20	8	12	2. 1	2. 9	1. 3	1. 8
H-C3	Holdrege-Colby complex, severely eroded	----	----	10	15	6	9	1. 9	2. 5	1. 1	1. 6
Hd	Hord silt loam, 0 to 1 percent slopes	63	90	24	30	18	22	3. 7	5. 5	2. 0	2. 5
HdA	Hord silt loam, 1 to 3 percent slopes	61	85	22	28	17	21	3. 5	5. 3	1. 9	2. 4
HdB2	Hord silt loam, 3 to 7 percent slopes, eroded	56	68	18	24	14	19	2. 8	4. 5	1. 7	2. 0
2HdA	Hord silt loam, thin solum variant, 0 to 3 percent slopes	60	84	20	26	16	20	3. 5	4. 9	1. 9	2. 3
2HdB	Hord silt loam, thin solum variant, 3 to 7 percent slopes	56	68	18	24	14	19	3. 5	5. 3	1. 9	2. 4
H-N	Hord-O'Neill complex, 0 to 1 percent slopes	52	69	7	12	4	9	1. 8	2. 8	. 4	. 8
Ks	Kenesaw silt loam, 0 to 1 percent slopes	60	80	21	27	16	20	3. 5	4. 9	1. 9	2. 3
KsA	Kenesaw silt loam, 1 to 3 percent slopes	55	72	18	24	14	18	3. 0	4. 5	1. 7	2. 0
KsB	Kenesaw silt loam, 3 to 7 percent slopes	46	60	11	16	9	12	2. 4	3. 8	1. 5	1. 7

See footnote at end of table.

To keep management at a high level and obtain the yields in columns B, a farmer must:

1. Use practices of wind and water erosion control where needed.
2. Use suitable cropping sequences so that tilth and the supply of organic matter are maintained.
3. Apply fertilizer and lime as indicated by soil tests.
4. Cultivate, seed, and apply water with care.
5. Use proper amounts of plants.
6. Plant suitable crop varieties.
7. Use insect, weed, and disease controls consistently.
8. Terrace and contour or bench level irrigated soils with slopes of 2 to 6 percent if row crops are to be planted.
9. Drain the land where needed.
10. Perform all management practices at the proper time.

yields of principal crops

B are those expected under a high level of management. Dashed lines indicate the crop is not suited to the soil or that it is grown only amounts]

Soybeans		Grain sorghum				Potatoes		Sugar beets		Tame pasture			
Irrigated		Irrigated		Dryland		Irrigated		Irrigated		Irrigated		Dryland	
A	B	A	B	A	B	A	B	A	B	A	B	A	B
Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit months* [1]	*Animal-unit months* [1]	*Animal-unit months* [1]	*Animal-unit months* [1]
---	---	---	---	---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	---	---	---	---
17	26	51	74	23	30	210	273	11.0	14.0	8.7	11.4	0.6	0.8
17	21	52	64	16	20	230	280	11.0	14.0	9.0	12.0	.7	.9
17	19	46	58	6	13	255	305	6.5	10.0	8.5	12.0	.5	.7
20	23	55	67	20	23	265	305	12.0	14.5	9.0	12.0	.7	.9
19	21	51	64	9	17	273	350	9.0	12.0	8.5	12.0	.5	.7
---	---	---	---	8	14	---	---	---	---	6.0	9.0	.4	.6
---	---	---	---	---	---	---	---	---	---	---	---	---	---
15	17	44	56	7	14	230	280	5.5	9.5	8.0	11.5	.7	1.0
---	---	30	41	12	17	---	---	---	---	8.0	10.9	.8	1.0
---	---	36	41	---	---	---	---	4.5	9.0	---	---	---	---
---	---	36	41	---	---	---	---	4.5	9.0	---	---	---	---
14	19	44	64	17	22	---	---	---	---	8.7	11.4	.5	.7
20	28	57	82	28	35	245	350	13.0	18.0	9.0	12.0	.9	1.1
17	24	53	75	22	31	220	320	11.5	15.0	8.5	11.7	.8	1.0
14	21	48	65	20	26	210	280	10.0	13.0	8.0	11.2	.6	.9
19	21	51	64	9	17	273	350	9.0	12.0	8.5	12.0	.6	.8
18	27	56	80	24	33	230	335	12.0	16.0	9.0	12.0	.9	1.1
17	24	53	75	22	31	220	320	11.5	15.0	8.5	11.7	.8	1.0
14	21	48	65	20	26	210	280	10.0	13.0	8.0	11.2	.7	.9
9	12	32	46	11	20	180	225	7.0	9.0	7.0	10.3	.6	.8
18	28	57	82	22	27	245	350	13.0	18.0	8.5	11.7	.6	.8
18	28	57	82	22	27	245	350	13.0	18.0	8.5	11.7	.9	1.1
20	28	57	82	28	35	245	350	13.0	18.0	9.0	12.0	.9	1.1
19	26	55	79	26	33	240	325	12.7	17.5	8.5	11.7	.8	1.0
18	24	53	70	23	30	230	300	12.0	15.0	8.2	11.5	.7	.9
17	23	51	68	21	28	222	290	11.5	14.5	8.0	11.2	.6	.9
---	---	---	---	16	25	---	---	---	---	7.2	10.3	.5	.8
---	---	---	---	15	24	---	---	---	---	7.2	10.3	.5	.8
---	---	---	---	11	20	---	---	---	---	7.2	10.3	.5	.8
20	28	57	82	28	35	245	350	13.0	18.0	9.0	12.0	.9	1.1
19	26	55	79	26	33	240	325	12.5	17.5	8.5	11.7	.8	1.0
17	23	51	68	21	28	222	290	11.5	14.5	8.0	11.2	.7	.9
17	25	55	78	25	31	225	320	11.5	16.5	8.7	11.5	.8	1.0
19	26	55	79	26	33	240	325	12.5	17.5	8.5	11.7	.8	1.0
18	20	48	60	7	14	260	310	7.0	11.0	8.5	12.0	.6	.8
17	25	55	78	25	31	225	320	11.5	16.5	8.7	11.5	.8	1.0
15	22	49	63	22	27	200	285	10.0	14.5	8.0	10.8	.7	.9
11	17	41	55	18	21	170	245	8.5	12.0	6.6	9.9	.5	.7

TABLE 2.—*Estimated average acre*

Yields in columns A are those expected when all practices required for a high level of management are *not* carried out; yields in columns a very small

Map Symbol	Soil	Corn				Wheat		Alfalfa			
		Irrigated		Dryland		Dryland		Irrigated		Dryland	
		A	B	A	B	A	B	A	B	A	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
La	Lamoure silt loam	48	72	20	25	15	19	3. 3	4. 8	1. 5	2. 2
2La	Lamoure silt loam, saline	35	50	16	20	10	14	1. 9	3. 0	. 8	1. 5
Lf	Leshara fine sandy loam	54	78	22	28	11	14	3. 3	5. 0	1. 7	2. 4
Le	Leshara silt loam	60	88	26	32	15	18	3. 5	5. 5	1. 9	2. 7
2Le	Leshara silt loam, saline	40	60	17	24	13	18	3. 0	3. 8	1. 6	2. 0
Lm	Loup loam	----	----	----	----	----	----	----	----	----	----
MdB	Meadin loamy sand, 3 to 11 percent slopes	----	----	----	----	----	----	----	----	----	----
Ms	Meadin sandy loam, 0 to 1 percent slopes	22	40	----	----	----	----	1. 1	2. 0	----	----
Ok	O'Neill loam, 0 to 1 percent slopes	56	70	8	14	6	11	1. 9	3. 0	. 5	1. 0
OkB2	O'Neill loam, 3 to 5 percent slopes, eroded	53	66	5	11	4	8	1. 7	2. 8	. 4	. 8
Om	O'Neill sandy loam, 0 to 1 percent slopes	52	65	7	12	4	9	1. 8	2. 8	. 4	. 8
OmB2	O'Neill sandy loam, 3 to 7 percent slopes, eroded	48	60	4	9	3	7	1. 5	2. 5	. 3	. 6
OrA	Ortello fine sandy loam, 0 to 3 percent slopes	57	70	15	20	11	14	3. 2	4. 1	1. 3	1. 9
OrB	Ortello fine sandy loam, 3 to 7 percent slopes	55	68	13	19	10	13	3. 1	4. 0	1. 2	1. 8
2Or	Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes	57	71	18	21	13	15	2. 8	4. 2	1. 4	1. 9
2OrB	Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes	55	67	17	20	12	14	1. 3	4. 0	1. 3	1. 8
Ot	Ortello loam, 0 to 1 percent slopes	62	76	20	23	16	18	3. 5	4. 5	1. 6	2. 2
Ov	Ovina fine sandy loam	54	67	16	19	11	13	2. 9	3. 7	1. 4	1. 9
Oa	Ovina loamy fine sand	28	35	10	16	6	9	2. 1	2. 6	1. 1	1. 5
Pt	Platte loam	43	52	----	----	----	----	1. 4	1. 8	----	----
P-S	Platte-Sarpy complex	----	----	----	----	----	----	. 3	1. 5	----	----
2P-S	Platte-Sarpy complex, channeled	----	----	----	----	----	----	----	----	----	----
P-W	Platte-Wann complex	38	45	----	----	----	----	1. 1	1. 4	----	----
2P-W	Platte-Wann complex, channeled	----	----	----	----	----	----	----	----	----	----
Rw	Riverwash	----	----	----	----	----	----	----	----	----	----
Sa	Sarpy fine sand	----	----	----	----	----	----	----	----	----	----
SgA	Sarpy loamy fine sand, 0 to 3 percent slopes	38	50	10	15	7	9	1. 8	2. 3	. 9	1. 2
SgB	Sarpy loamy fine sand, 3 to 7 percent slopes	35	45	9	13	6	8	1. 6	2. 1	. 8	1. 1
Sc	Scott silt loam	38	56	7	10	6	9	1. 8	2. 5	. 5	. 9
Si	Silver Creek silt loam	49	65	14	20	14	19	3. 1	4. 0	1. 2	2. 0
TsA	Thurman fine sandy loam, 0 to 3 percent slopes	55	67	15	20	11	14	3. 2	4. 2	1. 3	1. 8
TsB	Thurman fine sandy loam, 3 to 7 percent slopes	54	66	13	20	9	13	3. 0	3. 8	1. 1	1. 6
ThA	Thurman loamy fine sand, 0 to 3 percent slopes	40	52	11	16	7	10	1. 9	2. 4	1. 0	1. 3
ThB	Thurman loamy fine sand, 3 to 7 percent slopes	35	45	9	13	6	8	1. 6	2. 1	. 8	1. 1
2ThA	Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes	42	54	12	17	8	11	2. 0	2. 6	1. 1	1. 4
2ThB	Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes	38	49	11	15	7	10	1. 8	2. 3	. 9	1. 3
Th3	Thurman loamy fine sand, wind eroded	----	----	----	----	----	----	----	----	----	----
Va	Valentine fine sand	----	----	----	----	----	----	----	----	----	----
Vo	Volin silt loam	60	90	22	30	12	16	3. 2	5. 5	1. 7	2. 5
3Wb	Wann fine sandy loam, deep	55	68	17	21	13	15	3. 0	3. 9	1. 4	2. 0
Wb	Wann fine sandy loam	50	63	7	12	5	9	1. 4	2. 4	. 5	. 9
3Wm	Wann loam, deep	56	72	20	22	15	17	3. 2	4. 2	1. 6	2. 1
2Wm	Wann loam, deep, saline	55	62	15	18	12	14	2. 9	3. 8	1. 3	1. 9
Wm	Wann loam	54	68	9	15	8	13	1. 7	2. 9	. 7	1. 2
Wr	Wood River silt loam, 0 to 1 percent slopes	63	85	21	27	18	22	3. 1	4. 6	1. 5	2. 2
WrA	Wood River silt loam, 1 to 3 percent slopes	60	82	20	26	17	21	3. 0	4. 4	1. 4	2. 1
WrB2	Wood River silt loam, 3 to 7 percent slopes, eroded	56	77	17	21	14	19	2. 8	4. 1	1. 3	1. 9
W-Es	Wood River-Exline fine sandy loams	45	55	12	15	10	12	2. 9	3. 6	1. 3	1. 8
W-E	Wood River-Exline silt loams	46	60	12	17	12	15	3. 2	4. 0	1. 3	2. 0

[1] An animal-unit month is the amount of forage required to pasture a mature cow for 30 days. The figures in the columns under Tame pasture are the number of animal-unit months of grazing that 1 acre will provide during the grazing season.

yields of principal crops—Continued

B are those expected under a high level of management. Dashed lines indicate the crop is not suited to the soil or that it is grown only amounts]

Soybeans		Grain sorghum				Potatoes		Sugar beets		Tame pasture			
Irrigated		Irrigated		Dryland		Irrigated		Irrigated		Irrigated		Dryland	
A	B	A	B	A	B	A	B	A	B	A	B	A	B
Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Animal-unit months* [1]	*Animal-unit months* [1]	*Animal-unit months* [1]	*Animal-unit months* [1]
14	21	47	70	23	31	160	265	10. 0	14. 0	8. 7	11. 7	0. 9	1. 1
9	14	39	55	15	22	------	------	9. 0	12. 0	8. 0	10. 5	. 8	1. 0
16	24	51	77	28	34	180	285	11. 5	16. 0	9. 0	12. 0	1. 0	1. 2
18	26	54	80	30	37	190	295	12. 5	17. 5	9. 0	12. 0	. 8	1. 0
13	19	48	68	19	27	------	------	10. 5	12. 5	8. 0	10. 5	. 8	1. 0
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
19	21	51	64	9	17	273	350	9. 0	12. 0	8. 5	12. 0	. 5	. 7
17	19	47	60	7	14	250	305	8. 0	11. 0	6. 7	10. 5	. 4	. 6
18	20	48	60	7	14	260	310	7. 0	11. 0	8. 5	12. 0	. 5	. 7
16	18	45	56	5	12	245	300	6. 0	9. 5	6. 7	10. 5	. 4	. 6
17	21	52	64	16	20	230	280	11. 0	14. 0	9. 0	12. 0	. 7	. 9
16	20	50	62	15	19	228	278	10. 5	13. 5	8. 0	10. 9	. 5	. 7
18	22	54	66	21	25	237	284	12. 0	14. 5	8. 5	11. 7	. 7	. 9
16	20	50	62	19	23	234	275	11. 5	14. 0	8. 0	11. 2	. 5	. 7
20	24	57	69	23	26	275	315	12. 5	15. 0	9. 0	12. 0	. 7	. 9
14	18	49	60	18	22	220	250	11. 0	13. 5	8. 4	11. 5	1. 0	1. 2
------	------	26	40	11	18	------	------	------	------	8. 0	10. 9	. 7	. 9
------	------	37	45	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	27	38	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	30	42	9	14	------	------	------	------	8. 0	10. 8	. 6	. 8
------	------	29	38	8	13	------	------	------	------	7. 3	10. 2	. 5	. 7
------	------	36	47	8	11	------	------	------	------	------	------	------	------
13	18	39	55	14	22	140	200	10. 5	13. 0	8. 7	11. 7	. 9	1. 1
16	20	50	62	18	21	230	278	11. 0	14. 5	8. 5	11. 7	. 6	. 8
15	19	49	61	13	17	224	270	10. 5	14. 0	8. 5	11. 7	. 6	. 8
------	------	32	43	10	15	------	------	------	------	8. 2	11. 2	. 6	. 8
------	------	30	41	12	17	------	------	------	------	8. 0	10. 9	. 8	1. 0
------	------	33	44	11	16	------	------	------	------	8. 2	11. 2	. 6	. 8
------	------	31	41	10	15	------	------	------	------	7. 6	10. 6	. 5	. 7
------	------	------	------	------	------	------	------	------	------	------	------	------	------
------	------	------	------	------	------	------	------	------	------	------	------	------	------
17	28	54	82	26	35	205	325	12. 0	18. 0	9. 0	12. 0	. 8	1. 0
16	20	50	62	18	22	220	250	10. 5	13. 5	9. 0	12. 0	1. 0	1. 2
15	17	44	56	7	14	230	280	5. 5	9. 5	8. 5	12. 0	. 7	1. 0
19	21	53	65	22	25	235	275	12. 0	14. 5	9. 0	12. 0	1. 0	1. 2
15	17	49	60	16	20	------	------	10. 0	11. 5	8. 0	10. 6	. 8	1. 0
17	19	49	62	10	19	253	315	8. 5	11. 5	8. 5	12. 0	. 7	1. 0
17	26	51	74	23	30	210	273	11. 0	14. 0	8. 8	11. 7	. 6	. 8
16	24	50	72	22	29	200	260	10. 5	13. 5	8. 4	11. 2	. 5	. 7
14	21	47	69	20	27	180	225	9. 0	11. 0	7. 3	10. 2	. 4	. 6
14	17	48	58	16	20	------	------	10. 0	13. 5	8. 2	10. 5	. 7	1. 0
13	18	39	55	12	19	------	------	10. 5	13. 0	8. 0	10. 5	. 5	. 7

Use and Management of Range Land [4]

Native grasses grow in areas that make up about one-fourth of the land in Hall County. These areas of grasses, called range, are used for grazing and hay. Some are found in small tracts on farms, but most of it is in larger areas. A large part of approximately 42 sections lies in a more or less continuous band in the northern part of the county. Some rangeland borders the channels of the Platte River.

The purpose of this subsection is to furnish information on managing range so that the range will produce vigorous stands of desired grasses. You can get additional information on the management of your range from local technicians of the Soil Conservation Service.

Range sites

Range vegetation is influenced by habitat factors of the soil, such as water, air, and solutes in the soil as well as light, humidity, and temperature. As these factors differ from place to place, vegetation growing on the land differs. Kinds of land, therefore, can be separated on the basis of their capacity to produce different kinds and amounts of vegetation. Such kinds of lands are called range sites. A range site is a kind of rangeland that differs from other rangeland in its ability to produce a significantly different kind or amount of climax or original vegetation.

Although eight range sites are recognized in Hall County, most of the rangeland in the county is in six of these range sites—Wetland, Subirrigated, Silty, Saline lowland, Sandy, and Sands. In the following pages, for each range site in the county, the dominant grasses on the range when it is in excellent condition are given and the soils that make up the range site are listed.

WETLAND

The dominant grasses on this range site when it is in excellent condition are prairie cordgrass, northern reedgrass, bluejoint reedgrass, and tall sedges. There are no cattail and common reed. The soils in this range site are:

(Ba) Barney loam.
(Lm) Loup loam.

SUBIRRIGATED

The dominant grasses on this range site when it is in excellent condition are big bluestem, Indiangrass, and switchgrass. The soils in this range site are:

(Es) Elsmere fine sandy loam.
(Ea) Elsmere loamy fine sand.
(La) Lamoure silt loam.
(Lf) Leshara fine sandy loam.
(Le) Leshara silt loam.
(Ov) Ovina fine sandy loam.
(Oa) Ovina loamy fine sand.
(Pt) Platte loam.
(P–W) Platte-Wann complex.
(2P–W) Platte-Wann complex, channeled.
(Si) Silver Creek silt loam.
(3Wb) Wann fine sandy loam, deep.
(Wb) Wann fine sandy loam.
(3Wm) Wann loam, deep.
(Wm) Wann loam.

[4] This section was written by LORENZ F. BREDEMEIER, range conservationist, Soil Conservation Service.

OVERFLOW

The dominant grasses on this range site when it is in excellent condition are big bluestem, switchgrass, and western wheatgrass. The soils in the range site are:

(Sy) Alluvial land.
(Fm) Fillmore silt loam.
(Hb) Hobbs silt loam, 0 to 1 percent slopes.
(Sc) Scott silt loam.

SALINE LOWLAND

Switchgrass and western wheatgrass are the dominant grasses on this range site when it is in excellent condition. The soils in this range site are:

(E–Ws) Exline-Wood River fine sandy loams.
(E–W) Exline-Wood River silt loams.
(2La) Lamoure silt loam, saline.
(2Le) Leshara silt loam, saline.
(2Wm) Wann loam, deep, saline.
(W–Es) Wood River-Exline fine sandy loams.
(W–E) Wood River-Exline silt loams.

SANDS

The dominant grasses on this range site when it is in excellent condition are sand bluestem, switchgrass, prairie sandreed, and little bluestem. The soils in this range site are:

(P–S) Platte-Sarpy complex.
(2P–S) Platte-Sarpy complex, channeled.
(Sa) Sarpy fine sand.
(SgB) Sarpy loamy fine sand, 3 to 7 percent slopes.
(ThB) Thurman loamy fine sand, 3 to 7 percent slopes.
(2ThB) Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.
(Th3) Thurman loamy fine sand, wind eroded.
(Va) Valentine fine sand.

SANDY

The dominant grasses on this range site when it is in excellent condition are prairie sandreed, switchgrass, porcupinegrass, and little bluestem. The soils in this range site are:

(3Cs) Cass fine sandy loam, deep.
(Cs) Cass fine sandy loam.
(H–N) Hord-O'Neill complex, 0 to 1 percent slopes.
(Om) O'Neill sandy loam, 0 to 1 percent slopes.
(OmB2) O'Neill sandy loam, 3 to 7 percent slopes, eroded.
(OrA) Ortello fine sandy loam, 0 to 3 percent slopes.
(OrB) Ortello fine sandy loam, 3 to 7 percent slopes.
(2Or) Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.
(2OrB) Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.
(SgA) Sarpy loamy fine sand, 0 to 3 percent slopes.
(TsA) Thurman fine sandy loam, 0 to 3 percent slopes.
(TsB) Thurman fine sandy loam, 3 to 7 percent slopes.
(ThA) Thurman loamy fine sand, 0 to 3 percent slopes.
(2ThA) Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.

SILTY

The dominant grasses on this range site when it is in excellent condition are big bluestem, western wheatgrass, little bluestem, and side-oats grama. The soils in the range site are:

(Bl) Broken land.
(Bu) Butler silt loam.
(3Cm) Cass loam, deep.
(Cm) Cass loam.
(CbC) Colby silt loam, 7 to 11 percent slopes.
(CbD) Colby silt loam, 11 to 30 percent slopes.
(Ha) Hall silt loam, 0 to 1 percent slopes.

(HaA) Hall silt loam, 1 to 3 percent slopes.
(HaB2) Hall silt loam, 3 to 7 percent slopes, eroded.
(H-O) Hall-O'Neill complex, 0 to 1 percent slopes.
(Hs) Hastings silt loam, 0 to 1 percent slopes.
(HsA) Hastings silt loam, 1 to 3 percent slopes.
(HsB2) Hastings silt loam, 3 to 7 percent slopes, eroded.
(Hs3) Hastings complex, severely eroded.
(HbA) Hobbs silt loam, 1 to 3 percent slopes.
(Ho) Holdrege silt loam, 0 to 1 percent slopes.
(HoA) Holdrege silt loam, 1 to 3 percent slopes.
(HoB) Holdrege silt loam, 3 to 7 percent slopes.
(HoB2) Holdrege silt loam, 3 to 7 percent slopes, eroded.
(HoC) Holdrege silt loam, 7 to 11 percent slopes.
(HoC2) Holdrege silt loam, 7 to 11 percent slopes, eroded.
(H-C3) Holdrege-Colby complex, severely eroded.
(Hd) Hord silt loam, 0 to 1 percent slopes.
(HdA) Hord silt loam, 1 to 3 percent slopes.
(HdB2) Hord silt loam, 3 to 7 percent slopes, eroded.
(2HDA) Hord silt loam, thin solum variant, 0 to 3 percent slopes.
(2HdB) Hord silt loam, thin solum variant, 3 to 7 percent slopes.
(Ks) Kenesaw silt loam, 0 to 1 percent slopes.
(KsA) Kenesaw silt loam, 1 to 3 percent slopes.
(KsB) Kenesaw silt loam, 3 to 7 percent slopes.
(Ok) O'Neill loam, 0 to 1 percent slopes.
(OkB2) O'Neill loam, 3 to 5 percent slopes, eroded.
(Ot) Ortello loam, 0 to 1 percent slopes.
(Vo) Volin silt loam.
(Wr) Wood River silt loam, 0 to 1 percent slopes.
(WrA) Wood River silt loam, 1 to 3 percent slopes.
(WrB2) Wood River silt loam, 3 to 7 percent slopes, eroded.

SHALLOW

The dominant grasses on this range site when it is in excellent condition are little bluestem, side-oats grama, needle-and-thread, and western wheatgrass. The soils in this range site are:

(Ms) Meadin sandy loam, 0 to 1 percent slopes.
(MdB) Meadin loamy sand, 3 to 11 percent slopes.

* * *

The Wetland range site is on soils that are frequently flooded in the early part of the growing season and have a water table between 6 and 18 inches from the surface most of the season.

The Subirrigated range site is on soils that are flooded for short periods during the early part of the growing season and have a water table between 18 and 60 inches from the surface during most of the season.

The Overflow range site is on soils that frequently receive more than the normal amount of water because of runoff from higher land and water from streams that overflow.

The Saline lowland range site is on soils that are flooded, subirrigated, or otherwise wet and contain enough salt accumulation to affect the kinds of plants that grow.

The Sands range site is on deep, loose sands, loamy sands, and loamy fine sands (fig. 18).

The Sandy range site is on deep sandy loams and loamy fine sands.

The Silty range site is on very fine sandy loams, loams, and silt loams.

The Shallow range site is on soils that have clean gravel at depths of 10 to 20 inches from the surface.

Range plants

The range vegetation in Hall County consists of many different species of grasses, forbs, and shrubs. The grasses are tall, mid, or short. Each species has its own characteristics and habits of growth. Some grow best in the short days of the cool season; others grow best during the long days of the warm season. Some grasses grow in bunches and must spread by seed. Others have underground stems by which they can spread. The zone of new plant cell development and growth differs for different plants. Some grasses have the growth zone at the base of the stem or leaf. Others have the growth zone higher above the ground. The growth zone of the forbs and woody species is at the end of branches. Plants also show a difference in their suitability to grow on different range sites. Closeness of grazing and time of grazing influences growth of range plants.

***Figure 18.*—A Sands range site showing a severe degree of use but in fair condition. Yucca, cactus, prairie sandreed, and sand dropseed are the principal plants in this vegetation.**

Degree of use

By degree of use is meant the degree that the annual growth of range plants is grazed, or the closeness of grazing. The degree of use affects the kinds and amounts of different plants growing on identical land. For example, figure 19 shows a Sands range site with different kinds of vegetation. The vegetation on the left side of the fence is mostly sand bluestem, switchgrass, prairie sandreed, and little bluestem. On the right the vegetation is mostly prairie sandreed, blue grama, and invader grasses and forbes. The difference in the vegetation is caused by overuse of the grasses on the right for a period of years.

All food for plant growth and reproduction is manufactured in the leaves. A plant having an abundance of leaves is able to manufacture an abundance of food. Perennial grasses store in the underground buds and roots that food not needed for growth and seed production. The stored food produces and feeds the young shoots that grow the following year. If the leaves are grazed close during the growing season, little food is stored and new shoots are weak.

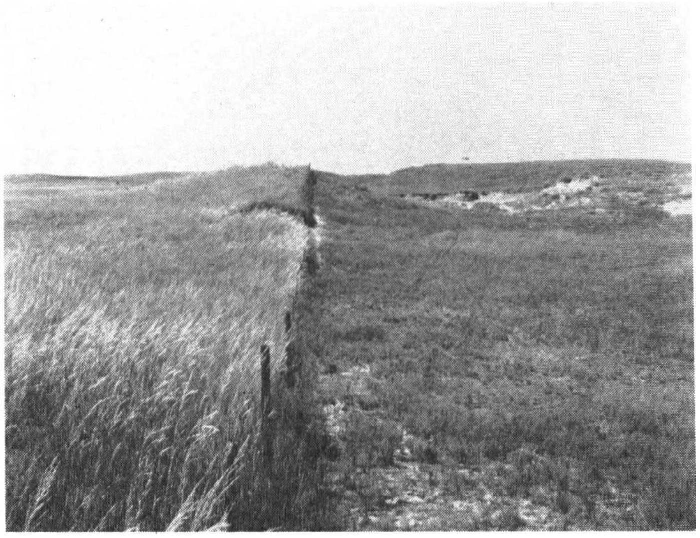

Figure 19.—**The grasses on the left have not been grazed and are in good condition. Those on the right have been severely overgrazed and are in poor condition.**

Response of plants to grazing

When a range is overgrazed during the growing season, grasses that livestock prefer are grazed so close to the ground that they give way to other grasses that may not be grazed so close or are not grazed after they mature. Because the percentage of these closely grazed grasses in the forage decreases, these grasses are called *decreasers*. The grasses that are replacing the decreasers produce, at least for a time, a larger part of the total forage than they formerly did. These grasses are called *increasers*.

Some grasses are grazed out of the vegetation and others become weak from continued grazing. Both of these kinds of grasses may be replaced by plants, called *invaders*, that originally were not present or were in only very small amounts.

Range condition

A system for classifying range condition based on the behavior of range plants is used to evaluate the condition of native grass pasture in relation to its potential. This system compares the proportion of decreasers, increasers, and invaders in the vegetation and the relative vigor of these groups of plants. Pastures are in the best condition when decreasers dominate, and there are some increasers but essentially no invaders. They are in the poorest condition when invaders dominate and make up essentially all of the vegetation.

The system of classifying range condition used by the Soil Conservation Service recognizes four condition classes (*2*). These are excellent, good, fair, and poor.

A range in *excellent* condition consists mostly of vigorous decreasers and vigorous increasers but essentially no invaders. On a range in *good* condition, the amount of decreasers and their vigor is less and the amount and vigor of the increasers is greater; a few invaders may be seen. A range in *fair* condition has only a very small amount to essentially no decreasers, and some species of increasers are lacking and others are weak; invaders are abundant. A range in *poor* condition has no decreasers, and a small amount of weak increasers; the invaders make up the greatest part of the vegetation (fig. 20).

Forage production

The production of forage on rangeland fluctuates from year to year in a given pasture, mainly because of differences in total and seasonal precipitation, kinds of vegetation, and the vigor of plants. Also, the amount of forage in a given year varies from one range site to another. Table 3 gives the relative productivity of six range sites in excellent, good, fair, and poor condition. The ratings of the range sites in these conditions are based on the productivity of the Sands range site in excellent condition, which is assigned the rating of 100.

As the condition of the range falls from excellent to good, fair, or poor, the amount of grazing should be reduced so that the condition of the range is improved. Moist sites provide more grazing than the drier sites. For example, a Subirrigated site in excellent condition provides twice the grazing provided by a Silty site in excellent condition.

Seeding native grasses

All soils in the county are suitable for the native grasses. By using the best management and cultural practices, the most net income is obtained if native grasses are grown on nonarable land in classes VI and VII and introduced grasses are planted on arable land in classes I, II, and III. The best seed mixture of native grasses for a site is one that corresponds closest to composition of climax vegetation on the site. Climax vegetation is the kinds of vegetation that grew on the site before the site was disturbed.

Mixtures.—Desirable mixtures in Hall County include tall and mid cool-season grasses and mid warm-season grasses in proper proportions. Table 4 shows the mixtures for different sites in keeping with the potential of each site. This shows the amount of pure live seed (purity multiplied by percentage of germination) to plant per acre. To find the amount to plant of the

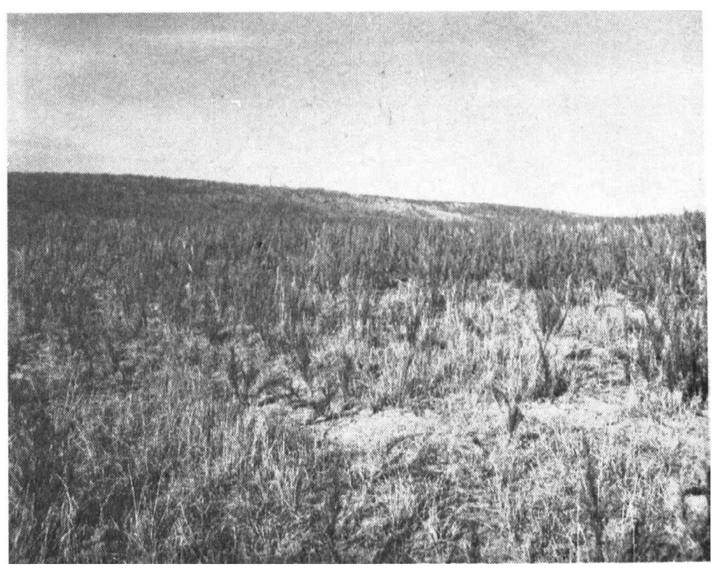

Figure 20.—**A Sands range site in Hall County in poor condition. Green sagewort and annuals make up 80 percent of the vegetation.**

TABLE 3.—*Relative productivity of six range sites*

[Productivity of the Sands range site in excellent condition is 100]

Range site	Range condition			
	Excellent	Good	Fair	Poor
Wetland	300	225	150	75
Subirrigated	200	150	100	50
Saline lowland	125	94	62	31
Sands	100	75	50	25
Sandy	100	75	50	25
Silty	100	75	50	25

quality seed under consideration, divide pure live seed index (purity multiplied by percentage of germination) into the figure shown in table 4.

Seedbed preparation and seeding.—Successful stands are dependent on minimum competition for the grass seedlings, prevention of blowing, and a firm seedbed. The most successful way to prepare a seedbed consists of drilling a stubble crop and then planting the grass in the stubble after the crop is harvested. Sudangrass, cane, millet, or a similar crop is drilled during the year that precedes planting the grass. This crop is harvested, leaving a 6- to 18-inch stubble, and the grass seed is drilled into the stubble. The best depth is ½ inch in silty soils and ¾ inch in sands and sandy soils. The establishment of the stand is assisted by a packer behind the drill to firm the soil over the seed. Seeded stands should not be grazed until the grass is well established. Then manage these stands the same as native range.

Range management

Successful grazing management of rangeland depends on: (1) proper degree of use, (2) proper season of use, (3) proper distribution of grazing, and (4) use of proper kinds of grazing animals.

Proper degree of use.—The number of livestock and the length of grazing period should be in balance with the available forage. In a correct balance one-half of the current year's growth is used by the end of the growing season. The forage left on the ground does these things:

1. Permits manufacture of plant food for vigorous growth of tops and roots. Deep roots reach and take in the deep moisture, and more grass is produced.
2. Makes a mulch that causes rapid intake and storage of soil moisture. If more water is stored in the ground, more grass can grow.
3. Protects soil from wind and water erosion.
4. Encourages the vigor of the best grasses, and enables them to crowd out weeds.
5. Enables plant food to be stored in roots and used in quick and vigorous growth in spring and after droughts.
6. Holds the snow where it falls and thereby causes more uniform moisture in the soil.
7. Provides a greater feed reserve for dry spells that otherwise might force sale of livestock at a loss.

Proper season of use.—Grazing at different seasons can be used to improve the condition of the range, allow maximum forage production, and obtain the greatest livestock gains. Some pastures may need rest during the growing season to improve their production and range condition; pastures in excellent condition are not so urgently in need of rest. A survey of a range site and its condition made with the assistance of Soil Conservation Service technicians will help determine the most desirable season of use for each pasture.

Proper distribution of grazing.—Distribute the grazing throughout the pasture so that the closely grazed

TABLE 4.—*Native grass mixtures suitable for seeding different range sites in Hall County, Nebr. (pounds of pure live seed per acre)*

Kind of grass	Range sites							
	Wetland	Subirrigated	Overflow	Saline lowland	Sands	Sandy	Silty	Shallow [1]
Tall:	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Reed canarygrass	1.0							
Northern or bluejoint reedgrass	1.0							
Big bluestem		1.6	1.1				0.5	
Indiangrass		1.5	1.0		0.8	0.6	.5	0.3
Switchgrass		.7	.5	[2] 1.1	.3	.3	.3	.2
Sand bluestem					1.2	.9		.5
Mid warm season:								
Little bluestem			.3		.7	.6	.5	.3
Side-oats grama			.4				.7	.4
Sand lovegrass					.1	.1		.1
Alkali sacaton				.1				
Mid cool season:								
Western wheatgrass			1.6	[2] 2.4		.8	1.6	1.4
Green needlegrass					.4	.5	1.0	.8
Canada wildrye					.6	.8		1.3

[1] Shallow site has predominately sandy soils.
[2] Use seed of strains harvested on Saline lowland.

portion does not exceed 5 percent of the pasture and is balanced by an equal amount that is grazed lightly. Distribution of grazing can be controlled by fencing, salting, and herding. Herding is almost prohibited because of labor cost.

The best location and arrangement of fences provide summer, fall, and winter pasture for all classes of livestock. Where possible, put fences on the boundaries between range sites. Subirrigated sites can be managed best when fences separate them from Sands sites; the grasses are different on the two sites, and it is difficult to graze the whole pasture uniformly if the two sites are fenced together.

Proper kinds of grazing animals.—Range vegetation and soil differ with the climate. Select the kind of grazing animals needed to suit these conditions. Most of the range in Hall County is grazed by cattle.

Use and Management of Woodlands [5]

The natural forest growth in Hall County is mainly along the Platte River on recently deposited sediments and along the Wood River, Prairie Creek, and some of the smaller drainageways in narrow strips. The low-lying, elongated islands, formed by a number of widely separated channels of the Platte River, support much of the native cottonwood and willow. The nonarable parts of the flood plains and slopes of the lower valleys support some cottonwood, willow, boxelder, American and red elm, green and red ash, hackberry, and redcedar.

Much of the woodland area is grazed in conjunction with adjacent grassland. Products from native woods consist of small amounts of fuel wood, some fence posts, and occasionally small amounts of saw timber for farm use.

Tree planting

The proper preparation of the soil for tree planting varies for different site conditions. Summer fallow is desirable to assist in storing moisture in the finer textured soils and in all sod or alfalfa ground. Fall plowing and spring disking are normally adequate for the medium-textured soils. In the sandhills in the northern part of the county, prepare only a narrow band for each row of trees, and, to control soil blowing, leave a strip of native sod between rows.

Planting sites and suitable species

In table 5 the soils of Hall County have been grouped in eight woodland sites, according to the capacity of the sites to support similar tree growth. Species of trees suitable for planting on each site are listed.

Maintenance of tree plantings

Successful establishment of trees in the prairie-plains region largely depends on proper care and protection. To survive and make satisfactory growth, trees must be clean cultivated until they form a canopy that will shade out weeds and grass (fig. 21). Generally this takes from 5 to 6 years.

[5] This section was written by SIDNEY S. BURTON, woodland conservationist, Soil Conservation Service.

***Figure 21.*—The spring-toothed harrow is excellent for cultivating.**

Windbreaks

Hall County is near the eastern margin of the Great Plains where the planting of windbreaks is important. These windbreaks can be used to protect farm buildings and livestock and to protect fields. Livestock should be kept out of windbreaks permanently if a good barrier is to be maintained.

PROTECTION OF FARM BUILDINGS AND LIVESTOCK

Windbreaks for winter protection of farm buildings and feed lots should be wide enough—seven to ten rows of trees—to hold most of the snow within the trees. They should be located on the northern and western sides of the area to be protected and not closer than 100 feet from the main buildings. A combination of low trees, shrubby growth, medium-height trees, and tall trees should be included in the windbreaks to provide a satisfactory barrier. For adequate winter protection and longer life, a windbreak should be made up of at least 50 percent conifers. Redcedar makes an excellent outside row having dense growth to the ground.

The benefits from windbreaks will more than repay the planter for the expense and labor that goes into their establishment. Windbreaks prevent snow drifting in yards, prevent soil blowing, reduce fuel costs, reduce feed costs, provide shelter for livestock, protect gardens, and beautify the farm home.

PROTECTION OF FIELDS

Field windbreaks are of particular value in controlling wind erosion on some of the lighter soils under cultivation. Tree belts protect for a distance of about 20 times the height of the barrier. For this reason, complete protection for fields can be obtained only by planting a series of belts at regular intervals across the field. Wide belts are not necessary for field protection, but the belts should consist of dense growing trees that do not take the moisture from the field. One- to three-row belts, chiefly of redcedar and pine, are suggested.

TABLE 5.—*Woodland sites and species suitable for planting*

Woodland site and soils	Map symbol	Capability unit (dryland)	Species suitable for planting and remarks
Silty to clayey:			
Deep, well-drained, silty, clayey, or claypan soils except the saline-alkali soils.			*Shrubs:* Lilac, Tatarian honeysuckle, cotoneaster, and chokecherry. *Conifers:* Redcedar, Rocky Mountain juniper, Austrian pine, and ponderosa pine. *Low broadleaf:* Russian-olive and mulberry. *Medium and tall broadleaf:* Green ash, hackberry, honeylocust, American elm, and Siberian elm. *Remarks:* The soils in this woodland site have satisfactory tree growth if the trees are established. Blowing soil and drought are the main hazards. These hazards can be overcome by summer fallow, cover cropping, clean cultivation, and watering when needed. Of most importance is planting stock of good quality, careful handling of trees before planting to prevent drying, and careful planting.
Broken land	Bl	VIe-1	
Butler silt loam	Bu	IIs-2	
Cass loam, deep	3Cm	I-1	
Cass loam	Cm	IIs-5	
Colby silt loam, 7 to 11 percent slopes	CbC	IVe-1	
Colby silt loam, 11 to 30 percent slopes	CbD	VIe-1	
Hall silt loam, 0 to 1 percent slopes	Ha	IIc-1	
Hall silt loam, 1 to 3 percent slopes	HaA	IIe-1	
Hall silt loam, 3 to 7 percent slopes, eroded	HaB2	IIIe-1	
Hall-O'Neill complex, 0 to 1 percent slopes	H-0	IIc-1	
Hastings silt loam, 0 to 1 percent slopes	Hs	IIc-1	
Hastings silt loam, 1 to 3 percent slopes	HsA	IIe-1	
Hastings silt loam, 3 to 7 percent slopes, eroded.	HsB2	IIIe-1	
Hastings complex, severely eroded	Hs3	IVe-1	
Hobbs silt loam, 0 to 1 percent slopes	Hb	IIc-1	
Hobbs silt loam, 1 to 3 percent slopes	HbA	IIe-1	
Holdrege silt loam, 0 to 1 percent slopes	Ho	IIc-1	
Holdrege silt loam, 1 to 3 percent slopes	HoA	IIe-1	
Holdrege silt loam, 3 to 7 percent slopes	HoB	IIIe-1	
Holdrege silt loam, 3 to 7 percent slopes, eroded.	HoB2	IIIe-1	
Holdrege silt loam, 7 to 11 percent slopes	HoC	IVe-1	
Holdrege silt loam, 7 to 11 percent slopes, eroded.	HoC2	IVe-1	
Holdrege-Colby complex, severely eroded	H-C3	IVe-1	
Hord silt loam, 0 to 1 percent slopes	Hd	IIc-1	
Hord silt loam, 1 to 3 percent slopes	HdA	IIe-1	
Hord silt loam, 3 to 7 percent slopes, eroded.	HdB2	IIIe-1	
Hord silt loam, thin solum variant, 0 to 3 percent slopes.	2HdA	IIc-1	
Hord silt loam, thin solum variant, 3 to 7 percent slopes.	2HdB	IIIe-1	
Kenesaw silt loam, 0 to 1 percent slopes	Ks	IIc-1	
Kenesaw silt loam, 1 to 3 percent slopes	KsA	IIIe-1	
Kenesaw silt loam, 3 to 7 percent slopes	KsB	IIIe-1	
O'Neill loam, 0 to 1 percent slopes	Ok	IIs-5	
O'Neill loam, 3 to 5 percent slopes, eroded	OkB2	IIIe-1	
Ortello loam, 0 to 1 percent slopes	Ot	IIc-1	
Volin silt loam	Vo	I-1	
Wood River silt loam, 0 to 1 percent slopes	Wr	IIs-2	
Wood River silt loam, 1 to 3 percent slopes	WrA	IIs-2	
Wood River silt loam, 3 to 7 percent slopes, eroded.	WrB2	IIIe-2	
Sandy:			
Slightly sandy soils and nearly level to gently sloping very sandy soils.			*Shrubs:* Lilac, American plum, Tatarian honeysuckle, cotoneaster, and three-leaved sumac. *Conifers:* Redcedar, Rocky Mountain juniper, ponderosa pine, and Austrian pine. *Low broadleaf:* Russian-olive, mulberry, and boxelder. *Medium and tall broadleaf:* Green ash, honeylocust, hackberry, cottonwood, and Siberian elm. *Remarks:* The soils in this woodland site are good for tree planting. Soil blowing is prevented by cultivating only in tree rows and leaving a strip of vegetation between the rows.
Cass fine sandy loam, deep	3Cs	IIe-3	
Cass fine sandy loam	Cs	IIe-3	
Hord-O'Neill complex, 0 to 1 percent slopes	H-N	IIe-3	
O'Neill sandy loam, 0 to 1 percent slopes	Om	IIe-3	
O'Neill sandy loam, 3 to 7 percent slopes, eroded.	OmB2	IIIe-3	
Ortello fine sandy loam, 0 to 3 percent slopes	OrA	IIe-3	
Ortello fine sandy loam, 3 to 7 percent slopes	OrB	IIIe-3	
Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.	2Or	IIe-3	
Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.	2OrB	IIIe-3	
Sarpy loamy fine sand, 0 to 3 percent slopes	SgA	IIIe-5	
Sarpy loamy fine sand, 3 to 7 percent slopes	SgB	IVe-5	
Thurman fine sandy loam, 0 to 3 percent slopes.	TsA	IIe-3	
Thurman fine sandy loam, 3 to 7 percent slopes.	TsB	IIIe-3	

TABLE 5.—*Woodland sites and species suitable for planting*—Continued

Woodland site and soils	Map symbol	Capability unit (dryland)	Species suitable for planting and remarks
Sandy—Continued			
Slightly sandy soils and nearly level to gently sloping very sandy soils—Continued			
Thurman loamy fine sand, 0 to 3 percent slopes.	ThA	IIIe-5	
Thurman loamy fine sand, 3 to 7 percent slopes.	ThB	IVe-5	
Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.	2ThA	IIIe-5	
Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.	2ThB	IVe-5	
Very sandy:			
Very sandy soils and loose sand that cannot be safely cultivated.			
Platte-Sarpy complex	P-S	VIIe-5	*Conifers:* Redcedar, Rocky Mountain juniper, and ponderosa pine. *Remarks:* The soils in this woodland site cannot be cultivated. Trees must be planted in shallow furrows and not be cultivated. Only coniferous species can succeed under these conditions.
Platte-Sarpy complex, channeled	2P-S	VIIe-5	
Sarpy fine sand	Sa	VIIe-5	
Thurman loamy fine sand, wind eroded	Th3	VIe-5	
Valentine fine sand	Va	VIIe-5	
Moderately wet:			
Soils on bottom lands, benches, and uplands that are occasionally wet because of high water table or flooding; some areas are flooded frequently for a short time.			
Alluvial land	Sy	VIw-1	*Shrubs:* Lilac, Tatarian honeysuckle, buffaloberry, American plum, red-osier dogwood, and purple willow. *Conifers:* Redcedar and, on the drier sites, Austrian pine. *Low broadleaf:* Russian-olive, boxelder, and diamond willow. *Medium and tall broadleaf:* Golden willow, green ash, hackberry, honeylocust, American elm, cottonwood, Siberian elm, and white willow. *Remarks:* The soils in this woodland site are good for planting trees, but species of trees and shrubs must be planted that can tolerate occasional wetness.
Elsmere fine sandy loam	Es	IIIw-5	
Elsmere loamy fine sand	Ea	IIIw-5	
Fillmore silt loam	Fm	IIIw-2	
Hobbs silt loam, 0 to 1 percent slopes	Hb	IIw-3	
Lamoure silt loam	La	IIIw-2	
Leshara fine sandy loam	Lf	IIw-6	
Leshara silt loam	Le	IIw-4	
Ovina fine sandy loam	Ov	IIw-6	
Ovina loamy fine sand	Oa	IIIw-5	
Silver Creek silt loam	Si	IIIw-2	
Wann fine sandy loam, deep	3Wb	IIw-6	
Wann fine sandy loam	Wb	IIw-6	
Wann loam, deep	3Wm	IIw-4	
Wann loam	Wm	IIw-4	
Wet:			
Soils in depressions on the bottom lands, benches, and uplands that are extremely wet or ponded because of flooding, high water table, or poor drainage.			
Barney loam	Ba	Vw-1	*Shrubs:* Purple willow and red-osier dogwood. *Conifers:* None. *Low broadleaf:* Diamond willow. *Medium and tall broadleaf:* Golden willow, white willow, and cottonwood. *Remarks:* Tree growth on the soils in this woodland site is limited by excessive wetness. Only those species can be sucessfully grown that are tolerant of wetness.
Loup loam	Lm	Vw-1	
Scott silt loam	Sc	IVw-2	
Moderately saline or alkali:			
Moderately saline or alkali soils.			
Lamoure silt loam, saline	2La	IVs-1	*Shrubs:* Buffaloberry and American plum. *Conifers:* None. *Low broadleaf:* Russian-olive and diamond willow. *Medium and tall broadleaf:* Green ash, Siberian elm, and cottonwood. *Remarks:* The soils on this woodland site are suited to only those species that are somewhat tolerant of moderate salinity or alkalinity.
Leshara silt loam, saline	2Le	IVs-1	
Wann loam, deep, saline	2Wm	IVs-1	
Wood River-Exline fine sandy loams	W-Es	IVs-1	
Wood River-Exline silt loams	W-E	IVs-1	

TABLE 5.—*Woodland sites and species suitable for planting*—Continued

Woodland site and soils	Map symbol	Capability unit (dryland)	Species suitable for planting and remarks
Shallow:			
Shallow soils having a limited root zone above dry gravel.			
Meadin sandy loam, 0 to 1 percent slopes	Ms	VIIs-4	*Shrubs:* None.
Meadin loamy sand, 3 to 11 percent slopes	MdB	VIIs-4	*Conifers:* Redcedar.
Platte loam	Pt	VIIs-4	*Low broadleaf:* None.
Platte-Wann complex	P-W	VIIs-4	*Medium and tall broadleaf:* None.
Platte-Wann complex, channeled	2P-W	VIIs-4	*Remarks:* Only limited tree planting is possible on these shallow soils. Extensive windbreaks are seldom needed. If tree plantings are desired, careful examination of the site should be made to determine the depth of the soil.
Not plantable:			
Strongly saline or alkali soils and riverwash.			
Riverwash	Rw	VIII	No planting of trees can be successful on these sites.
Exline-Wood River fine sandy loams	E-Ws	VIs-1	
Exline-Wood River silt loams	E-W	VIs-1	

A complete system of field windbreaks helps control soil blowing, increases soil moisture by holding snow on the fields, prevents mechanical damage to crops by strong winds, reduces evaporation, and furnishes food and cover for wildlife (fig. 22).

