

Historical Replica — Part I

Issued March 1971

SOIL SURVEY

Arapahoe County, Colorado



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
COLORADO AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1958-63. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1963. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the West Arapahoe, Agate, Kiowa, and Deer Trail Soil Conservation Districts. Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of Arapahoe County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the pages for the range site and the tree planting suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored

green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and tree planting suitability groups.

Community planners and others can read about soil properties that affect the choice of sites for homes, small industrial buildings, and other nonfarm uses in the section "Nonfarm Uses of Soils."

Game managers, sportsmen, and others concerned with wildlife can find information of interest in the section "Use of Soils for Wildlife."

Ranchers and others can find, under "Use and Management of Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others concerned with recreational development can find in the section "Use of Soils for Recreation" information about limitations of the soils as sites for recreational and vacation facilities.

Engineers and builders can find, under "Engineering Uses of Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Arapahoe County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the sections "Climate of Arapahoe County" and "Additional Facts About the County."

Cover picture: Contour stripcropping on Fondis silt loam, 3 to 5 percent slopes.

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I

SOIL SURVEY OF ARAPAHOE COUNTY, COLORADO

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE
COLORADO AGRICULTURAL EXPERIMENT STATION

ARAPAHOE COUNTY is in the northeastern part of Colorado (fig. 1). It has a land area of 520,960 acres, or 814 square miles. The county is about 72 miles long and about 12 miles wide.



Figure 1.—Location of Arapahoe County in Colorado.

This county has a warm, semiarid climate, which is cooler and slightly more moist in the western part than in other parts. The altitude ranges from 6,200 feet above sea level in the extreme southwestern part of the county to 4,750 feet at the northeastern edge. Average altitude is about a mile.

The county is drained by the South Platte River and its tributaries. The South Platte River flows northward across the extreme western edge of the county. Some of its tributaries originate in or east of the Black Forest, flow northward across the county, and join the river outside the county. The South Platte River and Cherry Creek are the only streams in the county that flow continuously. The other streams seldom flow for more than two weeks, generally in March or April and during heavy storms in summer. Flash floods are common in summer.

The western one-fourth of this county is part of the expanding metropolitan area of Denver, and the eastern three-fourths is used mostly for farming. Almost half of this acreage is used for cultivated crops, mainly winter wheat. Most of the remaining acreage is in native grass that is grazed by cattle and sheep.

The irrigated acreage in the county decreased from about 23,000 acres in 1940 to about 2,200 acres in 1961, and it continues to decrease. This decrease is due to community development near the western edge of the county and to use of water from the South Platte River for domestic purposes. The generally small areas that are now irrigated are used to grow supplemental winter feed for livestock. Water for irrigation is not available in sufficient quantities to irrigate other areas.

How This Survey Was Made

This survey was made to learn what kinds of soils are in Arapahoe County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The categories of their classification most used in a local survey are the *soil series* and the *soil phase*.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or

other geographic feature near the place where a soil of that series was first observed and mapped. Bresser and Fondis, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Bresser loamy sand, terrace, 0 to 3 percent slopes, is one of several phases within the Bresser series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Arapahoe County: the soil complex and the undifferentiated soil group.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Bresser-Stapleton sandy loams, 3 to 9 percent slopes, is an example.

An undifferentiated soil group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated soil group consists of the names of the dominant soils, joined by "and." Bresser and Truckton soils, 3 to 9 percent slopes, eroded, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gravelly land and Loamy alluvial land are examples of two land types in Arapahoe County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of

soils. Yields under defined management are estimated for all the soils.

The soil scientists set up trial groups of soils on the basis of yield and practice tables and other data they have collected. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultations. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this soil survey shows, in color, the soil associations in Arapahoe County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other landscape. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Arapahoe County are described in the following pages.

1. Alluvial Land-Nunn Association

Deep, nearly level, mainly loamy and sandy soils; on flood plains and terraces

This soil association consists of deep, nearly level, mainly loamy and sandy soils along major streams. About half the acreage is subject to flooding.

This association occupies about 13 percent of the county. About 26 percent is made up of Loamy alluvial land, 23 percent of Sandy alluvial land, 18 percent of Nunn soils, and the remaining 33 percent of minor soils.

Loamy alluvial land is nearly level and subject to occasional flooding. It consists of deep, dark-colored, stratified loam and sandy loam that recently have been deposited. In some places the range in texture is wide within short distances. Sandy alluvial land occurs next to the major stream channels and is frequently flooded. It consists of nearly level, deep, light-colored sand.

Nunn soils occur on terraces and are not subject to flooding. These soils are deep and have a loamy surface layer and a clay loam or clay subsoil. They are cultivated in most places.

Minor soils in this association are in the Bresser, Bijou, Beckton, Fort Collins, and Heldt series. The Bresser, Bijou, and Fort Collins soils occur on terraces and are

not subject to flooding. Beckton and Heldt soils also occur on terraces and normally contain excessive salts. They are not subject to frequent flooding.

About half of this association is cultivated to small grains, mainly wheat. Crops grow better on the Nunn, Fort Collins, Bresser, and Bijou soils than on the other soils in this association. Only those soils are irrigated, because water for irrigation is available only along streams. The Beckton and Heldt soils are in native grass. They are not suited to dryland cultivation, because they contain excessive salts. Loamy alluvial land is well suited to crops, but protection from or control of flooding is needed to control water erosion and gullying. Sandy alluvial land is mostly in cottonwood trees and grasses. The hazards of soil blowing and water erosion are so severe on this land that cultivation is prevented, but the trees growing on it protect livestock in winter.