Engineering Uses of Soils[6]

This soil survey report of Hall County, Nebraska, contains information helpful to engineers in—

1. Making soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Making estimates of runoff and erosion characteristics for use in designing structures and planning dams and other structures for water and soil conservation.
3. Making reconnaissance surveys of soil and ground conditions that will aid in the selection of highway and airport locations and in planning detailed soil studies for the intended locations.
4. Estimating drainage areas and runoff characteristics for culvert and bridge design.
5. Classifying soils along the proposed highway route and using this information in making preliminary estimates of required flexible pavement thicknesses.
6. Estimating the necessity of clay surfacing on nonpaved roads.
7. Locating deposits of sand, gravel, rock, mineral filler, and soil binder for use in construction of subbase courses, base courses, and surface courses of flexible pavements for highways and structures.
8. Estimating terrain conditions such as topography, surface drainage, subsurface drainage, and height of water table in connection with the design of highway embankments, subgrades, and pavements, both rigid and flexible.
9. Correlating structure performance with types of soil and thus developing information that will be useful in designing and maintaining such structures.

[6] Much of this section was prepared by the Division of Materials and Tests, Nebraska Department of Roads, and the Conservation Engineer for Nebraska, Soil Conservation Service.

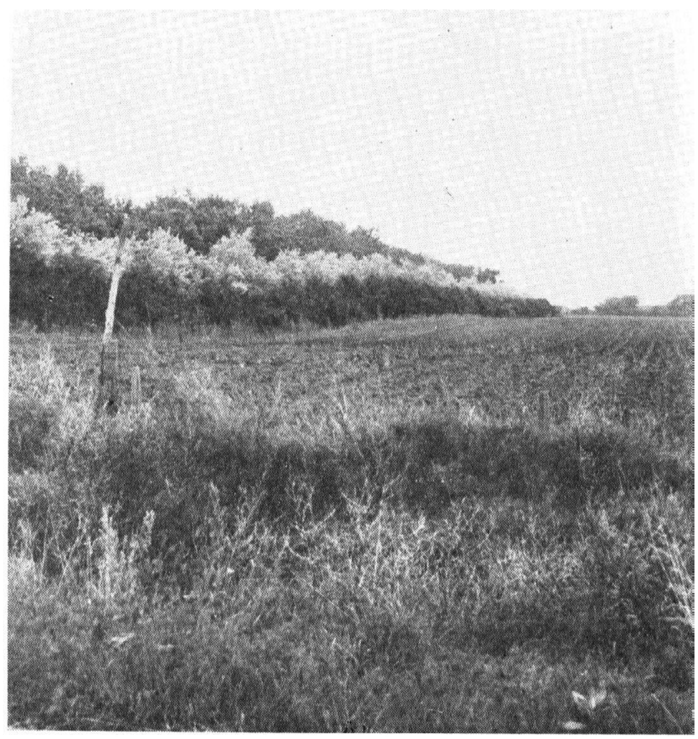

Figure 22.—A field windbreak with redcedar on both sides of taller growing broadleaf species makes a good barrier against the wind.

Soil science terminology

Some of the terms used by the agricultural soil scientist may be unfamiliar to the engineer, and some words —for example, soil, clay, silt, sand, and aggregate—may have special meaning in soil science. These and other special terms that are used in the soil survey report are defined in the Glossary.

Soil test data and engineering soil classifications

To be able to make the best use of the soil maps and the soil survey reports, the engineer should know the physical properties of the soil materials and the condition of the soil in place. After testing soil materials and observing the behavior of soils in engineering structures and foundations, the engineer can develop design recommendations for the soil units delineated on the maps.

SOIL TEST DATA

Samples of 26 different soil types were tested by the Division of Materials and Tests, Nebraska Department of Roads, in accordance with the standard procedures of the American Association of State Highway Officials (AASHO) (*1*). The test data are given in table 6.

TABLE 6.—*Engineering test [1] data for soil samples*

Soil name and location	Parent material	Nebraska Dept. of Roads report No.	Depth	Horizon	Moisture-density: Maximum dry density per cubic foot	Moisture-density: Optimum moisture
			Feet		*Pounds*	*Percent*
Broken land: 130 feet north and 50 feet west of SE corner, sec. 13, T. 12 N., R. 12 W.	Peorian loess	S57-3841	0 - 1.0	Upper	—	—
		S57-3842	1.0 - 4.0	Parent material	—	—
Cass fine sandy loam, deep: 2,405 feet north and 1,770 feet east of SW corner, sec. 11, T. 10 N., R. 10 W.	Alluvium underlain by sands and gravel.	MA56-2001	0 - 2.0	Upper	—	—
		MA56-2002	2.0 - 6.5	Parent material	—	—
2,500 feet east and 35 feet north of SW corner, sec. 29, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	S59-3189	0 - 1.4	Upper	104	17.3
Cass loam: 1,042 feet west and 30 feet north of SE corner, sec. 25, T. 11 N., R. 10 W.	Alluvium underlain by sands and gravel.	S59-3186	0 - 1.0	Upper	—	—
		S59-3192	1.0 - 3.0	Middle	—	—
		S59-3171	3.0 - 4.5	Parent material	—	—
Fillmore silt loam: 450 feet south and 45 feet west of NE corner, sec. 13, T. 10 N., R. 12 W.	Peorian loess	S55-2066	0 - 1.2	Upper	—	—
		S55-2067	1.2 - 2.1	Middle	—	—
Hall silt loam: 45 feet east and 500 feet north of intersection of U.S. Highway 30 and State Highway 60, sec. 19, T. 10 N., R. 11 W.	Silts and clays	S55-2053	0 - 1.0	Upper	—	—
		S55-2054	1.0 - 3.5	Middle	—	—
2,420 feet south and 40 feet east of NW corner, sec. 31, T. 12 N., R. 11 W.	Silts and clays	S55-2301	0 - 1.7	Upper	—	—
		S55-2302	1.7 - 2.4	Middle	—	—
		S55-2303	2.4 - 4.0	Lower	—	—
Hall-O'Neill complex (O'Neill profile): 1,650 feet north and 50 feet east of SW corner, sec. 24, T. 11 N., R. 10 W.	Alluvium underlain by sands and gravel.	S59-3161	0 - 0.8	Upper	—	—
		S59-3170	0.8 - 1.8	Middle	—	—
		S59-3148	1.8 - 3.5	Lower	—	—
2,350 feet south and 1,500 feet east of NW corner, sec. 24, T. 11 N., R. 10 W.	Alluvium underlain by sands and gravel.	S59-3160	0 - 0.4	Upper	—	—
		S59-3169	0.4 - 1.6	Middle	—	—
		S59-3147	1.6 - 3.5	Lower	—	—
Holdrege silt loam: 580 feet south and 60 feet east of NW corner, sec. 8, T. 9 N., R. 9 W.	Peorian loess	S59-1907	0 - 1.5	Upper	—	—
		S59-1908	1.5 - 3.0	Upper middle	—	—
		S59-1909	3.0 - 6.0	Lower middle	—	—
		S59-1920	6.0 - 8.8	Parent material	—	—
Hord silt loam: 3,340 feet north and 45 feet west of SE corner, sec. 13, T. 10 N., R. 12 W.	Peorian loess	S55-2063	0 - 1.5	Upper	—	—
		S55-2064	1.5 - 4.0	Parent material	—	—
Hord silt loam, thin solum variant: 860 feet south and 40 feet east of NW corner, sec. 19, T. 10 N., R. 11 W.	Alluvial silts	S55-2057	0 - 1.8	Upper	—	—
		S55-2058	1.8 - 4.0	Parent material	—	—
Kenesaw silt loam: 1,940 feet south and 50 feet west of NE corner, sec. 13, T. 12 N., R. 12 W.	Peorian loess	S57-3923	0 - 0.5	Upper	104	17.6
		S57-3924	0.5 - 3.5	Middle	101	20.0

The soil test data in table 6 are from samples obtained and tested in soil surveys of five highway projects located in Hall County. Each soil was sampled by natural horizons, but the terminology used by the Nebraska Department of Roads in naming each horizon differs somewhat from that used by the U.S. Department of Agriculture. Therefore, the horizons are called upper, middle, and lower, or parent material.

The soils listed in table 6 were sampled in one or more locations. The test data for the soils sampled in only one location indicate the engineering characteristics for these soils at the specific locations where they were sampled. It must be understood that there may be variations in the physical test characteristics of each soil at locations other than the one where it was sampled. Even for those soils sampled in more than one location, the test data probably do not show the maximum range in characteristics of materials that may be encountered.

The engineering soil classifications in table 6 are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. The mechanical analysis data for each soil sample identified in table 6 were obtained by a combination of sieve and hydrometer analyses. Percentages of clay obtained by the hydrometer method should not be used in naming soil textural classes.

taken from 36 soil profiles, Hall County, Nebr.

Mechanical analysis [2]											Liquid limit [3]	Plasticity index [3]	Classification	
Percentage passing sieve—							Percentage smaller than—						AASHO [4]	Unified [5]
¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 50 (0.295 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
------	------	------	------	100	98	55	42	------	13	------	21	3	A-4(4)	ML.
------	------	------	------	100	99	45	28	------	8	------	NP	NP	A-4(2)	SM.
------	------	------	100	94	87	31	20	------	8	------	NP	NP	A-2-4(0)	SM.
------	------	------	100	94	89	31	17	------	7	------	NP	NP	A-2-4(0)	SM.
------	------	------	100	94	90	69	51	------	15	------	31	8	A-4(7)	CL-ML.
------	------	------	100	94	92	82	59	------	7	------	30	6	A-4(8)	ML.
------	------	------	100	99	98	94	71	------	8	------	29	6	A-4(8)	ML.
100	99	98	95	58	50	24	12	------	1	------	NP	NP	A-2-4(0)	SM.
------	------	------	------	100	99	98	80	------	24	------	33	9	A-4(8)	ML.
------	------	------	------	100	99	96	82	------	33	------	42	16	A-7-6(11)	ML-CL.
------	------	------	100	99	98	91	80	------	27	------	36	10	A-4(8)	ML.
------	------	------	100	96	93	83	73	------	29	------	37	15	A-6(10)	CL.
------	------	------	100	99	99	97	78	------	23	------	35	10	A-4(8)	ML.
------	------	------	------	------	100	98	88	------	46	------	49	21	A-7-6(14)	ML.
------	------	------	------	------	100	99	87	------	42	------	49	19	A-7-5(13)	ML.
------	------	------	100	85	74	42	29	------	8	------	NP	NP	A-4(1)	SM.
------	------	------	100	84	74	48	38	------	11	------	22	6	A-4(3)	SM-SC.
------	------	------	100	75	56	8	4	------	2	------	NP	NP	A-3(0)	SP-SM.
------	------	------	100	90	80	27	17	------	7	------	NP	NP	A-2-4(0)	SM.
------	------	------	100	93	86	29	18	------	4	------	NP	NP	A-2-4(0)	SM.
------	------	------	100	93	82	24	12	------	6	------	NP	NP	A-2-4(0)	SM.
------	------	------	100	91	85	64	45	------	15	------	25	6	A-4(6)	ML-CL.
------	------	------	100	78	67	39	25	------	10	------	21	4	A-4(1)	SM-SC.
------	------	------	100	91	87	71	51	------	18	------	24	5	A-4(7)	ML-CL.
------	------	------	100	99	99	96	76	------	25	------	35	13	A-6(9)	CL.
------	------	------	100	99	99	94	78	------	24	------	33	8	A-4(8)	ML.
------	------	------	------	------	100	92	69	------	18	------	26	5	A-4(8)	CL-ML.
------	------	------	100	96	93	84	74	------	22	------	31	9	A-4(8)	CL.
------	------	100	99	79	70	54	38	------	16	------	27	11	A-6(4)	CL.
------	------	------	100	99	98	85	60	------	16	------	27	5	A-4(8)	ML.
------	------	------	------	------	100	98	78	------	27	------	39	15	A-6(10)	CL.

556518—61——5

TABLE 6.—*Engineering test [1] data for soil samples*

Soil name and location	Parent material	Nebraska Dept. of Roads report No.	Depth	Horizon	Moisture-density: Maximum dry density per cubic foot	Moisture-density: Optimum moisture
			Feet		*Pounds*	*Percent*
O'Neill loam:						
2,240 feet east and 600 feet south of NW corner, sec. 20, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	S59-3155	0 - 1.2	Upper		
		S59-3163	1.2 - 2.4	Middle		
		S59-3141	2.4 - 3.5	Lower		
1,950 feet west and 1,300 feet south of NE corner, sec. 24, T. 11 N., R. 10 W.	Alluvium underlain by sands and gravel.	S59-3158	0 - 0.8	Upper		
		S59-3167	0.8 - 1.5	Upper middle		
		S59-3153	1.5 - 3.0	Lower middle	104	18.4
		S59-3144	3.0 - 3.5	Lower		
Ortello fine sandy loam, loamy substratum:						
640 feet east and 500 feet south of NW corner, sec. 20, T. 11 N., R. 9 W.	Alluvial sands	S59-3156	0 - 0.7	Upper	105	15.2
		S59-3164	0.7 - 2.4	Middle	111	13.8
2,200 feet west and 1,480 feet south of NE corner, sec. 24, T. 11 N., R. 10 W.	Alluvial sands	S59-3159	0 - 0.8	Upper		
		S59-3168	0.8 - 1.5	Middle		
		S59-3145	1.5 - 3.5	Parent material		
1,000 feet north and 50 feet east of SW corner, sec. 7, T. 12 N., R. 11 W.	Eolian sands	No test	0 - 0.25	Upper		
		S57-3861	0.25- 3.0	Middle		
	Underlain by loess.	S57-3862	3.0 -14.0	Parent material		
Platte loam:						
150 feet south and 250 feet east of NW corner, sec. 5, T. 10 N., R. 9 W.	Alluvium underlain by sands and gravel.	No test	0 - 2.0	Upper		
		S56-1938	2.0 -13.8	Lower		
Platte-Sarpy complex (Platte profile):						
2,400 feet west and 35 feet north of SE corner, sec. 28, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	S59-3191	0 - 1.0	Upper		
		S59-3182	1.0 - 1.8	Middle		
		S59-3183	1.8 - 3.5	Lower		
Platte-Sarpy complex, channeled (Sarpy profile):						
110 feet east and 70 feet south of NW corner, sec. 33, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	S59-3190	0 - 0.8	Upper		
		S59-3180	0.8 - 3.5	Middle		
Platte-Wann complex (Platte profile):						
0.58 mile south and 70 feet west of NE corner, sec. 32, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	No test	0 - 0.3	Upper		
		MA59-2476	0.3 - 1.6	Middle		
		MA59-2477	1.6 - 3.6	Lower		
Sarpy fine sand:						
1,800 feet south and 30 feet west of NE corner, sec. 25, T. 10 N., R. 10 W.	Alluvial sands	S56-1924	0 - 3.0	Upper		
Sarpy loamy fine sand:						
830 feet north and 30 feet west of SE corner, sec. 24, T. 10 N., R. 10 W.	Alluvial sands	S56-1927	0 - 4.0	Upper		
Thurman loamy fine sand:						
2,300 feet west and 125 feet north of SE corner, sec. 32, T. 10 N., R. 9 W.	Eolian sands	MA56-1982	0 - 1.5	Upper		
		MA56-1983	1.5 - 6.5	Lower		
Thurman loamy fine sand, loamy substratum:						
1,860 feet north and 1,450 feet west of SE corner, sec. 24, T. 11 N., R. 10 W.	Eolian sands	S56-1953	0 - 2.0	Upper	112	12.2
		S56-1954	2.0 - 3.8	Middle	120	11.1
		S56-1955	3.8 - 8.8	Lower	115	10.7
1,770 feet west and 80 feet north of SE corner, sec. 13, T. 11 N., R. 10 W.	Eolian sands	MA56-2003	0 - 0.8	Upper		
		MA56-2004	0.8 - 2.7	Lower		
Valentine fine sand:						
2,330 feet north and 500 feet west of SE corner, sec. 1, T. 12 N., R. 12 W.	Eolian sands	S57-3874	0 -14.0	Parent material		
Volin silt loam:						
700 feet east and 35 feet north of SW corner, sec. 29, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	S59-3187	0 - 1.5	Upper		
		No test	1.5 - 2.0	Middle		
		S59-3174	2.0 - 4.0	Lower		
Wann fine sandy loam:						
1,560 feet east and 1,400 feet north of SW corner, sec. 24, T. 10 N., R. 10 W.	Alluvium underlain by sands and gravel.	No test	0 - 2.2	Upper		
		MA56-1986	2.2 - 4.0	Middle		
		MA56-1987	4.0 - 6.0	Lower		

taken from 36 soil profiles, Hall County, Nebr.—Continued

Mechanical analysis [2]											Liquid limit [3]	Plasticity index [3]	Classification	
Percentage passing sieve—							Percentage smaller than—							
¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 50 (0.295 mm.)	No. (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [4]	Unified [5]
			100	89	82	62	42		12		22	3	A-4(5)	ML.
			100	82	72	46	36		10		22	4	A-4(2)	SM-SC.
	100	99	97	74	60	19	11		6		NP	NP	A-2-4(0)	SM.
			100	90	84	60	43		11		22	4	A-4(5)	ML-CL.
			100	90	85	73	60		25		33	13	A-6(9)	CL.
			100	98	96	91	75		29		36	14	A-6(10)	CL.
			100	77	62	10	7		4		NP	NP	A-3(0)	SP-SM.
			100	96	91	74	49		14		27	6	A-4(8)	ML-CL.
			100	89	80	57	46		15		25	6	A-4(4)	ML-CL.
			100	83	74	46	34		12		21	5	A-4(2)	SM-SC.
	100	99	98	83	76	45	39		19		27	10	A-4(2)	SC.
			100	87	72	7	3		2		NP	NP	A-3(0)	SP-SM.
			100	98	93	42	33		11		NP	NP	A-4(1)	SM.
			100	99	99	96	80		27		36	11	A-6(8)	ML.
	100	91	76	41	31	8	4		1		NP	NP	A-1-b(0)	SP-SM.
			100	79	65	19	10		1		NP	NP	A-2-4(0)	SM.
			100	88	81	29	15		2		NP	NP	A-2-4(0)	SM.
	100	98	86	55	43	7	1		0		NP	NP	A-3(0)	SP-SM.
			100	98	97	68	50		15		33	9	A-4(7)	ML.
			100	98	97	62	41		6		NP	NP	A-4(5)	ML.
			100	87	76	24	11		2		NP	NP	A-2-4(0)	SM.
		100	99	83	70	14	8		2		NP	NP	A-2-4(0)	SM.
		100	99	78	61	8	3		1		NP	NP	A-3(0)	SP-SM.
			100	95	90	35	17		2		NP	NP	A-2-4(0)	SM.
			100	72	56	17	12		5		NP	NP	A-2-4(0)	SM.
			100	75	60	15	10		5		NP	NP	A-2-4(0)	SM.
			100	89	80	31	17		6		NP	NP	A-2-4(0)	SM.
			100	86	77	51	40		12		24	7	A-4(3)	CL-ML.
	100	98	95	54	47	7	4		3		NP	NP	A-3(0)	SP-SM.
		100	99	71	55	19	14		5		NP	NP	A-2-4(0)	SM.
			100	86	72	15	8		4		NP	NP	A-2-4(0)	SM.
			100	91	78	6	3		3		NP	NP	A-3(0)	SP-SM.
			100	96	94	84	63		16		32	9	A-4(8)	CL.
100	99	93	76	31	19	3	1		0		NP	NP	A-1-b(0)	SW.
		100	99	81	68	13	7		2		NP	NP	A-2-4(0)	SM.
	100	99	99	88	81	39	22		4		NP	NP	A-4(1)	SM.

TABLE 6.—*Engineering test*[1] *data for soil samples*

Soil name and location	Parent material	Nebraska Dept. of Roads report No.	Depth	Horizon	Moisture-density: Maximum dry density per cubic foot	Moisture-density: Optimum moisture
			Feet		*Pounds*	*Percent*
Wann loam:						
2,750 feet north and 30 feet west of SE corner, sec. 24, T. 10 N., R. 10 W.	Alluvium underlain by sands and gravel.	S56-1926	0 - 2.0	Upper		
1,600 feet east and 35 feet north of SW corner, sec. 29, T. 11 N., R. 9 W.	Alluvium underlain by sands and gravel.	S59-3188	0 - 1.5	Upper		
Wann loam, deep:						
1,890 feet south and 85 feet east of NW corner, sec. 17, T. 10 N., R. 9 W.	Alluvium underlain by sands and gravel.	S56-1929	0 - 3.5	Upper		
Wood River silt loam:						
850 feet south and 45 feet west of NE corner, sec. 12, T. 10 N., R. 12 W.	Terrace loess	S55-2070	0 - 1.3	Upper		
		S55-2071	1.3 - 2.5	Middle		
		S55-2072	2.5 - 4.0	Lower		
2,150 feet south and 40 feet east of NW corner, sec. 19, T. 11 N., R. 11 W.	Terrace loess	S55-2281	0 - 1.8	Upper		
		S55-2282	1.8 - 2.8	Middle		
		S55-2283	2.8 - 4.0	Lower		
580 feet north and 40 feet west of SE corner, sec. 25, T. 12 N., R. 12 W.	Terrace loess	S55-2304	0 - 1.8	Upper		
		S55-2305	1.8 - 3.0	Middle		
		S55-2306	3.0 - 4.0	Lower		

[1] Tests performed by the Division of Materials and Tests, Nebr., Department of Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] Mechanical analysis according to the AASHO Designation: T 88. Results by this procedure frequently differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The

The liquid limit and plastic limit tests measure the effects of water on the consistence of the soil material. As the moisture content of a clay soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 6 also gives compaction (moisture-density) data for a few of the tested soils. If a soil material is compacted at progressively higher moisture content, assuming that the compactive force remains constant, the density of the compacted material will increase until the "optimum moisture content" is reached; after that the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in earthwork, for, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

ENGINEERING CLASSIFICATION SYSTEMS

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (*1*). The principal characteristics considered in this system for classifying soils are shown in table 7. In this system soil materials are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, which is made up of clay soils having low strength when wet. Within each group the relative engineering value of the material is indicated by a group index number, ranging from 0 for the best material in the soil group to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol, in the next to last column of table 6.

Many engineers prefer to use the Unified soil classification system (*10*). In this system soils are identified according to their texture and plasticity and are grouped according to their performance as engineering construction materials. The characteristics of the soils in each group in the Unified system are shown in table 8. The *taken from 36 soil profiles, Hall County, Nebr.*—Continued

Mechanical analysis [2]											Liquid limit [3]	Plasticity index [3]	Classification	
Percentage passing sieve—							Percentage smaller than—							
¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 50 (0.295 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [4]	Unified [5]
			100	94	90	46	22		4		NP	NP	A-4(2)	SM.
			100	85	78	58	41		10		28	8	A-4(5)	CL.
		100	99	85	76	36	21		7		NP	NP	A-4(0)	SM.
				100	99	98	78		24		32	7	A-4(8)	ML.
					100	98	85		42		53	27	A-7-6(17)	CH.
					100	99	85		33		44	20	A-7-6(13)	CL.
					100	98	79		33		32	5	A-4(8)	ML.
					100	98	87		44		49	19	A-7-5(13)	ML.
					100	99	89		47		62	32	A-7-5(20)	CH.
					100	96	72		25		34	9	A-4(8)	ML.
					100	98	71		31		39	12	A-6(9)	ML.
					100	99	83		33		35	11	A-6(8)	CL–ML.

mechanical analyses used in this table are not suitable for use in naming textural classes for soils. The percentages of 0.02 millimeter and 0.002 millimeter size particles are not determined by the Nebr. Department of Roads.

[3] NP—Nonplastic.

[4] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1. Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M 145–49.

[5] Based on the Unified Soil Classification System. Tech. Memo. 3-357, v. 1, Waterways Experiment Station, Corps of Engineers, March 1953.

system establishes 15 soil groups which are divided into three divisions—coarse-grained soils (eight classes), fine-grained soils (six classes), and highly organic soils. Boundary classifications are provided for soils which have characteristics of two groups. Table 8 lists the letter symbols for the 15 soil groups and the physical characteristics of each group. The system provides for both a simple field method and a laboratory method for determining the amount and type of basic constituents of the soil. Both methods are based on gradation and plasticity and vary only in degree of accuracy. The laboratory method uses mechanical analyses, liquid limit data and plasticity index data for an exact classification. A plasticity chart, on which the liquid limit and the plasticity index may be plotted, is used in classifying the fine-grained soil material and the fine-grained component of the silty and clayey sands and gravels.

Geology of the county

Information on the geology of Hall County is found on page 100 under Parent Materials.

Soil engineering data and interpretations

Engineering information about each soil in the county is given in tables 9 and 10. For more detailed information on the soils it will often be necessary to refer to the text of the report, particularly to the section, Soils of Hall County.

Table 10 is divided into two parts, the first part beginning on page 82, and the second on page 88. The first part lists properties that concern highway construction, and the second those that concern agricultural structures.

The soil test data in table 6, together with information given in the remainder of the report and experience with the same soils in other counties, were used as a basis for preparing the soil engineering data in table 9 and the interpretations given in table 10.

The texture (grain size) of alluvial materials varies considerably. It should not, therefore, be assumed that the engineering soil classification given in tables 9 and 10 will apply to all parts, or layers, of an alluvial soil or to the alluvial soil wherever it occurs. Special field studies must be made for engineering structures that are to be constructed on alluvial soils so that the class of the specific materials present can be accurately determined.

The engineering characteristics of the loess soils are usually more uniform than those of alluvial soils. Therefore, the number of borings in loess areas can usually be less than in alluvial areas unless some special problem, such as a high water table or potential frost, is anticipated.

TABLE 7.—*Classification of soils by American*

General classification	Granular materials (35 percent or less passing No. 200 sieve)				
	A–1		A–3	A–2	
Group classification	A–1–a	A–1–b		A–2–4	A–2–5
Sieve analysis: Percent passing—					
No. 10	50 maximum				
No. 40	30 maximum	50 maximum	51 minimum		
No. 200	15 maximum	25 maximum	10 maximum	35 maximum	35 maximum
Characteristics of fraction passing No. 40 sieve:					
Liquid limit			NP [2]	40 maximum	41 minimum
Plasticity index	6 maximum	6 maximum	NP [2]	10 maximum	10 maximum
Group index	0	0	0	0	0
Usual types of significant constituent materials.	Stone fragments, gravel, and sand.	Stone fragments, gravel, and sand.	Fine sand	Silty gravel and sand.	Silty gravel and sand.
General rating as subgrade	Excellent to good				

[1] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1; ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M 145–49.

[2] NP—Nonplastic.

TABLE 8.—*Characteristics of soil groups*

Major division	Group symbol	Soil description	Value as foundation material [2]	Value as base course directly under bituminous pavement	Value for embankments
Coarse-grained soils (*less than 50 percent passing No. 200 sieve*):					
Gravels and gravelly soils (*more than half of coarse fraction retained on No. 4 sieve.*)	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.	Excellent	Good	Very stable; use in pervious shells of dikes and dams.
	GP	Poorly graded gravels and gravel-sand mixtures; little or no fines.	Good to excellent.	Poor to fair	Reasonably stable; use in pervious shells of dikes and dams.
	GM	Silty gravels and gravel-sand-silt mixtures.	Good	Poor to good	Reasonably stable; not particularly suited to shells, but may be used for impervious cores or blankets.
	GC	Clayey gravels and gravel-sand-clay mixtures.	Good	Poor	Fairly stable; may be good for impervious core.
Sands and sandy soils (*more than half of course fraction passing No. 4 sieve*).	SW	Well-graded sands and gravelly sands; little or no fines.	Good	Poor	Very stable; may be used in pervious sections; slope protection required.
	SP	Poorly graded sands and gravelly sands; little or no fines.	Fair to good	Poor to not suitable.	Reasonably stable; may be used in dike section having flat slopes.
	SM	Silty sands and sand-silt mixtures.	Fair to good	Same	Fairly stable; not particularly suited to shells, but may be used for impervious cores or dikes.
	SC	Clayey sands and sand-clay mixtures.	Fair to good	Not suitable	Fairly stable; use as impervious core for flood-control structures.

Association of State Highway Officials [1]

Granular materials—Continued (35 percent or less passing No. 200 sieve)		Silt-clay materials (More than 35 percent passing No. 200 sieve)				
A-2—Continued		A-4	A-5	A-6	A-7	
A-2-6	A-2-7				A-7-5	A-7-6
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35 maximum	35 maximum	36 minimum	36 minimum	36 minimum	36 minimum	36 minimum.
40 maximum 11 minimum	41 minimum 11 minimum	40 maximum 10 maximum	41 minimum 10 maximum	40 maximum 11 minimum	41 minimum 11 minimum [3]	41 minimum. 11 minimum.[3]
4 maximum	4 maximum	8 maximum	12 maximum	16 maximum	20 maximum	20 maximum.
Clayey gravel and sand.	Clayey gravel and sand.	Nonplastic to moderately plastic silty soils.	Highly elastic silts.	Medium plastic clays.	Highly plastic clays.	Highly plastic clays.
Fair to poor						

[3] Plasticity index of A-7-5 subgroup is equal to or less than minus 30. Plasticity index of A-7-6 subgroup is greater than minus 30.

in Unified soil classification system [1]

Compaction: Characteristics and recommended equipment	Approximate range in AASHO maximum dry density [3]	Field (in place) CBR	Subgrade modulus k	Drainage characteristics	Comparable groups in AASHO classification
	Lb./cu. ft.		*Lb./sq.in./in*		
Good; use crawler-type tractor, pneumatic-tire roller, or steel-wheel roller.	125–135	60–80	300+	Excellent	A-1.
Same	115–125	25–60	300+	Excellent	A-1.
Good, but needs close control of moisture; use pneumatic-tire or sheepsfoot roller.	120–135	20–80	200–300+	Fair to practically impervious	A-1 or A-2.
Fair, use pneumatic-tire or sheepsfoot roller.	115–130	20–40	200–300	Poor to practically impervious	A-2.
Good; use crawler-type tractor or pneumatic-tire roller.	110–130	20–40	200–300	Excellent	A-1.
Same	100–120	10–25	200–300	Excellent	A-1 or A-3.
Good, but needs close control of moisture; use pneumatic-tire or sheepsfoot roller.	110–125	10–40	200–300	Fair to practically impervious	A-1, A-2, or A-4.
Fair; use pneumatic-tire roller or sheepsfoot roller.	105–125	10–20	200–300	Poor to practically impervious.	A-2, A-4, or A-6.

TABLE 8.—*Characteristics of soil groups in*

Major division	Group symbol	Soil description	Value as foundation material [2]	Value as base course directly under bituminous pavement	Value for embankments
Fine-grained soils (*more than 50 percent passing No. 200 sieve*):					
Silts and clays (*liquid limit of 50 or less*).	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, and clayey silts of slight plasticity.	Fair to poor.	Not suitable.	Poor stability; may be used for embankments if properly controlled.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, and lean clays.	Fair to poor.	Not suitable.	Stable; use in impervious cores and blankets.
	OL	Organic silts and organic clays having low plasticity.	Poor	Not suitable.	Not suitable for embankments.
Silts and clays (*liquid limit greater than 50*).	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, and elastic silts.	Poor	Not suitable.	Poor stability; use in core of hydraulic fill dam; not desirable in rolled fill construction.
	CH	Inorganic clays having high plasticity and fat clays.	Poor to very poor.	Not suitable.	Fair stability on flat slopes; use in thin cores, blankets, and dike sections of dams.
	OH	Organic clays having medium to high plasticity and organic silts.	Same	Not suitable.	Not suitable for embankments.
Highly organic soils	Pt	Peat and other highly organic soils.	Not suitable.	Not suitable.	Not used in embankments, dams, or subgrades for pavements.

[1] Based on information in the Unified Soil Classification System, Technical Memorandum No. 3-357, Volumes 1, 2, and 3, Waterways Experiment Station, Corps of Engineers, 1953. Ratings and ranges in test values are for guidance only. Design should be based on field survey and test of samples from construction site.

[2] Ratings are for subgrade and subbases for flexible pavement.

TABLE 9.—*Characteristics and classification of soils of Hall County,*

[Dashed lines indicate engineering properties not determined;

Map symbol	Soil	Position	Parent material	Runoff	Depth to water table [1]	Depth to bedrock or mixed sand and gravel	Depth of horizons	USDA
					Feet	*Inches*	*Inches*	
Sy	Alluvial land	Bottom land	Alluvium	Medium	5–10	24–60+	----------	----------
Ba	Barney loam	Bottom land	Alluvium	Very slow	0–4	10–20	0–15	Loam
							15–36+	Sand and gravel.
Bl	Broken land	Stream terrace	Alluvium or loess.	Very rapid	6–30+	48–60+	----------	----------
Bu	Butler silt loam	Upland	Loess	Slow	More than 15.	No sand or gravel.	0–15	Silt loam
							15–45	Silty clay or clay.
							45–60+	Silt loam
3Cs	Cass fine sandy loam, deep.	Bottom land	Alluvium	Slow	5–15	36–60+	0–24	Fine sandy loam.
							24–78	Sandy loam.
Cs	Cass fine sandy loam.	Bottom land	Alluvium	Slow	5–15	20–36	0–24	Fine sandy loam.
							24+	Sand and gravel.
3Cm	Cass loam, deep	Bottom land	Alluvium	Medium	5–15	36–60+	0–12	Loam or silt loam.
							12–48	Sandy loam.
							48–60	Coarse sand.

Unified soil classification system [1]—Continued

Compaction: Characteristics and recommended equipment	Approximate range in AASHO maximum dry density [3]	Field (in place) CBR	Subgrade modulus k	Drainage characteristics	Comparable groups in AASHO classification
	Lb./cu. ft.		*Lb./sq. in./in.*		
Good to poor; close control of moisture is essential; use pneumatic-tire or sheepsfoot roller.	95–120	5–15	100–200	Fair to poor	A–4, A–5, or A–6.
Fair to good; use pneumatic-tire or sheepsfoot roller.	95–120	5–15	100–200	Practically impervious	A–4, A–6, or A–7.
Fair to poor; use sheepsfoot roller[4]	80–100	4–8	100–200	Poor	A–4, A–5, A–6, or A–7.
Poor to very poor; use sheepsfoot roller.[4]	70–95	4–8	100–200	Fair to poor	A–5 or A–7.
Fair to poor; use sheepsfoot roller[4]	75–105	3–5	50–100	Practically impervious	A–7.
Poor to very poor; use sheepsfoot roller.[4]	65–100	3–5	50–100	Practically impervious	A–5 or A–7.
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[3] Determined in accordance with test designation: T 99–49, A.A.S.H.O, which is equivalent to later designation T 99–57, Method A.

[4] Pneumatic-tire rollers may be advisable, particularly when moisture content is higher than optimum.

Nebr., and physical properties that affect their engineering uses

soil has variable characteristics or is strongly saline or alkaline]

Classification			Percent passing—			Permeability	Soil structure	Available water	Dispersion	Shrink-swell potential
AASHO	Unified									
	Symbol	Texture	No. 4 sieve	No. 10 sieve	No. 200 sieve					
						Inches per hour		*Inches per foot*		
A–4	SM–SC	Silty sand	99	98	48	0. 8–2. 5	Crumb	2. 05	Low	Low.
A–3 or A–2–4.	SP or SW	Sand and gravel	100	96	4	10+	None	0 to .75	Low	None.
A–4 or A–6.	ML	Clayey to sandy silt.	100	100	98	. 8–2. 5	Granular	2. 0	Low	Low.
A–7–6	CL–CH	Silty clay to clay	100	100	96	. 05–. 2	Blocky	2. 2	Low	High.
A–7–6 to A–6.	ML–CL	Clayey silt	100	100	96	. 8–2. 5	Massive	2. 0	Low	Low.
A–4 or A–2–4.	SM to ML	Silty sand to sandy silt.	100	100	31–69	2. 5–5. 0	Crumb	1. 75	Low	Very low.
A–2–4	SM	Silty sand	100	100	31	2. 5–5. 0	Single grain	1. 75	Low	Very low.
A–4 or A–2–4.	SM to ML	Silty sand to sandy silt.	100	100	30–60	2. 5–5. 0	Crumb	1. 75	Low	Very low.
A–3 or A–2–4.	SP or SW	Sand and gravel	100	96	4	10+	None	0 to .75	Low	None.
A–4	ML	Sandy silt	100	100	82	. 8–2. 5	Granular	2. 0	Low	Low.
A–2–4	SM	Silty sand	100	100	31	2. 5–5. 0	Massive	1. 75	Low	Very low.
A–2–4	SM	Silty sand	98	95	24	10+	Single grain	. 75	Low	None.

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TABLE 9.—*Characteristics and classification of soils of Hall County, Nebr.,*

[Dashed lines indicate engineering properties not determined;

Map symbol	Soil	Position	Parent material	Runoff	Depth to water table [1]	Depth to bedrock or mixed sand and gravel	Depth of horizons	USDA
					Feet	*Inches*	*Inches*	
Cm	Cass loam	Bottom land	Alluvium	Medium	5–15	20–36	0–12	Loam or silt loam.
							12–36	Sandy loam.
							36–54	Coarse sand.
CbC	Colby silt loam, 7 to 11 percent slopes.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–10	Silt loam
							10–48+	Silt loam
CbD	Colby silt loam, 11 to 30 percent slopes.	Upland	Loess	Very rapid	More than 15.	No sand or gravel	0–10	Silt loam
							10–48+	Silt loam
Es	Elsmere fine sandy loam.	Bottom land	Alluvium	Slow	4–8	More than 60.	0–14	Fine sandy loam.
							14–30	Loamy fine sand.
							30–60	Sand
Ea	Elsmere loamy fine sand.	Bottom land	Alluvium	Slow	4–8	36–72+	0–12	Loamy fine sand.
							12–24	Loamy fine sand.
							24–60	Sand
E–Ws	Exline-Wood River fine sandy loams.[2]	Stream terrace	Loess or alluvium.	Slow	3–15	More than 48.	----------	----------
E–W	Exline-Wood River silt loams.[2]	Stream terrace	Loess or alluvium.	Slow	3–15	More than 48.	----------	----------
Fm	Fillmore silt loam	Depression	Alluvium or loess.	Ponded	6–30+	More than 60.	0–15	Silt loam
							15–48	Silty clay or clay.
							48–60+	Silt loam
Ha	Hall silt loam, 0 to 1 percent slopes.	Stream terrace	Loess or alluvium.	Slow	6–20+	36–60+	0–18	Silt loam
							18–40	Silty clay loam.
							40–48	Silt loam
HaA	Hall silt loam, 1 to 3 percent slopes.	Stream terrace	Loess or alluvium.	Medium	6–20+	36–60+	0–18	Silt loam
							18–40	Silty clay loam.
							40–54+	Silt loam
HaB2	Hall silt loam, 3 to 7 percent slopes, eroded.	Stream terrace	Loess or alluvium.	Rapid	6–30+	36–60+	0–12	Silt loam
							18–40	Silty clay loam.
							40–54+	Silt loam
H–O	Hall-O'Neill complex, 0 to 1 percent slopes.[2]	Stream terrace	Alluvium	Slow	6–30+	10–60+	----------	----------
Hs	Hastings silt loam, 0 to 1 percent slopes.	Upland	Loess	Slow	More than 15.	No sand or gravel.	0–18	Silt loam
							18–42	Silty clay loam.
							42–60+	Silt loam
HsA	Hastings silt loam, 1 to 3 percent slopes.	Upland	Loess	Medium	More than 15.	No sand or gravel.	0–18	Silt loam
							18–42	Silty clay loam.
							42–60+	Silt loam
HsB2	Hastings silt loam, 3 to 7 percent slopes, eroded.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–18	Silt loam
							18–42	Silty clay loam.
							42–60+	Silt loam
Hs3	Hastings complex, severely eroded.[2]	Upland	Loess	Rapid	More than 15.	No sand or gravel.	----------	----------
Hb	Hobbs silt loam, 0 to 1 percent slopes.	Colluvial slope	Colluvium and alluvium.	Medium	6–15	More than 60.	0–18	Silt loam
							18–48	Silt loam
HbA	Hobbs silt loam, 1 to 3 percent slopes.	Colluvial slope	Colluvium and alluvium.	Medium	More than 15.	More than 60.	0–18	Silt loam
							18–48	Silt loam

and physical properties that affect their engineering uses—Continued

soil has variable characteristics or is strongly saline or alkaline]

Classification			Percent passing—			Permeability	Soil structure	Available water	Dispersion	Shrink-swell potential
AASHO	Unified									
	Symbol	Texture	No. 4 sieve	No. 10 sieve	No. 200 sieve					
						Inches per hour		*Inches per foot*		
A-4	ML	Sandy silt	100	100	82	0. 8 – 2. 5	Granular	2. 0	Low	Low.
A-2-4	SM	Silty sand	100	100	31	2. 5 – 5. 0	Massive	1. 75	Low	Very low.
A-2-4	SM	Silty sand	98	95	24	10+	Single grain	. 75	Low	None.
A-4	ML	Sandy silt	100	100	55	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-4	SM	Silty sand	100	100	45	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4	ML	Sandy silt	100	100	55	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-4	SM	Silty sand	100	100	45	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-2-4	SM	Silty sand	100	100	15	2. 5 – 5. 0	Crumb	1. 75	Low	Very low.
A-2-4	SP-SM	Silty sand	100	98	10	5. 0 – 10	Crumb	1. 25	Low	Very low.
A-2-4 or A-3.	SP or SW	Sand	99	90	4	5. 0 – 10	Single grain.	. 75	Low	None.
A-2-4	SP-SM	Sandy	100	98	8	5. 0 – 10	Crumb	1. 25	Low	Very low.
A-2-4	SP-SM	Sandy	100	98	8	5. 0 – 10	Single grain.	1. 25	Low	Very low.
A-2-4 or A-3	SP or SW	Sand	99	90	4	5. 0 – 10	Single grain.	75	Low	None.
---	---	---	---	---	---	---	---	---	High	High in subsoil.
---	---	---	---	---	---	---	---	---	High	High in subsoil.
A-4	ML	Clayey silt	100	100	98	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-7-6	CL-CH	Silty clay to clay	100	100	96	. 05– . 2	Blocky	2. 2	Low	High.
A-7-6 to A-6.	ML-CL	Clayey silt (upland).	100	100	96	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4 or A-6	ML	Clayey silt	100	100	97	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-6 or A-7-6.	ML-CL	Clayey silt	100	100	98	. 2 – . 8	Blocky	2. 1	Low	Medium.
A-7-5 or A-7-6.	ML	Clayey silt	100	100	92	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4 or A-6	ML	Clayey silt	100	100	97	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-6 or A-7-6.	ML-CL	Clayey silt	100	100	98	. 2 – . 8	Blocky	2. 1	Low	Medium.
A-7-5 or A-7-6.	ML	Clayey silt	100	100	92	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4 or A-6	ML	Clayey silt	100	100	97	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-6 or A-7-6.	ML-CL	Clayey silt	100	100	98	. 2 – . 8	Blocky	2. 1	Low	Medium.
A-7-5 or A-7-6.	ML	Clayey silt	100	100	92	. 8 – 2. 5	Massive	2. 0	Low	Low.
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A-4	ML	Clayey silt	100	100	97	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-7-6	ML-CL	Clayey silt	100	100	98	. 2 – . 8	Blocky	2. 1	Low	Medium.
A-4 or A-6	ML-CL	Clayey silt	100	100	96	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4	ML	Clayey silt	100	100	97	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-7-6	ML-CL	Clayey silt	100	100	98	. 2 – . 8	Blocky	2. 1	Low	Medium.
A-4 or A-6	ML-CL	Clayey silt	100	100	96	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4	ML	Clayey silt	100	100	97	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-7-6	ML-CL	Clayey silt	100	100	98	. 2 – . 8	Blocky	2. 1	Low	Medium.
A-4 or A-6	ML-CL	Clayey silt	100	100	96	. 8 – 2. 5	Massive	2. 0	Low	Low.
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A-4 or A-6	CL-ML	Clayey silt	100	100	84	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-6 or A-7-6.	ML	Clayey to sandy silt	100	100	71	. 8 – 2. 5	Massive	2. 0	Low	Low.
A-4 or A-6	CL-ML	Clayey silt	100	100	84	. 8 – 2. 5	Granular	2. 0	Low	Low.
A-6 or A-7-6.	ML	Clayey to sandy silt	100	100	71	. 8 – 2. 5	Massive	2. 0	Low	Low.

TABLE 9.—*Characteristics and classification of soils of Hall County, Nebr.,*

[Dashed lines indicate engineering properties not determined;

Map symbol	Soil	Position	Parent material	Runoff	Depth to water table [1]	Depth to bedrock or mixed sand and gravel	Depth of horizons	USDA
					Feet	*Inches*	*Inches*	
Ho	Holdrege silt loam, 0 to 1 percent slopes.	Upland	Loess	Slow	More than 15.	No sand or gravel.	0–18 18–36 36–72	Silt loam Silt loam Silt loam
HoA	Holdrege silt loam, 1 to 3 percent slopes.	Upland	Loess	Medium	More than 15.	No sand or gravel.	0–18 18–36 36–72	Silt loam Silt loam Silt loam
HoB	Holdrege silt loam, 3 to 7 percent slopes.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–18 18–36 36–72	Silt loam Silt loam Silt loam
HoB2	Holdrege silt loam, 3 to 7 percent slopes, eroded.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–18 18–36 36–72	Silt loam Silt loam Silt loam
HoC	Holdrege silt loam, 7 to 11 percent slopes.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–18 18–36 36–72	Silt loam Silt loam Silt loam
HoC2	Holdrege silt loam, 7 to 11 percent slopes, eroded.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–18 18–36 36–72	Silt loam Silt loam Silt loam
H–C3	Holdrege-Colby complex, severely eroded.[2]	Upland	Loess	Rapid	More than 15.	No sand or gravel.	----------	----------
Hd	Hord silt loam, 0 to 1 percent slopes.	Stream terrace	Loess or alluvium.	Slow	6–20+	36–60+	0–18 18–48	Silt loam Silt loam
HdA	Hord silt loam, 1 to 3 percent slopes.	Stream terrace	Loess or alluvium.	Medium	6–20+	36–60+	0–18 18–48	Silt loam Silt loam
HdB2	Hord silt loam, 3 to 7 percent slopes, eroded.	Stream terrace	Loess or alluvium.	Rapid	6–20+	36–60+	0–18 18–48	Silt loam Silt loam
2HdA	Hord silt loam, thin solum variant, 0 to 3 percent slopes.	Stream terrace	Loess or alluvium.	Slow	6–20+	36–72+	0–10 10–48	Silt loam Loam
2HdB	Hord silt loam, thin solum variant, 3 to 7 percent slopes.	Stream terrace	Loess or alluvium.	Medium	6–20+	36–72+	0–10 10–48	Silt loam Loam
H–N	Hord-O'Neill complex, 0 to 1 percent slopes.[2]	Terrace	Sandy alluvium	Slow	6–20+	10–60+	----------	----------
Ks	Kenesaw silt loam, 0 to 1 percent slopes.	Upland	Loess	Slow	More than 15.	No sand or gravel.	0–10 10–60+	Silt loam Silt loam
KsA	Kenesaw silt loam, 1 to 3 percent slopes.	Upland	Loess	Medium	More than 15.	No sand or gravel.	0–10 10–60+	Silt loam Silt loam
KsB	Kenesaw silt loam, 3 to 7 percent slopes.	Upland	Loess	Rapid	More than 15.	No sand or gravel.	0–10 10–60+	Silt loam Silt loam
La	Lamoure silt loam	Bottom land	Alluvium	Slow	3–8	36–72	0–16 16–42 42–60+	Silt loam Silty clay Sand and gravel.
2La	Lamoure silt loam, saline.[4]	Bottom land	Alluvium	Slow	3–8	36–72	----------	----------
Lf	Leshara fine sandy loam.	Bottom land	Alluvium	Slow	3–8	36–72	0–14 14–48 48+	Fine sandy loam. Silt loam or loam. Sand and gravel.

and physical properties that affect their engineering uses—Continued

soil has variable characteristics or is strongly saline or alkaline]

Classification			Percent passing—			Permeability	Soil structure	Available water	Dispersion	Shrink-swell potential
AASHO	Unified									
	Symbol	Texture	No. 4 sieve	No. 10 sieve	No. 200 sieve					
						Inches per hour		*Inches per foot*		
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	64-97	0.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	68-97	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	71-99	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	64-97	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	68-97	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	71-99	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	64-97	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	68-97	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	71-99	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	64-97	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	68-97	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	71-99	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	64-97	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	68-97	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	71-99	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	64-97	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	68-97	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML-CL	Sandy clayey silt	100	100	71-99	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML	Clayey silt	100	100	94	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	CL-ML	Clayey silt	100	100	92	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML	Clayey silt	100	100	94	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	CL-ML	Clayey silt	100	100	92	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-6	ML	Clayey silt	100	100	94	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-6	CL-ML	Clayey silt	100	100	92	.8 - 2.5	Massive	2.0	Low	Low.
A-4	CL	Clayey silt	100	100	84	.8 - 2.5	Granular	2.0	Low	Low.
A-6	CL	Sandy clayey silt	100	99	54	.8 - 2.5	Massive	2.0	Low	Low.
A-4	CL	Clayey silt	100	100	84	.8 - 2.5	Granular	2.0	Low	Low.
A-6	CL	Sandy clayey silt	100	99	54	.8 - 2.5	Massive	2.0	Low	Low.
A-4	ML	Clayey silt	100	100	85	.8 - 2.5	Granular	2.0	Low	Low.
A-6	CL	Clayey silt	100	100	98	.8 - 2.5	Crumb	2.0	Low	Low.
A-4	ML	Clayey silt	100	100	85	.8 - 2.5	Granular	2.0	Low	Low.
A-6	CL	Clayey silt	100	100	98	.8 - 2.5	Crumb	2.0	Low	Low.
A-4	ML	Clayey silt	100	100	85	.8 - 2.5	Granular	2.0	Low	Low.
A-6	CL	Clayey silt	100	100	98	.8 - 2.5	Crumb	2.0	Low	Low.
A-4	ML	Sandy silt	100	100	72-80	.8 - 2.5	Granular	2.0	Low	Low.
A-6 to A-7-6.	CL-CH	Silty clay	100	100	80-100	.05- .2	Blocky	2.2	Low	High.
A-2-4	SP-SM	Sand and gravel	100	98	10	10+	None	0 to .75	Low	None.
A-2-4	SM	Silty sand	100	100	15	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4	ML	Sandy silt	100	100	60	.8 - 2.5	Granular	2.0	Low	Low.
A-2-4 or A-3.	SP-SM	Sand and gravel	100	98	10	10+	None	0 to .75	Low	None.

TABLE 9.—*Characteristics and classification of soils of Hall County, Nebr.,*

[Dashed lines indicate engineering properties not determined;

Map symbol	Soil	Position	Parent material	Runoff	Depth to water table [1]	Depth to bedrock or mixed sand and gravel	Depth of horizons	USDA
					Feet	*Inches*	*Inches*	
Le	Leshara silt loam	Bottom land	Alluvium	Slow	3–8	36–72	0–14	Silt loam or loam.
							14–48	Very fine sandy loam.
							48+	Sand and gravel.
2Le	Leshara silt loam, saline.[4]	Bottom land	Alluvium	Slow	3–8	36–72	----------	----------
Lm	Loup loam	Bottom land	Alluvium	Very slow	0–4	More than 60.	0–10	Loam
							10–36+	Sand and gravel.
MdB	Meadin loamy sand, 3 to 11 percent slopes.	Stream terrace	Alluvium	Very rapid	6–15+	0–10	0–8	Loamy sand.
							8–60+	Sand and gravel.
Ms	Meadin sandy loam, 0 to 1 percent slopes.	Stream terrace	Alluvium	Slow	6–15+	10–20	0–15	Sandy loam
							15–60+	Sand and gravel.
Ok	O'Neill loam, 0 to 1 percent slopes.	Stream terrace	Alluvium	Slow	6–15+	20–36	0–15	Loam
							15–28	Sandy loam
							28+	Coarse sand
OkB2	O'Neill loam, 3 to 5 percent slopes, eroded.	Stream terrace	Alluvium	Rapid	6–15+	20–36	0–15	Loam
							15–28	Sandy loam
							28+	Coarse sand.
Om	O'Neill sandy loam, 0 to 1 percent slopes.	Stream terrace	Alluvium	Slow	6–15+	20–36	0–28	Sandy loam
							28+	Coarse sand.
OmB2	O'Neill sandy loam, 3 to 7 percent slopes, eroded.	Stream terrace	Alluvium	Rapid	6–15+	20–36	0–28	Sandy loam
							28+	Coarse sand.
OrA	Ortello fine sandy loam, 0 to 3 percent slopes.	Stream terrace and upland.	Alluvial and eolian sands.	Slow	6–30+	More than 72.[3]	0–15	Fine sandy loam.
							15–36	Sandy loam
							36–72+	Very fine sandy loam.
OrB	Ortello fine sandy loam, 3 to 7 percent slopes.	Stream terrace and upland.	Alluvial and eolian sands.	Moderately rapid.	6–30+	More than 72.[3]	0–15	Fine sandy loam.
							15–36	Sandy loam
							36–72+	Very fine sandy loam.
2Or	Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.	Stream terrace and upland.	Alluvial and eolian sands.	Slow	6–30+	More than 72.[3]	0–12	Fine sandy loam.
							12–36	Sandy loam
							36–72+	Silty clay loam.
2OrB	Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.	Stream terrace and upland.	Alluvial and eolian sands.	Moderately rapid.	6–30+	More than 72.[3]	0–12	Fine sandy loam.
							12–36	Sandy loam
							36–72+	Silty clay loam.
Ot	Ortello loam, 0 to 1 percent slopes.	Stream terrace and upland.	Alluvial and eolian sands.	Slow	6–30+	More than 72.[3]	0–23	Loam
							23–36	Sandy loam
							36–60+	Sand to coarse sand.

and physical properties that affect their engineering uses—Continued

soil has variable characteristics or is strongly saline or alkaline]

Classification: AASHO	Classification: Unified: Symbol	Classification: Unified: Texture	Percent passing—: No. 4 sieve	Percent passing—: No. 10 sieve	Percent passing—: No. 200 sieve	Permeability	Soil structure	Available water	Dispersion	Shrink-swell potential
						Inches per hour		*Inches per foot*		
A-4	ML	Sandy silt	100	100	60	0.8 - 2.5	Granular	2.0	Low	Low.
A-2-4	SM	Silty sand	100	100	30	.8 - 2.5	Massive	1.75	Low	Low.
A-2-4	SP-SM	Sand and gravel	100	98	10	10+	None	0 to .75	Low	None.
A-4 or A-2-4.	SM-ML	Sandy silt	100	100	50	.8 - 2.5	Crumb	2.0	Low	Low.
A-3 or A-2-4.	SP or SW	Sand and gravel	100	96	4	10+	None	0 to .75	Low	Low.
A-2-4	SM	Silty sand	100	100	17	5.0 -10	Single grain	1.25	Low	Very low.
A-3 or A-2-4.	SP or SW	Sand and gravel	100	100	4	10+	None	0 to .75	Low	None.
A-2-4	SM	Silty sand	100	100	17	2.5 - 5.0	Crumb	1.25	Low	Very low.
A-3 or A-2-4.	SP or SW	Sand and gravel	100	100	4	10+	None	0 to .75	Low	None.
A-4 or A-2-4.	ML	Sandy silt	100	100	62	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-2-4.	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.5	Low	Very low.
A-2-4 or A-3.	SM	Silty sand	99	97	19	5.0 -10	Single grain	.75	Low	None.
A-4 or A-2-4.	ML	Sandy silt	100	100	62	.8 - 2.5	Granular	2.0	Low	Low.
A-4 or A-2-4.	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.5	Low	Very low.
A-2-4 or A-3.	SM	Silty sand	99	97	19	5.0 -10	Single grain	.75	Low	None.
A-4	SM	Silty sand	100	100	45	2.5 - 5.0	Granular	1.5	Low	Very low.
A-2-4	SM	Silty sand	99	97	19	5.0 -10	Single grain	.75	Low	None.
A-4	SM	Silty sand	100	100	45	2.5 - 5.0	Granular	1.5	Low	Very low.
A-2-4	SM	Silty sand	99	97	19	5.0 -10	Single grain	.75	Low	None.
A-4	ML-CL	Sandy silt	100	100	74	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4 or A-2-4.	CL-ML	Sandy clayey silt	100	100	51	.8 - 2.5	Massive	2.0	Low	Very low.
A-4	ML-CL	Sandy silt	100	100	74	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4 or A-2-4.	CL-ML	Sandy clayey silt	100	100	51	.8 - 2.5	Massive	2.0	Low	Very low.
A-4	ML-CL	Sandy silt	100	100	74	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-6	ML	Clayey silt	100	100	96	.2 - .8	Massive	2.1	Low	Low to medium.
A-4	ML-CL	Sandy silt	100	100	74	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-4	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-6	ML	Clayey silt	100	100	96	.2 - .8	Massive	2.1	Low	Low to medium.
A-4	ML-CL	Sandy silt	100	100	60	.8 - 2.5	Crumb	2.0	Low	Low.
A-4	SM	Silty sand	100	100	42	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-3	SW or SP	Sand	97	82	3	10+	Single grain	0 to .75	Low	Very low.

TABLE 9.—*Characteristics and classification of soils of Hall County, Nebr.,*

[Dashed lines indicate engineering properties not determined;

Map symbol	Soil	Position	Parent material	Runoff	Depth to water table [1]	Depth to bedrock or mixed sand and gravel	Depth of horizons	USDA
					Feet	*Inches*	*Inches*	
Ov	Ovina fine sandy loam.	Stream terrace	Alluvium	Slow	2–8	More than 60.	0–25 25–70+	Fine sandy loam. Loam.
Oa	Ovina loamy fine sand.	Stream terrace	Alluvium	Slow	2–8	More than 60.	0–20 20–60	Loamy fine sand. Loam.
Pt	Platte loam	Bottom land	Alluvium	Slow	2–6	10–20	0–20 20–72+	Loam. Sand and gravel.
P–S	Platte-Sarpy complex.[2]	Bottom land	Alluvium	Medium	2–12	10–60+	--------	--------
2P–S	Platte-Sarpy complex, channeled.[2]	Bottom land	Alluvium	Rapid	2–12	10–60+	--------	--------
P-W	Platte-Wann complex.[2]	Bottom land	Alluvium	Slow	2–8	10–60+	--------	--------
2P–W	Platte-Wann complex, channeled.[2]	Bottom land	Alluvium	Medium	2–8	10–60+	--------	--------
Rw	Riverwash	Bottom land	Alluvium	Very slow	0–3	0–8	--------	--------
Sa	Sarpy fine sand	Bottom land	Alluvium	Slow	6–12	48–60+	0–36	Fine sand.
SgA	Sarpy loamy fine sand, 0 to 3 percent slopes.	Bottom land	Alluvium	Slow	6–12	48–60+	0–48	Loamy sand.
SgB	Sarpy loamy fine sand, 3 to 7 percent slopes.	Bottom land	Alluvium	Medium	6–12	48–60+	0–48	Loamy sand.
Sc	Scott silt loam	Depression	Alluvium or loess.	Ponded	6–30+	More than 72.[3]	0–6 6–48 48–60+	Silt loam. Clay. Silt loam.
Si	Silver Creek silt loam.	Stream terrace	Alluvium or loess.	Slow	3–10	36–60+	0–14 14–42 42+	Silt loam. Silty clay or clay. --------
TsA	Thurman fine sandy loam, 0 to 3 percent slopes.	Upland and stream terrace.	Eolian and alluvial sands.	Slow	8–15+	More than 60.[5]	0–18 18–80	Fine sandy loam. Loamy sand.
TsB	Thurman fine sandy loam, 3 to 7 percent slopes.	Upland and stream terrace.	Eolian and alluvial sands.	Medium	8–15+	More than 60.[5]	0–18 18–80	Fine sandy loam. Loamy sand.
ThA	Thurman loamy fine sand, 0 to 3 percent slopes.	Upland and stream terrace.	Eolian and alluvial sands.	Slow	8–15+	More than 60.[5]	0–18 18–80	Loamy fine sand. Loamy sand.
ThB	Thurman loamy fine sand, 3 to 7 percent slopes.	Upland and stream terrace.	Eolian and alluvial sands.	Medium	8–15+	More than 60.[5]	0–18 18–80	Laomy fine sand. Loamy sand.
2ThA	Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.	Upland and stream terrace.	Eolian and alluvial sands.	Slow	8–15+	More than 60.[5]	0–24 24–45 45–102	Loamy fine sand. Very fine sandy loam. Fine sand.

and physical properties that affect their engineering uses—Continued

soil has variable characteristics or is strongly saline or alkaline]

Classification: AASHO	Classification: Unified Symbol	Classification: Unified Texture	Percent passing— No. 4 sieve	Percent passing— No. 10 sieve	Percent passing— No. 200 sieve	Permeability	Soil structure	Available water	Dispersion	Shrink-swell potential
						Inches per hour		*Inches per foot*		
A-4	ML-CL	Sandy silt	100	100	60	2.5 - 5.0	Granular	1.75	Low	Low.
A-4 or A-6	ML-CL	Sandy silt	100	100	70	.8 - 2.5	Blocky	2.0	Low	Low to medium.
A-4 or A-2-4.	SM	Silty sand	100	100	20	5.0 -10	Crumb	1.25	Low	Low.
A-4 or A-6	ML-CL	Sandy silt	100	100	70	.8 - 2.5	Blocky	2.0	Low	Low to medium.
A-2-4 or A-1-b.	CL-ML	Sandy silt	100	100	50-77	.8 - 2.5	Crumb	2.0	Low	Low.
A-2-4 or A-1-6.	SP-SM	Sand and gravel	91	76	8	10+	None	0 to .75	Low	None.
A-2-4	SP-SM	Sand	100	99	8	5.0 -10	Single grain	.75	Low	None.
A-2-4	SM	Silty sand	100	100	35	5.0 -10	Single grain	1.25	Low	Very low.
A-2-4 or A-3.	SM	Silty sand	100	100	35	5.0 -10	Single grain	1.25	Low	Very low.
A-4 or A-6	ML	Clayey silt	100	100	98	.8 - 2.5	Platy	2.0	Low	Low.
A-7-6	CH	Clay	100	100	96	.05- .2	Blocky	2.2	Low	High.
A-6 to A-7-6.	ML-CL	Clayey silt	100	100	96	.8 - 2.5	Massive	2.0	Low	Low.
A-4	ML-CL	Clayey sandy silt	100	100	70-80	.8 - 2.5	Granular	2.0	Low	Low.
A-6 to A-7-6.	CL-CH	Silty to sandy clay.	100	100	60-80	.05- .2	Blocky	2.2	Low	High.
A-2-4 to A-4.	SM	Silty sand	100	100	30-40	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-2-4	SM	Silty sand	100	100	15	5.0 -10	Single grain	1.25	Low	Very low.
A-2-4 to A-4.	SM	Silty sand	100	100	30-40	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-2-4	SM	Silty sand	100	100	15	5.0 -10	Single grain	1.25	Low	Very low.
A-2-4	SM	Silty sand	100	100	17	2.5 - 5.0	Single grain	1.25	Low	Very low.
A-2-4	SM	Silty sand	100	100	15	2.5 - 5.0	Single grain	1.25	Low	Very low.
A-2-4	SM	Silty sand	100	100	17	2.5 - 5.0	Single grain	1.25	Low	Very low.
A-2-4	SM	Silty sand	100	100	15	2.5 - 5.0	Single grain	1.25	Low	Very low.
A-2-4	SM	Silty sand	100	100	30	5.0 -10	Crumb	1.25	Low	Very low.
A-4	CL-ML	Sandy clayey silt	100	100	51	.8 - 2.5	Massive	2.0	Low	Low.
A-2-4 or A-3.	SP-SM	Sand	98	95	7	5.0 -10	Single grain	.75	Low	Very low.

TABLE 9.—*Characteristics and classification of soils of Hall County, Nebr.,*

[Dashed lines indicate engineering properties not determined;

Map symbol	Soil	Position	Parent material	Runoff	Depth to water table [1]	Depth to bedrock or mixed sand and gravel	Depth of horizons	USDA
					Feet	*Inches*	*Inches*	
2ThB	Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.	Upland and stream terrace.	Eolian and alluvial sands.	Medium	8–15+	More than 60.[5]	0–24	Loamy fine sand.
							24–45	Very fine sandy loam.
							45–102	Fine sand
Th3	Thurman loamy fine sand, wind eroded.	Upland and stream terrace.	Eolain and alluvial sands.	Medium	8–15+	More than 60.	0–60	Loamy sand.
Va	Valentine fine sand	Upland	Eolian sands	Slow	8–15+	More than 60.	0–100+	Fine sand
Vo	Volin silt loam	Bottom land	Alluvium	Medium	5–10	36–72	0–18	Silt loam
							18–24	Silt loam
							24–48+	Very fine sandy loam.
3Wb	Wann fine sandy loam, deep.	Bottom land	Alluvium	Slow	3–8	36–60+	0–24	Fine sandy loam.
							24–48+	Sandy loam
Wb	Wann fine sandy loam.	Bottom land	Alluvium	Slow	3–8	20–36	0–27	Fine sandy loam.
							27–48	Coarse sand.
3Wm	Wann loam, deep	Bottom land	Alluvium	Slow	3–8	36–60+	0–12	Loam
							12–48	Sandy loam
2Wm	Wann loam, deep, saline.[4]	Bottom land	Alluvium	Slow	3–8	36–60+	0–12	Loam
							12–48	Sandy loam
Wm	Wann loam	Bottom land	Alluvium	Slow	3–8	20–36	0–12	Loam
							12–30	Sandy loam
							30+	Coarse sand.
Wr	Wood River silt loam, 0 to 1 percent slopes.	Stream terrace	Alluvium and loess.	Slow	5–15+	48–60+	0–18	Silt loam
							18–36	Silty clay or clay.
							36–48	Silt loam
WrA	Wood River silt loam, 1 to 3 percent slopes.	Stream terrace	Alluvium and loess.	Medium	5–15+	48–60+	0–18	Silt loam
							18–36	Silty clay or clay.
							36–48	Silt loam
WrB2	Wood River silt loam, 3 to 7 percent slopes, eroded.	Stream terrace	Alluvium and loess.	Rapid	5–15+	48–60+	0–18	Silt loam
							18–36	Silty clay or clay.
							36–48	Silt loam
W–Es	Wood River-Exline fine sandy loams.	Stream terrace	Alluvium and loess.	Slow	3–15+	48–60+	----------	----------
W–E	Wood River-Exline silt loams.	Stream terrace, nearly level.	Alluvium and loess.	Slow	3–15+	48–60+	----------	----------

[1] The wide range in depth to water table occurs on some soils because they are on stream terraces and uplands.

[2] See data given for individual soils in soil series of this complex.

[3] Depth on uplands; on terraces depth to sand and gravel is 48

and physical properties that affect their engineering uses—Continued

soil has variable characteristics or is strongly saline or alkaline]

Classification: AASHO	Classification: Unified: Symbol	Classification: Unified: Texture	Percent passing—: No. 4 sieve	Percent passing—: No. 10 sieve	Percent passing—: No. 200 sieve	Permeability	Soil structure	Available water	Dispersion	Shrink-swell potential
						Inches per hour		*Inches per foot*		
A-2-4	SM	Silty sand	100	100	30	5.0 -10	Crumb	1.25	Low	Very low.
A-4	CL-ML	Sandy clayey silt	100	100	51	.8 - 2.5	Massive	2.0	Low	Low.
A-2-4 or A-3.	SP-SM	Sand	98	95	7	5.0 -10	Single grain	.75	Low	Very low.
A-2-4	SM	Silty sand	100	100	15	5.0 -10	Single grain	1.25	Low	Very low.
A-3 or A-2-4.	SP-SM	Sand	100	100	6	5.0 -10	Single grain	1.25	Low	None.
A-4	CL	Clayey silt	100	100	84	.8 - 2.5	Granular	2.0	Low	Low.
A-4	ML	Sandy clayey silt	100	100	71	.8 - 2.5	Massive	2.0	Low	Low.
A-4 or A-2-4.	SM	Silty sand	100	100	39	.8 - 2.5	Massive	2.0	Low	Low.
A-4	SM	Silty sand	100	100	46	2.5 - 5.0	Crumb	1.75	Low	Very low.
A-2-4	SM	Silty sand	100	100	30	2.5 - 5.0	Single grain	1.75	Low	Very low.
A-4	SM	Silty sand	100	100	46	2.5 - 5.0	Crumb	1.75	Low	Low.
A-2-4 to A-1-b.	SP-SM	Sand	98	95	10	10+	Single grain	.75	Low	None.
A-4	SM-CL	Silty sand to sandy clayey silt.	100	100	46-58	.8 - 2.5	Granular	2.0	Low	Low.
A-2-4	SM	Silty sand	100	100	31	2.5 - 5.0	Massive	1.75	Low	Very low.
A-4	SM-CL	Silty sand to sandy clayey silt.	100	100	46-58	.8 - 2.5	Granular	2.0	Low	Moderate.
A-2-4	SM	Silty sand	100	100	31	2.5 - 5.0	Massive	1.75	Low	Low.
A-4	SM-CL	Silty sand to sandy clayey silt.	100	100	46-58	.8 - 2.5	Granular	2.0	Low	Low.
A-2-4	SM	Silty sand	100	100	31	2.5 - 5.0	Massive	1.75	Low	Very low.
A-2-4 to A-1-b.	SP or SW	Sand	98	95	4	10+	Single grain	.75	Low	None.
A-4	ML	Clayey silt	100	100	96-98	.8 - 2.5	Blocky	2.0	Low	Low.
A-7-6	CH	Silty clay to clay	100	100	98	.05- .2	Blocky	2.2	Medium	High.
A-6 to A-7-6.	ML-CL	Clayey silt	100	100	96	.8 - 2.5	Massive	2.0	Low	Low.
A-4	ML	Clayey silt	100	100	96-98	.8 - 2.5	Blocky	2.0	Low	Low.
A-7-6	CH	Silty clay to clay	100	100	98	.05- .2	Blocky	2.2	Medium	High.
A-6 to A-7-6.	ML-CL	Clayey silt	100	100	96	.8 - 2.5	Massive	2.0	Low	Low.
A-4	ML	Clayey silt	100	100	96-98	.8 - 2.5	Blocky	2.0	Low	Low.
A-7-6	CH	Silty clay to clay	100	100	98	.05- .2	Blocky	2.2	Medium	High.
A-6 to A-7-6	ML-CL	Clayey silt	100	100	96	.8 - 2.5	Massive	2.0	Low	Low.
---	---	---	---	---	---	---	---	---	Medium	High in subsoil.
---	---	---	---	---	---	---	---	---	Medium	High in subsoil.

to 72 inches.

[4] Saline condition of this soil affects engineering uses.

[5] Depth on uplands; on terraces depth to sand and gravel is 36 to 60 inches.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*

[Dashed lines indicate that engineering properties are not determined; soil has variable characteristics or is saline or alkaline]

Map symbol	Soil	Engineering classification: AASHO	Engineering classification: Unified	Suscepti-bility to frost action	Suitability of soil material for—: Road subgrade: Paved	Suitability of soil material for—: Road subgrade: Gravel	Suitability of soil material for—: Road fill	Suitability as source of—: Topsoil	Suitability as source of—: Sand and gravel	Effect of water table and drainage on vertical alinement of highways
Sy	Alluvial land	------	------	------	------	------	------	------	------	------
Ba	Barney loam	A-4 or A-2-4 over A-2-4 or A-3.	SM-SC over SP or SW.	Suscept-ible.	Good to fair.	Fair to poor.	Good to poor.	Poor	Good	Subject to high water table; may need 4 to 7 feet of fill or more.
Bl	Broken land	------	------	------	------	------	------	------	------	------
Bu	Butler silt loam	A-4 or A-6 over A-7-6.	ML surface soil; CL-CH over ML-CL subsoil.	Suscept-ible.	Poor	Good	Fair to poor.	Good	None	Water table no problem.
Cs	Cass fine sandy loam	A-4 or A-2-4 over A-2-4 or A-3.	SM to ML over SP or SW.	Suscept-ible.	Good to fair.	Fair to poor.	Good to fair.	Fair	Fair	Subject to high water table; may need 4 to 7 feet of fill or more.
3Cs	Cass fine sandy loam, deep.	A-4 or A-2-4 over A-2-4.	SM to ML over SM.	Suscept-ible.	Good to fair.	Fair to poor.	Good to fair.	Fair	Fair	Subject to seasonally high water table; may need 4 to 7 feet of fill or more.
Cm	Cass loam	A-4 or A-2-4 over A-2-4 or A-3.	ML over SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Fair	Fair	Subject to seasonally high water table; may need 4 to 7 feet of fill.
3Cm	Cass loam, deep	A-4 or A-2-4 over A-2-4 or A-3.	ML over SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Fair	Fair	Subject to seasonally high water table; may need 4 to 7 feet of fill.
CbC	Colby silt loam, 7 to 11 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML over SM.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
CbD	Colby silt loam, 11 to 30 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML over SM.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
Es	Elsmere fine sandy loam.	A-2-4 over A-2-4 or A-3.	SP-SM over SP or SW.	Susceptible	Good	Poor	Excel-lent to good.	Fair	Good for fine sand.	Subject to high water table; may need 4 feet of fill or more.
Ea	Elsmere loamy fine sand.	A-2-4 over A-2-4 or A-3.	SP-SM over SP or SW.	Susceptible	Good	Poor	Excel-lent to good.	Poor	Good for fine sand.	Subject to high water table; may need 4 feet of fill or more.
E-Ws	Exline-Wood River fine sandy loams.[2]	------	------	------	------	------	------	------	------	------
E-W	Exline-Wood River silt loams.[2]	------	------	------	------	------	------	------	------	------
Fm	Fillmore silt loam	A-4 or A-6 over A-6 or A-7-6.	ML surface; CL-CH subsoil over ML-CL.	Susceptible	Poor	Good	Fair to poor.	Good	None	Subject to seasonally high water table; may need 7 feet of fill or more.

Ha	Hall silt loam, 0 to 1 percent slopes.	A-4 or A-6 over A-6 or A-7-6.	ML surface; ML-CL subsoil over ML.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill or more.
Ha	Hall silt loam, 1 to 3 percent slopes.	A-4 or A-6 over A-6 or A-7-6.	ML surface; ML-CL subsoil over ML.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill or more.
HaB2	Hall silt loam, 3 to 7 percent slopes, eroded.	A-4 or A-6 over A-6 or A-7-6.	ML surface; ML-CL subsoil over ML.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill or more.
H-O	Hall-O'Neill complex, 0 to 1 percent slopes.[2]	---	---	---	---	---	---	---	---	---
Hs	Hastings silt loam, 0 to 1 percent slopes.	A-4 or A-6 over A-4 or A-7-6.	ML over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
HsA	Hastings silt loam, 1 to 3 percent slopes.	A-4 or A-6 over A-4 or A-7-6.	ML over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
HsB2	Hastings silt loam, 3 to 7 percent slopes, eroded.	A-4 or A-6 over A-4 or A-7-6.	ML over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
Hs3	Hastings complex, severely eroded.[2]	---	---	---	---	---	---	---	---	---
Hb	Hobbs silt loam, 0 to 1 percent slopes.	A-4 or A-6 over A-6 or A-7-6.	CL-ML over ML.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
HbA	Hobbs silt loam, 1 to 3 percent slopes.	A-4 or A-6 over A-6 or A-7-6.	CL-ML over ML.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
Ho	Holdrege silt loam, 0 to 1 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML-CL	Susceptible	Fair to poor.	Good	Fair	Good	None	Water table no problem.
HoA	Holdrege silt loam, 1 to 3 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML-CL	Susceptible	Fair to poor.	Good	Fair	Good	None	Water table no problem.
HoB	Holdrege silt loam, 3 to 7 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML-CL	Susceptible	Fair to poor.	Good	Fair	Good	None	Water table no problem.
HoB2	Holdrege silt loam, 3 to 7 percent slopes, eroded.	A-4 or A-6 over A-4 or A-6.	ML-CL	Susceptible	Fair to poor.	Good	Fair	Good	None	Water table no problem.
HoC	Holdrege silt loam, 7 to 11 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML-CL	Susceptible	Fair to poor.	Good	Fair	Good	None	Water table no problem.
HoC2	Holdrege silt loam, 7 to 11 percent slopes, eroded.	A-4 or A-6 over A-4 or A-6.	ML-CL	Susceptible	Fair to poor.	Good	Fair	Good	None	Water table no problem.
H-C3	Holdrege-Colby complex, severely eroded.[2]	---	---	---	---	---	---	---	---	---
Hd	Hord silt loam, 0 to 1 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill.
HdA	Hord silt loam, 1 to 3 percent slopes.	A-4 or A-6 over A-4 or A-6.	ML over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill.
HdB2	Hord silt loam, 3 to 7 percent slopes, eroded.	A-4 or A-6 over A-4 or A-6.	ML over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Engineering classification		Suscepti-bility to frost action	Suitability of soil material for—			Suitability as source of—		Effect of water table and drainage on vertical alinement of highways
					Road subgrade		Road fill			
		AASHO	Unified		Paved	Gravel		Topsoil	Sand and gravel	
2HdA	Hord silt loam, thin solum variant, 0 to 3 percent slopes.	A-4 over A-6	CL	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill.
2HdB	Hord silt loam, thin solum variant, 3 to 7 percent slopes.	A-4 over A-6	CL	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to poor.	Subject to seasonally high water table; may need 7 feet of fill.
H-N	Hord-O'Neill complex, 0 to 1 percent slopes.[2]									
Ks	Kenesaw silt loam, 0 to 1 percent slopes.	A-4 over A-6	ML over CL	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
KsA	Kenesaw silt loam, 1 to 3 percent slopes.	A-4 over A-6	ML over CL	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
KsB	Kenesaw silt loam, 3 to 7 percent slopes.	A-4 over A-6	ML over CL	Susceptible	Fair to poor.	Good	Fair to poor.	Good	None	Water table no problem.
La	Lamoure silt loam	A-4 over A-2-4	ML surface; CL-CH subsoil over SP-SM.	Susceptible	Fair to poor.	Good to poor.	Good to fair.	Good	Good to fair.	Subject to high water table; needs 4 to 7 feet of fill or more.
2La	Lamoure silt loam, saline.	A-4 over A-2-4	ML surface; CL-CH subsoil over SP-SM.	Susceptible	Fair to poor.	Good to poor.	Good to fair.	Good	Good to fair.	Subject to high water table; needs 4 to 7 feet of fill or more.
Lf	Leshara fine sandy loam.	A-4 or A-2-4 over A-2-4 or A-3.	SM to ML over SP-SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Fair	Good to fair.	Subject to high water table; needs 4 to 7 feet of fill or more.
Le	Leshara silt loam	A-4 over A-2-4	ML to SM over SP-SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Good	Fair	Subject to high water table; needs 4 to 7 feet of fill or more.
2Le	Leshara silt loam, saline.	A-4 over A-2-4	ML to SM over SP-SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Good	Fair	Subject to high water table; needs 4 to 7 feet of fill or more.
Lm	Loup loam	A-4 or A-2-4 over A-2-4 or A-3.	SM-ML over SP or SW.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Poor	Good for fine sand.	Subject to high water table; needs 4 to 7 feet of fill or more.
MdB	Meadin loamy sand, 3 to 11 percent slopes.	A-2-4 over A-2-4 or A-3.	SM over SP or SW.	Moderately susceptible.	Good	Poor	Good	Poor	Good	Subject to seasonally high water table; may need fill of 4 feet.
Ms	Meadin sandy loam, 0 to 1 percent slopes.	A-2-4 over A-2-4 or A-3.	SM over SP or SW.	Moderately susceptible.	Good	Poor	Good	Fair	Good	Subject to seaseasonally high water table; may need fill of 4 feet.

Ok	O'Neill loam, 0 to 1 percent slopes.	A-4 or A-2-4 over A-2-4 or A-3.	ML over SM	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Good	Good	Subject to seasonally high water table; may need fill of 4 to 7 feet.
OkB2	O'Neill loam, 3 to 5 percent slopes, eroded.	A-4 or A-2-4 over A-2-4 or A-3.	ML over SM	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Good	Good	Subject to seasonally high water table; may need fill of 4 to 7 feet.
Om	O'Neill sandy loam, 0 to 1 percent slopes.	A-4 or A-2-4	SM	Susceptible	Fair	Good	Fair	Fair	Good	Subject to seasonally high water table; may need fill of 4 to 7 feet.
OmB2	O'Neill sandy loam, 3 to 7 percent slopes, eroded.	A-4 or A-2-4	SM	Susceptible	Fair	Good	Fair	Fair	Good	Subject to seasonally high water table; may need fill of 4 to 7 feet.
OrA	Ortello fine sandy loam, 0 to 3 percent slopes.	A-4 over A-2-4	ML-CL surface; SM subsoil over ML-CL.	Susceptible	Fair	Fair	Fair	Fair	Fair to none.	Subject to seasonally high water table; may need fill of 4 to 7 feet.
OrB	Ortello fine sandy loam, 3 to 7 percent slopes.	A-4 over A-2-4	ML-CL surface; SM subsoil over ML-CL.	Susceptible	Fair	Fair	Fair	Fair	Fair to none.	Subject to seasonally high water table; may need fill of 4 to 7 feet.
2Or	Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.	A-4 over A-4 or A-6.	ML-CL sufface; SM subsoil over ML.	Susceptible	Fair	Fair	Fair	Fair	Fair to none.	Subject to seasonally high water table; may need fill of 4 to 7 feet.
2OrB	Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.	A-4 over A-4 or A-6.	ML-CL surface; SM subsoil over ML.	Susceptible	Fair	Fair	Fair	Fair	Fair to none.	Subject to seasonally high water table; may need fill of 4 to 7 feet.
Ot	Ortello loam, 0 to 1 percent slopes.	A-4 over A-4 or A-3.	ML-CL surface; SM subsoil over SP or SW.	Susceptible	Good to fair.	Fair to poor.	Fair	Good	Fair to none.	Subject to seasonally high water table; may need fill of 4 to 7 feet.
Ov	Ovina fine sandy loam	A-4 or A-6	ML-CL	Susceptible	Fair	Good	Fair	Fair	Poor	High water table; may need fill of 7 feet or more.
Oa	Ovina loamy fine sand	A-4 or A-2-4 over A-4 or A-6.	SM over ML-CL.	Susceptible	Good to poor.	Fair to poor.	Good to fair.	Poor	Poor	High water table; may need fill of 7 feet.
Pt	Platte loam	A-4 over A-2-4 or A-1-b.	CL-ML over SP-SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Fair to poor.	Good	High water table; may need fill of 7 feet or more.
P-S	Platte-Sarpy complex [2]									
2P-S	Platte-Sarpy complex, channeled.[2]									
P-W	Platte-Wann complex [2]									
2P-W	Platte-Wann complex, channeled.[2]									
Rw	Riverwash									
Sa	Sarpy fine sand	A-2-4 or A-3	SP-SM	Moderately susceptible.	Good	Poor	Good	Poor	Good for fine sand.	Subject to seasonally high water table; may need fill of 4 feet or more.
SgA	Sarpy loamy fine sand, 0 to 3 percent slopes.	A-2-4 or A-3	SM	Moderately susceptible.	Good	Poor	Good	Poor	Good for fine sand.	Subject to seasonally high water table; may need fill of 4 feet or more.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Engineering classification		Suscepti-bility to frost action	Suitability of soil material for—			Suitability as source of—		Effect of water table and drainage on vertical alinement of highways
		AASHO	Unified		Road subgrade: Paved	Road subgrade: Gravel	Road fill	Topsoil	Sand and gravel	
SgB	Sarpy loamy fine sand, 3 to 7 percent slopes.	A-2-4 or A-3	SM	Moderately suscep-tible.	Good	Poor	Good	Poor	Good for fine sand.	Subject to season-ally high water table; may need fill of 4 feet or more.
Sc	Scott silt loam	A-4 or A-6 over A-7-6.	ML surface; CH subsoil over ML-CL.	Susceptible	Poor	Fair	Fair to poor.	Poor	Fair to none.	Subject to season-ally high water table; may need fill of 7 feet or more.
Si	Silver Creek silt loam	A-4 over A-6 or A-7-6.	ML-CL over CL-CH.	Susceptible	Good to fair.	Fair to poor.	Fair	Good	Fair to poor.	Subject to high water table; may need fill of 4 to 7 feet or more.
TsA	Thurman fine sandy loam, 0 to 3 percent slopes.	A-4 or A-2-4	SM	Moderately suscep-tible.	Good	Poor	Good	Fair	Good for fine sand.	Usually no prob-lem.
TsB	Thurman fine sandy loam, 3 to 7 percent slopes.	A-4 or A-2-4	SM	Moderately suscep-tible.	Good	Poor	Good	Fair	Good for fine sand.	Usually no prob-lem.
ThA	Thurman loamy fine sand, 0 to 3 percent slopes.	A-2-4	SM	Moderately suscep-tible.	Good	Poor	Good	Poor	Good for fine sand.	Usually no prob-lem.
ThB	Thurman loamy fine sand, 3 to 7 percent slopes.	A-2-4	SM	Moderately suscep-tible.	Good	Poor	Good	Poor	Good for fine sand.	Usually no prob-lem.
Th3	Thurman loamy fine sand, wind eroded.	A-2-4	SM	Moderately suscep-tible.	Good	Poor	Good	Poor	Good for fine sand.	Usually no prob-lem.
2ThA	Thurman loamy fine sand, loamy sub-stratum, 0 to 3 per-cent slopes.	A-4 or A-2-4 over A-2-4 or A-3.	SM surface; CL-ML subsoil over SP-SM.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Poor	Good for fine sand.	Usually no prob-lem.
2ThB	Thurman loamy fine sand, loamy sub-stratum, 3 to 7 percent slopes.	A-4 or A-2-4 over A-2-4 or A-3.	SM surface; CL-ML subsoil over SP-SM.	Suscep-tible.	Good to fair.	Fair to poor.	Good to fair.	Poor	Good for fine sand.	Usually no problem.
Va	Valentine fine sand	A-2-4 or A-3	SP-SM	Moderate-ly sus-ceptible.	Good	Poor	Good	Poor	Good for fine sand.	Usually no problem.
Vo	Volin silt loam	A-4 over A-4 or A-2-4.	CL-ML over SM.	Suscep-tible.	Fair to good.	Poor	Fair to good.	Poor	Good	Usually no problem.
Wb	Wann fine sandy loam	A-4 or A-2-4	SM	Moderate-ly sus-ceptible.	Good to fair.	Fair to poor.	Good to fair.	Fair	Good to fair.	Subject to season-ally high water table; may need fill of 4 to 7 feet or more.
3Wb	Wann fine sandy loam, deep.	A-4 or A-2-4	SM	Moderate-ly sus-ceptible.	Good to fair.	Fair to poor.	Good to fair.	Fair	Good to fair.	Subject to season-ally high water table; may need fill of 4 to 7 feet or more.

Wm	Wann loam	A-4 over A-2-4.	SM to CL surface; SM subsoil over SP or SW.	Susceptible	Good to fair.	Fair to poor.	Good to fair.	Good	Good	Subject to seasonally high water table; may need fill of 4 to 7 feet or more.
3Wm	Wann loam, deep	A-4 over A-2-4.	SM to CL over SM.	Susceptible	Fair	Fair	Fair	Fair to poor.	Fair	Subject to seasonally high water table; may need fill of 7 feet or more.
2Wm	Wann loam, deep, saline.	A-4 over A-2-4.	SM to CL over SM.	Susceptible	Fair	Fair	Fair	Fair to poor.	Fair	Subject to seasonally high water table; may need fill of 7 feet or more.
Wr	Wood River silt loam, 0 to 1 percent slopes.	A-4 over A-6 or A-7-6.	ML surface; CH subsoil over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to none.	Subject to seasonally high water table; may need fill of 7 feet or more.
WrA	Wood River silt loam, 1 to 3 percent slopes.	A-4 over A-6 or A-7-6.	ML surface; CH subsoil over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to none.	Subject to seasonally high water table; may need fill of 7 feet or more.
WrB2	Wood River silt loam, 3 to 7 percent slopes, eroded.	A-4 over A-6 or A-7-6.	ML surface; CH subsoil over ML-CL.	Susceptible	Fair to poor.	Good	Fair to poor.	Good	Fair to none.	Subject to seasonally high water table; may need fill of 7 feet or more.
W-Es	Wood River-Exline fine sandy loams.[2]	------	------	------	------	------	------	------	------	------
W-E	Wood River-Exline silt loams.[2]	------	------	------	------	------	------	------	------	------

See footnotes at end of table.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Compaction characteristics	Soil features affecting— Foundations	Low dams: Reservoir area	Low dams: Embankment	Dikes or levees	Agricultural drainage	Irrigation	Terraces and waterways
Sy	Alluvial land						Locally a water table and flooding problem.	Generally low water-holding capacity.	([1]).
Ba	Barney loam	Fair to good to depth of 15 inches; good below 15 inches.	Below depth of 15 inches good to poor bearing, depending on density.	If sand is exposed, seepage may be a problem.	Fairly stable; pervious.	Need of nearly level slopes or slope protection, or both.	High water table and flooding problem; very rapidly premeable subsoil.	Very low water-holding capacity; adequate drainage necessary.	([1]).
Bl	Broken land						([1])	([1])	Very highly erosive.
Bu	Butler silt loam	Fair	Good to poor bearing.	Seepage not a problem.	Fairly stable; impervious.	([1])	Locally poor surface drainage; slowly permeable subsoil.	High water-holding capacity; slow intake rate.	Slightly erosive.
Cs	Cass fine sandy loam.	Good to poor to depth of 24 inches; good below 24 inches.	Good to poor bearing, depending on density of substrata.	Moderate seepage; excessive if sand exposed.	Fairly stable; pervious; may require toe drainage.	May need nearly level slopes; moderate to high piping hazard.	([1])	Low water-holding capacity.	Highly erosive.
3Cs	Cass fine sandy loam, deep.	Good to poor to depth of 24 inches; good below 24 inches; close control essential.	Good to poor bearing, depending on density of substrata; moderate to high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; moderate to high piping hazard.	([1])	Moderate water-holding capacity.	Highly erosive.
Cm	Cass loam	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; high piping hazard.	([1])	Moderate water-holding capacity.	Highly erosive.
3Cm	Cass loam, deep	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; high piping hazard.	([1])	Moderate water-holding capacity.	Highly erosive.