2. Litle-Samsil Association

Rolling soils that are clayey except in the upper few inches; moderately deep to shallow over shale; on uplands

This association is in the southeastern part of the county. It consists of moderately deep to shallow soils that formed in material weathered from saline Pierre shale. In most places these soils are rolling and have slopes ranging from 3 to 9 percent, but moderately steep soils occur next to drainageways and are moderately to severely eroded.

This association occupies about 5 percent of the county. About 63 percent is made up of Litle soils, 25 percent of Samsil soils, and the remaining 12 percent of minor soils.

The Litle soils have a silty clay loam surface layer about 6 inches thick. The subsoil, about 18 inches thick, is pale-brown silty clay to clay that, in the lower part, contains visible salts, mostly gypsum.

The Samsil soils have a clay loam surface layer about 5 inches thick. Much visible gypsum occurs between this layer and the underlying shale. Depth to shale normally is less than 18 inches.

Both Litle and Samsil soils take in water slowly. The Litle soils have moderate to high available water holding capacity. Because they are shallow and saline, the Samsil soils have only moderate or low available water holding capacity. Both soils are alkaline and are suited to alkali sacaton and other plants tolerant of alkali.

Also in this association are closely intermingled Adena and Colby soils and, in small drainageways, areas of frequently flooded, clayey alluvium. The Colby soils occupy the crests of ridges, and the Adena soils occur just below them on east-facing slopes. In almost all places the Adena soils occur on slopes facing east or southeast.

This association is in native grass that is used to pasture sheep and cattle. Roads are few and gravel is scarce.

3. Weld-Adena-Colby Association

Deep, nearly level to sloping, loamy soils that have a clayey to loamy subsoil; formed in silty, wind-deposited material; on high-lying divides between creeks

This association occupies high areas between creeks throughout the eastern half of the county. The landscape is one of tables and flats, areas bordering drainageways, and ridgetops.

This association occupies about 18 percent of the county. About 43 percent is made up of Weld soils, 28 percent of Adena soils, 15 percent of Colby soils, and the remaining 14 percent of minor soils.

The Weld soils are nearly level and occupy the tables and flats. They have a silt loam surface layer about 5 inches thick. Their subsoil of brownish clay loam, silty clay, and clay typically contains lime at a depth of about 14 inches.

The Adena soils border the drainageways and in most places have slopes of 3 to 5 percent. They have a grayish-brown silt loam surface layer about 2 inches thick. Their subsoil is brownish silty clay loam and silt loam in which lime has accumulated in the lower part.

Colby soils occur on ridgetops and in other high areas. They have a surface layer of light brownish-gray, limy silt loam about 5 inches thick. The next layer contains much lime and slightly more clay than the surface layer.

The Weld, Adena, and Colby soils have moderate intake of water and high available water holding capacity. They are, however, highly susceptible to water erosion and to soil blowing.

Also in this association are the Deertrail, Renohill, Buick, and Thedalund soils of the uplands and Loamy alluvial land along drainageways. The Deertrail soils generally are in areas less than 1 acre in size and are closely intermingled with Weld soils. The Renohill and Buick soils are gently sloping to moderately steep. Thedalund soils are next to drainageways and small rough areas.

The Weld soils are among the soils most suitable for cultivation in the county. The Adena and Colby soils are suited to cultivated crops, though not so well suited as the Weld. All of these soils need protection against soil blowing and water erosion. The Weld soils are especially susceptible to soil blowing.

4. Thedalund-Baca Association

Mainly gently sloping to rolling soils that are loamy throughout; moderately deep and deep over interbedded shale and sandstone; on uplands

This association is on uplands in the eastern part of the county. It consists of soils that have a layer of loess deposited over interbedded shale and sandstone. In most places these soils have slopes ranging from 3 to 9 percent, but steep soils occur next to drainageways. A few deep gullies have vertical banks more than 15 feet high.

This association occupies about 4 percent of the county. About 60 percent is made up of Thedalund soils, 30 percent of Baca soils, and the remaining 10 percent of minor soils.

The Thedalund soils are light olive-brown clay loam to a depth of about 9 inches. Below this is light yellowish-brown silty clay loam underlain, at a depth of about 30 inches, by consolidated shale that contains crystals and seams of gypsum and strata of sandstone and siltstone.

The Baca soils have a grayish-brown loamy surface layer about 3 inches thick and a grayish-brown and light olive-brown clay loam subsoil. Interbedded, soft sandstone and shale generally occur at a depth ranging from 3 to 5 feet.

The Thedalund and Baca soils generally are alkaline and contain moderate amounts of free lime. Thedalund soils have a moderate to rapid rate of water intake and

low available water holding capacity. Baca soils have a moderate rate of water intake and high available water holding capacity.

Also in this association are areas of Rock outcrop, Colby soils, and Loamy alluvial land. Outcrops of sandstone, less than 50 feet in diameter, are common. The Colby soils generally occur as bands, about 100 feet wide, on the ridgetops. Loamy alluvial land is along the drainageways in areas less than 100 feet wide.

Most of this association is used to pasture sheep and cattle, but limited water is available for livestock and domestic use. The main native plants are blue grama, side-oats grama, western wheatgrass, and pricklypear cactus. More grass grows on Loamy alluvial land than on the other soils in this association. Because of steepness, shallowness, and the severe hazard of erosion, less than 10 percent of this soil association is used for cultivated crops. Wheat, the main cultivated crop, grows fairly well.

5. Terry-Olney-Thedalund Association

Sloping soils that are loamy throughout; moderately deep and deep over sandstone and shale; on uplands

This association is on uplands in the eastern part of the county. It consists of soils that formed in loamy, wind-deposited material mixed with material weathered from

sandstone and from interbedded sandstone and shale. In most places slopes range from 5 to 9 percent, but areas next to drainageways are steep (fig. 2).

This association occupies about 7 percent of the county. About 45 percent is made up of Terry soils, 33 percent of Olney soils, 12 percent of Thedalund soils, and the remaining 10 percent of minor soils.

The Terry soils have a grayish-brown fine sandy loam surface layer about 8 inches thick. Their subsoil is light yellowish-brown fine sandy loam. Soft sandstone occurs at a depth of about 26 inches. Typically, accumulated lime occurs at a depth of about 20 inches.

The Olney soils have a grayish-brown fine sandy loam surface layer about 6 inches thick. Their subsoil is brown and pale-brown fine sandy loam about 12 inches thick. Lime typically is at a depth of about 18 inches. Underlying the subsoil is a mixture of material deposited by the wind and material weathered from fine-grained sandstone.

The Thedalund soils have a light olive-brown clay loam surface layer that is about 9 inches thick and is non-calcareous in the uppermost 5 inches. Below this is light yellowish-brown silty clay loam underlain, at a depth of about 30 inches, by consolidated shale that contains crystals and seams of gypsum and strata of sandstone and siltstone.



Figure 2.—Typical landscape in the Terry-Olney Thedalund soil association.

The Terry, Olney, and Thedalund soils take in water at a moderate to rapid rate, and they have low to high available water holding capacity.

Also in this association are areas where sandstone crops out in narrow ledges and a few small areas of Colby and Baca soils. The Colby soils are on ridgetops in bands about 100 feet wide. The Baca soils are just below the Colby soils on east-facing slopes. Thick, sandy, and loamy alluvium occurs on the bottom of draws.

Almost all of this association is in native grass that is grazed by cattle and sheep. Water for livestock and domestic use generally is available from wells, about 200 feet deep, that yield 10 gallons or more per minute. In most areas the soils are not suitable for cultivation, because they are too steep, shallow, and susceptible to erosion.

6. Renohill-Buick-Little Association

Sloping to steep, loamy soils that have a loamy to clayey subsoil; moderately deep and deep over shale or sandstone; on uplands

This association is on uplands, mainly in the western half of the county (fig. 3). In most places slopes range from 5 to 25 percent. Most of the association is in the Lowry Air Force Base Bombing Range.



Figure 3.—Typical landscape in the Renohill-Buick-Little association.

This association occupies about 15 percent of the county. About 50 percent is made up of Renohill soils, 23 percent of Buick soils, 13 percent of Little soils, and the remaining 14 percent of minor soils.

The Renohill soils have a grayish-brown loam surface layer about 5 inches thick and a brown and light olive-brown clay loam subsoil. Depth to shale is about 26 inches. Lime generally occurs between the subsoil and shale, but in some places these soils are limy throughout.

The Buick soils have a brown loam surface layer about 3 inches thick. The next layer also consists of 3 inches of brown loam. The subsoil, to a depth of about 22 inches, is

brown and light yellowish-brown clay loam, and below that depth is very pale brown sandy clay loam. Lime occurs at a depth of about 12 inches.

The Little soils have a light brownish-gray silty clay loam, generally limy, surface layer about 3 inches thick. Their subsoil, about 13 inches thick, is limy, pale-brown clay or silty clay in the upper part and is clay in the lower part. Beds of partly consolidated, clayey shale occur at a depth of about 39 inches.

The major soils in this association are slowly to moderately permeable. Runoff generally is moderate to rapid. Erosion normally is slight to moderate, but it is severe in some cultivated areas.

Minor parts of this association are the Thedalund, Sam-sil, and Fondis soils on uplands and Loamy alluvial land along streams.

Most of this association is used to pasture cattle or as wildlife habitat. The native grasses are western wheatgrass, blue grama, plains bluegrass, and pricklypear cactus. Where the soils are cultivated, wheat is the principal crop. Stubble mulching, terracing, contour stripcropping, and other intensive conservation practices are needed to help control erosion, conserve moisture, and maintain or increase the growth of crops. Many homes are in this association in the western part of the county. Gravel roads are about 2 to 3 miles apart through most of the association. One improved road crosses the middle of the Lowry Bombing Range from west to east.

7. Nunn-Bresser-Ascalon Association

Deep, nearly level and undulating, loamy soils that have a clayey to loamy subsoil; developed in outwash; on uplands and terraces

This association is on uplands in the western and central parts of the county. Most areas are undulating and have slopes ranging from 0 to 4 percent. The soils are deep and have a clayey to loamy subsoil.

This association occupies about 13 percent of the county. About 60 percent is made up of Nunn soils, 15 percent of Bresser soils, 15 percent of Ascalon soils, and the remaining 10 percent of minor soils.

The Nunn soils occur in the more nearly level areas of this association. They have a grayish-brown loam surface layer about 3 inches thick. Their subsoil is brownish clay loam, light clay, and sandy clay loam about 19 inches thick. Lime occurs at a depth of about 22 inches.

The Bresser soils occur on knobs and in rolling areas. Their surface layer is dark grayish-brown sandy loam about 5 inches thick. The subsoil extends to a depth of about 28 inches. It is hard or very hard when dry. It is dark-brown sandy loam in the upper part, brown sandy clay loam in the middle part, and light-brown sandy loam in the lower part.

The Ascalon soils are similar to the Bresser soils but have a slightly grayer subsoil and lime at a depth of about 17 inches.

The major soils in this association take in water readily and have moderate to high available water holding capacity.

Also in this association are Truckton soils on the crests of knobs and low-lying areas called wet weather lakes. The low areas are near the Nunn soils and generally are less than 5 acres in size. They are ponded after heavy rains, for there is a dense clayey layer below the surface.