CbC	Colby silt loam, 7 to 11 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	([1])	([1])	High water-holding capacity.	Very highly erosive.
CbD	Colby silt loam, 11 to 30 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	([1])	([1])	High water-holding capacity.	Very highly erosive.
Es	Elsmere fine sandy loam.	Good to depth of 30 inches with close control; good below 30 inches.	Good to poor bearing to depth of 30 inches; good below 30 inches.	Low to moderate seepage; excessive if substratum is exposed.	Fairly stable; moderately pervious; may need toe drainage.	May need flat slopes; moderate piping hazard.	Locally poor drainage; high water table.	Low water-holding capacity; adequate drainage necessary.	([1]).
Ea	Elsmere loamy fine sand.	Good to depth of 30 inches with close control; good below 30 inches.	Good to poor bearing to depth of 30 inches; good below 30 inches.	Low to moderate seepage; excessive if substratum is exposed.	Fairly stable; moderately pervious; may need toe drainage.	May need flat slopes; moderate piping hazard.	Locally poor drainage; high water table.	Low water-holding capacity; adequate drainage necessary.	([1]).
E-Ws	Exline–Wood River fine sandy loams.[2]						Locally poor drainage; slowly permeable subsoil.	High water-holding capacity; saline-alkali problem.	([1]).
E-W	Exline-Wood River silt loams.[2]						Locally poor drainage; slowly permeable subsoil.	High water-holding capacity; saline-alkali problem.	([1]).
Fm	Fillmore silt loam	Fair	Good to poor bearing.	Seepage not a problem.	Fairly stable; impervious.	([1])	Outlets may be lacking; slow internal drainage.	High water-holding capacity; slow intake rate.	([1]).
Ha	Hall silt loam, 0 to 1 percent slopes.	Good to poor; close control essential.	Very poor to fair bearing; moderate to high piping hazard.	Seepage a minor problem at locations where sand and gravel strata are deep.	Fair to poor stability; impervious; may need toe drainage.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
HaA	Hall silt loam, 1 to 3 percent slopes.	Good to poor; close control essential.	Very poor to fair bearing; moderate to high piping hazard.	Seepage a minor problem at locations where sand and gravel strata are deep.	Fair to poor stability; impervious; may need toe drainage.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
HaB2	Hall silt loam, 3 to 7 percent slopes, eroded.	Good to poor; close control essential.	Very poor to fair bearing; moderate to high piping hazard.	Seepage a minor problem at locations where sand and gravel strata are deep.	Fair to poor stability; impervious; may need toe drainage.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Compaction characteristics	Soil features affecting—						
			Foundations	Low dams		Dikes or levees	Agricultural drainage	Irrigation	Terraces and waterways
				Reservoir area	Embankment				
H-O	Hall-O'Neill complex, 0 to 1 percent slopes.[2]								([1]).
Hs	Hastings silt loam, 0 to 1 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
HsA	Hastings silt loam, 1 to 3 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
HsB2	Hastings silt loam, 3 to 7 percent slopes, eroded.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
Hs3	Hastings complex, severely eroded.[2]								
Hb	Hobbs silt loam, 0 to 1 percent slopes.	Good to poor; close control essential.	Very poor bearing; high piping hazard.	Low to moderate seepage.	Poor stability; impervious; may need toe drainage.	([1])	([1])	High water-holding capacity.	Slightly erosive.
HbA	Hobbs silt loam, 1 to 3 percent slopes.	Good to poor; close control essential.	Very poor bearing; high piping hazard.	Low to moderate seepage.	Poor stability; impervious; may need toe drainage.	([1])	([1])	High water-holding capacity.	Slightly erosive.
Ho	Holdrege silt loam, 0 to 1 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Slightly to moderately erosive; maintenance may be a problem, especially where subsoil is exposed.

HoA	Holdrege silt loam, 1 to 3 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Slightly to moderately erosive; maintenance may be a problem, especially where subsoil is exposed.
HoB	Holdrege silt loam, 3 to 7 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Slightly to moderately erosive; maintenance may be a problem, especially where subsoil is exposed.
HoB2	Holdrege silt loam, 3 to 7 percent slopes, eroded.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Slightly to moderately erosive; maintenance may be a problem, especially where subsoil is exposed.
HoC	Holdrege silt loam, 7 to 11 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Slightly to moderately erosive; maintenance may be a problem, especially where subsoil is exposed.
HoC2	Holdrege silt loam, 7 to 11 percent slopes, eroded.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Slightly to moderately erosive; maintenance may be a problem, especially where subsoil is exposed.
H-C3	Holdrege-Colby complex, severely eroded.[2]								
Hd	Hord silt loam, 0 to 1 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
HdA	Hord silt loam, 1 to 3 percent slopes.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.
HdB2	Hord silt loam, 3 to 7 percent slopes, eroded.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	([1])	([1])	High water-holding capacity.	Erosive; maintenance may be a problem, especially where subsoil is exposed.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Compaction characteristics	Soil features affecting—						
			Foundations	Low dams		Dikes or levees	Agricultural drainage	Irrigation	Terraces and waterways
				Reservoir area	Embankment				
2HdA	Hord silt loam, thin solum variant, 0 to 3 percent slope.	Fair to good	Good to poor bearing.	Seepage not a problem.	Stable; impervious.	(1)	(1)	High water-holding capacity.	Erosive; if subsoil is exposed, may be problem of establishment or maintenance or both.
2HdB	Hord silt loam, thin solum variant, 3 to 7 percent slope.	Fair to good	Good to poor bearing.	Seepage not a problem.	Stable; impervious.	(1)	(1)	High water-holding capacity.	Erosive; if subsoil is exposed, may be problem of establishment or maintenance or both.
H-N	Hord-O'Neill complex, 0 to 1 percent slopes.[2]	----	----	----	----	----	----	----	
Ks	Kenesaw silt loam, 0 to 1 percent slopes.[2]	Fair to good	Good to poor bearing.	Seepage not a problem.	Stable; impervious.	(1)	(1)	High water-holding capacity.	Erosive; maintenance may be a problem.
KsA	Kenesaw silt loam, 1 to 3 percent slopes.	Fair to good	Good to poor bearing.	Seepage not a problem.	Stable; impervious.	(1)	(1)	High water-holding capacity.	Erosive; maintenance may be a problem.
KsB	Kenesaw silt loam, 3 to 7 percent slopes.	Fair to good	Good to poor bearing.	Seepage not a problem.	Stable; impervious.	(1)	(1)	High water-holding capacity.	Erosive; maintenance may be a problem.
La	Lamoure silt loam	Fair to poor above depth of 42 inches; good below 42 inches.	Good to poor bearing.	Seepage not a problem unless sand is exposed.	Fairly stable; impervious above depth of 42 inches.	May need nearly level slopes; moderate to high piping hazard.	Slow internal drainage; seasonally high water table.	Moderate to high water-holding capacity; subject to flooding; adequate drainage necessary.	(1).
2La	Lamoure silt loam, saline.	Fair to poor above depth of 42 inches; good below 42 inches.	Good to poor bearing.	Seepage not a problem unless sand is exposed.	Fairly stable; impervious above depth of 42 inches.	May need nearly level slopes; moderate to high piping hazard.	Slow internal drainage; seasonally high water table.	Moderate to high water-holding capacity; subject to flooding; adequate drainage necessary.	(1).

Lf	Leshara fine sandy loan.	Good to poor; close control essential.	Fair to very poor bearing above depth of 48 inches; high to moderate piping hazard.	Moderate seepage; excessive if sand is exposed.	Fair to poor stability; impervious; may need toe drainage.	May need nearly level slopes; moderate to high piping hazard.	Moderate internal drainage; seasonally high water table.	Moderate water-holding capacity; adequate drainage necessary.	(1).
Le	Leshara silt loam	Good to poor; close control essential.	Fair to very poor bearing above depth of 48 inches high to moderate piping hazard.	Moderate seepage; excessive if sand is exposed.	Fair to poor stability; impervious; may need toe drainage.	May need nearly level slopes; moderate to high piping hazard.	Moderate internal drainage; seasonally high water table.	Moderate water-holding capacity; adequate drainage necessary.	(1).
2Le	Leshara silt loam, saline.	Good to poor; close control essential.	Fair to very poor bearing above depth of 48 inches; high to moderate piping hazard.	Moderate seepage; excessive if sand is exposed.	Fair to poor stability; impervious; may need toe drainage.	May need nearly level slopes; moderate to high piping hazard.	Moderate internal drainage; seasonally high water table.	Moderate water-holding capacity; adequate drainage necessary.	(1).
Lm	Loup loam	Good	Good bearing; excessive below depth of 10 inches.	Excessive seepage	Stable; pervious; may need toe drainage.	(1)	Rapid internal drainage; high water table; subject to flooding.	Very low water-holding capacity; adequate drainage necessary.	(1).
MdB	Meadin loamy sand, 3 to 11 percent slopes.	Good	Good to poor bearing to depth of 8 inches, depending on density; moderate below.	Excessive seepage.	Stable; pervious; may require toe drainage.	(1)	(1)	Very low water-holding capacity; rapid intake rate.	Highly erosive; maintenance may be a problem.
Ms	Meadin sandy loam, 0 to 1 percent slopes.	Good	Good to poor bearing to depth of 15 inches, depending on density; moderate below.	Moderate seepage; excessive if sand is exposed.	Stable; pervious; may need toe drainage.	(1)	(1)	Very low water-holding capacity.	Erosive; maintenance may be a problem.
Ok	O'Neill loam, 0 to 1 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage	Fairly stable, impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	(1)	Low water-holding capacity.	Erosive; waterway maintenance may be a problem where subsoil is exposed.

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Compaction characteristics	Soil features affecting— Foundations	Low dams: Reservoir area	Low dams: Embankment	Dikes or levees	Agricultural drainage	Irrigation	Terraces and waterways
OkB2	O'Neill loam, 3 to 5 percent slopes, eroded.	Good with close control.	Good to poor bearing; depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	[1]	Low water-holding capacity.	Erosive; waterway maintenance may be a problem where subsoil is exposed.
Om	O'Neill sandy loam, 0 to 1 percent slopes.	Good with close control.	Good to poor bearing; depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	[1]	Low water-holding capacity; moderately rapid permeability.	Erosive; waterway maintenance may be a problem where subsoil is exposed.
OmB2	O'Neill sandy loam, 3 to 7 percent slopes, eroded.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	[1]	Low water-holding capacity; moderately rapid permeability.	Erosive; waterway maintenance may be a problem where subsoil is exposed.
OrA	Ortello fine sandy loam, 0 to 3 percent slopes.	Fair; close control desirable.	Good to poor bearing; high piping hazard above 36 inches.	Seepage not a problem.	Fairly stable; impervious.	May require flat slopes; high piping hazard.	[1]	Moderate water-holding capacity.	Erosive; maintenance may be a problem.
OrB	Ortello fine sandy loam, 3 to 7 percent slopes.	Fair; close control desirable.	Good to poor bearing; high piping hazard above 36 inches.	Seepage not a problem.	Fairly stable; impervious.	May require flat slopes; high piping hazard.	[1]	Moderate water-holding capacity.	Erosive; maintenance may be a problem.
20r	Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.	Good to poor; close control essential.	Good to poor bearing; moderate piping hazard.	Moderate seepage problem.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	[1]	Moderate water-holding capacity.	Erosive; maintenance may be a problem.
20rB	Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.	Good to poor; close control essential.	Good to poor bearing; moderate piping hazard.	Moderate seepage problem.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	[1]	Moderate water-holding capacity.	Erosive; maintenance may be a problem.

Ot	Ortello loam, 0 to 1 percent slopes.	Fair to good to depth of 36 inches; good below 36 inches.	Good bearing below depth of 36 inches.	Moderate seepage to depth of 36 inches; excessive if sand is exposed.	Fairly stable: impervious to depth of 36 inches; stable and pervious below 36 inches.	May need nearly level slopes; high piping hazard.	(1)	Moderate water-holding capacity.	Slightly erosive.
Ov	Ovina fine sandy loam.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	(1)	Moderately rapid internal drainage; seasonally high water table.	Moderate water-holding capacity; adequate drainage necessary.	Erosive; maintenance may be a problem.
Oa	Ovina loamy fine sand.	Fair; close control desirable.	Poor to good bearing; moderate piping hazard.	Seepage not a problem.	Fairly stable; impervious.	(1)	Moderately rapid internal drainage; seasonally high water table.	Moderate water-holding capacity; rapid intake rate; adequate drainage necessary.	Erosive; maintenance may be a problem.
Pt	Platte loam	Fair to depth of 20 inches; good below 20 inches.	Good to poor bearing.	Seepage excessive if sand is exposed.	Fairly stable; moderately pervious; may need toe drainage.	May need nearly level slopes; moderate piping hazard.	Very rapid internal drainage; high water table; subject to flooding.	Very low water-holding capacity; moderate drainage necessary.	(1).
P-S	Platte-Sarpy complex.[2]	-----	-----	-----	-----	-----	-----	-----	
2P-S	Platte-Sarpy complex, channeled.[2]	-----	-----	-----	-----	-----	-----	-----	
P-W	Platte-Wann complex.[2]	-----	-----	-----	-----	-----	-----	-----	
2P-W	Platte-Wann complex, channeled.[2]	-----	-----	-----	-----	-----	-----	-----	
Rw	Riverwash	-----	-----	-----	-----	-----	-----	-----	
Sa	Sarpy fine sand	Good	Good to poor bearing, depending on density.	Excessive seepage.	Fairly stable; previous; may need toe drainage.	May need nearly level slopes; moderate piping hazard.	(1)	Very low water-holding capacity; rapid intake rate.	(1).
SgA	Sarpy loamy fine sand, 0 to 3 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; high piping hazard.	(1)	Low water-holding capacity; rapid intake rate.	(1).
SgB	Sarpy loamy fine sand, 3 to 7 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; high piping hazard.	(1)	Low water-holding capacity; rapid intake rate.	(1).

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TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Compaction characteristics	Soil features affecting—						
			Foundations	Low dams		Dikes or levees	Agricultural drainage	Irrigation	Terraces and waterways
				Reservoir area	Embankment				
Sc	Scott silt loam	Fair to poor	Fair to poor bearing.	Seepage not a problem.	Fairly stable; impervious.	(1)	Outlets usually lacking; slow internal drainage.	High water-holding capacity; slow intake rate; adequate drainage necessary.	(1).
Si	Silver Creek silt loam.	Fair to poor	Good to poor bearing.	Seepage not a problem.	Fairly stable; impervious.	May need nearly level slopes.	Locally poor surface drainage; slowly permeable subsoil.	High water-holding capacity; slow intake rate; adequate drainage necessary.	(1).
TsA	Thurman fine sandy loam, 0 to 3 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	(1)	(1)	Low to moderate water-holding capacity.	Highly erosive; maintenance a problem.
TsB	Thurman fine sandy loam, 3 to 7 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	(1)	(1)	Low to moderate water-holding capacity.	Highly erosive; maintenance a problem.
ThA	Thurman loamy fine sand, 0 to 3 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	(1)	(1)	Low water-holding capacity; rapid intake rate.	Highly erosive; maintenance a problem.
ThB	Thurman loamy fine sand, 3 to 7 percent slopes.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	(1)	(1)	Low water-holding capacity; rapid intake rate.	Highly erosive; maintenance a problem.
Th3	Thurman loamy fine sand, wind eroded.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	(1)	(1)	Low water-holding capacity; rapid intake rate.	Highly erosive; maintenance a problem.

2ThA	Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.	Fair to good with close control to depth of 45 inches; good below 45 inches.	Good to poor bearing, depending on density; moderate piping hazard.	Moderate seepage; excessive if sand is exposed.	Fairly stable; moderately pervious; may require toe drainage.	[1]	[1]	Moderate water-holding capacity; rapid intake rate.	Highly erosive; maintenance a problem.
2ThB	Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.	Fair to good with close control to depth of 45 inches; good below 45 inches.	Good to poor bearing, depending on density; moderate piping hazard.	Moderate seepage; excessive if sand is exposed.	Fairly stable; moderately pervious; may require toe drainage.	[1]	[1]	Moderate water-holding capacity; rapid intake rate.	Highly erosive; maintenance a problem.
Va	Valentine fine sand.	Good	Good to poor bearing, depending on density.	Excessive seepage.	Fairly stable; pervious; may require toe drainage.	[1]	[1]	Very low water-holding capacity; rapid intake rate.	Wind erosion a severe hazard.
Vo	Volin silt loam	Fair to good to depth of 24 inches; good with close control below.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious may require toe drainage.	May need nearly level slopes; high piping hazard.	[1]	High water-holding capacity.	[1].
Wb	Wann fine sandy loam.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; high piping hazard.	Seasonally high water table; rapid permeability in subsoil.	Low water-holding capacity; adequate drainage necessary.	[1].
3Wb	Wann fine sandy loam, deep.	Good with close control.	Good to poor bearing, depending on density; high piping hazard.	Moderate seepage.	Fairly stable; impervious; may require toe drainage.	May need nearly level slopes; high piping hazard.	Seasonally high water table; rapid permeability in subsoil.	Low water-holding capacity; adequate drainage necessary.	[1].
Wm	Wann loam	Fair to good to depth of 30 inches; good below 30 inches.	Good to poor bearing below depth of 12 inches, depending on density.	Moderate seepage; excessive if sand is exposed.	Fairly stable; impervious to depth of 30 inches; stable and pervious below 30 inches; may need toe drainage.	May need nearly level slopes; moderate to high piping hazard.	Seasonally high water table; rapid permeability in subsoil.	Low water-holding capacity; adequate drainage necessary.	[1].

TABLE 10.—*Engineering interpretation of soils in Hall County, Nebr.*—Continued

Map symbol	Soil	Compaction characteristics	Soil features affecting—						
			Foundations	Low dams: Reservoir area	Low dams: Embankment	Dikes or levees	Agricultural drainage	Irrigation	Terraces and waterways
3Wm	Wann loam, deep	Good with close control.	Good to poor bearing below depth of 12 inches, depending on density.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	Moderately rapid internal drainage; seasonally high water table.	Moderate water-holding capacity; adequate drainage necessary; saline-alkali problem.	(1).
2Wm	Wann loam, deep, saline.	Good with close control.	Good to poor bearing below depth of 12 inches, depending on density.	Moderate seepage.	Fairly stable; impervious; may need toe drainage.	May need nearly level slopes; high piping hazard.	Moderately rapid internal drainage; seasonally high water table.	Moderate water-holding capacity; adequate drainage necessary; saline-alkali problem.	(1).
Wr	Wood River silt loam, 0 to 1 percent slopes.	Fair; close control desirable.	Fair to poor bearing.	Seepage is not a problem.	Fairly stable; impervious.	(1)	Locally poor surface drainage; slowly permeable subsoil.	High water-holding capacity; slow intake rate.	Moderately to highly erosive.
WrA	Wood River silt loam, 1 to 3 percent slopes.	Fair; close control desirable.	Fair to poor bearing.	Seepage is not a problem.	Fairly stable; impervious.	(1)	Locally poor surface drainage; slowly permeable subsoil.	High water-holding capacity; slow intake rate.	Moderately to highly erosive.
WrB2	Wood River silt loam, 3 to 7 percent slopes, eroded.	Fair; close control desirable.	Fair to poor bearing.	Seepage is not a problem.	Fairly stable; impervious.	(1)	Locally poor surface drainage; slowly permeable subsoil.	High water-holding capacity; slow intake rate.	Moderately to highly erosive.
W-Es	Wood River-Exline fine sandy loams.[2]	------	------	------	------	------	------	------	
W-E	Wood River-Exline silt loams.[2]	------	------	------	------	------	------	------	

[1] Because of position, topography (including slope), or nature of the soil, this practice is generally not needed or applicable.
[2] See data for individual soils in soil series of this complex.

The suitability of soils for winter grading varies from year to year, depending on the moisture content of the soil and the temperatures during winter. During some winters, soil moisture is low and no frost forms in the soils. When temperature permits, moisture can be added to provide proper conditions for grading and compaction. In those winters when soil moisture is high and temperatures are below freezing for extended periods, winter grading, earth movement, and compaction are stopped or are difficult to perform. Gravelly or sandy materials that contain only a small percentage of silt or clay are generally more suitable for winter grading than soils that have relatively high percentages of silt and clay. Grading, however, should not be allowed in gravelly or sandy soils unless the required standards of construction, with respect to compaction of soils and exclusion of frozen material, are maintained.

Frost action is an important soil-engineering problem in Hall County. The susceptibility of a soil material to frost action varies. A soil generally is not susceptible to frost action if less than 10 percent of the soil material passes the No. 200 sieve. Soils with high percentages of silt and clay are usually more susceptible to softening due to frost action than are those with a low percentage. In addition to the content of silt and clay, the permeability of the underlying material, the water table, moisture content, temperature, drainage, and other factors affect the susceptibility of a soil to frost action.

The ratings given in table 10 for suitability of soils as sources of topsoil or sand and gravel apply only to Hall County. Many of the soils are rated *poor* as a source of topsoil because the material is too sandy to be high in fertility. If a soil is rated *good* as a suitable source of sand and gravel, it may still be necessary to explore extensively to find material that will meet gradation requirements.

In general, the soil features listed in table 10 as affecting engineering were selected according to the problems that these features might cause in construction or maintenance, or both. The soil features listed for a given soil were based on the profile of that soil as shown in table 9. Variations in profile, for example, variations in depth to gravel, will change the ratings for some kinds of structures or practices.

The soil features that result from a saline or alkali condition of soils and affect engineering practices have not been rated. Such condition, depending upon degree of salinity or alkalinity and the quantity of materials affected, may seriously affect the piping hazard, internal drainage, and workability. Also, this condition restricts the use of vegetation in waterways and other structures. The Nebraska Irrigation Guide for Central and Eastern Nebraska, September 1959, contains recommendations for use of soil amendments.

The compaction characteristics of the soils were rated only for that portion of the soil below foundation preparation depth (6 to 12 inches) and only to the depths of the profiles given in table 9. Compaction characteristics have been rated on the basis of the workability of the soil with standard compaction equipment.

The rating in table 10 for bearing capacity and piping hazard of soils in foundations have been rated for use in designing small dams and concrete structures. These ratings apply to the depths of the horizons given in table 9.

Those soil features affecting the reservoir area and the embankment (under Low dams) have been rated for small earth dams. These data may serve to guide preliminary design for larger grade stabilization, as in irrigation and floodwater retarding structures, but it is assumed that for these large structures a detailed geologic investigation of site will be made.

For dikes and levees only relatively low structures were considered, and soil features of only the upper part of the profile (approximately 30-inch depth) were rated. This information should help in the preliminary planning for larger dikes and levees, but for these large structures it is assumed that a detailed investigation of site will be made.

For agricultural drainage the surface or internal drainage and the permeability are rated and the general height of the water table is given. The permeability rating is based on the following classification:

Inches per hour	*Rating*
0.05 to 0.2	Slow
.2 to .8	Moderately slow
.8 to 2.5	Moderate
2.5 to 5.0	Moderately rapid
5.0 to 10.0	Rapid
Over 10	Very rapid

Under irrigation, ratings have been given for the available water-holding capacity (water-holding capacity in table 10) and the water intake. Irrigation hazards related to slope are not shown. The Soil Conservation Service Irrigation Guide for Central and Eastern Nebraska, September 1959, contains information on the suitability of various soils and slopes for irrigation.

The water-holding capacity is for the top 4 feet of the soil and has been rated according to the following classification:

Water-holding capacity	*Rating*
More than 8 inches	High
5 to 8 inches	Moderate
3 to 5 inches	Low
Less than 3 inches	Very low

The intake rate is rated only as *slow* or *rapid*. If classified as *slow*, the intake rate is less than ½ inch per hour. If classified as *rapid*, the intake rate is 2 inches per hour or more. For all soils the intake rate was based on border or sprinkler irrigation with cover.

For terraces and waterways, the erosiveness of the slopes of terraces and the channels of waterways is rated for those soils on which these structures are practicable.

At many construction sites, major soil variations may occur within the depth of proposed excavation and several soil units may be encountered within a short distance. The soil map and profile descriptions, as well as the engineering data and recommendations given in this section, should be used in planning detailed surveys of soils at construction sites. Using the information in the soil survey reports will enable the soils engineer to concentrate on the most suitable soil units. Then a minimum number of soil samples will be required for laboratory testing, and an adequate soil investigation can be made at minimum cost.

Genesis, Classification, and Morphology of Soils

This section consists of four main parts. The first part discusses the factors of soil formation as they relate to the development of soils in Hall County. In the second part, the soil series of the county are placed in great soil groups and soil orders in table 11, and some of the factors are given that contributed to the morphology of the soils in the series. The third part discusses the great soil groups in the county. In the fourth part is a description of each soil series that includes a description by horizons of a profile representative of the series.

Factors of Soil Formation

Soil is formed by a process of physical and chemical weathering of parent materials. The kind of soil that forms depends on the effect of the interaction of the five factors of soil formation—parent materials, climate, vegetation and living organisms, relief and drainage, and time. All these factors are important, but, in different locations and under different conditions, some have more effect than others.

The five soil-forming factors are interdependent; each modifies the effect of the others. Climate and vegetation are the active forces that change the parent material and gradually form a soil. Relief, mainly by its control of runoff, influences the effectiveness of climate and vegetation. By his treatment, man makes soils better or worse than he finds them. The length of time that these forces have been working to form soils is another factor in their development. The interrelation of all these factors is complex.

Parent materials

The soils of Hall County have developed in three kinds of parent materials—loess, alluvium, and eolian sands.

Much of the loess is Peorian loess. It is as much as 35 feet thick and consists of pale-yellow or gray silt loam. Beneath this lies the reddish-brown Loveland formation, which outcrops on the valley sides in a few places. The Loveland formation consists of loess, sands, and alluvial silts and clays. It ranges from a few feet to 100 feet in thickness. Southwest of Doniphan there is an area of eolian sands and Peorian loess that have been reworked by the wind. The resulting soil parent material is extremely variable, grading from loess to eolian sand. Another smaller area of these mixed materials occurs west of Cairo.

The high terrace levels in the county are covered with loess that visually cannot be distinguished from the Peorian loess of the uplands. But this loess on high terraces has been salinized in the upper part. Laboratory tests show that soluble salts may extend to a depth of 8 feet. The salinity is not uniform throughout the entire loess-covered terrace but occurs mostly on the more nearly flat areas that lack adequate surface drainage. The salinity is probably the result of a water table that was high. It is not inherent in the material that was deposited.

Most bottom land in the valleys of the Platte and South Loup Rivers has been derived from alluvium of Recent age. This alluvium ranges from clay to sand in texture and is commonly stratified. The silty and sandy material is lighter colored than the clayey material, which is dark in most places. This recent alluvium was deposited to a depth of 1 to 8 feet over the basal sand or mixed sand and gravel. Some of the sandy alluvium has been reworked by the wind and redeposited in the form of hummocks or low sand ridges. More extensive deposition is unlikely in the Platte Valley, since dams have been constructed upstream. The most recent alluvium is found in upland draws and along the narrow bottom land of the Wood River, Prairie Creek, and Dry Creek, where fresh material is still being deposited after heavy local rains.

Other alluvial deposits are on the lowest terrace level. This terrace level is in the area north and directly west of Grand Island and continues southwestward to the Buffalo County line. Here, much of the alluvium has been mixed with or covered by wind-blown sands. One or more dark, buried soils occur in many places on this terrace level.

The deep, sandy upland soils in the northern part of the county were developed in eolian sands that probably were once alluvial sands in the valley of the South Loup River. Likewise, the deep, sandy soils on uplands southwest and northeast of Doniphan were formed in sandy material that was once alluvial sands in the Platte Valley. These sandy soils are not uniformly distributed; they were deposited and formed hummocks and hills as the power of the wind decreased. The eolian sandy deposits in Hall County range from 2 to about 50 feet in thickness. The sandhills consist of about 95 to 98 percent fine and medium sand and less than 5 percent silt and clay.

A basal deposit of coarse sand or mixed sand and gravel underlies nearly all of Hall County. This material is mainly quartz and feldspars containing minor quantities of mica. The gravel weathered from a great variety of rocks, principally those of igneous origin.

No bedrock formations are exposed in the county.

The parent materials are shown in figure 23. This diagram also shows the relationship of certain soil series to physiography, topography, and the water table.

Climate

The climate of Hall County is important in the formation of soils. The county has a typical continental climate characterized by wide seasonal variations. Winter temperatures below 0° F. and summer temperatures above 100° are common. The average precipitation is 24.63 inches per year and the average annual temperature is 51°. The average number of days without killing frost is 160. If moisture is sufficient, frost penetrates to depths of 2 to 4 feet.

Areas in this climate produce short, mid, and tall prairie grasses. The rainfall is not heavy enough to leach the soils deeply. Except in the sandy and shallow soils, leaching is normally in the upper 2 to 3 feet. Some translocation of colloids has taken place, and soils with a claypan have formed on the stream terraces and uplands. Climate directly and indirectly causes variations in plant and animal life, which is a factor in the formation of soils.

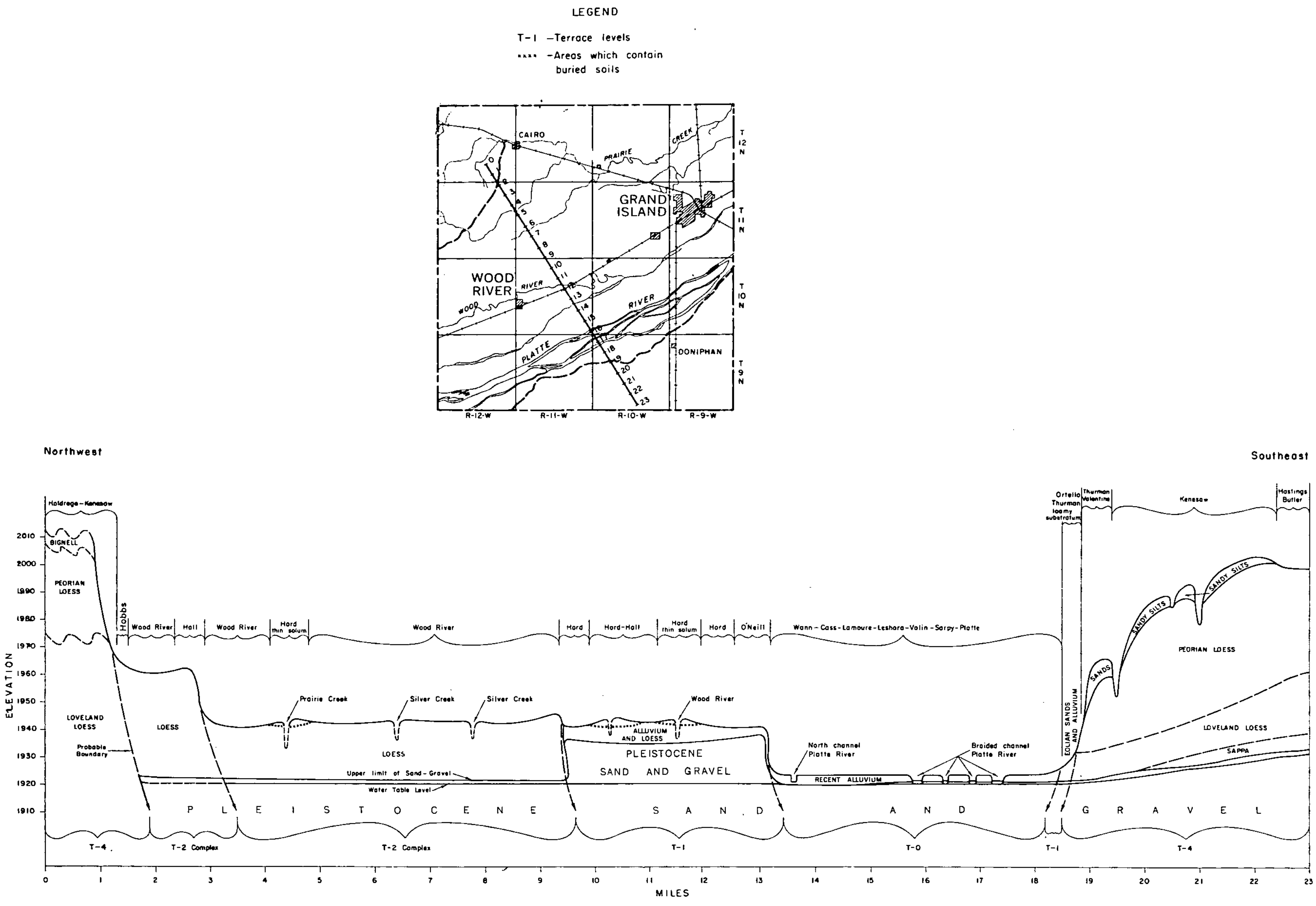

Figure 23.—A geologic profile section across the Platte River Valley in Hall County, showing relationship of terrace development, parent material, elevation, and level of water table to soil series.

Many of the mature soils in the county have a thick, dark-colored, granular surface horizon and free lime carbonates in the lower subsoil. These soils are Chernozems. Climate, along with native grass vegetation, has been a dominant factor in the formation of these soils.

Vegetation and living organisms

The native vegetation in Hall County consists primarily of short, mid, and tall grasses. Only a few areas are forested, along the Platte, South Loup, and Wood Rivers, and Prairie Creek. On the well-drained soils, the native prairie grasses are mainly big bluestem, little bluestem, buffalograss, and blue grama. The fibrous roots of these grasses penetrate to depths of 12 or 18 inches, and some of the smaller roots go much deeper. Nutrients, mainly calcium, are brought to the surface by these roots and are returned to the soil in the surface horizon as a part of the organic matter. The calcium tends to keep the soils open. Open soils are favorable to bacterial action, and the accumulation of humus aids in the development of granular structure. These soils are easily penetrated by roots and water.

The type of vegetation on the wet soils of the bottom land is different from that of the upland. This difference affects soil development. The decay of the organic matter may be slower in wet areas than in dry because living organisms are scarce in extremely wet areas. Generally, the imperfectly drained soils on the bottom land in the Platte River Valley are thinner in the surface soil than the well-drained soils on the upland; the surface soil, however, is equally as dark as that of the well-drained upland soils. The native grasses cause a dark-colored surface horizon to form in the young soils of the sandhill region, but rapid oxidation of the organic matter and wind erosion tends to slow the process.

The number and kinds of living organisms are significant to the development of soils. The undecomposed organic matter in the soil is food for micro-organisms and, by the action of the micro-organisms, is changed to humus. Some bacteria can take nitrogen from the air and use it for their own growth. When the bacteria die, the nitrogen can be used by plants. The plants, in turn, produce organic matter, which is important in soil formation. Other living organisms, such as fungi, earthworms, and the larger animals, affect soil development, both physically and chemically.

Man has a great effect on soil development. His management of the soil is a primary factor. He conserves fertility, or he allows the soil to be drained of its nutrients; he plants soil-conserving grasses or allows erosion to progress. He plows the fields and may irrigate the land. Some fields are fallowed in summer, and others are fertilized with commercial fertilizer. Whatever man does to the soil affects its development in some way.

Time

Time is required for soil formation. How much time is needed depends on the kind of parent material and many other factors. If the factors of soil formation have not operated long enough to form a soil that is in equilibrium with its environment, the soil is considered young or immature. In general, the older soils have reached an equilibrium with their environment. However, if land use, irrigation, or something else should change the environment, the soils will then establish a new equilibrium to meet the new environment.

The soils of Hall County range from young soils with little or no development to old soils with thick profiles and pronounced development. The Valentine soils on the sandhills are young soils because they have been stabilized for only a short time. The rolling, loose sands support only a thin, sparse vegetation, and soil development proceeds slowly. Riverwash has been deposited so recently that a true soil has not had time to develop. Kenesaw soils are young soils developing in recently deposited materials. Colby soils have had time enough for some soil development, but erosion and the sparse vegetation have kept development from proceeding faster. The alluvial soils on the bottom lands are young soils and, in places, soil material is still being deposited.

Exline soils are immature and have had some soil development, but these soils are not yet in equilibrium with their environment.

The oldest soils in Hall County are some of the buried soils that are found in many parts of the terraces and uplands. Soil development on the Loveland formation took place many years before the material was covered by the Peorian loess. The Hall, Wood River, Hastings, Holdredge, and Butler soils have thick, well-developed profiles and are older, mature soils.

Relief and drainage

Most of Hall County is nearly level, but many areas are sloping and steep. Some of the sandy soils are hummocky, and parts of the sandhill region are hilly. The loess hills and bluffs are very steep.

Relief, or lay of the land, affects runoff and drainage. If other factors such as vegetative cover and rainfall are about equal, runoff is rapid on steep slopes and slower or lacking on level areas. If there is too much runoff, little water enters the soil, plants do not grow vigorously, and soil formation proceeds slowly. Soil horizons are indistinct and shallower than normal. Unless a good vegetative cover is maintained, erosion may progress faster than soil development. The lime zones are at or near the surface on steep slopes because less lime is leached and soil is formed more slowly than on milder slopes.

On soils that are nearly flat or in depressions where there is too little runoff, a claypan may develop in the subsoil as new minerals and colloids are added to the lower horizons by leaching and the weathering of silts to clays.

The poorly drained areas with high water tables have slow or incomplete decay of organic materials. At times capillary action from the water table dissolves salts and deposits them at or near the surface. This deposition makes the areas saline or alkali.

Classification of Soils

Soils may be classified in different ways to bring out their relationship to one another. The categories of classification commonly used in the field are series, type, and phase. These categories are defined in the subsection, How Soils are Mapped and Described.

Soil series are grouped into higher categories called soil orders and great soil groups. All three soil orders—

zonal, intrazonal, and azonal—are represented in this county.

Zonal soils have well-developed characteristics that reflect the influence of the active factors of soil formation, climate and living organisms, chiefly vegetation. Hall County lies in the Chernozem belt, and the zonal soils in the county have characteristics of the Chernozem great soil group. Zonal soils generally have thick, dark-colored, weak, granular A horizons. The B horizons are thick, slightly lighter colored, and show structural development. A horizon of lime accumulation is in the B_3 horizons. The zonal soils of Hall County are developed on the older loessal uplands and stream terrace levels.

Intrazonal soils have more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief and drainage or parent material over the normal effect of climate and vegetation. The intrazonal soils of Hall County include the solodized Solonetz and Humic Gley great soil groups. These soils are characterized by saline-alkali conditions (solodized Solonetz) or impeded drainage (Humic Gley). They developed on stream terraces and bottom lands.

The azonal soils do not have well-developed B horizons; their youth, parent materials, or relief have prevented the development of distinct profile characteristics. Azonal soils in this county include the Regosol and Alluvial great soil groups. They are on bottom lands, stream terraces, and uplands.

About 34 percent of the county has zonal soils; 18 percent has intrazonal soils; and 48 percent has azonal soils.

To show their relation to the higher categories and to each other, the soil series of Hall County are classified in table 11 according to soil orders and great soil groups. The physiographic position, parent material, dominant relief, natural drainage, and subsoil texture are also given.

Great Soil Groups in Hall County

A great soil group consists of many soil types that have profiles with major features in common. Every soil type in any one great soil group has the same number and kinds of definitive horizons, although they need not be expressed in every profile to the same degree. Collectively, the members of a single great soil group have a wide range in many characteristics or properties. They may also have a wide range in fertility, tilth, moisture-holding capacity, susceptibility to erosion, and other qualities.

The great soil groups in Hall County are Chernozems, Humic Gley soils, Planosols, solodized Solonetz soils, Alluvial soils, and Regosols.

Chernozem soils

The Chernozem soils are a zonal group of soils having thick, dark surface horizons that are rich in organic matter. These horizons commonly have weak granular structure. The subsoils are lighter colored than the surface horizons. In most profiles, there is an accumulation of calcium carbonate in the lower subsoil, normally at depths of 2 to 4 feet; but, in sandy soils, the lime may be leached deeper. Chernozem soils have developed in areas of mixed short, mid, and tall grasses where the climate is subhumid and temperate to cool. In Hall County, the soil series in the Chernozem great soil group are soils of the Hall, Hastings, Holdrege, Hord, Meadin, O'Neill, Ortello, Ovina, Thurman, and Wood River. The Hord, Meadin, O'Neill, Ortello, Ovina, and Thurman soils are not sufficiently developed to be classed true Chernozems. They are intergrades to the Regosol great soil group. The Wood River soils have faint A_2 horizons and moderate amounts of exchangeable sodium in their clayey subsoils. Thus, they are intergrades to the solodized Solonetz great soil group (see table 11).

Humic Gley soils

Humic Gley soils are intrazonal soils that, in Hall County, occur on bottom lands and stream terraces where they have developed under conditions of poor drainage in areas of grass. Most of these soils have a gleyed subsoil horizon and are calcareous throughout the profile. The Humic Gley soils in the county are in the Lamoure and Silver Creek series (see table 11).

Planosols

These are an intrazonal group of soils that have a leached (eluviated) surface horizon underlain by a compact claypan subsoil. They are developed on nearly flat or depressed topography. The Planosols of Hall County are in the Butler, Fillmore, and Scott series (see table 11).

Solodized Solonetz soils

These soils have thin surface horizons that vary from place to place in friability. The lower part is a light-colored, leached A_2 horizon. This A_2 horizon is abruptly underlain by a dark, hard B horizon that ordinarily has columnar structure, is highly alkaline, and may be saline. In Hall County, these soils are developed under grass vegetation in a subhumid climate. The Exline soils are the only solodized Solonetz soils in Hall County (see table 11).

Alluvial soils

The Alluvial great soil group consists of azonal soils developing in alluvium that has been transported and deposited relatively recently. Except for the organic matter that has been added and has darkened the surface horizon, the materials that were deposited have had little or no modification by the soil-forming processes. In Hall County the following soil series are in the Alluvial great soil group: Barney, Cass, Elsmere, Hobbs, Leshara, Loup, Platte, Sarpy, Volin, and Wann (see table 11).

Regosols

Regosols are light-colored azonal soils that are developing from thick unconsolidated deposits but do not have definite genetic horizons. In Hall County the unconsolidated deposits are sand and loess. The Regosols in this county are in the Colby, Kenesaw, and Valentine series (see table 11).

Soil Series, Including Descriptions of Profiles

This subsection was prepared for those who need more scientific information about the soils in the county than is given elsewhere in the report. In the following pages is

TABLE 11.—*Soil series classified according to soil order and great soil group and some characteristics that affect morphology*

Great soil group and soil series	Physiographic position	Parent material	Dominant relief	Natural drainage	Subsoil texture
ZONAL					
Chernozems:					
Hall	Stream terrace	Loess or alluvium	Nearly level	Good	Moderately fine.
Hastings	Upland	Peorian loess	Nearly level	Good	Moderately fine.
Holdrege	Upland	Peorian loess	Nearly level	Good	Medium.
Hord (intergrading to Regosols)	Stream terrace	Loess or alluvium	Nearly level	Good	Medium.
Meadin (intergrading to Regosols)	Stream terrace	Sandy alluvium	Nearly level	Excessive	Coarse.
O'Neill (intergrading to Regosols)	Stream terrace	Sandy alluvium	Nearly level	Excessive	Moderately coarse.
Ortello (intergrading to Regosols)	Stream terrace	Sandy alluvium	Nearly level	Somewhat excessive.	Moderately coarse.
Ovina (intergrading to Regosols)	Stream terrace	Eolian sand	Nearly level	Imperfect	Moderately coarse.
Thurman (intergrading to Regosols)	Upland	Eolian sand	Hummocky	Somewhat excessive.	Coarse.
Wood River (intergrading to solodized Solonetz)	Stream terrace	Loess or alluvium	Nearly level	Imperfect	Fine.
INTRAZONAL					
Humic Gley soils:					
Lamoure	Bottom land	Recent alluvium	Nearly level	Imperfect	Fine.
Silver Creek	Stream terrace	Loess or alluvium	Nearly level	Imperfect	Fine.
Planosols:					
Butler	Upland	Peorian loess	Nearly level	Imperfect	Fine.
Fillmore	Depression	Loess or alluvium	Nearly level	Poor	Fine.
Scott	Depression	Loess or alluvium	Nearly level	Very poor	Fine.
Solodized Solonetz soils:					
Exline	Stream terrace	Loess or alluvium	Nearly level	Imperfect	Fine.
AZONAL					
Alluvial soils:					
Barney	Bottom land	Recent alluvium	Nearly level	Poor	Medium to moderately coarse.
Cass	Bottom land	Recent alluvium	Nearly level	Somewhat excessive.	Moderately coarse.
Elsmere	Bottom land	Recent alluvium	Nearly level	Imperfect	Coarse.
Hobbs (intergrading to Chernozems)	Colluvial slopes	Colluvium and alluvium.	Very gently sloping.	Good	Medium.
Leshara	Bottom land	Recent alluvium	Nearly level	Imperfect	Medium.
Loup	Bottom land	Recent alluvium	Nearly level	Poor	Coarse.
Platte	Bottom land	Recent alluvium	Nearly level	Imperfect	Very coarse.
Sarpy	Bottom land	Recent alluvium	Nearly level to gently sloping.	Excessive	Coarse.
Volin	Bottom land	Recent alluvium	Nearly level	Good	Medium.
Wann	Bottom land	Recent alluvium	Nearly level	Imperfect	Moderately coarse.
Regosols:					
Colby	Upland	Loess	Steep to very steep.	Excessive	Medium.
Kenesaw	Upland	Peorian loess	Nearly level to steep.	Good	Medium.
Valentine	Upland	Eolian sand	Hummocky	Excessive	Coarse.

a description of each soil series that tells about the soil maturity, great soil group, natural drainage, and general location of the soils in the series. Following this is a block profile description of a soil representative of the series. The profile descriptions were prepared after studying profiles at specific sites in the county.

The reader should turn to the section, Soils of Hall County, for a description of topography, surface drainage, permeability, vegetation, range in characteristics, and dominant land use.

Barney series

The Barney series consists of dark, poorly drained Alluvial soils of the Chernozem soil zone. The soils are shallow, 10 to 20 inches thick, over coarse sand or mixed sand and gravel. The water table fluctuates from 4 feet beneath the surface in dry periods to slightly above the surface during the wettest seasons. Barney soils are on flood plains of the Missouri River and tributary streams.

Profile of Barney loam in a native pasture, 0.2 mile east and 300 feet south of the northwest corner of sec. 11, T. 9 N., R. 11 W.:

A_{11} 0 to 2 inches, dark-gray (10YR 4/1, dry) loam; black (10YR 2/1) when moist; moderate, fine and medium, crumb structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

A_{12} 2 to 6 inches, very dark gray (10YR 3/1, dry) loam or silt loam; black (10YR 2/1) when moist; weak, fine, crumb structure; friable when moist, slightly hard when dry; a few white, noncalcareous segregations; clear, smooth boundary

C 6 to 16 inches, grayish-brown (10YR 5/1.5, dry) loam; dark grayish brown (10YR 4/1.5) when moist; a few, fine, faint mottlings; weak, coarse, prismatic structure breaking to moderate, coarse fragments; friable when moist, slightly hard when dry; noncalcareous; some medium sand grains along prismatic structural faces; abrupt, smooth boundary.

D 16 to 60 inches +, brownish mixed sand and gravel; common, medium, prominent, dark-brown and yellowish mottlings; single grain (structureless); noncalcareous.

At the time of sampling, the water table was at a depth of 28 inches.

Butler series

The Butler series consists of dark, imperfectly drained claypan soils on the loessal uplands in the Chernozem soil zone and in the drier parts of the Prairie soil zone. They have a horizon of lime accumulation and are not so subject to inundation as the depressional soils of the Fillmore and Scott series. Butler soils have an A_2 horizon that is not apparent when they are moist. These soils are chiefly in south-central and eastern Nebraska and adjacent parts of Kansas.

Profile of Butler silt loam in a field of winter wheat, 500 feet west and 100 feet south of the northeast corner of sec. 25, T. 9 N., R. 10 W.:

A_{1p} 0 to 6 inches, dark grayish-brown (10YR 4/1.5, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 5.5; abrupt, smooth boundary.

A_{12} 6 to 10 inches, gray (10YR 4.5/1, dry) silt loam; black (10YR 2/1) when moist; structure and consistence as in horizon above; noncalcareous; pH 5.3; abrupt, smooth, boundary

A_2 10 to 14 inches, light-gray (10YR 5.5/1, dry) silt loam; dark gray (10YR 3.5/1) when moist; weak, fine and moderate, crumb structure; friable when moist, soft to slightly hard when dry; noncalcareous; pH 5.2; abrupt, smooth boundary

B_{21} 14 to 26 inches, dark-gray (10YR 4/1, dry) silty clay or clay; very dark gray (10YR 3/1) when moist; strong, medium, prismatic breaking to moderate, medium, blocky structure; very firm when moist, very hard when dry; noncalcareous; pH 5.7; gradual, smooth boundary.

B_{22} 26 to 38 inches, gray (10YR 5/1, dry) silty clay; very dark gray (10YR 3/1) when moist; moderate, medium, blocky structure; very firm when moist, very hard when dry; noncalcareous; pH 6.4; gradual, smooth lower boundary.

B_{23} 38 to 44 inches, gray (5YR 5/1, dry), heavy silty clay loam; dark gray (5YR 4/1) when moist; moderate, coarse, blocky structure; very firm when moist, hard when dry; noncalcareous; pH 6.5; gradual, smooth boundary.

B_3 44 to 50 inches, light olive gray (5Y 5.5/2, dry) silty clay loam; olive gray (5Y 4/2) when moist; moderate, coarse, subangular blocky structure; firm when moist, hard when dry; noncalcareous; pH 7.0; clear, smooth boundary.

C_2 50 to 60 inches, light-gray (5Y 7.5/1, dry) silt loam; gray (5Y 6/1) when moist; a few yellowish stains; massive (structureless); friable when moist, soft when dry; strong effervescence; pH 7.7.

The low chroma and value of the lower subsoil are typical of the Butler soils in Hall County.

Cass series

The Cass series is made up of dark, immature Alluvial soils on stream flood plains. They are forming in recently deposited sediments, chiefly sand and gravel, and are in the Prairie and Chernozem soil zones. These soils are somewhat excessively drained, and they have a dark surface horizon, a sandy subsoil, and a moderate depth to the water table. They have little or no lime carbonate in their profile. Mottles may be present in the lower part of the subsoil. Cass soils are in the northern Great Plains region, along the Missouri and Mississippi Rivers and their tributaries.

Profile of Cass fine sandy loam, deep, in a field of dryland corn, 1,300 feet east and 700 feet south of the northwest corner of sec. 17, T. 10 N., R. 9 W.:

A 0 to 12 inches, gray (10YR 5/1.5, dry) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, crumb structure; very friable when moist, soft when dry; noncalcareous; pH 6.8; roots abundant; gradual, smooth boundary.

A–C 12 to 20 inches, gray (10YR 5/1, dry) fine sandy loam; dark gray (10YR 4/1) when moist; weak, coarse, prismatic structure breaking to irregular fragments; very friable when moist, soft when dry; pH 6.4; gradual, smooth boundary.

C_1 20 to 47 inches, grayish-brown (10YR 5.5/2, dry) fine sandy loam; dark grayish brown (10YR 4.5/2) when moist; massive (structureless); very friable when moist, soft when dry; noncalcareous; pH 6.6; somewhat lighter colored in lower part; diffused boundary.

C_2 47 to 60 inches, very pale brown (10YR 7/3, dry) loamy fine sand; grayish brown (10YR 5/2.5) when moist; only slightly coherent; loose consistence when dry; noncalcareous; pH 6.8.

Mixed sand and gravel are at depths of 3 to 5 feet in many profiles of Cass soils.

Colby series

Colby soils are light-colored, well-drained, calcareous Regosols in loess or other similar sediments. They occur in gently sloping to strongly sloping areas within the

Chestnut and Brown soil zones, and on some of the steeper areas within the Chernozem soil zone. Colby soils are associated with Richfield, Keith, Baca, and Kenesaw soils, of which only the Kenesaw soils are mapped in Hall County. Soils of the Colby series are extensive in the semiarid and subhumid areas of the Great Plains.

Profile of Colby silt loam, 11 to 30 percent slopes, in a native pasture, 250 feet east and 100 feet south of the northwest corner of sec. 4, T. 11 N., R. 12 W.:

A 0 to 4 inches, light brownish-gray (10YR 6/2, dry) silt loam; dark grayish brown (10YR 4.5/2) when moist; weak, moderate, platy structure; slightly hard when dry, friable when moist; slight effervescence; a few, hard, small concretions of carbonate on surface; clear, wavy boundary.

C_{11} 4 to 9 inches, light-gray (10YR 7/2, dry) silt loam; grayish brown (10YR 5/2) when moist; common, medium, yellowish iron stains; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; strong effervescence; clear, smooth boundary.

C_{12} 9 to 22 inches, same as horizon above except weak, coarse, indefinite blocky structure; slight effervescence; smooth boundary.

C_2 22 to 60 inches +, very pale brown (10YR 7.5/3, moist) silt loam; light brownish gray (10YR 5.5/2) when moist; a few, medium and distinct, yellowish iron stains; massive (structureless); soft when dry, very friable when moist; strong effervescence.

Elsmere series

The Elsmere series consists of dark-colored, immature soils developed in dominantly eolian sands in broad basins, on narrow valley floors, and on the long, gentle slopes of sandhill areas in the northern part of the Chernozem and Chestnut soil zones. Elsmere soils are imperfectly drained. The ground-water level fluctuates between 4 and 8 feet. Mottles are common in the subsoil. Elsmere soils are in Nebraska, South Dakota, and North Dakota.

Profile of Elsmere fine sandy loam in a permanent pasture about 0.3 mile south and 80 feet west of the northeast corner of sec. 5, T. 12 N., R. 12 W.:

A_1 0 to 11 inches, gray (10YR 5/1, dry) fine sandy loam; very dark gray (10YR 3/1) when moist; weak, medium and coarse, crumb structure; very friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

A_3 11 to 14 inches, grayish-brown (10YR 5/2, dry) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic breaking to weak, medium, subangular blocky structure; very friable when moist, slightly hard when dry; strong effervescence; clear, smooth boundary.

C_1 14 to 21 inches, light brownish-gray (10YR 6.5/2, dry) loamy fine sand; grayish brown (10YR 5.5/2) when moist; a few, medium, faint mottlings; weak, coarse, irregular fragments; very friable when moist, loose when dry; noncalcareous; gradual, smooth boundary.

D_2 21 to 46 inches, light-gray (10YR 7/2, dry) mixed fine and medium sand; light brownish gray (10YR 6/2) when moist; many, medium, and distinct mottlings; single grain (structureless); loose when dry; noncalcareous; abrupt, smooth boundary.

D_3 46 to 60 inches, white (10YR 8/2, dry) mixed medium and coarse sand; light gray (10YR 6.5/2) when moist; single grain (structureless); loose when moist, loose when dry; noncalcareous.

The soil is saturated at a depth of 48 inches.

Exline series

The Exline series consists of solodized Solonetz soils that developed on silty terrace materials in the northern part of the Chernozem zone. Their surface horizon is thin or moderately thick. An A_2 horizon normally is just above the fine-textured, columnar B horizon. Exline soils have slow internal and external drainage. The profile of Exline soils may be saline, saline-alkali, or alkali, depending upon where it is sampled. Exline soils occur in Nebraska, South Dakota, and North Dakota.

Profile of Exline silt loam in a native pasture in the SE¼SW¼ sec. 33, T. 12 N., R. 9 W.:

A_1 0 to 3 inches, gray (10YR 5/1, dry) silt loam; dark gray (10YR 4/1) when moist; thin, platy to weak, fine, crumb structure; friable when moist, soft when dry; noncalcareous; pH 6.6; abrupt boundary.

A_2 3 to 5½ inches, light-gray (10YR 5.5/1, dry) silt loam; dark gray (10YR 4/1) when moist; thick, platy structure; friable when moist, soft when dry; noncalcareous; pH 7.1; abrupt boundary.

B_{21} 5½ to 13 inches, grayish-brown (10YR 5/2, dry) silty clay loam in upper part grading to silty clay in lower part; very dark grayish brown (10YR 3/2) when moist; strong, medium, prismatic structure; dark glaze or coating caused by organic matter on structural planes; very firm when moist, very hard when dry; noncalcareous; pH 8.0; gradual boundary.

B_{22} 13 to 22 inches, grayish-brown (2.5Y 5/2, dry) silty clay; dark grayish brown (2.5Y 4/2) when moist; strong, prismatic breaking to moderate, medium, blocky structure; calcareous; pH 8.3; gradual boundary.

B_3 22 to 30 inches, grayish-brown (2.5Y 4.5/2, dry) silty clay loam; dark grayish brown (2.5Y 4/2) when moist; moderate, coarse, blocky structure; calcareous; a few white cyrstals of lime, salt, or both; pH 8.1; gradual boundary.

$C_{1ca\text{-}sa}$ 30 to 48 inches, grayish-brown (10YR 5/2, dry) silty clay loam; dark grayish brown (10YR 4/2) when moist; moderate, medium, blocky structure; firm when moist, hard when dry; numerous white crystals of lime, salt, or both; weakly calcareous; pH 8.0; gradual boundary.

$C_{2ca\text{-}sa}$ 48 to 61 inches, olive-gray (5Y 5/2, dry) silty clay loam; olive gray (5Y 4/2) when moist; nearly massive; firm when moist, hard when dry; strongly calcareous; numerous white crystals of lime, salt, or both; gradual boundary.

C_3 61 to 78 inches, light brownish-gray (2.5Y 6/2, dry) fine sandy loam; grayish brown (2.5Y 5/2) when moist; loamy fine sand in lower part; common, medium, distinct, yellowish-brown mottles; single grain (structureless); friable when moist, soft to loose when dry; a few silty clay loam nodules present; noncalcareous.

The soil is saturated at 48 inches. All pH readings are on saturated paste.

Fillmore series

Fillmore soils are dark-colored Planosols developed in shallow basins and in depressions on the nearly level areas of the loessal uplands and terraces of the Chernozem zone. They have a thick A horizon that includes a faint A_2 horizon. Fillmore soils occur throughout central and eastern Nebraska and north-central Kansas.

Profile of Fillmore silt loam in a field of dryland corn, one-fourth mile south and 900 feet east of the northwest corner of sec. 6, T. 11 N., R. 11 W.:

A_{1p} 0 to 5 inches, gray (10YR 5/1, dry) silt loam; very dark gray (10YR 3/1) when moist; weak, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 5.1; gradual smooth boundary.

A_{12p}-A_{21} 5 to 10 inches, mixed light-gray and gray (dry) silt loam; weak, medium, platy structure; friable when moist, soft when dry; noncalcareous; pH 5.7; clear, smooth boundary.

A_{22} 10 to 17 inches, about same as layer above except weak, coarse, blocky structure; very friable when moist, soft when dry; noncalcareous; pH 5.9; sprinkling to fairly numerous fine, soft to moderately hard, shotlike pellets of iron-manganese; clear, smooth boundary.

A_{23}-B_1 17 to 22 inches, light-gray (10YR 6/1, dry), heavy silt loam; dark gray (10YR 4/1) when moist; moderate, medium, blocky structure; slightly vesicular with light-gray silt coatings on structure faces; friable when moist, slightly hard when dry; noncalcareous; pH 6.0; clear, smooth boundary.

B_{21} 22 to 31 inches, grayish-brown (2.5Y 5/2, dry) silty clay; very dark grayish brown (2.5Y 3.5/2) when moist; strong, prismatic-blocky structure; glazed faces on aggregates; plastic when wet, very hard when dry; noncalcareous; pH 6.1; gradual lower boundary.

B_{22} 31 to 45 inches, grayish-brown (2.5Y 5/2, dry) silty clay; very dark grayish brown (2.5Y 3.5/2) when moist; strong, coarse, blocky structure; moderate glaze on structural aggregates; plastic when wet, very hard when dry; noncalcareous; pH 6.4; clear, smooth boundary.

B_{31} 45 to 55 inches, light brownish-gray (2.5Y 6/2, dry) silty clay loam; very dark grayish brown (2.5Y 3/2) when moist; moderate, coarse, blocky structure; plastic when wet, firm when moist, and hard when dry; noncalcareous; pH 6.5; gradual boundary.

B_{32} 55 to 62 inches, same as horizon above except slightly less clayey; free water along structural planes.

Hall series

The Hall series consists of Chernozem soils that developed on silty stream terraces. The principal features are a thick, dark surface horizon; a lighter colored, moderately fine textured B horizon; and a medium textured to moderately sandy substratum. A zone of lime accumulation normally is in the lower subsoil. Hall soils occur along the larger streams of central Nebraska and Kansas and in south-central South Dakota.

Profile of Hall silt loam in a field of irrigated corn, 2,000 feet south and 150 feet east of the northwest quarter corner of sec. 11, T. 10 N., R. 11 W.:

A_{1p} 0 to 5 inches, dark grayish-brown (10YR 4/1.5, dry) silt loam; very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.4; abrupt, smooth boundary.

A_{12} 5 to 13 inches, dark grayish-brown (10YR 4.5/1.5, dry) silt loam; very dark brown (10YR 2/2) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.4; gradual boundary.

A_3-B_1 13 to 16 inches, grayish-brown (10YR 5/1.5, dry), heavy silt loam or light silty clay loam; very dark brown (10YR 2/3) when moist; weak, fine, blocky structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.1; clear, smooth boundary.

B_{21} 16 to 24 inches, grayish-brown (10YR 5/2, dry) silty clay loam; dark grayish brown (10YR 4/2) when moist; moderate, fine and medium, subangular blocky structure; friable when moist, hard when dry, and slightly plastic when wet; noncalcareous; pH 6.0; clear, smooth boundary.

B_{22} 24 to 30 inches, light brownish-gray (10YR 6/2, dry) silty clay loam; grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; slightly plastic when wet, firm when moist, and hard when dry; noncalcareous; pH 6.2; clear, smooth boundary.

B_3 30 to 36 inches, silt loam of same color as horizon above; weak, coarse, blocky structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.5; clear, smooth boundary.

C_1 36 to 47 inches, light-gray (10YR 7/2.5, dry) silt loam or very fine sandy loam; light brownish gray (10YR 6/2) when moist; massive (structureless); friable when moist, soft when dry; noncalcareous; pH 6.8; abrupt, smooth boundary.

C_2 47 to 54 inches, light brownish-gray (10YR 6/2, dry) silt loam; grayish brown (10YR 5/2) when moist; massive (structureless); friable when moist, soft when dry; contains thin lenses and streaks of lime carbonate; pH 7.4; clear, smooth boundary. (Although darker than the layer above or below, this layer seems to be an alluvial stratification rather than the A_1 of a buried soil.)

C_3 54 to 62 inches, light-gray (10YR 7/2.5, dry) stratified silt loam and very fine sandy loam; pale brown (10YR 6/3) when moist; moderate effervescence. (Auger borings show this layer continues to a depth of 82 inches, where it rests on a mixture of coarse sand and fine gravel.)

Hastings series

Hastings soils are moderately heavy Chernozems of the loessal uplands. In consistence, their subsoil is intermediate between the friable subsoil of the Holdrege soils and the fine-textured subsoil of the Butler soil. Hastings soils occur in south-central Nebraska and the adjoining parts of Kansas.

Profile of Hastings silt loam, 0.4 mile west and 0.4 mile south of the northeast corner of sec. 35, T. 9 N., R. 9 W.:

A_{1p} 0 to 8 inches, dark grayish-brown (10YR 4/2, dry) silt loam; very dark grayish brown (10YR 2.5/1.5) when moist; weak, granular to crumb structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.2; clear, smooth boundary.

A_{12} 8 to 14 inches, dark grayish-brown (10YR 4/2, dry), heavy silt loam; very dark grayish brown (10YR 2.5/1.5) when moist; weak, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.4; abrupt, smooth boundary.

B_2 14 to 24 inches, grayish-brown (10YR 5/2, dry) silty clay loam; dark grayish brown (10YR 4/2) when moist; moderate, fine and medium, subangular blocky structure; firm when moist, hard when dry; noncalcareous; pH 6.7; clear, smooth boundary.

B_3 24 to 30 inches, light-gray (2.5Y 7/2, dry) silty clay loam; light brownish gray (2.5Y 5.5/2) when moist; weak, medium, subangular blocky structure; firm when moist, hard when dry; noncalcareous; pH 7.0; clear, smooth boundary.

C_1 30 to 36 inches, light-gray (2.5Y 7/2, dry) silt loam; grayish brown (2.5Y 5/2) when moist; poorly defined, weak, blocky structure; friable when moist, slightly hard when dry; some dark-colored iron concretions and numerous yellowish iron stainings; noncalcareous; pH 7.4; clear, smooth boundary.

C_{21ca} 36 to 48 inches, pale-yellow (2.5Y 7/3, dry) silt loam; light yellowish brown (2.5Y 6/3) when moist; massive (structureless); friable when moist, soft when dry; violent effervescence; pH 8.0; contains soft concretions of lime and shows a few yellowish iron stainings; gradual, smooth boundary.

C_{22ca} 48 to 60 inches, light-gray (2.5Y 7/2, dry) silt loam; grayish brown (2.5Y 5/2) when moist; massive (structureless); friable when moist, soft when dry; moderate effervescence; a few soft concretions of lime; pH 8.1.

Hobbs series

The Hobbs series consists of immature soils of the Prairie and Chernozem soil zones. These soils have a noncalcareous, dark-colored profile, and they developed from colluvial material, washed down from the silty loessal uplands. Hobbs soils occur mainly in central Kansas and south-central Nebraska.

Profile of Hobbs silt loam in a field of temporary pasture, 0.25 mile south and 0.15 mile west of the northeast corner of sec. 10, T. 11 N., R. 12 W.:

A_{1p} 0 to 6 inches, gray (10YR 5/1, dry) silt loam; very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, platy structure; friable when moist, slightly hard when dry; noncalcareous; abrupt, smooth boundary.

A_1 6 to 10 inches, gray (10YR 5/1.5, dry) silt loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

C 10 to 29 inches, weak, coarsely stratified, light-colored (10YR 5/1.5, dry; 10YR 3.5/2, moist) and dark-colored (10YR 5/1, dry; 10YR 3/2, moist) layers of silt loam; weak, coarse, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; abrupt, smooth boundary.

A_1 29 to 37 inches, dark-gray (10YR 4/1, dry) silt loam; very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky breaking to weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

B_{2b} or C_{1b} 37 to 60 inches, grayish-brown (10YR 4.5/2, dry), heavy silt loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous.

Holdrege series

Holdrege soils are normal, medial Chernozems of the loessal uplands. They have a thick, dark surface horizon over a lighter colored, medium-textured subsoil. A zone of lime accumulation normally occurs in the lower subsoil or upper part of the substratum. Holdrege soils occur in central and south-central Nebraska and the adjacent parts of Kansas.

Profile of Holdrege silt loam, 0.2 mile north and 75 feet west of the southeast corner of sec. 33, T. 9 N., R. 10 W.:

A_{1p} 0 to 6 inches, dark grayish-brown (10YR 4/2, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; weak, fine, medium and coarse, granular structure; friable when moist, soft when dry; noncalcareous; pH 6.0; abrupt, smooth boundary.

A_1 6 to 12 inches, dark grayish-brown (10YR 4/2, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; weak, coarse, granular structure; friable when moist, soft when dry; noncalcareous; pH 6.2; clear, smooth boundary.

B_{21} 12 to 16 inches, dark grayish-brown (10YR 4/2, dry) silt loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic breaking to weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.3; clear, smooth boundary.

B_{22} 16 to 23 inches, grayish-brown (10YR 5/2, dry), light silty clay loam; dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic breaking to weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.3; clear, smooth boundary.

B_3 23 to 45 inches, light-gray (2.5Y 7/2, dry) silt loam; grayish brown (2.5Y 5/2) when moist; weak, coarse, prismatic breaking to weak, coarse, subangular blocky structure; friable when moist, soft when dry; noncalcareous; pH 6.8; gradual boundary.

C_1 45 to 56 inches, light-gray (2.5Y 7.5/2, dry) silt loam; grayish brown (2.5Y 5/2) when moist; massive (structureless); friable when moist, soft when dry; noncalcareous; pH 7.5; gradual boundary.

C_2 56 to 63 inches +, light-gray (2.5Y 7.5/2, dry) silt loam; light brownish gray (2.5Y 5.5/2) when moist; massive (structureless); friable when moist, soft when dry; pH 7.8; slightly calcareous.

Hord series

Hord soils are deep, medium-textured Chernozem-Regosols, or minimal Chernozems, on well-drained stream terraces. The parent materials are loams, silt loams, and very fine sandy loams, with or without visible stratification. Thin lenses and strata of fine sandy loam may be present beneath the upper 2 feet of the soils. Hord soils occur in the Chernozem and Chernozem-Prairie transitional belt. They are only in eastern Nebraska.

Profile of Hord silt loam in a field of wheat stubble, 0.3 mile north and 100 feet west of the southeast quarter corner of sec. 24, T. 12 N., R. 9 W.:

A_{1p} 0 to 7 inches, dark grayish-brown (10YR 4/2, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; weak, medium and coarse, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.3; abrupt, smooth boundary.

A_1 7 to 14 inches, dark grayish-brown (10YR 4/1.5, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; weak, coarse, prismatic breaking to weak, medium, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.2; clear, smooth boundary.

B_1 14 to 21 inches, dark grayish-brown (10YR 4/2.5, dry) silt loam; very dark grayish brown (10YR 3/2.5) when moist; weak, coarse, prismatic breaking to coarse, moderate, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.5; gradual, smooth boundary.

B_2 21 to 29 inches, grayish-brown (10YR 5.5/2, dry) silt loam; dark grayish brown (10YR 4.5/2) when moist; weak, coarse, prismatic breaking to weak, coarse, subangular blocky structure; friable when moist, soft when dry; noncalcareous; pH 6.6; gradual, smooth boundary.

C 29 to 60 inches, light brownish-gray (10YR 6/1.5, dry) very fine sandy loam; grayish brown (10YR 5/2) when moist; massive (structureless); friable when moist, soft when dry; noncalcareous; pH 7.0.

Kenesaw series

Kenesaw soils are silty, well-drained Regosols of the loessal uplands. They occur on nearly level to moderately steep slopes of the Chernozem and Chestnut soil zones. Kenesaw soils have a thin or only moderately thick, noncalcareous A horizon that is moderately dark in color. A thin, weakly developed B horizon is present in some profiles. Calcareous Peorian loess occurs at depths of 10 to 20 inches. Kenesaw soils occur in central Nebraska and the adjoining parts of Kansas.

Profile of Kenesaw silt loam in a permanent pasture, 0.38 mile east and 50 feet south of the northwest corner of sec. 19, T. 9 N., R. 10 W.:

A_1 0 to 5 inches, grayish-brown (10YR 5/2, dry) silt loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

A–B 5 to 7 inches, light brownish-gray (10YR 6/2, dry) silt loam; dark grayish brown (10YR 4/2) when moist; weak, coarse, granular structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

B 7 to 12 inches, pale-brown (10YR 6/3, dry) silt loam; grayish brown (10YR 5/2.5) when moist; weak, coarse, prismatic breaking to weak, medium, blocky structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

C_1 12 to 18 inches, light-gray (10YR 7/2, dry) silt loam; grayish brown (10YR 5/2.5) when moist; weak, coarse, prismatic breaking to weak, coarse, subangular blocky structure; friable when moist, soft when dry; slight effervescence; a few yellowish iron stainings; gradual, smooth boundary.

C_{21} 18 to 36 inches, color and consistence and structure as in C_1 horizon; strong effervescence; free, disseminated lime; a few iron stains; gradual, smooth boundary.

C_{22} 36 to 60 inches, color and consistence as in C_1 horizon; massive (structureless); slight effervescence; free, disseminated lime; a few yellowish iron stains.

Lamoure series

The Lamoure series consists of imperfectly drained Humic Gley soils that formed in alluvial materials of the Chernozem and Prairie soil zones. Their calcareous surface horizon varies between clay and silt loam. The subsoil is dark-gray, prismatic-blocky, mottled, calcareous clay.

The Lamoure series is the fine-textured analog of the Leshara series. Lamoure soils occur in the north-central Great Plains States.

These soils, as they occur in Hall County, have a finer textured subsoil than is normal for the series.

Profile of Lamoure silt loam in a native pasture, 0.15 mile east and 75 feet south of the northwest corner of sec. 8, T. 10 N., R. 9 W.:

A 0 to 10 inches, dark-gray (10YR 4/1, dry) silt loam; black (10YR 2/1) when moist; moderate, coarse, granular structure; friable when moist, slightly hard when dry; effervesces violently; pH 7.3; clear, smooth boundary.

C_1 10 to 15 inches, gray (10YR 4.5/1, dry) silty clay loam; black (10YR 2/1) when moist; moderate, fine, subangular blocky structure; firm when moist, hard when dry; effervesces violently; pH 7.2; clear, smooth boundary.

C_{21} 15 to 24 inches, dark-gray (10YR 4/1, dry) silty clay; black (10YR 2/1) when moist; moderate, medium, prismatic breaking to moderate, blocky structure; firm when moist; very hard when dry; effervesces violently; pH 7.1; clear, smooth boundary.

C_{22} 24 to 36 inches, gray (10YR 5/1, dry) clay; dark gray (10YR 4/1) when moist; strong, medium, prismatic breaking to moderate, medium, blocky structure; very firm when moist, very hard when dry; a few brownish mottlings; noncalcareous; pH 6.2; clear, smooth boundary.

C_{3g} 36 to 40 inches, dark-gray (10YR 4/1, dry) sandy clay; very dark gray (10YR 3/1) when moist; mottlings are dark brown, common, medium, and distinct; moderate, coarse, subangular blocky structure; very firm when moist, very hard when dry; noncalcareous; pH 5.5; clear, smooth boundary.

D 40 to 60 inches +, brownish and grayish mixed sand and gravel; single grain (structureless); loose; slightly mottled with brown in upper part.

Leshara series

The Leshara series consists of imperfectly drained Alluvial soils with weak zonal characteristics such as those possessed by Prairie and Chernozem soils. The Leshara soils occupy low terraces or high bottoms along major streams in the western part of the Prairie soil zone and the eastern part of the Chernozem soil zone. The parent material is silty or only slightly sandy alluvium that is 24 to 36 inches deep over medium-textured to very sandy alluvium. Leshara soils occur in eastern Nebraska and possibly in the adjacent parts of adjoining States.

Profile of Leshara silt loam in a field of irrigated corn, 0.4 mile north and 50 feet west of the southeast corner of sec. 5, T. 9 N., R. 11 W.:

A_{1p} 0 to 10 inches, gray (10YR 4.5/1, dry) silt loam; very dark gray (10YR 3.5/1) when moist; moderate, fine and medium, crumb structure; friable when moist, slightly hard when dry; strong effervescence; abrupt, smooth boundary.

C 10 to 16 inches, grayish-brown (10YR 5/1.5, dry) loam; very dark grayish brown (10YR 3/1.5) when moist; moderate, medium and coarse, crumb structure; friable when moist, slightly hard when dry; strong effervescence; abrupt, smooth boundary.

A_b 16 to 32 inches, dark-gray (10YR 4.5/1, dry) silt loam; very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure; friable when moist, slightly hard when dry; strong effervescence; clear, smooth boundary.

C_{1b} 32 to 42 inches, light olive-gray (5Y 6/2, dry), heavy silt loam; olive gray (5Y 4.5/2) when moist; indefinite breakage; firm when moist, hard when dry; common, medium and fine, distinct mottles; slight effervescence; numerous soft segregations of lime; clear, smooth boundary.

C_{2b} 42 to 62 inches, light-gray (2.5Y 7/2, dry) very fine sandy loam; grayish brown (2.5Y 5/2) when moist; common, fine, and distinct mottles; fine, medium, and coarse stratification; platy structure breaking to medium and coarse fragments; very friable when moist, soft when dry; noncalcareous; gradual boundary.

D 62 inches +, brownish mixed sand and gravel; distinct mottling in upper part; single grain (structureless); loose; noncalcareous.

Loup series

The Loup series consists of dark-colored, immature sandy soils in broad basins, on narrow valley floors, and on long, very gentle slopes in sandhill areas in the northern part of the Chernozem and Chestnut soil zones. The ground-water level of these poorly drained soils fluctuates from 2 to 4 feet beneath the surface. Loup soils occur in Nebraska, South Dakota, and North Dakota.

Profile of Loup loam in a native pasture in the center of sec. 7, T. 12 N., R. 12 W.:

A 0 to 10 inches, gray (10YR 5/1, dry) heavy loam; very dark gray (10YR 3/1) when moist; weak, medium, prismatic breaking to moderate, medium and coarse, blocky structure; firm when moist, hard when dry; noncalcareous; a few, fine, distinct mottles; abrupt, smooth boundary; roots numerous.

D_1 10 to 18 inches, light-gray (10YR 7/1, dry) fine and medium sand; light brownish gray (10YR 6/2) when moist; many, coarse, and prominent mottles; single grain (structureless); loose; noncalcareous; gradual lower boundary.

D_{2g} 18 to 36 inches +, grayish-brown fine and medium sand; single grain (structureless); loose; few, medium, faint mottles; ground-water level at 24 inches.

The vegetation is sedges and annual weeds.

Meadin series

Meadin soils are excessively drained, medium- to coarse-textured Chernozems that intergrade to Regosols. These soils grade into or rest abruptly on a substratum of mixed sand and gravel at a depth of 10 to 20 inches. They are "shallow to gravel" associates of the O'Neill, Ortello, and Thurman soils of the sandy stream terraces in the Chernozem soil zone and the western part of the Prairie soil zone. Meadin soils occur mainly on stream terraces in the broader valleys of eastern Nebraska.

Profile of Meadin sandy loam in a field of oat stubble, 1, 890 feet north and 50 feet west of the east quarter corner of sec. 26, T. 11 N., R. 10 W.:

A_{1p} 0 to 9 inches, gray or grayish-brown (10YR 5/1.5, dry) sandy loam; very dark gray or very dark grayish brown (10YR 3/1.5) when moist; moderate, fine to coarse, crumb structure; very friable when moist, soft when dry; noncalcareous; few small pebbles present; abrupt, smooth boundary.

C 9 to 15 inches, brown (10YR 5/3, dry) loamy sand; dark brown (10YR 4/3) when moist; weak, medium and coarse, crumb structure; very friable when moist, nearly loose when dry; noncalcareous; few small pebbles; gradual, smooth boundary.

D_1 15 to 19 inches, pale-brown (10YR 6/3, dry) fine, medium and coarse sand; dark brown (10YR 4/3) when moist; weak adherence of sand grains; very friable when moist, loose when dry; noncalcareous; few small pebbles; gradual, smooth boundary.

D_2 19 to 60 inches +, very pale brown (dry) mixed sand and gravel; single grain (structureless); loose; noncalcareous.

A few roots are at depths to 15 inches. There is a sprinkling of gravel on the surface. The water table is below a depth of 20 feet.

O'Neill series

The O'Neill series consists of noncalcareous soils developed on gravelly stream terraces in the Chernozem soil zone. Crossbedding, stratification, or other evidences of water deposition of sand and gravel are in most profiles. O'Neill soils have a sandy subsoil and are of medium depth over the coarse substratum. These soils occur mainly in Iowa, Minnesota, and Nebraska.

Profile of O'Neill loam in a permanent pasture, one-fourth mile east and 100 feet south of the northwest corner of sec. 11, T. 11 N., R. 9 W.:

A_1 0 to 10 inches, dark grayish-brown (10YR 4.5/2, dry) loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; gradual boundary.

A_3 10 to 18 inches, dark-gray (10YR 4/1.5, dry) loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

B_2 18 to 24 inches, grayish-brown (10YR 4.5/2, dry) sandy loam; dark grayish brown (10YR 3.5/2) when moist; weak, coarse, prismatic structure breaking to weak, coarse fragments; very friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

B_3 24 to 28 inches, grayish-brown (10YR 5/2, dry) loamy coarse sand; dark grayish brown (10YR 4/2) when moist; weak, coarse, irregular fragments; very friable when moist, soft when dry; noncalcareous; a sprinkling of gravel present; clear, smooth boundary.

D_1 28 to 32 inches, brown (10YR 5/3, dry) coarse sand; dark brown (10YR 4/3) when moist; single grain (structureless); loose; noncalcareous; few small pebbles; gradual, smooth boundary.

D_2 32 to 60 inches, pale-brown (10YR 6/3, dry) mixed sand and gravel; single grain (structureless); loose; noncalcareous.

Ortello series

The Ortello series consists of soils developed on sandy outwash plains and stream terraces within the Chernozem soil zone. Crossbedding, stratification, and other evidences of water deposition of sand may be in some profiles. In places, the material has been reworked by wind. Ortello soils have a moderately sandy subsoil and somewhat excessive natural drainage. The Ortello series occurs in Nebraska.

Profile of Ortello loam in a field of irrigated corn, 500 feet south and 0.5 mile east of northwest corner of sec. 32, T. 12 N., R. 9 W.:

A_{1p} 0 to 6 inches, grayish-brown (10YR 5/1.5, dry) loam; very dark grayish brown (10YR 3/1.5) when moist; moderate, coarse, platy structure breaking to coarse, moderate fragments; friable when moist, slightly hard when dry; noncalcareous; abrupt, smooth boundary.

A_1 6 to 23 inches, dark-gray (10YR 4/2, dry) loam; very dark gray (10YR 3/1) when moist; weak, coarse, prismatic structure breaking to coarse, indefinite fragments; friable when moist, slightly hard when dry; noncalcareous; clear, smooth boundary.

B_1 23 to 30 inches, grayish-brown (10YR 5/2, dry) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse fragments; very friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

B_{21} 30 to 36 inches, light brownish-gray (10YR 6/2, dry) sandy loam; dark grayish brown (10YR 4/2) when moist; weak, medium and coarse fragments; very friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

C_1 36 to 51 inches, pale-brown (10YR 6/3, dry) loamy sand; brown (10YR 4.5/3) when moist; weak, coarse fragments; very friable when moist, soft when dry; noncalcareous; few small pebbles; clear, smooth boundary.

C_2 51 to 65 inches, very pale brown (10YR 7/3, dry) coarse sand; brown (10YR 5/3) when moist; single grain (structureless); loose; noncalcareous; gradual, smooth boundary.

D 65 inches +, brownish coarse sand and gravel; single grain (structureless); loose; noncalcareous.

Roots are plentiful to 17 inches; there are a few to a depth of 36 inches. In this profile the A horizon is thicker than is typical for the series.

Ovina series

The Ovina series consists of imperfectly drained, moderately dark colored, somewhat sandy Chenozems that intergrade to Regosols. These soils have a loamy subsoil, ferruginous mottling within 30 inches, and a relatively shallow ground-water table. They developed in sandy materials that are generally eolian and often less than 3 feet thick over less sandy strata or buried soils. The Ovina soils occur in valley positions within or bordering sandhill areas in central and western Nebraska.

Profile of Ovina fine sandy loam in a native meadow, NE¼NW¼ sec. 1, T. 12 N., R. 9 W.:

A_1 0 to 9 inches, dark-gray (10YR 4.5/1, dry) fine sandy loam; weak, granular structure; very friable when moist; noncalcareous but mildly alkaline; gradual boundary.

AC 9 to 25 inches, grayish-brown (10YR 5/2, dry) fine sandy loam; massive (structureless); consistence and reaction as in horizon above; clear boundary.

D_{ca} 25 to 40 inches, grayish-brown (2.5Y 5/2, dry) loam; mottled with light olive brown and strong brown, slightly less dark at a depth of 30 inches; moderate, medium and coarse, subangular blocky structure; firm when moist; strongly calcareous; contains many whitish, friable concretions of lime carbonate; diffuse boundary.

40 to 52 inches, transitional layer.

D 52 to 70 inches +, light-gray (2.5Y 7/2, dry) loam; mottled with strong brown; massive (structureless); friable when moist; strongly calcareous but contains little or no segregated calcium carbonate. (This is the old alluvium of the Platte River, underlain at depths of less than 10 feet by gravelly coarse sand.)

Platte series

The Platte series consists of imperfectly drained Alluvial soils of the Chernozem and Chernozem-Prairie transitional soil zones. They are developing in silty to sandy recent alluvium that is 10 to 20 inches deep over coarse sand or mixed sand and gravel. Platte soils are the shallow to gravel associates of the Wann soils. Soils of the Platte series are on the flood plains in the Platte River Valley throughout Nebraska and adjacent areas of adjoining States.

Profile of Platte loam in a field of native hay, 100 feet east of U.S. Highway No. 34 in the SE¼NE¼ sec. 36, T. 11 N., R. 9 W.:

A_1 0 to 5 inches, gray (10YR 5/1, dry) loam; black (10YR 2.5/1) when moist; moderate, fine and medium, crumb structure; friable when moist, slightly hard when dry; very strong effervescence; clear, smooth boundary.

A–C 5 to 8 inches, grayish-brown (10YR 5/2, dry) very fine sandy loam; dark grayish brown (10YR 4/2) when moist; common, medium, distinct mottlings; massive (structureless); friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

C 8 to 15 inches, light-gray (10YR 7/2, dry) very fine sandy loam; grayish brown (10YR 5/2) when moist; common, medium, prominent mottlings; weak, medium, subangular blocky structure; friable when moist, soft when dry; noncalcareous; abrupt, smooth boundary.

D_1 15 to 33 inches, very pale brown (10YR 7/3, dry) coarse sand; pale brown (10YR 6/3) when moist; common, coarse, prominent mottlings; single grain (structureless); loose; noncalcareous; gradual, smooth boundary.

D_2 33 to 60 inches +, brownish mixed sand and gravel; mottlings are common, medium, and fine; single grain (structureless); loose; noncalcareous.

Roots are numerous to 5 inches, and plentiful at depths of 5 to 15 inches, but none are below this depth. At the time of sampling, the water table was 3 feet beneath the surface, or near its highest stage of the year.

Sarpy series

The Sarpy series consists of light-colored Alluvial soils developing in very sandy flood plain sediments, mainly in the Prairie and Chernozem soil zones. These soils are in an early stage of development. Sarpy soils occur in bottom-land areas along streams in the east-central part of the Great Plains region.

Profile of Sarpy fine sand in a native pasture, in the NW¼SE¼ sec. 6, T. 12 N., R. 12 W.:

A 0 to 6 inches, grayish-brown (10YR 5/2, dry) fine sand; dark grayish brown (10YR 4/2) when moist; single grain (structureless); loose; noncalcareous; clear, smooth boundary.

A-C 6 to 18 inches, light brownish-gray (10YR 6/2, dry) fine sand; grayish brown (10YR 4.5/2) when dry; single grain (structureless); loose; noncalcareous; gradual boundary.

C 18 to 60 inches +, white (10YR 8/1, dry) fine and medium sand; light brownish gray (10YR 6/2) when moist; single grain (structureless); loose; lower part contains more coarse sand than upper part.

This area is in the South Loup River Valley where the underlying sands are somewhat ligher in color and have a smaller percentage of the coarser grade sands than is typical of these soils in the Platte River Valley.

Scott series

Scott soils are Planosols of the basinlike depressions scattered through the more nearly level uplands and stream terraces in the Chernozem soil zone and the drier parts of the Prairie soil zone. They have a thinner surface horizon than that of the Butler or Fillmore soils. Scott soils occur in Nebraska and in northern and central Kansas.

Profile of Scott silt loam in a native pasture, 0.35 mile east and 0.25 mile south of the northwest corner of sec. 15, T. 9 N., R. 9 W.:

A_1 0 to 4 inches, gray (10YR 4.5/1, dry) silt loam; black (10YR 2/1) when moist; moderate, medium, platy structure; friable when moist, slightly hard when dry; noncalcareous; abrupt, smooth boundary.

A_2 4 to 5½ inches, gray (10YR 5/1, dry) silt loam; dark gray (10YR 3.5/1) when moist; moderate, medium, platy structure; friable when moist, slightly hard when dry; noncalcareous; abrupt, smooth boundary.

B_{21} 5½ to 9 inches, dark-gray (5Y 4.5/1, dry) silty clay; very dark gray (5Y 3/1) when moist; common, fine, and faint mottlings; strong, coarse, prismatic structure breaking to indefinite blocks; very firm when moist, very hard when dry, and plastic when wet; noncalcareous; clear, smooth boundary.

B_{22} 9 to 36 inches, color as in horizon above; clay; strong, coarse, prismatic breaking to strong, blocky structure; very firm when moist, very hard when dry, and very plastic when wet; noncalcareous; clear, smooth boundary.

B_{23} 36 to 40 inches, light-gray (5Y 6/1.5, dry) silty clay; dark olive gray (5Y 3.5/2) when moist; a few, fine, faint mottlings; strong, coarse, prismatic breaking to moderate, coarse and medium, blocky structure; very firm when moist, very hard when dry, and plastic when wet; noncalcareous; gradual, smooth boundary.

B_3 40 to 50 inches, pale-yellow (5Y 6.5/3, dry) silty clay loam; olive (5Y 5/3) when moist; common, medium, distinct mottlings; moderate, coarse, prismatic breaking to weak, coarse and medium, subangular blocky structure; firm when moist, hard when dry; noncalcareous; gradual, smooth boundary.

C_1 50 to 60 inches, pale-yellow (2.5Y 7/4, dry) silt loam; light olive brown (2.5Y 5/4) when moist; common, coarse, distinct mottlings; weak, coarse, subangular blocky structure; friable when moist, slightly hard when dry; noncalcareous.

Mottlings in the last two horizons are mainly brownish and yellowish iron stains; roots are plentiful to a depth of 4 inches but are few between depths of 4 and 36 inches.

Silver Creek series

The Silver Creek series consists of soils that are imperfectly drained intergrades between the Chernozem and the Humic Gley great soil groups. They are on broad, nearly level stream terraces. They lack good drainage mainly because they have a fluctuating water table. These soils have a thick, weakly granular surface horizon and a blocky silty clay to clay B_2 horizon in which there is a relatively thick, strongly developed horizon where lime carbonate has accumulated. Silver Creek soils are on the Platte River stream terraces of Nebraska.

Profile of Silver Creek silt loam in an area 0.1 mile west and 100 feet south of the northeast corner of sec. 33, T. 12 N., R. 9 W.:

A_{1p} 0 to 6 inches, gray (10YR 5/1, dry) silt loam; very dark brown (10YR 2/2) when moist; weak, fine, granular structure; friable when moist, slightly hard when dry; strong effervescence; pH 7.6; clear, smooth boundary.

A_1 6 to 18 inches, dark-gray (10YR 4/1, dry) silt loam; very dark brown (10YR 2/2) when moist; slightly finer textured in lower part; weak, coarse, subangular blocky structure; friable when moist, slightly hard when dry; weak effervescence; clear boundary.

B_2 18 to 36 inches, light-gray (10YR 6.5/1, dry) silty clay; gray (10YR 5/1) when moist; slightly darker on structural planes; intensely streaked with lime carbonate; strong, coarse, blocky breaking to strong, fine, blocky structure; very firm when moist, hard when dry, and plastic when wet; clear boundary.

B_3 36 to 53 inches, white (10YR 8/1, dry) silty clay loam; light gray (10YR 7/1) when moist; moderate, medium, subangular blocky structure; friable when moist, slightly hard when dry, and slightly plastic when wet. (This is a horizon that has a large accumulation of lime just above the fluctuating water table.)

C_1 53 to 60 inches, light-gray (10YR 7/1, dry) fine sandy loam; gray (10YR 5/1) when moist; few fine and coarse pebbles; common, medium, distinct, yellowish-brown mottlings; few dark-brown, soft, iron or iron-manganese spots; massive (structureless); friable when moist; weak effervescence; saturated; this is the zone of the fluctuating water table.

C_{2g} 60 to 66 inches, light-gray (10YR 6/1, dry) sandy loam; gray (10YR 5/1) when moist; contains thin seams of medium and coarse sand and some fine gravel; many yellowish-brown mottlings; dark-brown, soft, iron-manganese spots; massive (structureless); slightly sticky and plastic when wet, hard when dry; no lime carbonate; saturated.

D_1 66 to 70 inches, light-gray (10YR 7/2, dry) loamy sand; light brownish gray (2.5Y 6/2) when moist; single grain (structureless); loose; free water.

D_2 70 inches +, loose sand and gravel.

Thurman series

The Thurman series consists of sandy soils, chiefly in the Chernozem zone. They developed under the influence of grass vegetation, largely from loose sand and a small admixture of silt. Thurman soils have a darker and thicker surface layer than soils of the Valentine series. They have little or no structural development and are leached of their lime. Soils of the Thurman series occur in central, north-central, and northeastern Nebraska, the adjacent parts of South Dakota, and on sands reworked by wind in Iowa.