Most of this association is used for cultivated crops. All crops commonly grown in the county grow well, but wheat is the principal crop. In many places soil blowing is severe on the crest of knobs, but it, and water erosion as well, is reduced if crop residue is left on the surface.

8. Truckton-Bresser Association

Deep, rolling, loamy and sandy soils that have a loamy subsoil; on uplands

This association is on uplands. It occupies small areas on the eastern side of major drainageways throughout the western and central parts of the county. It consists of deep soils that formed in nonlimy, sandy material deposited by wind. The topography is rolling; most slopes are between 3 and 8 percent, but some are as much as 15 percent.

This association occupies about 14 percent of the county. About 50 percent is made up of Truckton soils, 27 percent of Bresser soils, and the remaining 23 percent of minor soils.

Truckton soils have a dark grayish-brown loamy sand surface layer about 6 inches thick. Their subsoil is brownish sandy loam that extends to a depth of 30 inches. It is hard or very hard when dry. These soils do not contain a limy layer but have streaks of lime in the underlying material.

The Bresser soils occur on the lower parts of slopes. They have a dark grayish-brown sandy loam surface layer about 5 inches thick. Their subsoil is dark-brown and light-brown sandy loam in the upper and lower parts and is brown sandy clay loam in the middle part. Like Truckton soils, Bresser soils do not contain a limy layer, but they have streaks of lime in the underlying material.

Except in bare areas, water is taken into the Truckton soils rapidly, but water is taken into the Bresser soils at a moderate to rapid rate. Both kinds of soils have moderate available water holding capacity.

Also in the association are the Blakeland, Ascalon, and Nunn soils and low, wet areas called wet weather lakes. The low wet areas generally are not more than 2 acres in size. Blakeland soils normally occur in small areas on ridgetops near Truckton soils. The Nunn soils are in small areas next to the wet weather lakes. Sandstone and shale crop out in small areas at the base of steep slopes next to the major drainageways.

About one-fourth of this association is used for cultivated crops, and the rest is in grass and is used for grazing. Among the native grasses are blue grama, needle-and-thread, sandreed, and little bluestem. Cultivated crops grow fairly well on the soils of this association, but soil blowing is severe in cultivated areas on the crest of knobs and rolling areas. Stubble mulching and stripcropping are among the practices needed for controlling soil blowing and conserving moisture.

9. Stapleton-Bresser Association

Moderately steep soils that are loamy throughout; moderately deep and deep over arkosic sandstone; on foothills

This association is on foothills at the highest elevations in the county. Slopes generally range from 8 to 25 percent. The association consists of moderately deep and deep, loamy soils on poorly consolidated beds of sand and silt mixed with windblown sandy deposits.

This association occupies about 3 percent of the county. About 42 percent is made up of Stapleton soils, 30 percent of Bresser soils, and the remaining 28 percent of minor soils.

The Stapleton soils are moderately deep. Their surface layer, about 8 inches thick, is grayish-brown sandy loam that contains a noticeable amount of mica and fine gravel. Below this layer is light brownish-gray and pale-yellow sandy loam that contains much fine gravel. Poorly consolidated beds of fine gravel and siltstone occur at a depth of about 16 inches.

The Bresser soils are deep. They have a dark grayish-brown sandy loam surface layer about 5 inches thick. The subsoil, about 23 inches thick, is dark-brown, brown, and light-brown sandy loam and sandy clay loam that is hard or very hard when dry. Interbedded shale and fine gravel or wind-deposited sand occurs below a depth of 3 feet.

Both Stapleton and Bresser soils have a moderate to rapid rate of water intake. Available water holding capacity is low in the Stapleton soils and moderate in the Bresser soils. Both kinds of soils generally are free of lime. They are susceptible to soil blowing and water erosion.

Also in this association are the Buick, Litle, and Renohill soils and, in draws, areas of frequently flooded loamy and sandy alluvium. Cobblestones, as much as 12 inches in diameter, occur on the surface of the Litle soils, and many gullies have formed in the areas consisting of loamy and sandy alluvium.

Most of this association is in native grass and western yellow pine. Cattle grazing is the main use. The pine trees have little or no commercial value, but they provide shade for livestock and areas where the trees grow can be developed for recreational uses. Because of the slope, water erosion generally is a severe hazard in cultivated areas.

10. Fondis-Weld Association

Deep, nearly level and gently sloping, loamy soils that have a clayey layer in the subsoil; formed mainly in silty, wind-deposited material; on foothills

This association is on uplands in the western part of the county. It consists of deep soils that formed mainly in silty material deposited by the wind. Slopes range from 1 to 5 percent in most places, but next to drainageways they are as much as 9 percent.

This association occupies about 8 percent of the county. About 70 percent is made up of Fondis soils, 22 percent of Weld soils, and the remaining 8 percent of minor soils.

The Fondis soils have a surface layer of dark grayish-brown silt loam to silty clay loam about 8 inches thick. The subsoil, to a depth of about 32 inches, is dark-brown clay and pale-brown silty clay loam. Below that depth are

layers of older buried soils. These layers are light yellowish-brown and dark-brown loam, silt loam, and clay loam; they contain much lime.

The Weld soils have a grayish-brown silt loam surface layer about 5 inches thick. Their subsoil, about 21 inches thick, is brown, grayish-brown, and light yellowish-brown clay loam, silty clay, and silty clay loam. These soils are limy at a depth of about 14 inches.

The Fondis and Weld soils take in water at a moderate rate, and they have high available water holding capacity.

The minor soils in this association are in the Heldt and Buick series. The Heldt soils occur on uplands and terraces and are nearly level to gently sloping. The Buick soils occur on uplands and are gently sloping to moderately steep.