Profile of Thurman loamy fine sand in a field of winter wheat, 0.15 mile west and 0.10 mile north of the southeast corner of sec. 28, T. 10 N., R. 9 W.:

A_{1p} 0 to 6 inches, grayish-brown (10YR 5/1.5, dry) loamy fine sand; dark grayish brown (10YR 3.5/2) when moist; weak, coarse, crumb structure; very friable when moist, soft when dry; noncalcareous; abrupt, smooth boundary.

A_1 6 to 12 inches, dark-gray (10YR 4/1, dry) loamy fine sand; very dark grayish brown (10YR 3/2) when moist; weak, coarse, blocky structure; very friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

C 12 to 32 inches, grayish-brown (10YR 5/2, dry) loamy fine sand or fine sand; brown (10YR 5/3) when moist; weak, coarse, prismatic breaking to poorly defined, blocky structure; very friable when moist, soft or nearly loose when dry; noncalcareous; abrupt, smooth boundary.

A_{1b} 32 to 40 inches, gray (10YR 5/1, dry) loamy fine sand; very dark grayish brown (10YR 3/2) when moist; weak, coarse, poorly defined, blocky structure; very friable when moist, soft when dry; noncalcareous; gradual, smooth boundary.

C_{2b} 40 to 52 inches, light brownish-gray (10YR 6/2, dry) loamy sand; brown (10YR 4.5/3) when moist; weak, coarse, poorly defined, blocky structure; very friable when moist, nearly loose when dry; noncalcareous; gradual, smooth boundary.

C_{3b} 52 to 60 inches, pale-brown (10YR 6/2.5, dry) sandy loam; brown (10YR 5/3) when moist; weak, coarse, subangular blocky structure; very friable when moist, soft when dry; noncalcareous.

Roots are plentiful to 6 inches; few from 6 to 30 inches.

Valentine series

Valentine soils developed in the northern part of the Chernozem, Chestnut, and Brown soil zones, under a sparse, grassy vegetation, from windblown materials consisting largely of sand. They have a lighter colored surface soil than Thurman soils and are free of lime. Valentine soils are extensive in the northern Great Plains.

Profile of Valentine fine sand in a native pasture, 0.2 mile north and 200 feet west of the southeast corner of sec. 5, T. 12 N., R. 9 W.:

A_1 0 to 8 inches, gray (10YR 5.5/1, dry) fine sand; dark gray (10YR 4/1) when moist; single grain (structureless); only slightly coherent; noncalcareous; pH 5.7; clear boundary.

C_1 8 to 48 inches, pale-brown (10YR 6/3, dry) fine sand; brown (10YR 5/3) when moist; single grain (structureless); incoherent; noncalcareous; pH 6.4; clear boundary.

A_b 48 to 60 inches, light brownish-gray (10YR 6/2, dry) fine sand; grayish brown (10YR 5/2) when moist; single grain (structureless); only slightly coherent; noncalcareous; pH 6.7.

This lower, slightly darker horizon represents a former land surface. The buried sand horizon is common in the sandhill areas of Hall County.

Volin series

The Volin series consists of well-drained azonal Alluvial soils, or young soils, with weak development of the zonal characteristics of Prairie soils. These soils occupy low stream terraces or high bottoms along major streams in the western part of the Prairie soil zone and in the eastern part of the Chernozem soil zone. They commonly contain lime carbonate in the lower horizon and are relatively free of mottles. Volin soils occur in eastern Nebraska and possibly in adjacent parts of adjoining States.

Profile of Volin silt loam in a field of dryland alfalfa, 0.3 mile south and 100 feet west of the northeast quarter corner of sec. 24, T. 11 N., R. 9 W.:

A_{1p} 0 to 9 inches, dark grayish-brown (10YR 4/1.5, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; moderate, medium, crumb structure; friable when moist, slightly hard when dry; noncalcareous; abrupt, smooth boundary.

A_1 9 to 18 inches, grayish-brown (10YR 5/1.5, dry) silt loam; very dark grayish brown (10YR 3/1.5) when moist; weak, coarse, prismatic structure; same consistency as in horizon above; weak effervescence; gradual boundary.

C_1 18 to 28 inches, light-gray (10YR 7/2, dry) silt loam; grayish brown (10YR 5/2) when moist; weak, coarse, prismatic structure; consistence as in A_{1p} horizon; noncalcareous; gradual boundary.

C_2 28 to 36 inches, color and texture as in horizon above; weak, coarse, prismatic structure breaking to weak, coarse fragments; friable when moist, slightly hard when dry; noncalcareous; abrupt boundary.

C_3 36 to 44 inches, light-gray (10YR 6/1, dry), heavy silt loam; gray (10YR 5/1) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; noncalcareous; clear boundary.

D_1 44 to 52 inches, white (10YR 8/1, dry) medium sand; light gray (10YR 7/1) when moist; single grain (structureless); loose; a few, coarse, yellowish mottles; gradual boundary.

D_2 52 inches +, brownish mixed sand and gravel; single grain (structureless); loose.

Wann series

The Wann series consists of dark, imperfectly drained Alluvial soils with a moderately coarse textured subsoil. They occur in the Chernozem, Chestnut, and Prairie soil zones. Wann soils occur in Nebraska and adjacent parts of Wyoming, Kansas, and eastern Colorado.

Profile of Wann loam in a field of irrigated corn, 200 feet north and 50 feet east of the southwest corner of sec. 16, T. 9 N., R. 12 W.:

A_{1p} 0 to 7 inches, gray (10YR 5/1, dry) loam; very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse, crumb structure; friable when moist, slightly hard when dry; violent effervescence; abrupt, smooth boundary.

A_1 7 to 16 inches, gray (10YR 5.5/1, dry) loam; very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic breaking to weak, medium and coarse, subangular blocky structure; friable when moist, slightly hard when dry; violent effervescence; clear, smooth boundary.

C_1 16 to 21 inches, light-gray (10YR 6/1, dry) fine sandy loam; dark gray (10YR 4/1) when moist; weak, coarse, prismatic structure breaking to weak, medium and coarse fragments; friable when moist, slightly hard when dry; violent effervescence; clear, smooth boundary.

C_{21} 21 to 30 inches, light brownish-gray (10YR 6/2, dry) fine sandy loam; dark grayish brown (10YR 4/2) when moist; a few, fine, faint mottlings; weak, medium and coarse fragments; very friable when moist, soft when dry; noncalcareous; clear, smooth boundary.

C_{22} 30 to 40 inches, light-gray (10YR 7.5/2, dry) fine sandy loam; light brownish gray (10YR 6/2) when moist; common, medium and distinct mottlings; massive (structureless); very friable when moist, soft when dry; noncalcareous; abrupt boundary.

D_1 40 to 48 inches, brownish coarse sand; common, medium and distinct mottlings; single grain (structureless); loose; noncalcareous; abrupt boundary.

D_2 48 to 60 inches, brownish mixed sand and gravel; common, medium and coarse, distinct mottlings; single grain (structureless); loose; noncalcareous.

Wood River series

The Wood River series consists of Chernozem soils that intergrade to solodized Solonetz. They are on alluvial stream terraces. They have an incipient A_2 horizon and a prismatic-blocky clayey subsoil. Most profiles have alkali or saline-alkali characteristics in the B_2 or B_3 horizons, or both. Wood River soils occur in the Platte River Valley in central Nebraska.

Profile of a phase of Wood River silt loam in a field of oat stubble, 1,250 feet east and 100 feet north of the southwest corner of sec. 32, T. 12 N., R. 11 W.:

A_{1p} and A_1 0 to 9 inches, dark grayish-brown (10YR 4/1.5, dry) silt loam; very dark brown (10YR 2/2) when moist; weak, medium, granular structure; friable when moist, slightly hard when dry; noncalcareous; pH 6.5; clear, smooth boundary.

A_{12} 9 to 14 inches, dark-gray (10YR 4/1, dry) silt loam; very dark gray (10YR 3/1) when moist; weak, medium and coarse, blocky structure; light-gray silt coatings on outer surface of blocks; vesicular; friable when moist, slightly hard when dry; pH 6.9; noncalcareous; abrupt, smooth boundary.

B_{21} 14 to 21 inches, grayish-brown (10YR 5/2, dry), heavy silty clay loam; dark brown (10YR 4/3) when moist; strong, coarse, prismatic and strong, medium, blocky structure; firm when moist, hard when dry, and plastic when wet; noncalcareous; pH 7.3; gradual, smooth boundary.

B_{22} 21 to 32 inches, grayish-brown (2.5Y 5.5/2, dry) silty clay; dark grayish brown (2.5Y 4/2) when moist; moderate to strong, medium, blocky structure; firm when moist, hard when dry; noncalcareous; pH 8.1 (saturated paste), 9.0 (1:5 dilution); abrupt, smooth boundary.

$B_{31ca\text{-}sa}$ 32 to 36 inches, light brownish-gray (2.5Y 6/2, dry), heavy silt loam or light silty clay loam; dark grayish brown (2.5Y 4/2) when moist; massive (structureless); friable when moist, only slightly hard when dry; strong effervescence; numerous visible white crystals; pH 7.9; soluble salts, 0.36 percent; clear, smooth boundary.

B_{32} 36 to 44 inches, color as in horizon above; silt loam; massive (structureless); strong effervescence; streaks and spots of segregated lime; friable when moist, soft when dry; pH 7.8; soluble salts, 0.22 percent; clear, smooth boundary.

B_{33} 44 to 54 inches, grayish-brown (2.5Y 5/2, dry) silt loam; dark grayish brown (2.5Y 3.5/2) when moist; massive (structureless); friable when moist, soft when dry; strong effervescence; many soft concretions of lime; pH 8.0; soluble salts, 0.25 percent; clear boundary.

C_1 54 to 60 inches, light brownish-gray (2.5Y 6.5/2, dry) silt loam, dark grayish brown (2.5Y 4/2) when moist; massive (structureless); friable when moist, soft when dry; strong effervescence; some segregated lime; pH 8.0; nonsaline.

Mechanical and Chemical Analyses

The data obtained by mechanical and chemical analyses for some selected soils in Hall County are given in table 12; profiles of the selected soils are described, beginning on page 116. The data in table 12 are useful to soil scientists in classifying soils and in developing concepts of soil genesis. They are also helpful for estimating water-holding capacity, wind erosion, fertility, tilth, and other practical aspects of soil management. The data on reaction, electrical conductivity, and percentage of exchangeable sodium are helpful in evaluating the possibility of reclaiming and managing saline-alkali areas.

Field and Laboratory Methods

All samples used to obtain the data in table 12 were collected from carefully selected pits. The samples are considered representative of the soil material that is made up of particles less than ¾ inch in diameter. Estimates of the fraction of the sample consisting of particles larger than ¾ inch were made during the sampling. If necessary, the sample was sieved after it was dried and rock fragments larger than ¾ inch in diameter were discarded. Then the material made up of particles less than ¾ inch was rolled, crushed, and sieved by hand to remove rock fragments larger than 2 millimeters in diameter. The fraction that consists of particles between 2 millimeters and ¾ inch in diameter is recorded on the data sheets and in table 12 as the percentage greater than 2 millimeters. This value is calculated from the total weight of the particles smaller than ¾ inch in diameter.

TABLE 12.—*Analytical data*

[Analysis made at Soil Survey Laboratory, Soil Conservation

Soil	Horizon	Depth	Particle size distribution: Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	Larger than 2 mm.
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Cass loam: *Location:* 150 feet NE. of S¼ corner, sec. 1, T. 10 N., R. 10 W. (*Sample No.* S 53 Neb–40–3; *laboratory No.* 1566–70).	A_{1p}	0–6	4. 0	11. 4	10. 2	11. 1	13. 7	35. 5	14. 1	1. 1
	A_{12}	6–15	9. 1	17. 7	15. 7	15. 8	8. 3	20. 8	12. 6	3. 5
	A_{13}	15–20	8. 5	20. 6	18. 2	17. 9	8. 0	16. 2	10. 6	2. 6
	A–C	20–27	10. 3	20. 6	19. 3	20. 6	7. 5	13. 2	8. 5	1. 9
	C	27–32	24. 6	26. 2	17. 8	17. 0	4. 6	5. 3	4. 5	7. 6
Exline silt loam (in Exline-Wood River silt loams): *Location:* SW¼SE¼, sec. 10, T. 11 N., R. 11 W. (*Sample No.* S 51 Neb–40–7; *laboratory No.* 917–24).	A_1	0–5	. 1	. 3	. 8	3. 2	16. 5	60. 4	18. 7	<1
	A_2	5–10	. 1	. 3	. 6	1. 9	18. 7	59. 5	18. 9	<1
	B_2	10–18	<. 1	. 3	. 7	1. 8	13. 7	46. 3	37. 2	<1
	B_3	18–21	<. 1	. 2	. 5	. 9	11. 9	42. 4	44. 1	<1
	B_{ca-cs}	21–28	. 7	. 7	. 6	1. 2	14. 9	48. 0	33. 9	[1] . 8
	C_1	28–42	. 8	. 6	. 6	1. 1	15. 3	52. 7	28. 9	[1] 3. 1
	C_2	42–47	2. 3	2. 3	1. 3	1. 9	15. 1	53. 5	23. 6	[1] 8. 7
	C_3	47–60	. 5	. 8	. 6	1. 2	18. 3	54. 3	24. 3	[1] 1. 4
Hall silt loam: *Location:* 650 feet N. and 150 feet E. of W¼ corner, sec. 11, T. 10 N., R. 11 W. (*Sample No.* S 52 Neb–40–3; *laboratory No.* 1183–91).	A_{1p}	0–5	. 2	. 2	. 2	. 5	11. 9	65. 8	21. 2	<1
	A_{12}	5–13	<. 1	. 1	. 2	. 4	10. 5	61. 2	27. 6	<1
	A_3–B_1	13–16	<. 1	. 1	. 1	. 3	9. 3	57. 5	32. 7	<1
	B_{21}	16–24	<. 1	<. 1	<. 1	. 3	11. 0	54. 5	34. 2	<1
	B_{22}	24–30	<. 1	<. 1	<. 1	. 1	10. 2	57. 1	32. 6	<1
	B_3	30–36	<. 1	<. 1	. 1	. 6	15. 9	61. 6	21. 8	<1
	C_1	36–47	<. 1	<. 1	. 2	1. 7	29. 8	56. 2	12. 0	<1
	C_2	47–54	<. 1	<. 1	<. 1	. 2	1. 6	70. 1	28. 1	<1
	C_3	54–62	<. 1	<. 1	. 2	. 5	15. 2	71. 9	12. 2	<1
Hord silt loam (deep in level area): *Location:* NW¼SW¼, sec. 10, T. 10 N., R. 11 W. (*Sample No.* S 52 Neb–40–5; *laboratory No.* 1199–1207).	A_{1p}	0–6	. 4	. 4	. 4	2. 1	19. 2	59. 2	18. 4	<1
	A_{12}	6–11	<. 1	. 2	. 4	1. 5	16. 9	55. 9	25. 1	<1
	B_{21}	11–19	<. 1	. 1	. 3	1. 6	15. 6	60. 7	21. 7	<1
	B_{22}	19–24	<. 1	. 2	. 5	2. 2	16. 6	59. 5	21. 0	<1
	B_{31}	24–31	<. 1	. 1	. 2	2. 0	21. 5	59. 4	16. 8	<1
	B_{32}	31–41	<. 1	. 2	. 3	1. 2	16. 3	66. 6	15. 4	<1
	C_1	41–49	<. 1	. 1	. 4	6. 4	41. 7	42. 9	8. 5	<1
	C_{2ca}	49–54	. 1	. 2	. 3	1. 1	20. 0	65. 5	12. 8	<1
	C_3	54–62	<. 1	<. 1	. 2	1. 4	31. 9	57. 0	9. 5	<1
Leshara silt loam: *Location:* 0.3 mile S. and 50 feet E. of NE. corner, sec. 3, T. 10 N., R. 10 W. (*Sample No.* S 53 Neb–40–4; *laboratory No.* 1571–77).	A_{1p}	0–6	. 3	. 8	1. 1	5. 5	12. 7	58. 0	21. 6	<1
	A_{12}	6–10	. 1	. 7	1. 0	4. 5	11. 4	59. 4	22. 9	<1
	A–C	10–15	<. 1	. 2	. 3	. 8	14. 0	65. 8	18. 9	<1
	C_1	15–24	. 1	. 1	. 1	. 2	16. 3	69. 4	13. 8	<1
	A_{1b}	24–29	. 5	. 3	. 1	. 5	1. 1	57. 6	39. 9	<1
	C_{1b}	29–36	. 1	. 1	. 2	5. 0	37. 9	44. 8	11. 9	<1
	C_{2b}	36–48	<. 1	. 7	1. 7	23. 0	34. 9	25. 9	13. 8	<1
O'Neill loam: *Location:* 200 feet SE. of NW. corner, sec. 24, T. 10 N., R. 11 W. (*Sample No.* S. 53 Neb–40–14; *laboratory No.* 1635–39).	A_{1p}	0–7	1. 1	11. 0	9. 5	8. 6	13. 0	44. 0	12. 8	<1
	A_{12}	7–15	2. 6	20. 3	15. 1	10. 9	7. 3	31. 1	12. 7	<1
	B_2	15–23	9. 6	37. 1	18. 3	12. 3	. 9	13. 6	8. 2	3. 0
	B_3	23–27	17. 3	30. 3	21. 6	14. 6	2. 5	7. 5	6. 2	11. 3
	C_1	27–32	34. 2	40. 0	14. 8	6. 1	. 7	1. 7	2. 5	20. 5
Ortello fine sandy loam: *Location:* 100 feet N. of road and 75 feet E. of farmstead shelterbelt, sec. 19, T. 12 N., R. 11 W. (*Sample No.* S 53 Neb–40–11; *laboratory No.* 1616–21).	A_{1p}	0–6	. 3	6. 7	11. 3	23. 0	24. 3	23. 9	10. 5	<1
	A_{12}	6–12	. 4	6. 2	10. 9	22. 3	24. 6	25. 0	10. 6	<1
	C_1	12–22	. 3	9. 8	20. 6	38. 7	15. 0	7. 7	7. 9	<1
	A_{1b}	22–29	. 4	3. 8	6. 0	30. 7	36. 1	12. 5	10. 5	<1
	B_{2b}	29–40	<. 1	1. 1	7. 0	53. 3	21. 8	8. 1	8. 7	<1
	C_{1b}	40–52	. 1	4. 4	10. 9	41. 2	25. 0	10. 2	8. 2	<1

for selected soil profiles

Service, Lincoln, Nebr. Dashes indicate values not determined]

Texture	Chemical analysis											
	Reaction (pH)		Organic carbon	Estimated salt	Electrical conductivity (EC×10[3] millimhos per cm. at 25° C.)	$CaCO_3$ equivalent	Cation exchange capacity (NH_4Ac)	Extractable cations (NH_4Ac)		Exchangeable cations		Exchangeable sodium percentage
	Saturated paste	1:10						Ca	Mg	Na	K	
			Percent	*Percent*		*Percent*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	
Loam	8.1	8.5	1.25	<0.20	1.1	2	13.9	------	------	0.4	1.0	3
Coarse sandy loam	8.4	8.9	.76	<.20	1.0	4	9.7	------	------	.7	.4	7
Coarse sandy loam	8.5	9.0	.37	<.20	.9	2	8.2	------	------	1.0	.2	12
Coarse sandy loam	8.0	7.7	.14	<.20	.8	1	7.0	------	------	.7	.2	10
Coarse sand	8.0	7.0	.07	<.20	.7	<1	3.4	------	------	.3	.1	9
Silt loam	5.8	6.7	3.16	<.20	.6	<1	21.0	9.4	3.6	.1	2.6	<1
Silt loam	6.0	7.1	1.59	<.20	.7	<1	16.8	6.7	3.9	.5	2.3	3
Silty clay loam	7.2	8.6	1.21	<.20	1.5	<1	28.3	8.8	10.6	4.5	4.7	16
Silty clay	8.0	8.9	.63	<.20	3.1	<1	32.9	9.4	15.0	6.3	5.8	19
Silty clay loam	8.1	8.5	.27	.37	9.0	4	26.4	------	------	4.7	4.6	18
Silty clay loam	8.3	9.7	.15	.24	6.0	9	23.5	------	------	4.9	4.1	21
Silt loam	8.2	9.7	.10	<.20	3.3	17	19.7	------	------	4.1	3.5	21
Silt loam	8.0	9.6	.09	<.20	2.1	5	22.8	------	------	3.8	3.7	17
Silt loam	6.4	7.3	1.73	<.20	.5	<1	20.4	13.6	4.2	.3	1.8	1
Silty clay loam [2]	6.4	7.3	1.58	<.20	.4	<1	23.0	15.2	4.8	.1	1.2	<1
Silty clay loam	6.1	7.2	1.39	<.20	.3	<1	25.8	16.9	5.6	.1	1.2	<1
Silty clay loam	6.0	7.2	.93	<.20	.3	<1	26.6	17.3	6.0	.3	1.6	1
Silty clay loam	6.2	7.3	.58	<.20	.3	<1	26.7	17.2	6.0	.3	1.9	1
Silt loam	6.5	7.5	.35	<.20	.3	<1	19.6	13.0	4.6	.2	1.8	1
Silt loam	6.8	7.8	.12	<.20	.5	<1	12.3	8.3	2.9	.2	1.4	2
Silty clay loam	7.4	8.5	.30	<.20	.6	1	28.3	24.9	6.7	.4	3.1	1
Silt loam	7.7	8.8	.09	<.20	.6	<1	15.3	14.3	3.9	.3	1.8	2
Silt loam	6.3	7.0	1.39	<.20	.4	1	17.4	11.8	3.3	.1	1.2	<1
Silt loam	6.0	7.4	1.12	<.20	.3	1	19.2	12.9	4.2	.1	1.0	<1
Silt loam	6.6	7.5	.78	<.20	.4	<1	18.9	12.8	4.2	.1	.8	<1
Silt loam	6.7	7.6	.52	<.20	.3	<1	18.5	12.6	4.3	.1	1.0	<1
Silt loam	6.6	7.7	.30	<.20	.4	<1	16.4	10.9	3.9	.1	1.2	1
Silt loam	7.0	7.9	.22	<.20	.4	<1	16.5	10.8	4.0	.1	1.9	1
Loam	7.7	8.7	.06	<.20	.7	<1	10.5	7.8	3.0	.1	1.2	1
Silt loam	7.8	8.9	.10	<.20	.6	1	15.6	------	------	.1	2.2	1
Silt loam	7.8	9.0	.05	<.20	.6	<1	11.8	10.6	4.0	<.1	1.7	<1
Silt loam	7.9	8.2	1.88	<.20	1.5	5	21.1	39.7	6.5	.3	1.3	1
Silt loam	8.1	8.3	1.79	<.20	.9	5	21.2	------	------	.5	1.1	2
Silt loam	8.3	8.5	.64	<.20	1.0	5	16.4	------	------	1.0	.8	6
Silt loam	8.2	8.6	.15	<.20	1.2	1	14.1	------	------	1.4	.9	10
Silty clay loam	7.9	8.5	.39	<.20	1.2	2	34.9	21.6	15.0	3.6	2.6	10
Loam	8.1	8.1	.09	<.20	1.6	<1	12.7	------	------	1.5	1.1	12
Very fine sandy loam.	7.9	7.7	.15	<.20	1.6	<1	12.0	7.4	3.7	1.1	.8	9
Loam	5.9	------	.82	------	------	------	------	------	------	------	------	------
Sandy loam	6.6	------	.75	------	------	------	------	------	------	------	------	------
Loamy coarse sand.[3]	6.9	------	.41	------	------	------	------	------	------	------	------	------
Loamy coarse sand	7.1	------	.20	------	------	------	------	------	------	------	------	------
Coarse sand	7.0	------	.08	------	------	------	------	------	------	------	------	------
Fine sandy loam	7.3	------	2.10	------	------	------	------	------	------	------	------	------
Fine sandy loam	6.7	------	.70	------	------	------	------	------	------	------	------	------
Loamy sand	6.6	------	.16	------	------	------	------	------	------	------	------	------
Very fine sandy loam.	6.8	------	.23	------	------	------	------	------	------	------	------	------
Loamy fine sand	6.8	------	.15	------	------	------	------	------	------	------	------	------
Loamy fine sand	7.0	------	.17	------	------	------	------	------	------	------	------	------

TABLE 12.—*Analytical data for*

[Analysis made at Soil Survey Laboratory, Soil Conservation

Soil	Horizon	Depth	Particle size distribution							
			Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	Larger than 2 mm.
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Silver Creek silt loam: *Location:* 0.1 mile W. and 100 feet S. of NE. corner, sec. 33, T. 12 N., R. 9 W. (*Sample No.* S 49 Neb–40–8; *laboratory No.* 142 to 146c).	A_{1p}	0–6	<0. 1	1. 2	1. 2	3. 4	19. 7	53. 7	20. 7	<1
	A_1	6–18	. 1	1. 1	1. 4	3. 3	17. 1	53. 2	23. 8	<1
	B_2	18–36	1. 3	2. 3	2. 5	5. 4	7. 9	38. 6	41. 8	<1
	B_3	36–53	4. 2	6. 1	5. 3	9. 8	11. 2	31. 4	32. 0	<1
	C_1	53–60	1. 0	4. 4	9. 7	36. 5	11. 8	20. 0	16. 4	<1
	C_{2g}	60–66	. 3	4. 2	16. 2	33. 0	12. 2	17. 8	16. 3	<1
	D_1	66–70	. 3	. 9	2. 7	15. 3	14. 0	34. 3	32. 5	<1
Wann loam: *Location:* 0.1 mile N. of E¼ corner, sec. 8, T. 10 N., R. 9 W. (*Sample No.* S 53 Neb–40–2; *laboratory No.* 1560–65).	A_{1p}	0–7	2. 6	7. 1	7. 2	12. 4	20. 7	35. 1	14. 9	. 9
	A_{12}	7–12	2. 6	8. 6	8. 4	15. 3	19. 3	32. 7	13. 1	1. 3
	A_{13}	12–17	7. 2	13. 0	10. 2	15. 4	22. 8	24. 7	6. 7	1. 7
	C_1	17–21	4. 3	9. 0	8. 9	16. 6	28. 8	26. 2	6. 2	1. 2
	C_2	21–27	5. 7	11. 2	10. 1	15. 4	32. 4	20. 5	4. 7	1. 8
	D	27–35	25. 5	29. 6	19. 2	15. 7	5. 3	3. 5	1. 2	6. 2
Wood River silt loam (Deep): *Location:* 0.4 mile N. of SW. corner NW¼SW¼, sec 19, T. 10 N., R. 12 W. (*Sample No.* S 50 Neb–40–2; *laboratory No.* 283–91).	A_{1p}	0–6	<. 1	. 4	. 6	1. 1	16. 3	63. 0	18. 6	<1
	A_{12}	6–10	<. 1	. 2	. 5	. 9	11. 8	68. 4	18. 2	<1
	A_2	10–13	<. 1	. 2	. 5	1. 1	14. 1	68. 6	15. 5	<1
	B_{21}	13–21	<. 1	. 2	. 4	. 6	7. 7	56. 3	34. 8	<1
	B_{22}	21–28	<. 1	<. 1	. 3	. 4	6. 1	51. 0	42. 2	<1
	B_{31}	28–30	<. 1	<. 1	. 2	. 3	6. 3	51. 4	41. 8	<1
	B_{32}	30–38	. 2	. 2	. 2	. 4	9. 6	54. 6	34. 8	<1
	B_{33}	38–53	. 5	. 2	. 1	. 4	11. 0	60. 0	27. 8	<1
	C	53–60	2. 7	. 9	. 4	. 5	9. 4	63. 8	22. 3	<1

[1] Mostly calcareous concretions. [2] Or silt loam. [3] Or coarse sandy loam.

The content given for the fractions that consist of particles larger than ¾ inch and of particles between 2 millimeters and ¾ inch is somewhat arbitrary. The accuracy of the data depends on the severity of the preparative treatment, which may vary with the objectives of the study. But it can be said that the two fractions contain relatively unaltered rock fragments that are larger than 2 millimeters in diameter and that they do not contain slakeable clods of earthy material.

Unless otherwise noted, all laboratory analyses are made on material that passes the 2-millimeter sieve and are reported on an oven-dry basis. In table 12, values for exchangeable sodium and potassium are for amounts of sodium and potassium that have been extracted by the ammonium acetate method minus the amounts that are soluble in the saturation extract.

Standard methods of the Soil Survey Laboratory were used to obtain most of the data in table 12. Determinations of clay were made by the pipette method (*3*) (*4*) (*6*). The reaction of the saturated paste and that of a 1:10 water suspension were measured with a glass electrode. Organic carbon was determined by wet combustion, using a modification of the Walkley-Black method (*7*). The calcium carbonate equivalent was determined by measuring the volume of carbon dioxide emitted from soil samples treated with concentrated hydrochloric acid. The cation exchange capacity was determined by direct distillation of adsorbed ammonia (*7*). To determine the extractable calcium and magnesium, calcium was separated as calcium oxalate and magnesium as magnesium ammonium phosphate (*7*). Extractable sodium and potassium were determined on original extracts with a flame spectrophotometer. The methods of the U. S. Salinity Laboratory were used to obtain the saturation extract (*8*). Soluble sodium and potassium were determined on the saturation extract with a flame spectrophotometer.

Soil Profiles of Soils Analyzed

Profiles of the soils listed in table 12, except Hall silt loam and Silver Creek silt loam, are described in the following pages. The profiles of the Hall and Silver Creek soils are described in the section, Soils of Hall County, and in the subsection, Soil Series, Including Descriptions of Profiles.

selected soil profiles—Continued

Service, Lincoln, Nebr. Dashes indicate values not determined]

Texture	Chemical analysis											
	Reaction (pH)		Organic carbon	Estimated salt	Electrical conductivity (EC×10³ millimhos per cm. at 25° C.)	$CaCO_3$ equivalent	Cation exchange capacity (NH_4Ac)	Extractable cations (NH_4Ac)		Exchangeable cations		Exchangeable sodium percentage
	Saturated paste	1:10						Ca	Mg	Na	K	
			Percent	*Percent*		*Percent*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	*Meq./100 gm.*	
Silt loam	7.6	8.2	1.96	<.20	1.4	<1	21.0	----	----	0.3	2.2	1
Silt loam	7.8	8.6	1.29	<.20	.8	1	18.4	----	----	.3	2.3	2
Clay	8.2	9.3	.49	<.20	1.2	16	20.3	----	----	2.3	2.9	11
Clay loam	7.7	8.9	.25	<.20	1.8	19	15.4	----	----	2.8	2.6	18
Fine sandy loam	7.2	8.3	.09	<.20	1.4	1	12.3	----	----	.3	1.1	3
Fine sandy loam	7.1	----	----	<.20	.9	----	----	----	----	----	----	----
Clay loam	8.9	----	----	----	----	----	----	----	----	----	----	----
Loam	8.1	9.0	1.19	<.20	1.2	5	12.7	----	----	.6	1.3	5
Fine sandy loam	8.3	8.9	.91	<.20	1.1	5	11.1	----	----	.7	.8	6
Sandy loam	8.2	8.8	.34	<.20	1.0	2	7.4	----	----	.4	.3	5
Fine sandy loam	7.9	7.6	.17	<.20	.9	1	7.4	5.7	2.2	.4	.2	5
Loamy sand [4]	7.8	7.2	.07	<.20	.9	1	5.6	3.9	1.6	.4	.2	7
Coarse sand	8.0	6.8	.03	<.20	1.3	1	2.2	----	----	.1	.1	4
Silt loam	6.8	7.4	1.47	<.20	.9	<1	17.9	11.9	3.8	.8	2.3	5
Silt loam	7.1	7.7	1.20	<.20	.8	<1	16.2	12.5	3.1	.8	1.4	5
Silt loam	7.3	8.0	.90	<.20	.7	<1	13.1	9.3	2.7	1.1	1.6	9
Silty clay loam	7.3	8.5	.52	<.20	1.0	<1	24.9	----	----	4.2	3.2	17
Silty clay	8.0	9.2	.35	<.20	1.2	<1	32.0	----	----	4.8	4.4	15
Silty clay	7.7	8.4	.24	.37	4.5	3	32.4	----	----	2.6	3.8	8
Silty clay loam	8.0	9.4	.16	<.20	1.3	2	30.2	----	----	4.4	4.2	15
Silty clay loam	7.7	9.2	.09	<.20	1.4	1	27.5	----	----	2.4	4.1	9
Silt loam	7.8	9.1	.07	<.20	1.0	8	23.7	----	----	1.4	3.4	6

[4] Or sandy loam.

CASS LOAM

Sample No. S 53 Neb–40–3–1 to 3–6
Laboratory (*MSL*) *No.* 1566–1570
Location: 150 feet NE. of S¼ corner, sec. 1, T. 10 N., R. 10 W.
Topographic position: Nearly level bottom land along Platte River above overflow.
Drainage: Moderately well drained.
Use: Cultivated, corn in 1952.

MSL

1566 A_{1p} 0 to 6 inches, dark gray (10YR 4/1, dry) or very dark gray (10YR 3/1, moist) silt loam; moderate, fine and very fine, granular structure; soft when dry, friable when moist; strong effervescence; abrupt and smooth boundary.

1567 A_{12} 6 to 15 inches, very dark gray (10YR 3.5/1, dry) or nearly black (10YR 2.5/1, moist) silt loam or loam; contains a few fine pebbles; strong, fine and very fine, granular structure; soft when dry, friable when moist; violent effervescence; clear and smooth boundary.

1568 A_{13} 15 to 20 inches, gray (10YR 5/1, dry) or very dark gray (10YR 3/1, moist) loam; contains a few fine pebbles; moderate, fine, granular structure; soft when dry, friable when moist; violent effervescence; clear and smooth boundary.

1569 A–C 20 to 27 inches, gray (10YR 5/1.5, dry) or dark-gray (10YR 4/1, moist) fine sandy loam; moderate, fine, granular structure; soft when dry, very friable when moist; weak effervescence in upper part; clear and smooth boundary.

1570 C 27 to 32 inches, light brownish-gray (10YR 6/2, dry) or grayish-brown (10YR 5/2, moist) loamy sand; single grain (structureless); loose; noncalcareous; gradual and wavy boundary.

D 32 to 40 inches +, very pale brown sand and fine gravel; loose; noncalcareous; water table at about 60 inches; at about 60 inches or more is a horizon with prominent brown mottles; little or no mottling above 60 inches. (Horizon not sampled for Mandan laboratory.)

EXLINE SILT LOAM

The sample of this soil was taken at about midposition in the microtopography of an area of Exline soil in Exline-Wood River silt loams.

Sample No. S 51 Neb–40–7–1 to 7–8
Laboratory (*MSL*) *No.* 917–24
Location: SW¼SE¼ sec. 10, T. 11 N., R. 11 W.
Topographic position: Level terrace with many microdepressions.

Use: Native pasture; saltgrass, grama, and western wheatgrass dominant.

MSL

917 A_1 0 to 5 inches, dark gray (10YR 4/1, dry) or very dark brown (10YR 2/2, moist) silt loam; fine, granular structure; soft when dry, friable when moist.

918 A_2 5 to 10 inches, grayish-brown (10YR 5/2, dry) or very dark gray (10YR 3/1, moist) silt loam: coarse, blocky or prismatic primary structure and fine, blocky secondary breakage; structure aggregates coated with lighter colored material than the base color.

919 B_2 10 to 18 inches, very dark brown (10YR 2/2, dry) silty clay; only slightly darker when moist; strong, coarse, columnar-prismatic structure with secondary breakage to medium and fine blocky; aggregates heavily coated with black, shiny organic colloids; columns ill-defined in lower parts and grade to layer below.

920 B_3 18 to 21 inches, light brownish-gray (2.5Y 6/2, dry) or dark grayish-brown (2.5Y 4/2, slightly moist) silty clay or heavy silty clay loam; medium to fine, blocky structure; firm when moist, moderately hard when dry, and moderately plastic when wet.

921 B_{ca-cs} 21 to 28 inches, light-gray (5Y 7/2, dry) or olive-gray (5Y 5/2, moist) silty clay loam; no well-defined structure but crushes to fine, subangular blocky mass; very high in salts, probably gypsum; many scattered hard concretions of lime carbonate; material generally not calcareous.

922 C_1 28 to 42 inches, pale-yellow (5Y 6.5/3, dry) or pale-olive (5Y 5.5/3, moist) silt loam; massive (structureless); friable; calcareous; concretions of lime as much as 1 inch in diameter.

923 C_2 42 to 47 inches, light-gray (5Y 7/2.5, dry) or olive-gray (5Y 5/2.5, moist) silt loam; massive (structureless); friable; strongly calcareous; moderate amount to abundant concretions of lime, some as much as 3 inches in diameter; common, small, distinct, reddish-brown and yellowish-red mottles.

924 C_3 47 to 60 inches, pale-yellow (5Y 7/3, dry) or olive (5Y 5/3, moist) silt loam; massive (structureless); friable; moderately calcareous; scattered concretions of lime; many mottles and stains of yellowish and brownish color.

HORD SILT LOAM

This profile of Hord silt loam was sampled in a level area where the soil material is deep.

Sample No. S 52 Neb–40–5–1 to 5–9
Laboratory (MSL) No. 1199–1207
Location: NW¼SW¼ of sec. 10, T. 10 N., R. 11 W.

MSL

1199 A_{1p} 0 to 6 inches, drak-gray (10YR 4/1, moist) or gray (10YR 5/1.5, dry), granular, friable silt loam.

1200 A_{12} 6 to 11 inches, very dark grayish-brown (10YR 3/2, moist) to grayish-brown (10YR 5/2, dry), granular, friable silt loam.

1201 B_{21} 11 to 19 inches, very dark grayish-brown (10YR 3/2, moist) or grayish-brown (10YR 5/2, dry) heavy silt loam; medium, blocky structure; friable; includes probably 1 inch of AB transition.

1202 B_{22} 19 to 24 inches, dark grayish-brown (10YR 4/2, moist) or light brownish-gray (10YR 6/2, dry) heavy silt loam; weak, blocky structure; friable.

1203 B_{31} 24 to 31 inches, pale-brown (10YR 5.5/3, moist) or light brownish-gray (10YR 6.5/2, dry) silt loam; weak, blocky structure; very friable.

1204 B_{32} 31 to 41 inches, pale-brown (10YR 6/3, moist) or light-gray (10YR 7/2, dry) silt loam; weak vertical structure but no horizontal cleavage; friable.

1205 C_1 41 to 49 inches, light brownish-gray (10YR 6/2, moist) or light-gray (10YR 7/2, dry), stratified very fine sandy loam and silt loam; overall texture of about very fine sandy loam; firm in place, but very friable when disturbed.

1206 C_{2ca} 49 to 54 inches, grayish-brown (2.5Y 5/2, moist) or light-gray (10YR 7/2, dry) silt loam with thin lenses of very fine sandy loam; many spots and seams of free carbonate of lime; firm in place, but friable when disturbed.

1207 C_3 54 to 62 inches, about same as C_{2ca} horizon except texture is very fine sandy loam, and there is less free lime.

The stratified sandy and silty materials continue down to a nearly black buried soil at a depth of 6½ feet. This buried soil is silt loam in the upper part and silty clay or silty clay loam in the lower part. It is about dark grayish brown in color at a depth of 10 feet 4 inches. No free lime occurs in the darkest upper part of the buried soil, but the soil is slightly calcareous below 9.5 feet.

LESHARA SILT LOAM

Sample No. S 53 Neb–40–4–1 to 4–8
Laboratory (MSL) No. 1571 to 1577
Location: 0.3 mile S. of NE. corner, sec. 3, T. 10 N., R 10 W.
Topographic position: Bottom land of the Platte River, slightly lower than the alluvial land to the north.
Relief: Slight.
Drainage: Imperfectly drained.
Ground water: Water table at depth of 48 inches in July; probably fluctuates between 3 and 6 feet during growing season.
Land use: Cultivated.

MSL

1571 A_{1p} 0 to 6 inches, dark gray (10YR 4.5/1, dry) or very dark gray (10YR 3/1, moist) silt loam; moderate, fine and very fine, granular structure; slightly hard when dry, friable when moist; strong effervescence; abrupt and smooth boundary.

1572 A_{12} 6 to 10 inches, dark gray (10YR 4/1, dry) or very dark gray (10YR 3/1, moist) silt loam; moderate, medium and fine, granular structure; slightly hard when dry, friable when moist; violent effervescence; many very fine and a few large pores and root channels; clear and smooth lower boundary.

1573 A–C 10 to 15 inches, about equal proportions of gray and dark-gray (10YR 5/1 and 4/1, dry) or dark gray and very dark gray (10YR 4/1 and 3/1, moist) silt loam as a result of intense earthworm action; moderate, fine and very fine, granular structure; slightly hard when dry, friable when moist; violent effervescence; clear and smooth boundary.

1574 C_1 15 to 24 inches, light-gray (2.5Y 7/2, dry) or light brownish-gray (2.5Y 6/2, moist) silt loam; moderate, medium and fine, crumb structure; slightly hard when dry; friable when moist; strong effervescence; many roots and worm channels, and some streaks and spots of white lime; clear and smooth boundary.

1575 A_{1b} 24 to 29 inches, gray (10YR 5.5/1, dry) or dark-gray (10YR 4/1.5, moist) silty clay loam; few, faint, fine, brown mottles; weak, subangular blocky structure breaking to moderate, fine and very fine, subangular blocky structure; hard when dry, friable when moist, and slightly plastic when wet; noncalcareous except for worm casts; clear and smooth boundary.

1576 C_{1b} 29 to 36 inches, light brownish-gray (2.5Y 6/2, dry) or grayish-brown (2.5Y 5/2, moist) very fine sandy loam or loam; many, distinct, coarse, brown and yellow mottles and stains; few coarse dark-brown spots of soft iron concretions; massive (structureless) breaking to rounded lumps; soft when dry, very friable when moist; noncalcareous; clear and smooth boundary.

1577 C_{2b} 36 to 48 inches, similar to horizon above with many, prominent, coarse, brown mottles and concentric staining around root channels; staining is very dark brown close to channels and grades outward to pale brown or yellowish brown; saturated; noncalcareous; roots from nearby cottonwood trees penetrate to the coarse material below; abrupt boundary.

C 48 inches +, light-gray (10YR 7/2, dry), coarse, clean sand and fine gravel; water table in this layer and in contact with the silty material above when sampled in June 1953. (Horizon not sampled for Mandan laboratory.)

O'NEILL LOAM

Sample No. S 53 Neb–40–14–1 to 14–5
Laboratory (MSL) No. 1635–39
Location: 200 feet SE. of NW. corner, sec. 24, T. 10 N., R. 11 W.
Land use: Cultivated, corn.

MSL
1635 A_{1p} 0 to 7 inches, grayish-brown (10YR 5/2, dry) or very dark gray (10YR 2.5/2, moist) silt loam; weak, crumb structure; friable.
1636 A_{12} 7 to 15 inches, dark gray (10YR 4/1, dry) or very dark gray (10YR 3/1, moist) loam; friable.
1637 B_2 15 to 23 inches, grayish-brown (10YR 5/2, dry) or very dark grayish-brown (10YR 3/2, moist) loam; (sl–BHW); blocky macrostructure; friable.
1638 B_3 23 to 27 inches, grayish-brown (10YR 5.5/2, dry) or very dark grayish-brown (10YR 3/2, moist) gravelly loamy sand; loose.
1639 C_1 27 to 32 inches, pale-brown (10YR 6/3, dry) weathered coarse sand and gravel; single-grain structure.
32 to 40 inches +, very pale brown (10YR 7/3, dry), clean medium sand; single-grain structure. (Horizon not sampled for Mandan laboratory.)

This is a gradational profile that is noncalcareous throughout.

ORTELLO FINE SANDY LOAM

Sample No. S 53 Neb–40–11–1 to 11–6
Laboratory (MSL) No. 1616–21
Location: 0.2 mile W. of SE. corner, sec. 10, T. 12 N., R. 11 W. 100 feet N. of road and 75 feet E. of farmstead shelterbelt.
Land use: Cultivated, corn.

MSL
1616 A_{1p} 0 to 6 inches, grayish-brown (10YR 5/1.5, dry) or very dark grayish-brown (10YR 3/1.5, moist), friable fine sandy loam.
1617 A_{12} 6 to 12 inches, grayish-brown (10YR 5/2, dry) or dark grayish-brown (10YR 4/1.5, moist), friable fine sandy loam.
1618 C_1 12 to 22 inches, light brownish-gray (10YR 6/2.5, dry) or dark grayish-brown (10YR 4/2, moist) loamy fine sand; very friable.
1619 A_{1b} 22 to 29 inches, light yellowish-gray (10YR 6/2.5, dry) or dark grayish-brown (10YR 4/2.5, moist), friable fine sandy loam.
1620 B_{2b} 29 to 40 inches, grayish-brown (10YR 5.5/2, dry) or dark grayish-brown (10YR 4/2, moist) sandy loam or loamy fine sand; very friable.
1621 C_1 40 to 52 inches, grayish-brown (10YR 5.5/2, dry) or dark grayish-brown (10YR 4/1.5, moist) fine sandy loam; slightly darker than C_1 horizon; dark and light streaks; friable.
C_2 52 to 60 inches, sand or loamy sand; very friable. (Horizon not sampled for Mandan laboratory.)

This horizon is noncalcareous throughout. A farmer reported that the depth to gravel is 44 feet.

WANN LOAM

Sample No. S 53 Neb–40–2–1 to 2–6
Laboratory (MSL) No. 1560–1565
Location: 0.1 mile N. of E¼ corner, sec. 8, T. 10 N., R. 9 W.
Topographic position: Broad slightly depressed flat on broadly undulating bottom land of Platte River above overflow.
Drainage: Imperfectly drained.
Use: Cultivated, corn in 1952.

MSL
1560 A_{1p} 0 to 7 inches, gray (10YR 5.5/1, dry) or very dark gray (10YR 3/1, moist) silt loam; strong, fine, granular structure; slightly hard when dry, friable when moist; violent effervescence; pH 8.5 (Soiltex); few coarse sand grains; abrupt and smooth boundary.
1561 A_{12} 7 to 12 inches, gray (10YR 5/1, dry) or very dark gray (10YR 3/1, moist) silt loam; strong, fine, granular structure; slightly hard when dry, friable when moist; many fine and medium pores and openings; violent effervescence; clear and smooth boundary.
1562 A_{13} 12 to 17 inches, gray (10YR 5.5/1, dry) or very dark gray (10YR 3/1, moist) loam; weak, medium and fine, granular structure; slightly hard when dry, friable when moist; strong effervescence; pH 8.5 (Soiltex); clear and smooth boundary.
1563 C_1 17 to 21 inches, grayish-brown (10YR 5/2, dry) or dark grayish-brown (10YR 4/2, moist) fine sandy loam; massive or weak, fine, granular structure; soft when dry, very friable when moist; no effervescence; pH 7.2; gradual and smooth boundary.
1564 C_2 21 to 27 inches, light brownish-gray (10YR 6/2, dry) or grayish-brown (10YR 5/2, moist) loamy fine sand or fine sandy loam; common, faint, fine, yellowish-brown mottles; massive (structureless); soft when dry, very friable when moist; noncalcareous; pH 7.0; gradual and smooth boundary.
1565 D 27 to 35 inches, light brownish-gray (10YR 6/2.5, dry) or pale-brown (10YR 6/3, moist) loamy sand or sand; massive (structureless); loose; noncalcareous; graded mixture largely fine sand to fine gravel with a little silt and clay; many, prominent, coarse, brown and yellowish-brown mottles; gradual and smooth boundary.
35 inches +, pale-brown sand and fine gravel; mottled and stained with iron; saturated; water table at 40 inches. (Not sampled for laboratory study.)