Most of this association is cultivated. Crops grow well

and also respond well to irrigation. Most of the farms are of the cash-grain type, and wheat is the principal crop. Much of this association is being diverted to residential and industrial use.

Descriptions of the Soils

This section describes the soil series and mapping units in Arapahoe County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series and then the mapping units in the series. Thus, to get full information on any one mapping unit, it is necessary to read the description of the unit and also the description of the soil series to which it belongs. The description of a soil series mentions features that apply to all the soils in

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

Mapping unit	Acre	Percent	Mapping unit	Acre	Percent
Adena-Colby fine sandy loams, 1 to 5 percent slopes.....	1, 780	0. 3	Lite silty clay loam, 1 to 9 percent slopes.....	9, 400	1. 8
Adena-Colby fine sandy loams, 5 to 9 percent slopes.....	830	. 2	Lite-Samsil, gypsum, silty clay loams, 3 to 9 percent slopes.....	6, 290	1. 2
Adena-Colby silt loams, 1 to 5 percent slopes.....	30, 750	5. 9	Loamy alluvial land.....	16, 289	3. 1
Adena-Colby silt loams, 5 to 9 percent slopes.....	4, 450	. 9	Nunn loam, 0 to 3 percent slopes.....	26, 888	5. 2
Ascalon sandy loam, 5 to 9 percent slopes.....	1, 746	. 3	Nunn-Bresser-Ascalon complex, 0 to 3 percent slopes.....	54, 390	10. 4
Baca loam, 3 to 5 percent slopes.....	920	. 2	Olney fine sandy loam, 5 to 9 percent slopes.....	1, 670	. 3
Baca loam, 5 to 9 percent slopes.....	1, 220	. 2	Renohill loam, 3 to 9 percent slopes.....	2, 210	. 4
Baca-Thedalund loams, 3 to 9 percent slopes.....	7, 500	1. 4	Renohill loam, reddish variant, 5 to 20 percent slopes.....	240	(¹)
Beckton loam, 0 to 3 percent slopes.....	5, 160	1. 0	Renohill-Buick loams, 3 to 9 percent slopes.....	31, 500	6. 1
Bijou sandy loam, 0 to 3 percent slopes.....	3, 330	. 6	Renohill-Buick loams, 9 to 20 percent slopes.....	8, 925	1. 7
Bijou sandy loam, wet, 0 to 3 percent slopes.....	2, 000	. 4	Renohill-Buick complex, 5 to 20 percent slopes, eroded.....	440	. 1
Blakeland loamy sand, 1 to 9 percent slopes, eroded.....	820	. 2	Renohill-Little clay loams, 3 to 9 percent slopes.....	1, 320	. 3
Blakeland loamy sand, 1 to 20 percent slopes.....	1, 040	. 2	Renohill-Little-Thedalund complex, 9 to 30 percent slopes.....	17, 398	3. 3
Bresser loamy sand, terrace, 0 to 3 percent slopes.....	490	. 1	Rock outcrop.....	360	. 1
Bresser sandy loam, terrace, 0 to 3 percent slopes.....	4, 280	. 8	Samsil clay, gypsum, 5 to 20 percent slopes.....	4, 220	. 8
Bresser loam, gravelly subsoil variant, 1 to 3 percent slopes.....	914	. 2	Samsil-Little stony clays, 20 to 50 percent slopes.....	840	. 2
Bresser-Stapleton sandy loams, 3 to 9 percent slopes.....	1, 070	. 2	Samsil-Renohill clay loams, 3 to 20 percent slopes.....	6, 130	1. 2
Bresser-Stapleton sandy loams, 9 to 20 percent slopes.....	10, 380	2. 0	Samsil-Shale outcrop complex.....	4, 200	. 8
Bresser-Truckton sandy loams, 3 to 5 percent slopes.....	31, 350	6. 0	Sand pits.....	330	. 1
Bresser-Truckton sandy loams, 5 to 20 percent slopes.....	18, 004	3. 5	Sandy alluvial land.....	7, 919	1. 5
Bresser and Truckton soils, 3 to 9 percent slopes, eroded.....	8, 350	1. 6	Shale outcrop.....	2, 700	. 5
Buick loam, 3 to 5 percent slopes.....	7, 020	1. 4	Stapleton sandy loam, 9 to 30 percent slopes.....	1, 100	. 2
Buick loam, 5 to 9 percent slopes.....	8, 250	1. 6	Tassel-Rock outcrop complex.....	1, 560	. 3
Clayey alluvial land.....	1, 345	. 3	Terrace escarpments.....	4, 340	. 8
Colby silt loam, 1 to 5 percent slopes.....	2, 430	. 5	Terry fine sandy loam, 5 to 20 percent slopes.....	4, 560	. 9
Colby silt loam, 5 to 20 percent slopes.....	2, 710	. 5	Terry-Olney-Thedalund sandy loams, 5 to 20 percent slopes.....	21, 530	4. 1
Colby and Adena soils, 1 to 9 percent slopes, eroded.....	1, 910	. 4	Thedalund clay loam, 9 to 20 percent slopes.....	2, 470	. 5
Edgewater loam, 0 to 3 percent slopes.....	1, 202	. 2	Thedalund clay loam, 9 to 20 percent slopes, eroded.....	2, 620	. 5
Fondis silt loam, 1 to 3 percent slopes.....	21, 393	4. 1	Truckton loamy sand, 1 to 5 percent slopes.....	3, 360	. 6
Fondis silt loam, 3 to 5 percent slopes.....	12, 620	2. 4	Truckton loamy sand, 5 to 20 percent slopes.....	9, 360	1. 8
Fondis-Ascalon, gravelly subsoil variant, complex, 1 to 9 percent slopes.....	760	. 2	Weld fine sandy loam, 1 to 5 percent slopes.....	760	. 1
Fondis-Colby silt loams, 3 to 5 percent slopes.....	9, 450	1. 8	Weld silt loam, 0 to 3 percent slopes.....	16, 670	3. 2
Fort Collins loam, 0 to 3 percent slopes.....	1, 440	. 3	Weld silt loam, 3 to 5 percent slopes.....	2, 150	. 4
Gravelly land.....	2, 640	. 5	Weld-Deertrail silt loams, 0 to 3 percent slopes.....	26, 150	5. 0
Heldt clay, 0 to 3 percent slopes.....	3, 290	. 6	Wet alluvial land.....	2, 167	. 4
Heldt clay, saline, 0 to 3 percent slopes.....	680	. 1	Water and stream channels.....	4, 980	1. 0
			Total.....	520, 960	100. 0