WOOD RIVER SILT LOAM

This profile of Wood River silt loam was sampled in an area where the soil is very deep.

Sample No. S 50 Neb–40–2–1 to 2–9
Laboratory (MSL) No. 283–91
Location: 0.4 mile N. of SW. sec. corner, NW¼SW¼ sec. 19, T. 10 N., R 12 W.
Topographic position: Terrace along Platte River.
Drainage: Good, surface and internal.
Land use: Irrigated corn in 1950.

MSL
283 A_{1p} 0 to 6 inches, very dark brown (10YR 2/2, moist), friable silt loam; granular structure.
284 A_{12} 6 to 10 inches, very dark brown (10YR 2/2, moist), friable silt loam; blocky and granular structure.
285 A_2 10 to 13 inches, very dark grayish-brown (10YR 3/2, moist), friable silt loam; blocky structure; weakly developed gray layer.
286 B_{21} 13 to 21 inches, very dark brown (10YR 2/3, moist) silty clay; large, blocky primary structure to medium, blocky secondary; plastic when wet, moderately hard when dry.
287 B_{22} 21 to 28 inches, dark grayish-brown (2.5Y 4/2, moist) silty clay to silty clay loam; coarse, blocky structure; moderately plastic.

288 B_{31} 28 to 30 inches, light olive-brown (2.5Y 5/4, moist) silty clay loam; weak, blocky structure; friable; many streaks of lime or salts, or both.

289 B_{32} 30 to 38 inches, yellowish-brown (10YR 5/4, moist) silt loam; weak, blocky structure; friable; calcareous; moderately soft concretions.

290 B_{33} 38 to 53 inches, light reddish-brown (2.5YR 6/4, moist) silt loam; weak, blocky structure; friable; calcareous; some concretions.

291 C 53 to 60 inches, light reddish-brown (2.5Y 6/4, moist) silt loam; massive (structureless); friable; stained and mottled; calcareous.

General Nature of the County

This section was prepared mainly for those not familiar with the county. It contains subsections on physiography, relief, and drainage; climate; natural resources; early history and population; and other subjects of general interest.

Physiography, Relief, and Drainage

Hall County lies near the eastern margin of the Great Plains. Generally, the county is nearly level to gently undulating.

The Platte River Valley crosses the county in a southwest-northeast direction. It varies in width from 12 to 19 miles. Near the southern border of the valley, the river separates into four channels and forms a group of low-lying, elongated islands. The alluvial bottom lands are 4 to 6 miles wide and lie 5 to 10 feet above the river bed. A broad, alluvial terrace forms the northern part of the valley. This terrace is 10 to 40 feet above the flood plains.

There are three distinct levels or ages of terraces in the county. The high terraces have been covered with loess, a silty windblown deposit. To the west of Grand Island is an area where the winds have reworked and deposited the sands to form low hummocks. Some nearly level areas occur that have no well-defined drainageways. The Wood River, Prairie Creek, and Silver Creek are the main drainage channels of the terraces. Drainage is lacking in a few depressions in the silty uplands and on a few terraces.

The extreme northwestern corner of the county consists of about 6 square miles of the South Loup River Valley. Sweet Creek flows into the South Loup River. Nearly all streams in the county have low gradients and flow in a northeasterly direction.

The Grand Island Airport area is at an elevation of 1,846 feet above sea level. The elevations of the first bottoms and stream terraces of the Platte River Valley range from 1,800 to 2,000 feet. The valley has a gradual eastward slope of about 7 feet in 1 mile. The elevation of the South Loup River Valley is about 1,900 feet, and the uplands in this area range from 1,940 to 2,100 feet. The elevation of the southeastern uplands ranges from 1,900 feet along the eastern boundary to about 2,060 feet on its western edge.

The upland areas are from 40 to 100 feet above the level of the bottom lands in the Platte River Valley. The silty uplands consist of two triangular-shaped areas. The larger of these is in the southeastern part of the county; the smaller area is in the northwestern part of the county. An area of hummocky and dunelike sandhills is along the northern edge of the county. This area is from 2 to 3 miles wide and forms a divide between the valleys of the South Loup and Platte Rivers. A similar but less extensive line of low sandhills faces the Platte Valley along the margin of the southern uplands in the south-central part of the county.

Climate

Hall County has a typical continental climate with wide seasonal variations. The weather changes rapidly from day to day and within a 24-hour period. Normal monthly, seasonal, and annual temperature and precipitation at the United States Weather Bureau Station at Grand Island are given in table 13.

Summers are warm. Moderately strong south and southeasterly winds are common. July, the hottest month, has an average temperature of 78° F. The hottest temperature ever recorded is 117°. A period of mild weather called Indian summer usually occurs in October after there has been frost. At this time, wind velocities are lower than at any other time of the year.

TABLE 13.—*Temperature and precipitation at Grand Island Station, Hall County, Nebraska*

[Elevation, 1,841 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1940)	Wettest year (1905)	Average snowfall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	27. 4	80	−18	0. 66	0. 90	0	4. 5
January	23. 7	70	−26	. 56	. 79	1. 64	6. 4
February	27. 5	73	−23	. 77	. 67	1. 55	5. 5
Winter	26. 2	80	−26	1. 99	2. 36	3. 19	1. 64
March	37. 8	90	−17	1. 26	1. 29	. 73	5. 6
April	50. 3	94	−1	2. 35	1. 75	4. 01	1. 9
May	61. 0	104	26	3. 93	1. 29	9. 53	. 2
Spring	49. 7	104	−17	7. 54	4. 33	14. 27	7. 7
June	71. 5	108	36	3. 85	. 71	8. 97	0
July	77. 9	117	46	3. 16	1. 66	6. 48	0
August	75. 6	112	40	2. 99	. 50	3. 66	0
Summer	75. 0	117	36	10. 00	2. 87	19. 11	0
September	66. 3	109	27	2. 55	. 53	5. 67	0
October	54. 0	96	14	1. 55	1. 23	1. 21	[3]
November	38. 9	82	−7	. 92	. 59	2. 40	2. 7
Fall	53. 1	109	−7	5. 02	2. 35	9. 28	2. 7
Year	51. 0	117	−26	24. 55	11. 91	45. 85	26. 8

[1] Average temperature based on a 54-year record, through 1958; highest and lowest temperatures on a 28-year record, through 1958.

[2] Average precipitation based on a 54-year record, through 1958; wettest and driest years based on a 54-year record, in the period 1905–1958; snowfall based on a 28-year record, through 1958.

[3] Trace.

Winters are fairly long and cold. During this season, winds are dominantly from the north and northwest. Most of the winter precipitation occurs as snow when the cold fronts advance. January, the coldest month, has an average temperature of 23.7°, but most of the snow falls in February and March. Blizzards occur nearly every winter, but they usually last less than 12 hours and they are not so severe as they are in the northern part of the State. The coldest temperature ever recorded is −26°.

The average annual precipitation at Grand Island is 24.55 inches. From April through September, the average precipitation is 3.14 inches per month. This occurs as showers and thundershowers. Evaporation during this period is high. From October through March, the average precipitation is only 0.95 inch per month. This occurs as showers late in fall or as snow during winter. Evaporation during this period is low. From 1901 to 1958, annual precipitation of more than 30 inches was reported in only 7 years. During this same period, less than 20 inches was reported in 11 years. Wet years and dry years commonly occur in cycles. Heavy rains in spring sometimes damage growing crops and make replanting necessary. Hail storms in summer and early in fall commonly damage corn, wheat, and other crops extensively.

Frost penetrates to an average depth of 2 feet but has penetrated as much as 4½ feet. During winters that follow a period of dry weather, there is little frost penetration. Wind velocities are highest during March and April when they average 14.3 miles per hour. The yearly average is 12.5 miles per hour.

The relative humidity at noon in January averages 63 percent. It is lowest at noon in September when it averages 43 percent. There are relatively few days during the year when high humidity combines with high temperatures to produce sticky uncomfortable weather. The percentage of clear and sunshiny days is high. Tornadoes have rarely caused extensive damage, but funnel clouds are sometimes seen, particularly in spring.

The average length of the growing season is 161 days, which is long enough for the crops commonly grown to mature. Occasionally, however, a wet spring and a frost early in fall combine to freeze some of the late-maturing corn. The average dates of the growing season are April 28 to October 6. The earliest frost ever recorded in fall was on September 12. The latest frost in spring was on May 24.

The greatest climatic limitation to farming is the lack of sufficient moisture during some seasons. In several droughty years dryland crops were almost a total failure. Drought injury is common on certain soils nearly every year. Good crop yields are produced most of the time if good management, moisture conserving practices, and irrigation are used.

Natural Resources

Because of the extension of irrigation and the need of water for other uses, the water supply in Hall County is becoming increasingly important. Other natural resources in the county are grasslands, woodlands, and sand and gravel pits.

Water

The principal source of surface water in Hall County is the Platte River. Since the completion of Kingsley Dam in Keith County, the Platte River has been dry in summer. The river is not likely to flood now that dams have been constructed upstream. The South Loup River crosses the county in the extreme northwestern corner. In the smaller, intermittent streams, the Wood River and Dry, Sweet, and Prairie Creeks, a considerable amount of water flows after flash rains.

The supply of ground water in the county is contained primarily in Pleistocene sands and gravels, which vary in thickness (fig. 24). The thickness of sand and gravel deposits generally increases as the deposits extend from the western side of the county to the eastern side. Wells drilled near the loess hills northwest of the town of Wood River yield little water for irrigation, but they supply enough for domestic use. Southeast of Grand Island, the water-bearing sand and gravel formation is more than 150 feet thick. The water-bearing sand and gravel throughout much of Hall County is 50 feet or more in thickness. Some of the irrigation wells can discharge more than 1,000 gallons per minute.

The coarse underground sediments in Hall County yield large quantities of good-quality water for industrial, household, and agricultural use. The ground water is recharged, or resupplied, by stream flow of the Platte River and its tributaries, local precipitation, underground movement of water, and seepage of irrigation water. Local precipitation contributes the largest amount. The underground water does not move more than 10 feet per day. Most recharge of ground water from streams takes place in spring and fall after the streams have been dry during the summer (*5*).

The general movement of ground water in the Platte Valley is to the northeast, parallel to the Platte River (fig. 25). In the extreme southeastern part of the county, the ground water moves in a southeasterly direction.

The depth to the ground water (water table) varies considerably. Along the bottom lands, and in some imperfectly drained areas of the terraces, it is at depths of less than 10 feet. In parts of the loessal uplands, it is below 150 feet.

The water table fluctuates in relation to the recharge and discharge of ground water. Small changes in the depth to the water table take place daily in summer, but larger fluctuations occur seasonally. The water table is generally lowest late in the summer after large amounts of water have been removed by irrigation wells and by the evaporation-transpiration of plants. During winter and spring, the water table is at its highest yearly level. There are also large fluctuations associated with wet and dry weather cycles.

From 1953 to 1958, the level of ground water in Hall County has generally lowered, particularly in an area west of Wood River.

The quality of ground water in the county is good, although the water is moderately hard. There are normally from 200 to 600 parts of total dissolved solids per 1,000,000 parts of water. Calcium and bicarbonate are the dominant constituents, and the amounts of iron and manganese are generally small. The temperature of the ground water varies from 53° F. to 55°.

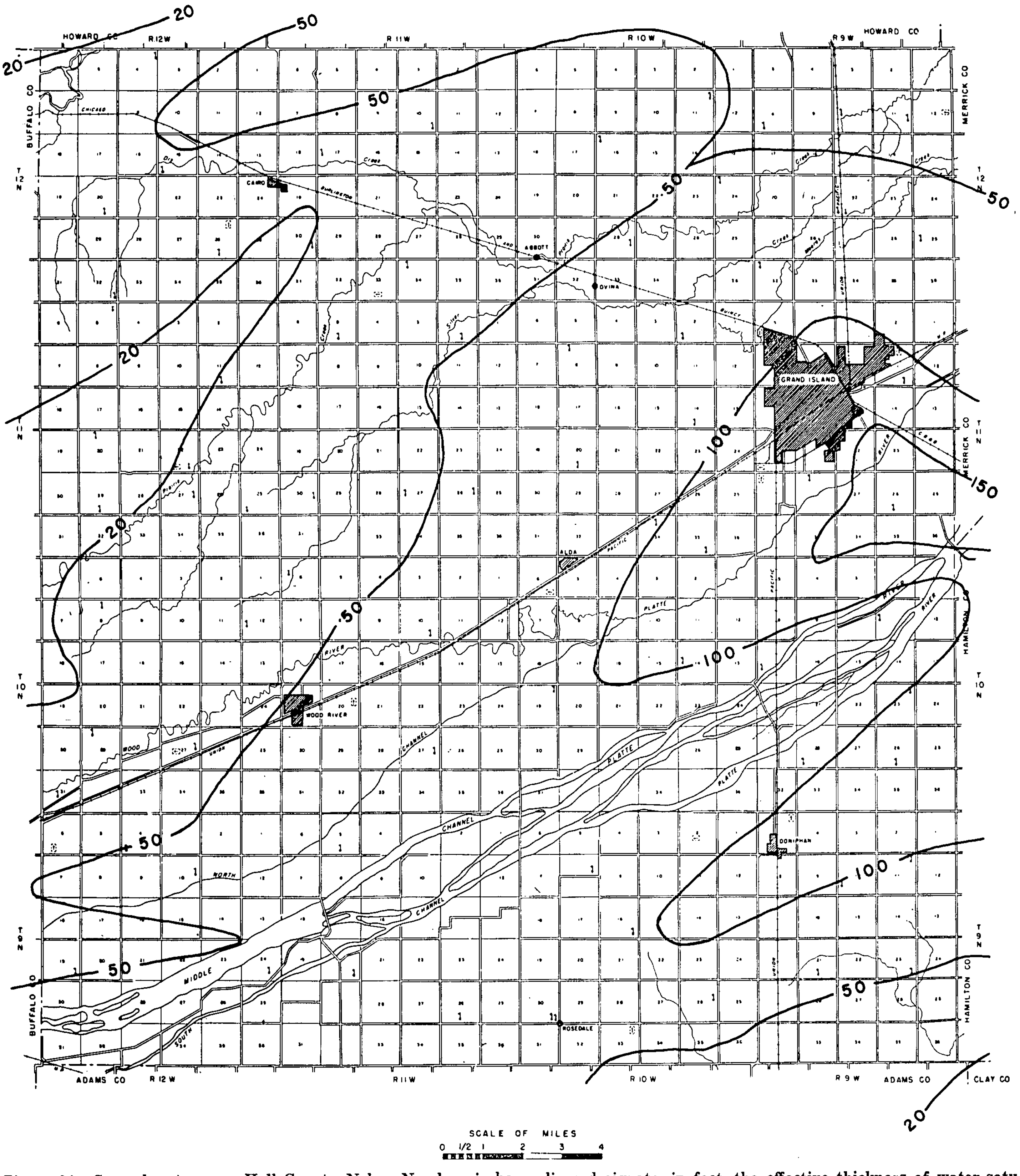

Figure 24.—Ground water map, Hall County, Nebr. Numbers in heavy lines designate, in feet, the effective thickness of water-saturated sand and gravel. Four feet of sand is evaluated as effective as 1 foot of sand and gravel. The 50-foot line designates equal effective thickness of water-saturated sand and gravel in Pleistocene mantlerock. Map does not show the possibility of deeper effective thickness in Ogallala bedrock that may exist in the southwestern part of Hall County.

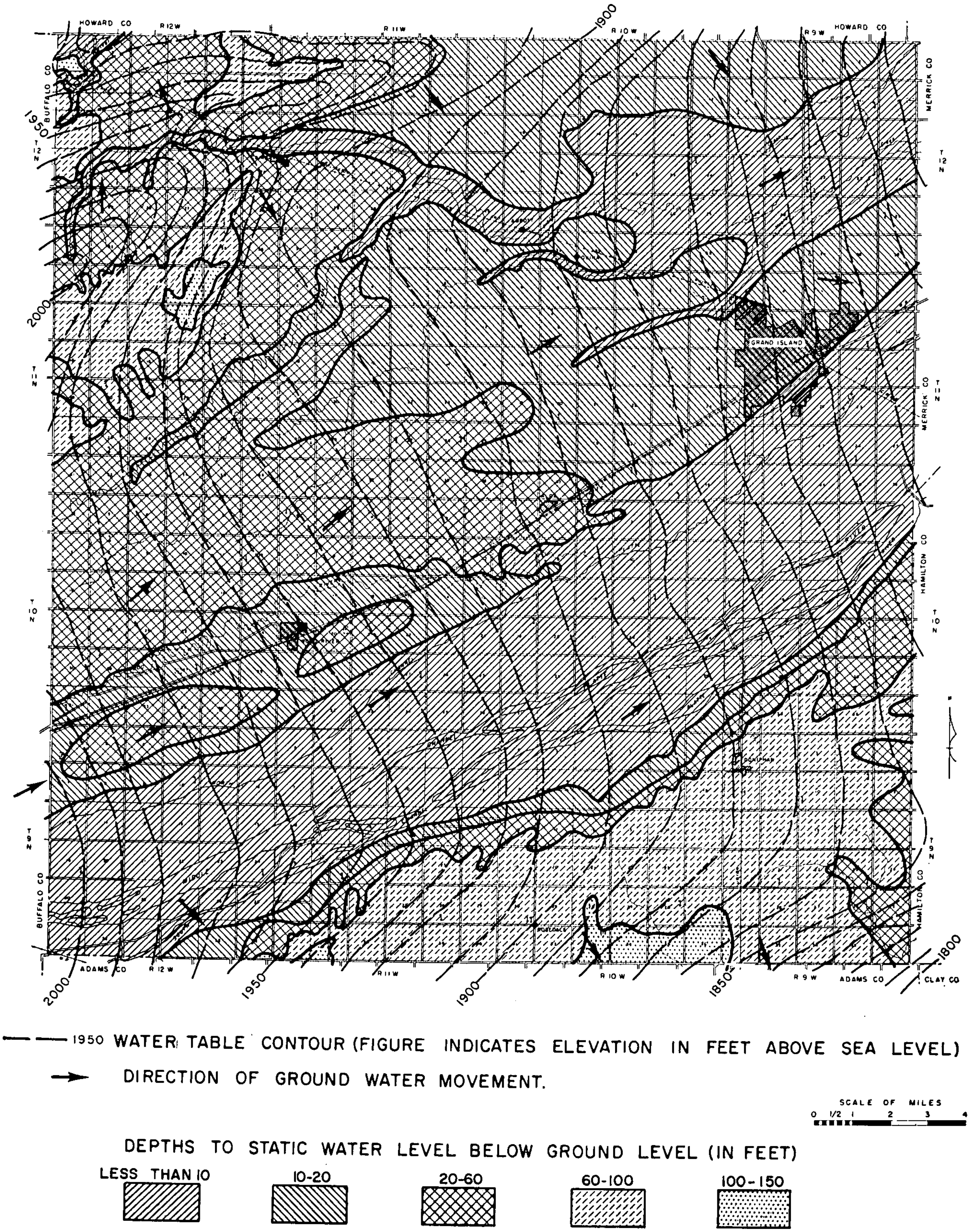

Figure 25.—Ground water map of Hall County, Nebr., showing the direction of general movement of ground water in the county.

Grasslands

In 1954, grass pasture covered 76,349 acres, or 22 percent of the county. Most of this pasture is in the sandhills and the very sandy and shallow bottom-land association. Both areas produce good stands of native grasses that are used to pasture livestock. Many pastures on the bottom lands and some of the more nearly level areas on the sandhills are mowed each fall. Many farms have a small pasture adjacent to the farmstead. Most of these are overstocked and need more careful management.

Improved and tame pastures are fairly common. Bromegrass has been used in many areas on uplands. Grass mixtures that include switchgrass, little bluestem, blue grama, and western wheatgrass are also common. Some tall wheatgrass has been used to reseed areas of alkali soils. Big and little bluestem, prairie sandreed, sand dropseed, and blue grama are the main species in the sandhills. Big and little bluestem, blue grama, switchgrass, and Indiangrass are the main species on the bottom lands and on the imperfectly drained stream terraces.

Native woodlands

According to the 1954 census, there were 546 acres of nonpastured woodland in Hall County. In addition, 485 acres of native woodland were pastured.

Most of the woodlands are along the Platte, Wood, and South Loup Rivers and Prairie Creek. The species of trees that occur on these native sites, along with their use, is discussed in the subsection, Use and Management of Woodlands.

Sand and gravel

Many sand and gravel pits are scattered throughout the bottom lands of the Platte River Valley. Most of the material from these pits is used in the county, but some is hauled by truck and rail to other counties and States.

Irrigation

The development of irrigation in Hall County has changed farming significantly. Many areas that were unproductive, or that frequently had crop loss because of drought, have been irrigated and made productive. Before 1900, many windmills were erected and some of the water pumped by them was used for irrigation. But the total acreage irrigated with water pumped by windmills was small, and this acreage decreased as more modern methods were introduced to drill wells.

Since 1912, when the first irrigation well was drilled in Hall County, the number of these wells in the county has steadily increased. A total of 2,190 wells were reported on December 31, 1957. The following list gives the number of wells in the county at the end of each year listed:

Year	Number of wells
1912	1
1918	2
1919	6
1920	7
1921	9
1922	10
1923	12
1924	15
1925	16
1926	25
1927	43
1928	72
1929	136
1930	202
1931	224
1942	598
1947	1,050
1948	1,210
1949	1,300
1950	1,350
1951	1,410
1952	1,420
1953	1,480
1954	1,686
1955	1,817
1956	1,990
1957	2,190

The first large irrigation project was in an area south and east of Wood River. Its construction lasted from 1920 to 1923. Potatoes, sugar beets, and corn were successfully grown in this irrigated area.

In early years, steam engines were used to furnish some of the power for the pumps but most farmers used old automobile engines. The early pumps were mostly centrifugal. To increase their efficiency, these pumps were placed as close to the water table as possible. Nearly all the pumps installed before 1940 were less than 60 percent efficient. Many of the early wells were not properly located, and large ditches had to be built so that the water could be forced through to the end of the field laterals. Most fields were not leveled, but some farmers tried make-shift leveling so that the irrigation water would reach the end of the field.

During the 1930's, low farm prices kept many farmers from using many of their wells. In 1939, less than half of the irrigation wells in the county were used. By 1941, however, the price trend was up. More efficient pumps and motors were developed, and contracts for land leveling were offered. Soon it appeared that increased production more than offset the cost of pumping (fig. 26). Much of the acreage in the county was suitable for irrigation, and wells soon were scattered throughout the valley. The nearly level soils were irrigated first. Later, when land-leveling equipment was improved, some of the sloping and hummocky areas were leveled and irrigated. Poverty Ridge produced crops comparable to those on the deeper soils, and some of the moderately saline and alkali soils were irrigated.

As more efficient pumps were made, farmers in the loessal uplands south of the Platte Valley began to install wells for irrigation. Most of the irrigation in this part of the county began around 1935, and expansion has been rapid since 1955. In the loessal hills southwest of Cairo, the first wells were drilled in 1948.

Land was still being prepared for irrigation in 1958. The first bench leveling in the county was on a farm northeast of Doniphan in 1956. Some of the shallow soils on bottom lands are successfully irrigated. During the droughty years of 1955 and 1956, the ground-water level was lowered under some of the strongly saline-alkali soils on terraces, and some of these soils were irrigated. Many hummocky areas, once considered to be impractical for irrigation, have recently been leveled and now produce excellent yields.

Figure 26.—**Irrigated and nonirrigated corn on Hord silt loam, 0 to 1 percent slopes. Corn in the foreground was burned beyond recovery during the drought of 1955; irrigated corn in background yielded 80 bushels per acre.**

Improved methods of agricultural engineering and the technical assistance offered by local Soil Conservation Districts were instrumental in helping the farmers to set up efficient irrigation systems. Many of the older systems are being reorganized, and some of the land is being leveled for the second time so that irrigation will be easier and more efficient.

The increase in irrigated land in the county from 1928 to 1957 is shown in figure 27.

In 1957, irrigated land amounted to 131,500 acres, or nearly 59 percent of all cropland in the county. The crops commonly irrigated are corn, sorghum, alfalfa, soybeans, potatoes, sugar beets, and tame pasture. Except on the wet, shallow bottom lands, irrigation is well distributed throughout the Platte Valley. Nearly all of the loessal uplands are irrigated except the steeper and hummocky areas. The sandhills are not irrigated because most of the land is too rolling and sandy and is better suited to grass than to irrigated crops.

The location of the irrigation wells in Hall County is shown in figure 28.

Practically all the present-day pumps are of the turbine type. Most of them are operated by farm tractors (fig. 29). About 650 pumps are electrically operated. Some farmers use stationary motors and gasoline or propane for fuel (fig. 30).

Early History and Population

The first residents in Hall County were Indians. The Pawnee, Missouri, and the Otoe tribes were found living in the Platte River Valley by members of the Lewis and Clark Expedition.

The first white settlement in the county was established on July 4, 1857, by a colony of Germans. These settlers endured many hardships the first years. Supplies were low, blizzards were severe, and there was always the danger of war with the Indians. The settlers raised corn and sold it to the Government for troops at Fort Kearney. In 1859, a prairie fire destroyed nearly all of the houses in the settlement. Other settlers came from Iowa and Germany, and a new community began to grow.

Hall County began to be settled rapidly after the Union Pacific Railroad reached Grand Island in 1868 and the Overland route went westward through this town. By 1870, the year the first newspaper was published, the population of Grand Island was 1,057. A private school had been established in 1862, and 3 years later public schools were started. A Catholic church was established in 1864. From 1874 to 1878, grasshoppers and crop failures caused much financial distress.

Industry began in the county when the Union Pacific Railroad built shops at Grand Island in 1880. In that year, a telephone exchange was established. Ten years later a sugar factory was built to process sugar beets.

Except in the period from 1930 to 1940 when the increase was slight, the population of Hall County increased steadily from 17,206 in 1900 to 32,186 in 1950. The population of the county in 1956 was estimated 36,990. Between 1900 and 1950, the population of Grand Island increased from 7,554 to 22,683. Wood River, Cairo, and Doniphan each have a population of less than 1,000.

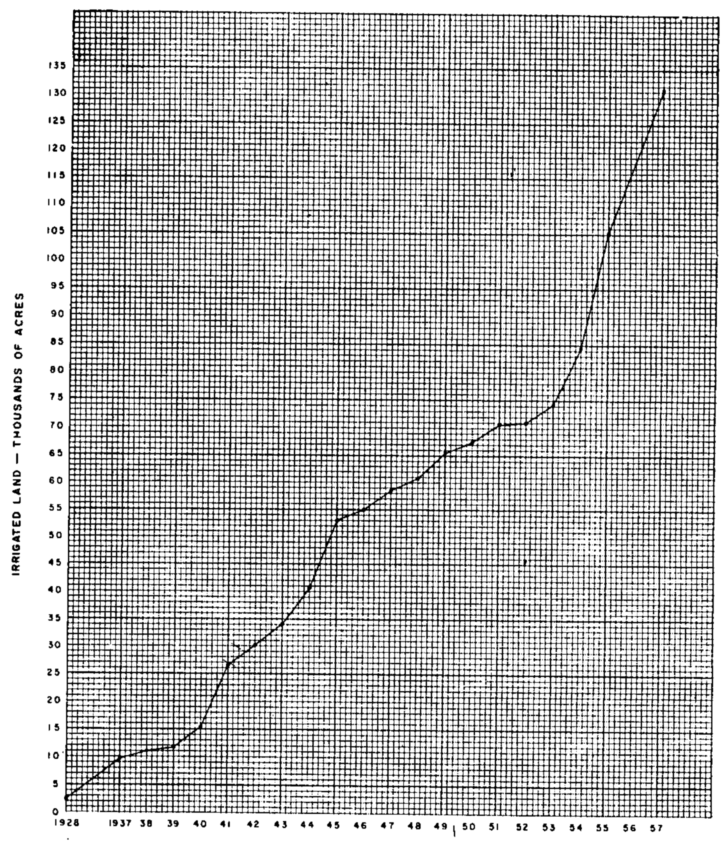

Figure 27.—**Irrigated land in Hall County, 1928 to 1957.**

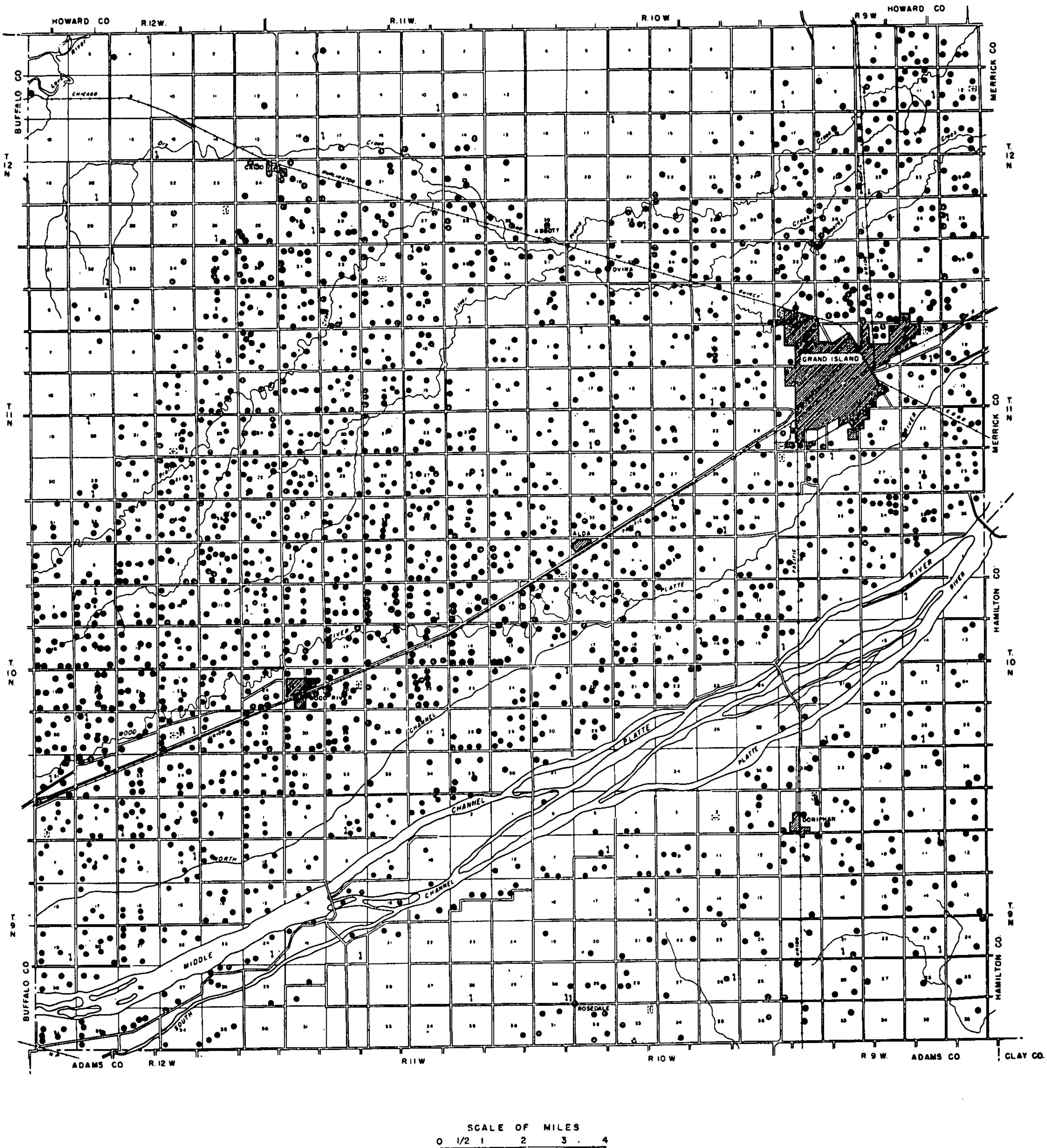

Figure 28.—Irrigation wells in Hall County on December 31, 1957.

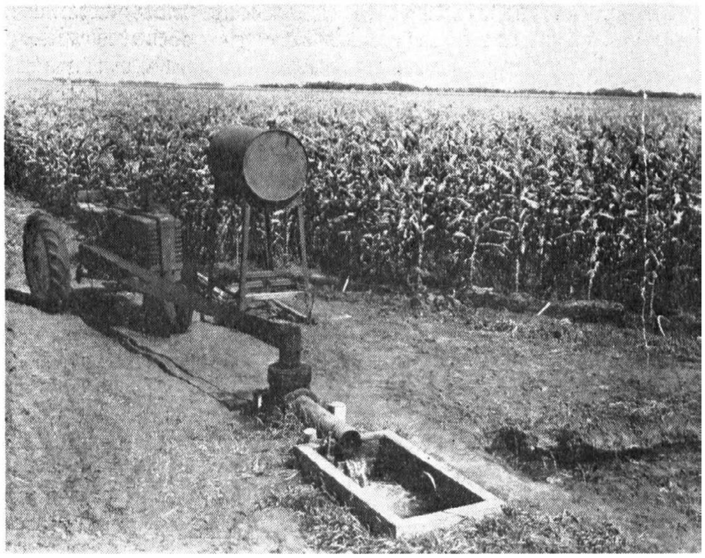

Figure 29.—This type of irrigation system is common in Hall County. The pump is tractor driven. Siphon tubes distribute the water to furrows on leveled land. This soil is Wood River silt loam, 0 to 1 percent slopes.

Transportation and Markets

The Union Pacific and the Chicago, Burlington and Quincy Railroads cross the county and furnish good rail transportation. State Highways 2, 60, and 69, and U.S. Highways 30, 34, and 281 provide automobile and truck outlets to markets. Graveled roads are on most every section line, except in the uplands of the rough sandhills and in some parts of the bottom lands of the Platte River. Rural mail routes reach all parts of the county.

Trunk airlines operate daily from the Grand Island municipal airport. Major trucking companies serve Grand Island and the county. All communities have regular bus service.

Grand Island is the principal farm market in the county. Two large livestock auction-sale establishments receive most of the cattle and hogs, which are then transported to larger markets by rail and truck or returned to the farms for further growth and fattening.

Most of the eggs, poultry, milk, and cream are marketed in Grand Island. Four large dairies and a number of smaller ones supply dairy products to Grand Island and many of the surrounding smaller towns.

Most of the corn, wheat, sorghum, and soybeans are sold to local elevator operators who transport it by rail and truck to larger markets, primarily in Omaha and Chicago. Some grain is trucked directly to Omaha from the farm. Most of the baled native hay is used locally, but in some years much of it is trucked to drought areas, primarily in Kansas, Oklahoma, and Colorado. Potatoes are normally shipped by refrigerator cars to eastern markets. Many of the farmers who live south of the Platte River market their products in Hastings and the nearby towns of Kenesaw, Hansen, and Trumbull.

Industry

All sugar beets grown in the county are processed in Grand Island. Small factories, mostly in Grand Island, produce dried eggs, serums, irrigation equipment, bullets, fertilizers, heating equipment, mattresses, wire fences, cereal products, plastic products, meat products, house trailers, protein supplements for livestock, and talc. Alfalfa dehydrator plants operate in Wood River and Abbott.

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Community Facilities and Recreation

Schools and churches are accessible to all residents of the county. In addition to the grade schools at Cairo, Doniphan, and Wood River, 45 rural grade schools are distributed throughout the county. Some rural schools have been consolidated in recent years. Two high schools are located at Grand Island and one each at Wood River, Cairo, and Doniphan. The Platte Valley Academy near the Buffalo County line is operated by the Seventh-day Adventist church. A music conservatory is in Grand Island.

Grand Island has 28 churches, and the smaller towns have one or more. There are also several rural churches. Three large hospitals are in Grand Island. A public library and a mobile library are available.

Stolley State Park is located at the edge of Grand Island. This city has ten municipal parks with picnic facilities. Available for recreation are a municipal ball park, a stadium, a municipal swimming pool, and two golf courses. Horse races are held at Fonner Park each spring. Hunting is popular in the county. Most fishing is in abandoned gravel pits that have been stocked.

Rural Fuel and Lighting

Electricity is available in all rural areas. All but three farms in the county had electricity in 1954. Natural gas is available to Grand Island and the smaller towns. Fuel oil, propane gas, coal, or wood is used for fuel. Farmers who use natural gas for their irrigation wells have the fuel piped into the house.

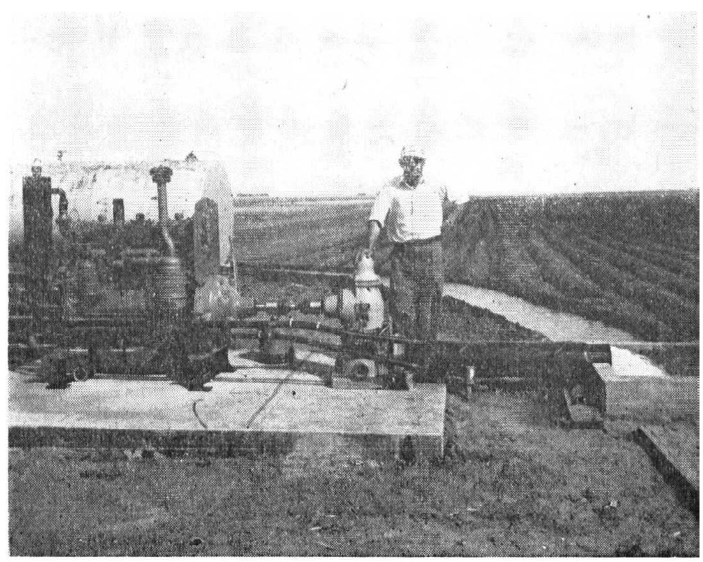

Figure 30.—This modern type turbine pump uses a stationary motor, run by propane fuel, for power. The farmer is fall irrigating Hord silt loam, 0 to 1 percent slopes.

Agriculture

The farming of the first settlers in Hall County consisted mainly of growing corn and wheat. Corn has always been grown more regularly than wheat. Wheat has been grown mainly as a cash crop, and its acreage has fluctuated with its market. Cattle and hogs were raised, but ranching was not so important as it was in the western part of the State.

Farming methods in the county were crude and wasteful at first. Little attention was given to preparing seedbeds, selecting seeds, rotating crops, or fertilizing. Consequently, yields were low. Early agricultural development was greatly retarded by unfamiliarity with the climate, soil needs, and insects, and by a lack of capital. In 1874, grasshoppers destroyed most of the crops; many farmers were forced to leave the county.

Today agriculture consists mainly of crop production, together with a well-balanced livestock program. Corn, wheat, sorghum, and alfalfa are grown on the largest acreages. Soybeans, sugar beets, potatoes, and sweetclover are less extensively grown. Sweetclover, tame grasses, rye, and vetch are used for forage and soil-building crops.

A few milk cows, chickens, and hogs are raised on most farms and are an important source of income. Most farmers raise vegetables on small garden plots.

Irrigation has become important since 1945. In 1956, 38 percent of the county was irrigated.

Crops

The acreage of the principal crops for 1939, 1949, and 1954 are listed in table 14.

Corn.—Corn is the most extensive crop in the county; it is grown on nearly all cultivated soils. The yields vary widely because of differences in the soils, weather, and management, including fertilization. The average yield of corn has increased considerably in recent years, primarily because of irrigation. In addition, more fertilizer is used, varieties of hybrid corn are better adapted, and management has improved. A small part of the corn is hogged down in the field, and some is fed to livestock on the farm. Some is used for silage.

TABLE 14.—*Acreage of principal crops in stated years*

Crop	1939	1949	1954
	Acres	*Acres*	*Acres*
Corn for all purposes	58, 635	105, 788	99, 793
Small grains threshed or combined:			
Wheat	43, 658	36, 705	27, 765
Oats	12, 517	15, 659	21, 531
Barley	19, 483	3, 173	1, 475
Rye	1, 869	910	290
Alfalfa cut for hay	9, 848	17, 176	23, 643
Sorghum for all purposes, except sirup	22, 381	2, 474	8, 742
Soybeans grown for all purposes	97	517	6, 367
Sugar beets harvested for sugar	1, 938	622	1, 279
Irish potatoes harvested for home use or for sale	702	[1] 308	[2] 270

[1] Does not include acreage for farms with less than 15 bushels harvested.

[2] Does not include acreage for farms with less than 20 bushels harvested.

Wheat.—Winter wheat is the second most extensive crop grown in the county. Its acreage fluctuates widely from year to year according to markets and Government programs. Yields fluctuate widely depending on fall and spring rainfall. Wheat is grown on nonirrigated soils, primarily on those in the Hastings, Holdrege, and Wood River series. Normally about 100 acres of spring wheat is grown in the county each year. A small amount is used for chicken feed.

Alfalfa.—The acreage in alfalfa has increased rapidly since 1945. Alfalfa is grown over a wide range of soil conditions and is well distributed throughout the county except for the sandhills and the shallow soils of the stream terraces. It is tolerant of salinity and alkalinity, and it does well on all soils high in lime. About 75 percent of the alfalfa grown in the county is used on the farm, primarily as hay for cattle in winter. About 500 acres were harvested for seed in 1954.

Sorghum.—Grain sorghum grown as a cash crop has increased rapidly in acreage since 1949. Forage sorghum makes up less than 5 percent of all sorghum grown in the county. Hybrid sorghum has been grown since 1955 and is increasing in acreage. Most of the sorghum is now irrigated. When it is grown under dryland conditions, however, the sorghum withstands short periods of drought, resumes growth when it rains, and produces good yields at maturity. Small amounts of sorghum are used for chicken feed. All of the forage sorghum is used on the farm as dry forage or silage.

Oats and sweetclover.—A large acreage of oats was grown in 1954, but the acreage of oats has decreased steadily since 1955. This decrease is a result of a change in cropping. Formerly, most of the oats were planted as a catch crop with sweetclover, which was used as green manure. Most farmers now, however, use a cropping system that requires large amounts of commercial fertilizer and the return to the soil of corn stalks, wheat stubble, beet tops, or other crop residues. Such a system does not include sweetclover as green manure, and oats are not needed as a catch crop with the sweetclover.

Damage by the sweetclover weevil has also caused a decline in the acreage of sweetclover. Some sweetclover and oats are still grown on the light-colored Kenesaw soils in the south-central part of the county.

Most oats are used on the farm to feed livestock, primarily hogs. After the second year's growth, sweetclover is returned to the soil as green manure. Both crops are suited to a wide range in soil conditions.

Soybeans.—The acreage of soybeans has increased rapidly since 1940. All of the soybeans are sold. They are suited to well-drained silty and moderately sandy soils, but yields are low on alkali and very sandy soils. Nearly all of the soybeans are irrigated.

Sugar beets.—The total acreage in sugar beets is small, but this crop is an important cash crop on some farms. Nearly all of the acreage is irrigated. Sugar beets are grown primarily on Hall, Hord, and Wood River soils. They are fairly tolerant of salinity and alkalinity. Yields of 20 tons per acre are not unusual from the best soils under excellent management.

Potatoes.—Commercial potatoes are grown on a relatively small acreage, but they are an important source of income on some farms. Most of the crop is shipped by refrigerator cars to eastern markets, but a small part is consumed locally. Nearly all of the commercial potatoes are grown on irrigated soils. They are grown south and southeast of Wood River on O'Neill soils. They are not well suited to saline and alkali soils or to soils that have a calcareous surface horizon.

Minor crops.—Some barley is grown each year to feed livestock. Rye and vetch are used primarily as cover crops and green-manure crops on the sandy and very sandy soils. Cherries, apples, and pears are produced in a few small orchards for local sale. Some farmers also raise tomatoes, watermelons, cantaloups, and cabbage, which are sold at local stores or roadside stands.

Use of Fertilizer

In the past 10 years, fertilizer has been used increasingly, especially on irrigated land. Its use on nonirrigated land has not been significant, especially in dry years, but it is becoming more important to the agricultural production of the county. Most of the fertilizer used is of high analysis and is applied mainly to corn. In 1954, 841 farms reported that 5,068 tons of commercial fertilizer was applied to 57,461 acres.

Some form of nitrogen is needed for all nonlegume crops that are irrigated. Many farmers apply nitrogen to wheat as soon as the crop begins to grow in spring. Phosphate fertilizer always increases yields on the imperfectly drained soils that have an excess of lime in the surface horizons. Many other soils in the county are low in phosphorus, particularly the alkali and sandy soils. Most soils have sufficient potassium. Additions of zinc have increased yields of corn grown on the imperfectly drained bottom lands. Zinc may also benefit the light-colored areas of the uplands that were cut when the land was leveled. Lime may be needed on the shallow and moderately deep soils on terraces and on the sandy soils on uplands and stream terraces. Apply lime, phosphate, and potash as indicated by soil tests.

Fertilizers can be applied in gas, liquid, or dry form, according to the desires of the farm operator. The county agricultural agent or technicians in the Soil Conservation Service are qualified to suggest the amounts, methods, and proper time to apply fertilizers.

Livestock and Livestock Products

Beef cattle and hogs are the principal livestock. Most well-established farms have one or two milk cows. A few farmers keep flocks of sheep, but the wool and lamb industry is relatively unimportant. The use of horses as draft animals is very limited, but most livestock farms have one or two riding horses. The number of livestock on the farms of the county in 1940, 1950, and 1954 is given in table 15.

Most of the dairy cattle are good grades of Holstein-Friesian, Guernsey, Milking Shorthorn, and Jersey; some purebred herds are also in the county.

Cattle feeding is the most important livestock enterprise in the county. The pastures of the sandhills and bottom lands furnish excellent grass for many herds of beef cattle, which are fattened in both large and small feedlots. The beef cattle are mainly Herefords. Aberdeen-Angus is the second most numerous breed, and Shorthorns, third. Most of the beef cattle are from good-grade cows and purebred sires.

TABLE 15.—*Number of livestock on farms in stated years*

Livestock	1940	1950	1954
	Number	*Number*	*Number*
Cattle and calves	[1] 22, 230	33, 503	52, 611
Horses and/or mules	[1] 4, 967	1, 658	761
Hogs and pigs	[2] 10, 212	25, 829	29, 482
Sheep and lambs	[3] 8, 707	4, 876	8, 488
Chickens	[2] 120, 711	[2] 132, 418	[2] 139, 233
Turkeys raised	3, 172	13, 901	21, 881
Ducks raised	2, 396	1, 686	3, 198

[1] Over 3 months old.
[2] Over 4 months old.
[3] Over 6 months old.