¹ Less than 0.1 percent.

the series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are indicated in the soil name. Unless otherwise stated, the descriptions of all mapping units in this section are for dry soils. As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. For example, Clayey alluvial land is a miscellaneous land type and does not belong to a soil series, nevertheless, it is listed in alphabetic order along with the series.

An essential part of each soil series is the description of the soil profile, the sequence of layers beginning at the surface and continuing downward to the depth beyond which roots of most plants do not penetrate. Each soil series contains a short description of a typical soil profile and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, the range site, and the tree planting suitability group in which the mapping unit has been placed. The pages on which each of these groups is described can be found by referring to the "Guide to Mapping Units" at the back of this soil survey. Many terms used in the soil descriptions and other sections of this survey are defined in the Glossary at the back of this soil survey and in the "Soil Survey Manual" (5).¹

Adena Series

The Adena series consists of well-drained, deep, undulating to rolling soils that occur mainly in the eastern three-fourths of the county. These soils developed in material deposited by the wind.

In a typical profile the surface layer is grayish-brown silt loam that is free of lime and about 2 inches thick. The subsoil, about 17 inches thick, is brown silty clay loam in the upper part and is pale-brown, limy silt loam or silty clay loam in the lower part. The underlying material is very pale brown and pale-brown, limy silt loam that extends to a depth of 60 inches and is easily penetrated by roots and water.

The Adena soils have moderate to moderately slow permeability, medium internal drainage, and high available water holding capacity. They are moderate to high in natural fertility but are highly susceptible to soil blowing and to water erosion.

These soils are well suited to grasses and to wheat and other nonirrigated crops. Most of the acreage is used for cultivated crops, mainly winter wheat.

Typical profile of an Adena silt loam, 900 feet north and 1,600 feet west of the southeast corner of section 16, T. 4 S., R. 59 W.; native grassland:

- A1—0 to 2 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist; abrupt, smooth boundary.
- B2t—2 to 6 inches, brown (10YR 5/3) silty clay loam, brown (10YR 4/3) when moist; moderate, medium, prismatic

structure that breaks to strong, fine, angular blocky structure; hard when dry, friable when moist; non-calcareous; thin, patchy clay films on ped surfaces; clear, smooth boundary.

- B3ca—6 to 19 inches, pale-brown (10YR 6/3) silt loam or silty clay loam, brown (10YR 5/3) when moist; weak, medium, prismatic structure that breaks to moderate, fine, subangular blocky structure; hard when dry, very friable when moist; very strongly calcareous; thin, patchy clay films on ped surfaces; clear, smooth boundary.
- C1ca—19 to 32 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 5.5/3) when moist; weak, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; very strongly calcareous; few medium concretions and fine seams of lime; clear, smooth boundary.
- C2—32 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive (structureless); soft when dry, very friable when moist; very strongly calcareous.

The A horizon is silt loam or fine sandy loam. It ranges from 1 to 4 inches in thickness and from grayish brown to very dark grayish brown in color. The B2t horizon ranges from 2 to 6 inches in thickness and is silty clay loam or clay loam in texture. Depth to lime ranges from 4 to 10 inches.

The Adena soils have thinner layers and lime closer to the surface than the Weld soils. In contrast to Colby soils, which are calcareous throughout and lack a B horizon, the Adena soils are noncalcareous in the upper few inches and have a distinct B horizon.

Adena-Colby fine sandy loams, 1 to 5 percent slopes (AcC).—This complex occurs in large areas along Deer Trail Creek in the eastern part of the county. The soils are undulating.

Adena fine sandy loam makes up about 60 to 80 percent of this complex, and Colby fine sandy loam, 20 to 40 percent. Included with these soils in mapping were small areas of Olney fine sandy loam. Also included were some areas of dark-colored alluvium in drainageways and in small depressions called wet weather lakes.

The Adena soil occurs on side slopes and in more nearly level areas. Its surface layer is grayish brown and about 4 inches thick. In the subsoil, which is clay loam about 17 inches thick, lime is about 10 inches from the soil surface. The underlying material ranges from 2 to many feet in thickness and is limy, loose, and loamy.

The Colby soil is on ridgetops or knolls. Its brown, limy surface layer is about 4 inches thick and is underlain by about 10 inches of limy loam. As in the Adena soil, the underlying material ranges from 2 to many feet in thickness and is limy, loose, and loamy.

Most of this complex is either in native grass or has been reseeded to grass. In addition to grass, the soils are suited to grain sorghum and to wheat, barley, and other small grains. If not protected, these soils are susceptible to severe soil blowing. (Capability unit IVe-6; Loamy Plains range site; tree planting suitability group 1)

Adena-Colby fine sandy loams, 5 to 9 percent slopes (AcD).—These soils occur in small, scattered areas along Deer Trail Creek in the eastern part of the county. Drainageways are well established.

Adena fine sandy loam makes up 50 to 70 percent of this complex, and Colby fine sandy loam, 30 to 50 percent. Included with these soils in mapping were small areas of Olney fine sandy loam and of Terry fine sandy loam. Also included were areas of loamy alluvium in drainageways that generally are less than 100 feet wide.

¹ Italicized numbers in parentheses refer to Literature Cited, p. 76.

The Adena soil occurs on side slopes. It has a grayish-brown surface layer about 3 inches thick and a clay loam subsoil about 12 inches thick. Depth to lime is about 8 inches. The underlying material ranges from 2 to many feet in thickness and is limy, loose, and loamy.

The Colby soil is on ridgetops and on slopes facing north or west. It has a limy, brown surface layer about 4 inches thick. Below this is a layer of limy silt loam about 6 inches thick. The underlying material ranges from 2 to many feet in thickness and is limy, loose, and loamy.

Most of this complex is in native grass and is used for grazing. Because soil blowing and water erosion are severe hazards, the soils in this complex are not suited to cultivated crops. Good range management is needed to prevent overgrazing and to control erosion. (Capability unit VIe-1; Loamy Plains range site; tree planting suitability group 1)

Adena-Colby silt loams, 1 to 5 percent slopes (AdC).—This complex of undulating soils occurs in the eastern three-fourths of the county, mainly in the northern part. Areas have a few broad drainageways.

Adena silt loam makes up 60 to 80 percent of this complex, and Colby silt loam, 20 to 40 percent. Included with these soils in mapping were small areas of Weld silt loam and of Loamy alluvial land.

The Adena soil occurs on side slopes. It has the profile described as typical for the series. Lime occurs at a depth of 6 to 9 inches.

The Colby soil, called white caps, has a limy surface layer about 4 inches thick that is underlain by about 9 inches of limy silt loam.

Most of the acreage of this complex is cultivated. Wheat and other small grains are suitable crops, but management is needed that controls erosion. Practices that help to control erosion are terracing, stripcropping, stubble mulching, and the use of close-growing crops. (Capability unit IVe-1; Loamy Plains range site; tree planting suitability group 1)

Adena-Colby silt loams, 5 to 9 percent slopes (AdD).—These soils occur in small, scattered areas in the eastern three-fourths of the county, mainly in the northern part.

Adena silt loam makes up 60 to 70 percent of this complex, and Colby silt loam, 30 to 40 percent. Included with these soils in mapping were small areas of Renohill soils that are next to drainageways in some places. Also included were areas of loamy alluvium in drainageways as much as 100 feet wide. Included in the extreme eastern part of the county were small areas of Little silty clay loam.

The Adena soil occurs on side slopes. It has a grayish-brown silt loam surface layer about 3 inches thick and a silty clay loam subsoil about 14 inches thick. Lime occurs at a depth of about 7 inches.

The Colby soil occurs on ridgetops and on slopes facing north or west. It has a limy surface layer about 4 inches thick. The next layer is limy silt loam about 6 inches thick.

Because soil blowing and water erosion are hazards, the soils in this complex are not suited to cultivated crops. Most areas are in native grass. (Capability unit VIe-1; Loamy Plains range site; tree planting suitability group 1)

Ascalon Series

The Ascalon series consists of deep, undulating to rolling soils that occur on uplands in the western three-fourths of the county. These soils developed in outwash material that has been reworked by the wind.

In a typical profile the surface layer is brown sandy loam that is free of lime and about 6 inches thick. The subsoil, about 11 inches thick, is brown sandy clay loam and is also free of lime. Below the subsoil is a layer of light-gray sandy loam that is about 13 inches thick and contains lime. This layer is underlain by very strongly calcareous, light yellowish-brown loamy sand.

The Ascalon soils have a rapid rate of water intake and generally moderate available water holding capacity. If they are cultivated, however, they tend to crust and become slick. This reduces the water intake rate and increases the hazard of erosion. These soils are easily penetrated by plant roots and are moderate to high in natural fertility. Unprotected areas are susceptible to severe soil blowing.

These soils are suited to grasses and to wheat and other nonirrigated crops. Most of the acreage is used for cultivated crops, mainly winter wheat. A few small areas are irrigated and are used mainly for corn and alfalfa.

Typical profile of Ascalon sandy loam, 600 feet east and 400 feet north of the southwest corner of section 5, T. 5 S., R. 62 W.:

- A1—0 to 6 inches, brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) when moist; weak, fine, crumb structure; slightly hard when dry, very friable when moist; non-calcareous; clear, smooth boundary.
- B2t—6 to 17 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) when moist and crushed; moderate, medium, angular blocky structure; hard when dry, firm when moist; thin, patchy clay films; non-calcareous; vertical streaks that are dark brown (10YR 3/3) when moist in about the upper one-third of this horizon; clear, smooth boundary.
- C1ca—17 to 30 inches, light-gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) when moist; weak, coarse, prismatic structure; very hard when dry, very friable when moist; very strongly calcareous; gradual boundary.
- C2—30 to 60 inches +, light yellowish-brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) when moist; massive (structureless) slightly hard when dry, friable when moist; very strongly calcareous.

The A horizon ranges from sandy loam to loam in texture and from 3 to 8 inches in thickness. The B2t horizon is 8 to 18 inches thick. The horizons are thinnest on steep slopes and on ridges that face west or north; they are thickest in swales and in areas near the low-lying areas called wet weather lakes. In the more nearly level areas, layers of buried soils commonly occur below a depth of 3 feet. Depth to lime is 12 to 30 inches. In some places gravel and cobblestones occur at a depth of 18 to 40 inches.