Hampshire, Duroc Jersey, and Spotted Poland China are the most common breeds of hogs. The Yorkshire breed has become increasingly popular in recent years.

Most of the chicken flocks on farms are Leghorns or a Leghorn cross. The broiler industry uses mainly New Hampshire and White Rock breeds. Commercial producers of turkeys raise heavy breeds, but a few smaller Beltsville Whites are also raised. Since 1940, the commercial production of turkeys has grown rapidly.

The amount of livestock products and the number of livestock sold alive or butchered in 1954 were as follows:

Whole milk sold .... pounds	9, 434, 509
Cream sold (butterfat) .... pounds	542, 859
Wool shorn .... pounds	45, 461
Chickens sold	714, 072
Eggs sold .... dozen	929, 706
Cattle and calves sold alive	40, 197
Hogs and pigs sold alive	41, 278
Sheep and lambs sold alive	9, 232
Horses and mules sold alive	89

Most of the feed for livestock, except protein or protein supplements, is produced on farms. The protein concentrates generally are purchased. Most poultry feed, except corn, is purchased. In 1954, 1,226 farms reported the purchase of feed. Much of the native hay is baled and used within the county.

Land Use

The number and average size of farms and the farm acreage for the years 1940, 1950, and 1954 are shown in table 16. As shown in this table, there has been a decrease in number of farms and an increase in the average size of farms. The percentage of the county in farms decreased slightly between 1940 and 1950.

TABLE 16.—*Number, average size of farms, and the farm acreage in stated years*

Year	Total farms	Land in farms	Land not in farms	Part of county in farms	Average size of farms
	Number	*Acres*	*Acres*	*Percent*	*Acres*
1940	1, 567	323, 951	21, 649	93. 7	206. 7
1950	1, 396	309, 736	35, 864	89. 7	221. 9
1954	1, 386	316, 293	29, 307	91. 5	228. 2

In 1942, the U.S. Army purchased 12,800 acres of land west of Grand Island. Most of this land was not farmed during World War II, but, since the war ended, much of it has been leased to farmers.

Between 1953 and 1958, some of the less desirable soils in the county, including the Platte, O'Neill, and Thurman soils, have been converted from native pasture to irrigated cropland. Only a small total acreage of cropland has been reseeded to permanent grass. Shelterbelts are common throughout the county, and most farmsteads have windbreaks. Only about 1,000 acres of native woodland remained in 1954. Most of this land is on islands in the Platte River and in areas adjacent to the river.

The conversion of dryland farming to irrigated farming greatly changed the type of agriculture in Hall County. Most of this change was on the better soils. The conversion was gradual from 1937 to 1952, but, stimulated by droughty years, it was more rapid from 1952 to 1957. In 1957, 131,500 acres were irrigated in the county.

In 1954 acreages of cropland, woodland, and pasture were reported as follows:

	Acres
Cropland	224, 460
Harvested	205, 208
Used only for pasture	10, 358
Not harvested and not pastured (includes crop failure, idle, and fallow)	8, 894
Woodland	1, 031
Pastured	485
Not pastured	546
Other land pastured (not cropland and not woodland)	76, 349
All other land (including house lots, barnyards, feedlots, roads, and wasteland)	14, 453

Types and Sizes of Farms

Field crop, livestock, and general farms are the principal types of farms in the county. The number and types of farms in 1954 were as follows:

Type of farm	*Number of farms*
Field crop	607
Cash grain	592
Other field crops	15
Livestock	421
Dairy	40
Poultry	11
Livestock other than dairy and poultry	370
General	255
Primarily crop	15
Primarily livestock	30
Crop and livestock	210
Miscellaneous and unclassified	103

In 1954, the 1,386 farms in the county ranged in size from less than 10 to more than 1,000 acres. Of this total number, 95 farms had less than 10 acres; 111 from 10 to 49 acres; 123 from 50 to 99; 358 from 100 to 179; 275 from 180 to 259; and 412 from 260 to 999. Twelve farms were 1,000 acres or more in size.

Farm Tenure and Labor

In 1954, owners or part owners operated 766 farms, or 55.3 percent of all the farms; tenants operated 614 farms, or 44.3 percent; and managers, 6 farms, or 0.4 percent. There were 58 cash tenants, 324 share-cash tenants, 202 share tenants and croppers, and 30 others. In the areas of the sandhills most of the farms are owner operated. Leases or arrangements between owners and tenants are generally for 1 year. Every year there is a shifting of tenants. The size of the operating unit tends to increase.

The total land in farms in 1954 was 316,293 acres, or 91.5 percent of the total area of the county. The percentage of this acreage that is rented is slightly larger than that operated by the owner.

In the week from September 26 to October 2, 1954, a period of peak farm employment, the number of workers on 1,358 farms, including family members and hired help, totalled 2,960 workers. Of this number, 225 farms reported 592 hired workers. The supply of labor is generally adequate except during the sugar beet season when farmers need help in thinning and harvesting the beets. Mechanization of beet harvesting equipment, however, is gradually reducing the need for outside labor.

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Glossary

Acid soil. Generally, a soil that is acid throughout most or all of the parts that plant roots penetrate. Commonly, only the plow layer or some other specific layer or horizon is designated acid. Practically, an acid soil is one that has a pH value less less than 6.6; precisely, a soil with a pH value less than 7.0. A soil containing a preponderance of hydrogen over hydroxyl ions.

Aeration, soil. Replacement of air in soil by air from the atmosphere. The composition of the air in a well-aerated soil is similar to the composition of air in the atmosphere; in a poorly aerated soil, the air in the soil contains considerably more carbon dioxide and less oxygen than the atmosphere.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has such a high degree of alkalinity that the growth of most crop plants is hindered. It has a pH value of at least 8.5 and a percentage of exchangeable sodium of at least 15 percent, or both. The term is also applied by some to those uncommon soils that contain sodium carbonate or other highly alkaline salts. In former years this term was also applied loosely to both alkali and saline soils.

Alkaline soil. Generally, a soil that is alkaline throughout most or all parts occupied by plant roots. The term is commonly applied to a specific layer, or horizon, of a soil. Precisely, any soil horizon having a pH value greater than 7.0; practically, a soil having a pH greater than 7.3.

Alluvium. Sand, mud, and other sediments deposited on land by streams.

Buried soil. A former soil profile that has been buried by the material in which the present soil is developing.

Calcareous soil. A soil alkaline in reaction because of the presence of calcium carbonate. A soil containing enough calcium carbonate to effervesce (fizz) when treated with dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that contains 40 percent or more of clay, less than 45 percent of sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon rich in clay and separated more or less abruptly from the overlying soil. Claypans are commonly hard when dry and plastic or stiff when wet.

Colloid, soil. Colloid refers to organic or inorganic matter having very small particle size and a correspondingly large surface area per unit of mass. Most colloidal particles are too small to be seen with the ordinary compound microscope. Soil colloids do not go into true solution as sugar or salt does, but they may be dispersed into a relatively stable suspension and thus be carried in moving water.

Colluvium. Mixed deposits of soil material and rock fragments near the base of rather steep slopes. The deposits have accumulated through soil creep, slides, and local wash.

Complex, soil. An intimate mixture of tiny areas of different kinds of soil that are too small to be shown separately on a publishable soil map. The whole group of soils must be shown together as a mapping unit and described as a pattern of soils.

Concretions. Hard grains, pellets, or nodules from concentrations of compounds in the soil that cement the soil grains together. The composition of some concretions is unlike that of the surrounding soil. Concretions can be of various sizes, shapes, and colors.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants when other factors of growth, such as light, moisture, temperature, and the physical condition of the soil, are favorable.

Genesis, soil. The mode of origin of the soil. A discussion of soil genesis ought to refer to the processes responsible for the development of the solum, or true soil, from the unconsolidated parent material.

Green-manure crop. Any crop grown and plowed under for the purpose of improving soil, especially by adding organic matter.

Internal drainage. The movement of water through the soil profile. The rate of movement is affected by the texture of the surface soil and subsoil, and by the height of the permanent or perched ground water table. Relative terms for expressing internal drainage are *very rapid, rapid, medium, slow, very slow,* and *none.*

Leaching, soil. Removal of materials in solution.

Loam. The textural class name for soil having a moderate amount of sand, silt, and clay. Loam soils contain 7 to 27 percent of clay, 28 to 50 percent of silt, and less than 52 percent of sand. As used in the United States, the term refers only to the relative amounts of sand, silt, and clay; loam soils may or may not be mellow.

Loess. Geological deposit of relatively uniform fine material that is mostly silt and presumably was transported by wind. Many unlike kinds of soil in the United States have developed from loess blown out of alluvial valleys and from other deposits during periods of aridity.

Morphology, soil. The physical constitution of the soil, including the thickness and arrangement of the soil horizons in the soil profile and the texture, structure, consistence, color, and other physical and chemical properties of these horizons.

Mottled. Marked with spots of color and usually associated with poor drainage. Descriptive terms for mottles follow: Contrast—*faint, distinct*, and *prominent;* abundance—*few, common*, and *many*; and size—*fine, medium*, and *coarse*. The size measurements are as follows: Fine, commonly less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, commonly ranging between 5 and 15 millimeters (about 0.2 to 0.6 inch) along the greatest dimension; and coarse, commonly more than 15 millimeters (about 0.6 inch) along the greatest dimension.

Natural drainage. Conditions of drainage that existed during the development of the soil as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by factors such as sudden deepening of channels or blocking of drainage outlets. The following relative terms are used to express natural drainage: *Excessively drained, somewhat excessively drained, well drained, moderately well drained, imperfectly* or *somewhat poorly drained, poorly drained*, and *very poorly drained.*

Nutrients, plant. The elements essential to plant growth that may be taken in by plants. They include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from air and water.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. The permeability of a soil may be limited by the presence of one nearly impermeable horizon even though the others are permeable.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil mass, expressed in either pH value or in words, as follows (*9*):

	pH
Extremely acid	Below 4.5.
Very strongly acid	4.5–5.0.
Strongly acid	5.1–5.5.
Medium acid	5.6–6.0.
Slightly acid	6.1–6.5.
Neutral	6.6–7.3.
Mildly alkaline	7.4–7.8.
Moderately alkaline	7.9–8.4.
Strongly alkaline	8.5–9.0.
Very strongly alkaline	9.1 and higher.

Relief. Elevations or inequalities of the land surface, the slope gradient, and the pattern of these, considered collectively.

Runoff. The amount of water removed by flow over the surface of the soil and the rapidity of this flow. The amount and rapidity of runoff are affected by factors such as texture, structure, and porosity of the surface soil; the vegetative covering; the prevailing climate; and the slope. Relative degree of runoff is expressed in six classes as follows: *Very rapid, rapid, medium, slow, very slow*, and *ponded.*

Saline soil. A soil containing enough soluble salts to impair its productivity for plants but not containing an excess of exchangeable sodium.

Saline-alkali soil. A soil having a combination of a harmful quantity of salts and either a high degree of alkalinity or a high amount of exchangeable sodium, or both, so distributed in the soil profile that the growth of most crop plants is less than normal.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.5 millimeter to 2.0 millimeters. Usually sand grains consist chiefly of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more of sand and not more than 10 percent of clay.

Silt. (1) Individual mineral particles of soil that range in diameter between the largest size of clay, 0.002 millimeter, and the smallest size of very fine sand, 0.05 millimeter. (2) Soils of the textural class silt that contain 80 percent or more of silt and less than 12 percent of clay. (3) Sediments deposited from water in which the individual grains are approximately of the size of silt, although the term is sometimes applied loosely to sediments containing considerable sand and clay.

Soil. (1) The natural medium for the growth of land plants. (2) A dynamic natural body on the surface of the earth in which plants grow, composed of mineral and organic materials and living forms. (3) The collection of natural bodies occupying parts of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter acting upon parent material, as conditioned by relief, over periods of time. A soil is an individual three-dimensional body on the surface of the earth unlike the adjoining bodies.

Soil association. A group of defined and named kinds of soil associated together in a characteristic geographic pattern. Except on detailed soil maps, it is not possible to delineate the various kinds of soil; therefore, on small-scale soil maps, the areas shown consist of soil associations or two or more kinds of soil that are geographically associated.

Soil conservation. The efficient use and stability of each area of soil that is needed for use at its optimum level of developed productivity according to the specific patterns of soil and water resources of individual farms, ranches, forests, and other land-management units. The term includes the positive concept of improvement of soils for use as well as their protection and preservation.

Subsoil. The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil), in which roots normally grow. Although a common term, it cannot be defined accurately. It has been carried over from early days when "soil" was conceived only as the plowed soil and that under it as the "subsoil."

Substratum. Any layer lying beneath the solum, or true soil. It is applied to both parent materials and to other layers unlike the parent material that are below the B horizon or the subsoil.

Terrace. An embankment or ridge constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff in order to retard it for infiltration into the soil and so that any excess may flow slowly to a prepared outlet without harm.

Terrace (Geological). A nearly flat or undulating plain, commonly rather narrow and usually with a steep front, bordering a river, a lake, or the sea. Although many old terraces have become more or less hilly through dissection by streams, they are still regarded as terraces.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil. Specifically, it refers to the proportions of sand, silt, and clay.

Tilth, soil. The physical condition of a soil in respect to its fitness for the growth of a specified plant or sequence of plants. Ideal soil tilth is not the same for each kind of crop nor is it uniform for the same kind of crop growing on contrasting kinds of soil.

Water-holding capacity. The capacity (or ability) of soil to hold water. The moisture-holding capacity of sandy soils is usually low, and that of clay is high. This property is often expressed in inches of water per foot depth of soil.

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SUMMARY OF THE IMPORTANT CHARACTERISTICS

Map symbol	Soil	Depth of soil material	Surface layers			Subsoil
			Thickness	Color (dry)	Consistence (moist)	Texture
		Inches	*Inches*			
Sy	Alluvial land	36–60+	6–12	Gray to dark gray	Friable	Loamy, in places stratified with clay.
Ba	Barney loam	10–20	5–10	Gray to dark gray	Friable	Stratified loam, silt loam, very fine sandy loam, or sandy loam.
Bl	Broken land	48–60+	0–6	Gray	Friable	Variable
Bu	Butler silt loam	60+	10–18	Dark grayish brown	Friable	Silty clay or clay
3Cs	Cass fine sandy loam, deep	36–60+	6–18	Gray to dark grayish brown.	Very friable	Fine sandy loam
Cs	Cass fine sandy loam	20–36	6–18	Gray to dark grayish brown.	Very friable	Sandy loam
3Cm	Cass loam, deep	36–60+	6–18	Gray to dark grayish brown.	Friable	Sandy loam
Cm	Cass loam	20–36	6–18	Gray to dark grayish brown.	Friable	Sandy loam
CbC	Colby silt loam, 7 to 11 percent slopes.	60+	0–6	Grayish brown	Friable	Silt loam
CbD	Colby silt loam, 11 to 30 percent slopes.	60+	0–6	Grayish brown	Friable	Silt loam
Es	Elsmere fine sandy loam	60+	8–14	Gray to very dark gray	Very friable	Loamy fine sand
Ea	Elsmere loamy fine sand	36–72+	8–16	Gray to very dark gray	Very friable	Loamy fine sand
E-Ws	Exline-Wood River fine sandy loams.	48+	1–10	Gray to grayish brown	Very friable	Silty clay loam or silty clay.
E-W	Exline-Wood River silt loams	48+	1–10	Gray to grayish brown	Friable	Silty clay loam or silty clay.
Fm	Fillmore silt loam	60+	10–16	Gray to dark gray	Friable	Silty clay
Ha	Hall silt loam, 0 to 1 percent slopes.	36–60+	10–18	Gray to dark grayish brown.	Friable	Silty clay loam
HaA	Hall silt loam, 1 to 3 percent slopes.	36–60+	8–14	Gray to dark grayish brown.	Friable	Silty clay loam
HaB2	Hall silt loam, 3 to 7 percent slopes, eroded.	36–60+	6–12	Gray to dark gray	Friable	Silty clay loam
H-O	Hall-O'Neill complex, 0 to 1 percent slopes.	10–60+	5–12	Gray to dark grayish brown.	Friable	Silty clay or sandy loam
Hs	Hastings silt loam, 0 to 1 percent slopes.	60+	10–18	Dark grayish brown	Friable	Silty clay loam
HsA	Hastings silt loam, 1 to 3 percent slopes.	60+	10–18	Dark grayish brown	Friable	Silty clay loam
HsB2	Hastings silt loam, 3 to 7 percent slopes, eroded.	60+	4–12	Dark grayish brown	Friable	Silty clay loam
Hs3	Hastings complex, severely eroded.	60+	0–8	Light gray to light brownish gray.	Friable	Silty clay loam
Hb	Hobbs silt loam, 0 to 1 percent slopes.	60+	6–18	Gray to dark grayish brown.	Friable	Silt loam
HbA	Hobbs silt loam, 1 to 3 percent slopes.	60+	8–12	Gray to dark grayish brown.	Friable	Silt loam
Ho	Holdrege silt loam, 0 to 1 percent slopes.	60+	10–18	Dark grayish brown	Friable	Heavy silt loam or light silty clay loam.
HoA	Holdrege silt loam, 1 to 3 percent slopes.	60+	10–30	Dark grayish brown	Friable	Heavy silt loam or light silty clay loam.
HoB	Holdrege silt loam, 3 to 7 percent slopes.	60+	10–30	Dark grayish brown	Friable	Heavy silt loam or light silty clay loam.
HoB2	Holdrege silt loam, 3 to 7 percent slopes, eroded.	60+	4–12	Grayish brown to light brownish gray.	Friable	Heavy silt loam or light silty clay loam.
HoC	Holdrege silt loam, 7 to 11 percent slopes.	60+	8–18	Dark grayish brown	Friable	Heavy silt loam or light silty clay loam.
HoC2	Holdrege silt loam, 7 to 11 percent slopes, eroded.	60+	4–12	Grayish brown to light brownish gray.	Friable	Heavy silt loam or light silty clay loam.
H-C3	Holdrege-Colby complex, severely eroded.	60+	0–8	Grayish brown to pale brown.	Friable	Heavy silt loam or light silty clay loam.
Hd	Hord silt loam, 0 to 1 percent slopes.	36–60+	12–18	Dark grayish brown	Friable	Heavy silt loam to very fine sandy loam.
HdA	Hord silt loam, 1 to 3 percent slopes.	36–60+	12–18	Dark grayish brown	Friable	Heavy silt loam to very fine sandy loam.
HdB2	Hord silt loam, 3 to 7 percent slopes, eroded.	36–60+	4–12	Grayish brown to light brownish gray.	Friable	Heavy silt loam to very fine sandy loam.

OF THE SOILS IN HALL COUNTY, NEBR.

Subsoil—Continued		Runoff	Permeability		Water-holding capacity
Color (dry)	Consistence (moist)		Surface soil	Subsoil	
Grayish brown	Friable	Medium	Moderate	Moderate	Medium.
Grayish brown	Friable	Very slow	Moderate	Very rapid	Very low.
Grayish brown to pale brown	Friable	Very rapid	Moderate	Moderate	Medium.
Gray to dark gray	Very firm	Slow	Moderate	Slow	High.
Grayish brown	Very friable	Slow	Moderately rapid	Moderately rapid	Moderately low.
Grayish brown	Very friable	Slow	Moderately rapid	Moderately rapid	Low.
Grayish brown	Very friable	Medium	Moderate	Moderately rapid	Moderately low.
Grayish brown	Very friable	Medium	Moderate	Moderately rapid	Low.
Light gray to very pale brown	Friable	Rapid	Moderate	Moderate	Medium.
Light gray to very pale brown	Friable	Very rapid	Moderate	Moderate	Medium.
Light brownish gray to grayish brown.	Loose	Slow	Moderately rapid	Very rapid	Very low.
Light brownish gray	Very friable	Slow	Rapid	Rapid	Low.
Grayish brown to dark grayish brown.	Very firm	Slow	Moderately rapid	Very slow	High.
Grayish brown to dark grayish brown.	Very firm	Slow	Moderate	Very slow	High.
Grayish brown to dark grayish brown.	Very firm	Ponded	Moderate	Very slow	High.
Grayish brown	Firm	Slow	Moderate	Moderately slow	High.
Grayish brown	Firm	Medium	Moderate	Moderately slow	High.
Grayish brown	Firm	Rapid	Moderate	Moderately slow	High.
Light brownish gray	Very friable	Slow	Moderate	Moderately slow	Low.
Grayish brown	Firm	Slow	Moderate	Moderately slow	High.
Grayish brown	Firm	Medium	Moderate	Moderately slow	High.
Grayish brown	Firm	Rapid	Moderate	Moderately slow	High.
Grayish brown to pale brown	Firm	Rapid	Moderate	Moderately slow	High.
Grayish brown to dark gray	Friable	Medium	Moderate	Moderate	Medium.
Grayish brown to dark gray	Friable	Medium	Moderate	Moderate	Medium.
Grayish brown	Friable	Slow	Moderate	Moderate	Medium.
Grayish brown	Friable	Medium	Moderate	Moderate	Medium.
Grayish brown	Friable	Rapid	Moderate	Moderate	Medium.
Grayish brown	Friable	Rapid	Moderate	Moderate	Medium.
Grayish brown	Friable	Rapid	Moderate	Moderate	Medium.
Grayish brown	Friable	Rapid	Moderate	Moderate	Medium.
Grayish brown	Friable	Rapid	Moderate	Moderate	Medium.
Grayish brown	Friable	Slow	Moderate	Moderate	Medium.
Grayish brown	Friable	Medium	Moderate	Moderate	Medium.
Grayish brown	Friable	Rapid	Moderate	Moderate	Medium.

SUMMARY OF THE IMPORTANT CHARACTERISTICS

Map symbol	Soil	Depth of soil material	Surface layers			Subsoil
			Thickness	Color (dry)	Consistence (moist)	Texture
		Inches	*Inches*			
2HdA	Hord silt loam, thin solum variant, 0 to 3 percent slopes.	36–72+	4–12	Light brownish gray to grayish brown.	Friable	Silt loam to clay loam
2HdB	Hord silt loam, thin solum variant, 3 to 7 percent slopes.	36–72+	4–12	Light brownish gray to grayish brown.	Friable	Silt loam to clay loam
H–N	Hord-O'Neill complex, 0 to 1 percent slopes.	10–60	6–14	Dark gray to dark grayish brown.	Very friable	Heavy silt loam to very fine sandy loam.
Ks	Kenesaw silt loam, 0 to 1 percent slopes.	60+	4–10	Gray to grayish brown	Friable	Silt loam
KsA	Kenesaw silt loam, 1 to 3 percent slopes.	60+	4–10	Gray to grayish brown	Friable	Silt loam
KsB	Kenesaw silt loam, 3 to 7 percent slopes.	60+	0–10	Gray to grayish brown	Friable	Silt loam
La	Lamoure silt loam	36–72	8–16	Gray to dark gray	Friable	Silty clay
2La	Lamoure silt loam, saline	36–72	8–16	Gray to dark gray	Friable	Silty clay
Lf	Leshara fine sandy loam	36–72	8–14	Gray to dark grayish brown.	Very friable	Silt loam or very fine sandy loam.
Le	Leshara silt loam	36–72	8–14	Gray to dark grayish brown.	Friable	Silt loam or very fine sandy loam.
2Le	Leshara silt loam, saline	36–72	8–16	Gray to dark grayish brown.	Friable	Silt loam or very fine sandy loam.
Lm	Loup loam	60+	6–12	Gray to grayish brown	Friable to firm.	Fine and medium sands
MdB	Meadin loamy sand, 3 to 11 percent slopes.	6–20	2–8	Grayish brown	Very friable	Coarse sandy loam or loamy sand.
Ms	Meadin sandy loam, 0 to 1 percent slopes.	10–20	4–10	Gray to grayish brown	Very friable	Coarse sandy loam or loamy sand.
Ok	O'Neill loam, 0 to 1 percent slopes.	20–36	8–14	Dark grayish brown to dark gray.	Friable	Sandy loam
OkB2	O'Neill loam, 3 to 5 percent slopes, eroded.	20–36	6–10	Dark grayish brown to grayish brown.	Friable	Sandy loam
Om	O'Neill sandy loam, 0 to 1 percent slopes.	20–36	8–14	Dark grayish brown to dark gray.	Very friable	Sandy loam
OmB2	O'Neill sandy loam, 3 to 7 percent slopes, eroded.	20–36	6–10	Dark grayish brown to grayish brown.	Very friable	Sandy loam
OrA	Ortello fine sandy loam, 0 to 3 percent slopes.	36–72+	8–14	Dark gray to grayish brown.	Friable	Sandy loam
OrB	Ortello fine sandy loam, 3 to 7 percent slopes.	36–72+	8–14	Dark gray to grayish brown.	Very friable	Sandy loam
2Or	Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.	42–60+	7–14	Gray to grayish brown	Friable	Sandy loam
2OrB	Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.	60+	8–14	Gray to grayish brown	Friable	Sandy loam
Ot	Ortello loam, 0 to 1 percent slopes.	36–72+	8–20	Gray to grayish brown	Friable	Sandy loam
Ov	Ovina fine sandy loam	42–60+	6–12	Dark gray	Very friable	Fine sandy loam
Oa	Ovina loamy fine sand	52+	7–14	Gray to grayish brown	Very friable	Fine sandy loam
Pt	Platte loam	10–20	3–12	Gray to dark gray	Friable	Stratified silt loam, loam, and very fine sandy loam.
P–S	Platte-Sarpy complex	10–60+	3–12	Dark gray to grayish brown.	Friable to loose.	Stratified silt loam, loam, and very fine sandy loam.
2P–S	Platte-Sarpy complex, channeled.	10–60+	3–12	Dark gray to grayish brown.	Friable to loose.	Stratified silt loam, loam, and very fine sandy loam.
P–W	Platte-Wann complex	10–48+	3–14	Gray to grayish brown	Friable to very friable.	Stratified silt loam, loam, and very fine sandy loam.
2P–W	Platte-Wann complex, channeled.	10–48+	3–14	Gray to grayish brown	Friable to very friable.	Stratified silt loam, loam, and very fine sandy loam.
Rw	Riverwash	0–8	0–8	Grayish brown to very pale brown.	Loose	

OF THE SOILS IN HALL COUNTY, NEBR.—Continued

Subsoil—Continued		Runoff	Permeability		Water-holding capacity
Color (dry)	Consistence (moist)		Surface soil	Subsoil	
Light brownish gray	Friable	Slow	Moderate	Moderate	Medium.
Light brownish gray	Friable	Medium	Moderate	Moderate	Medium.
Light brownish gray to grayish brown.	Very friable	Slow	Moderate	Moderately slow	Low.
Grayish brown to pale brown	Friable	Slow	Moderate	Moderate	Medium.
Grayish brown to pale brown	Friable	Medium	Moderate	Moderate	Medium.
Grayish brown to pale brown	Friable	Rapid	Moderate	Moderate	Medium.
Gray to dark gray	Very firm	Slow	Moderate	Slow	High.
Gray to dark gray	Very firm	Slow	Moderate	Slow	High.
Light gray to grayish brown	Friable	Slow	Moderate	Moderate	High.
Light gray to grayish brown	Friable	Slow to medium	Moderate	Moderate	High.
Light gray to grayish brown	Firm	Slow to medium	Moderate	Moderately slow	High.
Grayish brown	Loose	Very slow	Moderate	Rapid	Medium.
Brown to light brownish gray	Very friable	Very rapid	Rapid	Very rapid	Very low.
Brown to light brownish gray	Very friable	Slow	Moderately rapid	Very rapid	Very low.
Grayish brown	Very friable	Slow	Moderate	Moderately rapid	Low.
Grayish brown	Very friable	Rapid	Moderate	Moderately rapid	Low.
Grayish brown	Very friable	Slow	Moderately rapid	Moderately rapid	Low.
Grayish brown	Very friable	Rapid	Moderately rapid	Moderately rapid	Low.
Grayish brown to light brownish gray.	Very friable	Slow	Moderately rapid	Moderately rapid	Moderately low.
Grayish brown to light brownish gray.	Very friable	Moderately rapid	Moderately rapid	Moderately rapid	Moderately low.
Grayish brown to light brownish gray.	Very friable	Slow	Moderately rapid	Moderately rapid	Medium.
Grayish brown to light brownish gray.	Very friable	Moderately rapid	Moderately rapid	Moderately rapid	Medium.
Grayish brown to light brownish gray.	Very friable	Slow	Moderate	Moderately rapid	Moderately low.
Grayish brown	Very friable	Slow	Moderate to slow	Moderately rapid	Medium.
Grayish brown to light brownish gray.	Very friable	Slow	Moderate to slow	Rapid	Moderately low.
Light gray to very pale brown	Friable	Slow	Moderate	Very rapid	Very low.
Light gray to very pale brown	Friable to loose.	Medium	Moderately rapid	Very rapid	Very low.
Light gray to very pale brown	Friable to loose.	Rapid	Moderately rapid	Very rapid	Very low.
Light gray to very pale brown	Friable to very friable.	Moderate	Moderate	Moderate to very rapid.	Low.
Light gray to very pale brown	Friable to very friable.	Rapid	Moderate	Moderate to very rapid.	Low.
Very pale brown	Loose	Very slow	Very rapid	Very rapid	Very low.

SUMMARY OF THE IMPORTANT CHARACTERISTICS

Map symbol	Soil	Depth of soil material	Surface layers			Subsoil
			Thickness	Color (dry)	Consistence (moist)	Texture
		Inches	*Inches*			
Sa	Sarpy fine sand	48–72+	4–14	Gray to grayish brown	Loose	Fine sand
SgA	Sarpy loamy fine sand, 0 to 3 percent slopes.	48–72+	6–14	Gray to grayish brown	Very friable	Loamy sand
SgB	Sarpy loamy fine sand, 3 to 7 percent slopes.	48–72+	6–14	Gray to grayish brown	Very friable	Loamy sand
Sc	Scott silt loam	48+	4–10	Gray	Friable	Clay
Si	Silver Creek silt loam	36–60+	8–14	Gray to dark gray	Friable	Silty clay or clay
TsA	Thurman fine sandy loam, 0 to 3 percent slopes.	60+	10–20	Dark gray to dark grayish brown.	Very friable	Loamy sand or loamy fine sand.
TsB	Thurman fine sandy loam, 3 to 7 percent slopes.	60+	6–20	Grayish brown to dark grayish brown.	Very friable	Loamy sand or loamy fine sand.
ThA	Thurman loamy fine sand, 0 to 3 percent slopes.	36–72+	8–16	Dark gray to dark grayish brown.	Very friable	Loamy sand or loamy fine sand.
ThB	Thurman loamy fine sand, 3 to 7 percent slopes.	36–72+	8–16	Dark gray to dark grayish brown.	Very friable	Loamy sand or loamy fine sand.
2ThA	Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.	36–72+	8–16	Dark gray to dark grayish brown.	Very friable	Loamy sand or loamy fine sand.
2ThB	Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.	36–72+	8–16	Dark gray to dark grayish brown.	Very friable	Loamy sand or loamy fine sand.
Th3	Thurman loamy fine sand, wind eroded.	36–72+	0–10	Grayish brown to light brownish gray.	Very friable	Loamy sand or loamy fine sand.
Va	Valentine fine sand	60+	4–12	Gray to light brownish gray.	Loose	Fine sand or loamy fine sand.
Vo	Volin silt loam	36–72	6–18	Gray to dark grayish	Friable	Silt loam or very fine sandy loam.
3Wb	Wann fine sandy loam, deep	36–60+	6–14	Gray to dark gray	Very friable	Fine sandy loam
Wb	Wann fine sandy loam	20–36	6–14	Gray to dark gray	Very friable	Fine sandy loam
3Wm	Wann loam, deep	36–60+	6–14	Gray to dark gray	Friable	Fine sandy loam
2Wm	Wann loam, deep, saline	36–60+	6–14	Gray to dark gray	Friable	Fine sandy loam
Wm	Wann loam	20–36	6–14	Gray to dark gray	Friable	Fine sandy loam
Wr	Wood River silt loam, 0 to 1 percent slopes.	48–60+	10–20	Gray to dark grayish brown.	Friable	Silty clay
WrA	Wood River silt loam, 1 to 3 percent slopes.	48–60+	10–20	Gray to dark grayish brown.	Friable	Silty clay
WrB2	Wood River silt loam, 3 to 7 percent slopes, eroded.	48–60+	4–12	Gray to grayish brown	Friable	Silty clay
W–Es	Wood River-Exline fine sandy loams.	48–60+	1–10	Gray to grayish brown	Very friable	Silty clay
W–E	Wood River-Exline silt loams	48–60+	2–20	Gray to dark grayish brown.	Friable	Silty clay

OF THE SOILS IN HALL COUNTY, NEBR.—Continued

Subsoil—Continued		Runoff	Permeability		Water-holding capacity
Color (dry)	Consistence (moist)		Surface soil	Subsoil	
Light brownish gray to very pale brown.	Loose	Slow	Rapid	Rapid	Very low.
Grayish brown to light brownish gray.	Very friable	Slow	Rapid	Rapid	Low.
Grayish brown to light brownish gray.	Very friable	Medium	Rapid	Rapid	Low.
Dark gray to very dark gray	Very firm	Ponded	Moderate	Very slow	High.
Gray to light gray	Very firm	Slow	Moderate	Slow	High.
Grayish brown	Very friable	Slow	Moderately rapid	Rapid	Low.
Grayish brown to brown	Very friable	Medium	Moderately rapid	Moderately rapid	Moderately low.
Light brownish gray	Very friable	Slow	Rapid	Rapid	Low.
Light brownish gray	Very friable	Medium	Rapid	Rapid	Low.
Light brownish gray	Very friable	Slow	Rapid	Rapid	Low.
Light brownish gray	Very friable	Medium	Rapid	Rapid	Low.
Light brownish gray	Very friable	Medium	Rapid	Rapid	Low.
Pale brown	Loose	Slow	Rapid	Rapid	Very low.
Light gray to grayish brown	Friable	Medium	Moderate	Moderate	Medium.
Light gray to light brownish gray	Very friable	Slow	Moderately rapid	Moderately rapid	Moderately low.
Light gray to light brownish gray	Very friable	Slow	Moderately rapid	Moderately rapid	Low.
Light gray to light brownish gray	Very friable	Slow	Moderate	Moderately rapid	Moderately low.
Light gray to light brownish gray	Very friable	Slow	Moderate	Moderately rapid	Moderately low.
Light gray to light brownish gray	Very friable	Slow	Moderate	Moderately rapid	Low.
Grayish brown to dark grayish brown.	Very firm	Slow	Moderate	Slow	High.
Grayish brown to dark grayish brown.	Very firm	Medium	Moderate	Slow	High.
Grayish brown to dark grayish brown.	Firm	Rapid	Moderate	Slow	High.
Grayish brown to dark grayish brown.	Firm	Slow	Moderately rapid	Very slow	High.
Grayish brown to dark grayish brown.	Firm	Slow	Moderate	Very slow	High.

GUIDE FOR MAPPING UNITS

[See table 2, p. 50, for estimated yields for each soil under dryland farming and irrigated farming; see table 5, pp. 59-61, for woodland sites and species suitable for planting; see table 1, p. 8, for approximate acreage and proportionate extent of each soil; and see pages beginning at p. 103, for block profile descriptions representative of each soil series]

Map symbol	*Mapping unit*	*Page*	*Dryland capability unit*	*Page*	*Irrigated capability unit*	*Page*	*Range site*	*Page*	*Woodland site*
Ba	Barney loam	9	Vw-1	37	---------		Wetland	54	Wet
Bl	Broken land	9	VIe-1	37	---------		Silty	54	Silty to clayey
Bu	Butler silt loam	10	IIs-2	33	IIs-2	43	Silty	54	Silty to clayey
CbC	Colby silt loam, 7 to 11 percent slopes	11	IVe-1	36	IVe-1	48	Silty	54	Silty to clayey
CbD	Colby silt loam, 11 to 30 percent slopes.	11	VIe-1	37	---------		Silty	54	Silty to clayey
Cm	Cass loam	10	IIs-5	33	IIs-5	44	Silty	54	Silty to clayey
3Cm	Cass loam, deep	10	I-1	32	I-1	42	Silty	54	Silty to clayey
Cs	Cass fine sandy loam	11	IIe-3	33	IIe-3	43	Sandy	54	Sandy
3Cs	Cass fine sandy loam, deep	11	IIe-3	33	IIe-3	43	Sandy	54	Sandy
Ea	Elsmere loamy fine sand	12	IIIw-5	35	IIw-6	45	Subirrigated	54	Moderately wet
Es	Elsmere fine sandy loam	12	IIIw-5	35	IIw-6	45	Subirrigated	54	Sandy
E-W	Exline-Wood River silt loams	13	VIs-1	37	IVs-1	48	Saline lowland	54	Not plantable
E-Ws	Exline-Wood River fine sandy loams	12	VIs-1	37	IVs-1	48	Saline lowland	54	Not plantable
Fm	Fillmore silt loam	13	IIIw-2	35	IIIw-2	47	Overflow	54	Moderately wet
Ha	Hall silt loam, 0 to 1 percent slopes	14	IIc-1	32	I-1	42	Silty	54	Silty to clayey
HaA	Hall silt loam, 1 to 3 percent slopes	14	IIe-1	32	IIe-1	43	Silty	54	Silty to clayey
HaB2	Hall silt loam, 3 to 7 percent slopes, eroded.	14	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
Hb	Hobbs silt loam, 0 to 1 percent slopes	15	IIw-3	33	IIe-1	43	Overflow	54	Moderately wet
HbA	Hobbs silt loam, 1 to 3 percent slopes	15	IIe-1	32	IIe-1	43	Silty	54	Silty to clayey
H-C3	Holdrege-Colby complex, severely eroded.	16	IVe-1	36	IIIe-1	45	Silty	54	Silty to clayey
Hd	Hord silt loam, 0 to 1 percent slopes	17	IIc-1	32	I-1	42	Silty	54	Silty to clayey
HdA	Hord silt loam, 1 to 3 percent slopes	17	IIe-1	32	IIe-1	43	Silty	54	Silty to clayey
HdB2	Hord silt loam, 3 to 7 percent slopes, eroded.	17	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
2HdA	Hord silt loam, thin solum variant, 0 to 3 percent slopes.	17	IIc-1	32	I-1	42	Silty	54	Silty to clayey
2HdB	Hord silt loam, thin solum variant, 3 to 7 percent slopes.	17	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
H-N	Hord-O'Neill complex, 0 to 1 percent slopes.	17	IIe-3	33	IIe-3	43	Sandy	54	Sandy
Ho	Holdrege silt loam, 0 to 1 percent slopes.	16	IIc-1	32	I-1	42	Silty	54	Silty to clayey
HoA	Holdrege silt loam, 1 to 3 percent slopes.	16	IIe-1	32	IIe-1	43	Silty	54	Silty to clayey
HoB	Holdrege silt loam, 3 to 7 percent slopes	16	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
HoB2	Holdrege silt loam, 3 to 7 percent slopes, eroded.	16	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
HoC	Holdrege silt loam, 7 to 11 percent slopes.	16	IVe-1	36	IVe-1	48	Silty	54	Silty to clayey
HoC2	Holdrege silt loam, 7 to 11 percent slopes, eroded.	16	IVe-1	36	IVe-1	48	Silty	54	Silty to clayey
H-O	Hall-O'Neill complex, 0 to 1 percent slopes.	14	IIc-1	32	I-1	42	Silty	54	Silty to clayey
Hs	Hastings silt loam, 0 to 1 percent slopes.	15	IIc-1	32	I-1	42	Silty	54	Silty to clayey
HsA	Hastings silt loam, 1 to 3 percent slopes.	15	IIe-1	32	IIe-1	43	Silty	54	Silty to clayey
HsB2	Hastings silt loam, 3 to 7 percent slopes, eroded.	15	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
Hs3	Hastings complex, severely eroded	15	IVe-1	36	IIIe-1	45	Silty	54	Silty to clayey
Ks	Kenesaw silt loam, 0 to 1 percent slopes.	18	IIc-1	32	I-1	42	Silty	54	Silty to clayey
KsA	Kenesaw silt loam, 1 to 3 percent slopes.	18	IIIe-1	34	IIe-1	43	Silty	54	Silty to clayey
KsB	Kenesaw silt loam, 3 to 7 percent slopes.	18	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
La	Lamoure silt loam	19	IIIw-2	35	IIIw-2	47	Subirrigated	54	Moderately wet
2La	Lamoure silt loam, saline	19	IVs-1	36	IIIs-1	46	Saline lowland	54	Moderately saline-alkali
Le	Leshara silt loam	19	IIw-4	34	IIw-4	44	Subirrigated	54	Moderately wet
2Le	Leshara silt loam, saline	19	IVs-1	36	IIIs-1	46	Saline lowland	54	Moderately saline-alkali
Lf	Leshara fine sandy loam	19	IIw-6	34	IIw-6	45	Subirrigated	54	Sandy
Lm	Loup loam	20	Vw-1	37	---------		Wetland	54	Wet
MdB	Meadin loamy sand, 3 to 11 percent slopes.	20	VIIs-4	38	---------		Shallow	55	Shallow

GUIDE FOR MAPPING UNITS—Continued

Map symbol	*Mapping unit*	*Page*	*Dryland capability unit*	*Page*	*Irrigated capability unit*	*Page*	*Range site*	*Page*	*Woodland site*
Ms	Meadin sandy loam, 0 to 1 percent slopes.	20	VIIs-4	38	IVs-4	49	Shallow	55	Shallow
Oa	Ovina loamy fine sand	22	IIIw-5	35	IIIw-5	47	Subirrigated	54	Moderately wet
Ok	O'Neill loam, 0 to 1 percent slopes	21	IIs-5	33	IIs-5	44	Silty	54	Silty to clayey
OkB2	O'Neill loam, 3 to 5 percent slopes, eroded.	21	IIIe-1	34	IIIe-1	45	Silty	54	Silty to clayey
Om	O'Neill sandy loam, 0 to 1 percent slopes.	21	IIe-3	33	IIe-3	43	Sandy	54	Sandy
OmB2	O'Neill sandy loam, 3 to 7 percent slopes, eroded.	21	IIIe-3	35	IIIe-3	46	Sandy	54	Sandy
OrA	Ortello fine sandy loam, 0 to 3 percent slopes.	22	IIe-3	33	IIe-3	43	Sandy	54	Sandy
OrB	Ortello fine sandy loam, 3 to 7 percent slopes	22	IIIe-3	35	IIIe-3	46	Sandy	54	Sandy
2Or	Ortello fine sandy loam, loamy substratum, 0 to 3 percent slopes.	22	IIe-3	33	IIe-3	43	Sandy	54	Sandy
2OrB	Ortello fine sandy loam, loamy substratum, 3 to 7 percent slopes.	22	IIIe-3	35	IIIe-3	46	Sandy	54	Sandy
Ot	Ortello loam, 0 to 1 percent slopes	22	IIc-1	32	I-1	42	Silty	54	Silty to clayey
Ov	Ovina fine sandy loam	22	IIw-6	34	IIw-6	45	Subirrigated	54	Moderately wet
P-S	Platte-Sarpy complex	23	VIIe-5	38	IVe-5	48	Sand	54	Very sandy
2P-S	Platte-Sarpy complex, channeled	23	VIIe-5	38	---------		Sand	54	Very sandy
Pt	Platte loam	23	VIIs-4	38	IVs-4	49	Subirrigated	54	Shallow
P-W	Platte-Wann complex	24	VIIs-4	38	IVs-4	49	Subirrigated	54	Shallow
2P-W	Platte-Wann complex, channeled	24	VIIs-4	38	---------		Subirrigated	54	Shallow
Rw	Riverwash	24	VIII	38	---------		----------------		Not plantable
Sa	Sarpy fine sand	25	VIIe-5	38	---------		Sands	54	Very sandy
Sc	Scott silt loam	25	IVw-2	36	IVw-2	49	Overflow	54	Wet
SgA	Sarpy loamy fine sand, 0 to 3 percent slopes.	25	IIIe-5	35	IVe-5	48	Sands	54	Sandy
SgB	Sarpy loamy fine sand, 3 to 7 percent slopes.	25	IVe-5	36	IVe-5	48	Sands	54	Sandy
Si	Silver Creek silt loam	26	IIIw-2	35	IIIw-2	47	Subirrigated	54	Moderately wet
Sy	Alluvial land	9	VIw-1	38	---------		Overflow	54	Moderately wet
ThA	Thurman loamy fine sand, 0 to 3 percent slopes.	26	IIIe-5	35	IVe-5	48	Sandy	54	Sandy
ThB	Thurman loamy fine sand, 3 to 7 percent slopes.	26	IVe-5	36	IVe-5	48	Sands	54	Sandy
Th3	Thurman loamy fine sand, wind eroded.	27	VIe-5	37	---------		Sands	54	Very sandy
2ThA	Thurman loamy fine sand, loamy substratum, 0 to 3 percent slopes.	26	IIIe-5	35	IVe-5	48	Sands	54	Sandy
2ThB	Thurman loamy fine sand, loamy substratum, 3 to 7 percent slopes.	27	IVe-5	36	IVe-5	48	Sands	54	Sandy
TsA	Thurman fine sandy loam, 0 to 3 percent slopes.	26	IIe-3	33	IIe-3	43	Sandy	54	Sandy
TsB	Thurman fine sandy loam, 3 to 7 percent slopes.	26	IIIe-3	35	IIIe-3	46	Sandy	54	Sandy
Va	Valentine fine sand	27	VIIe-5	38	---------		Sand	54	Very sandy
Vo	Volin silt loam	28	I-1	32	I-1	42	Silty	54	Silty to clayey
Wb	Wann fine sandy loam	28	IIw-6	34	IIw-6	45	Subirrigated	54	Moderately wet
3Wb	Wann fine sandy loam, deep	28	IIw-6	34	IIw-6	45	Subirrigated	54	Moderately wet
W-E	Wood River-Exline silt loams	30	IVs-1	36	IIIs-1	46	Saline lowland	54	Moderately saline-alkali
W-Es	Wood River-Exline fine sandy loams	30	IVs-1	36	IIIs-1	46	Saline lowland	54	Moderately saline-alkali
Wm	Wann loam	29	IIw-4	34	IIw-4	44	Subirrigated	54	Moderately wet
2Wm	Wann loam, deep, saline	29	IVs-1	36	IIIs-1	46	Saline lowland	54	Moderately saline-alkali
3Wm	Wann loam, deep	28	IIw-4	34	IIw-4	44	Subirrigated	54	Moderately wet
Wr	Wood River silt loam, 0 to 1 percent slopes.	29	IIs-2	33	IIs-2	43	Silty	54	Silty to clayey
WrA	Wood River silt loam, 1 to 3 percent slopes.	29	IIs-2	33	IIIe-2	46	Silty	54	Silty to clayey
WrB2	Wood River silt loam, 3 to 7 percent slopes, eroded.	29	IIIe-2	34	IIIe-2	46	Silty	54	Silty to clayey

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