The Ascalon soils have a less clayey subsoil and less distinct horizons than the Nunn soils. Unlike the Bresser and Truckton soils, Ascalon soils contain lime in the lower part of the subsoil. Ascalon soils have a more clayey subsoil than Truckton soils. The C horizon of Ascalon soils is more mixed than that of Bresser soils and is less sandy than that of Truckton soils.

Ascalon sandy loam, 5 to 9 percent slopes (AsD).—This soil occurs on uplands in the western three-fourths of the county. Included with this soil in mapping were a few small areas of Bresser and Truckton sandy loams and of Renohill loam.

Most of this soil is in native grass, but cultivated crops are grown in the more gently sloping areas. Wheat is the main crop. Because of slope, the hazard of erosion is severe. Practices that help to control erosion are terracing, stubble mulching, and the use of close-growing crops. (Capability unit IVE-4; Sandy Plains range site; tree planting suitability group 1)

Baca Series

The Baca series consists of deep, gently sloping to strongly sloping soils that occur in the eastern part of the county.

In a typical profile the surface layer is grayish-brown loam that is free of lime and about 3 inches thick. The subsoil, about 9 inches thick, is grayish-brown and light olive-brown clay loam that contains lime at a depth of 9 inches. The subsoil is underlain by light yellowish-brown and light olive-gray, limy silty clay loam about 34 inches thick. Below this is olive-gray, limy fine sandy loam.

The Baca soils have a moderate rate of water intake and high available water holding capacity. They are moderate to high in natural fertility but are susceptible to soil blowing and to water erosion.

These soils are better suited to native grasses than to cultivated crops. Most of the acreage is used for range, but winter wheat and other nonirrigated crops are grown in some areas.

Typical profile of a Baca loam, 650 feet east and 200 feet north of the southwest corner of section 24, T. 4 S., R. 57 W.:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist; noncalcareous; clear, smooth boundary.
- B1—3 to 6 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay skins; noncalcareous; clear, smooth boundary.
- B2t—6 to 9 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, subangular blocky structure; slightly hard when dry, firm when moist; thin, continuous clay skins; noncalcareous; clear, smooth boundary.
- B3ca—9 to 12 inches, light olive-brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; slightly hard when dry, firm when moist; thin, patchy clay skins; strongly calcareous; clear, smooth boundary.
- C1ca—12 to 25 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; very strongly calcareous; clear, smooth boundary.
- C2—25 to 35 inches, light olive-gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) when moist; massive (structureless); slightly hard when dry, firm when moist; contains concretions of lime and iron; very strongly calcareous; clear, smooth boundary.
- C3—35 to 46 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) when moist; massive (structureless); slightly hard when dry, firm when moist; contains concretions of lime and iron; very strongly calcareous; clear, smooth boundary.

C4—46 inches, olive-gray (5Y 5/2) fine sandy loam, olive gray (5Y 4/2) when moist; massive and slightly consolidated fine-grained sandstone; very strongly calcareous.

The A horizon ranges from 2 to 5 inches in thickness and from loam to very fine sandy loam in texture. The B2t horizon is clay loam to clay 3 to 8 inches thick. Hard shale or sandstone generally occurs at a depth of more than 3 feet. Flat fragments of sandstone, 2 to 10 millimeters across, generally are scattered throughout the profile, but in some places they do not occur in the uppermost 12 inches.

The Baca soils are darker colored, have more distinct horizons, and are deeper to sandstone or shale than the associated Thedalund soils. Baca soils are similar to the Weld soils but formed in a mixture of wind-deposited material and material derived from sandstone and shale instead of silty material deposited by the wind.

Baca loam, 3 to 5 percent slopes (BcC).—This soil occurs in scattered areas in the eastern part of the county. The surface layer is friable loam about 5 inches thick, and the subsoil is silty clay loam to clay about 11 inches thick. Lime occurs at a depth of 10 to 12 inches. Sandstone and shale generally are at a depth of 4 to 5 feet.

Included with this soil in mapping were a few small areas in which the subsoil is exposed and the surface layer is limy clay loam. Also included were small areas of Colby silt loam and of Weld silt loam.

This soil is easy to work. Surface runoff is medium, and the available water holding capacity is high. Erosion is a severe hazard following a year of crop failure. Practices that help to control soil blowing and water erosion are stripcropping, stubble mulching, contour farming, and terracing.

Most of this soil is in native grass, but a few areas are used for cultivated crops, mainly wheat. Cultivated crops grow fairly well. (Capability unit IVE-1; Loamy Plains range site; tree planting suitability group 1)

Baca loam, 5 to 9 percent slopes (BcD).—This soil occurs in scattered areas in the eastern part of the county. It has the profile described as typical for the series. Lime occurs at a depth of about 8 or 9 inches. Surface runoff is medium to rapid, and the hazard of erosion is slight to moderate.

Included with this soil in mapping were small areas of Thedalund loam and of Colby silt loam. Also included were a few outcrops of barren, hard sandstone that are less than 50 feet in diameter.

Because tillage encourages erosion and loss of moisture, this soil is not suited to cultivated crops. Most of the acreage is in native range, mainly of blue grama and western wheatgrass. (Capability unit VIe-1; Loamy Plains range site; tree planting suitability group 1)

Baca-Thedalund loams, 3 to 9 percent slopes (BhD).—These soils occur in the eastern part of the county. Baca loam makes up about 50 to 60 percent of this complex, and Thedalund loam, 30 to 40 percent.

Included with these soils in mapping were some areas of Colby silt loam along ridgetops and some areas of Loamy alluvial land in drainageways. Also included were a few barren outcrops of hard sandstone less than 50 feet in diameter and 5 feet high. The Thedalund soils occur next to these outcrops, which are near drainageways.

The Baca soil is moderately deep and loamy throughout. The Thedalund soil is calcareous, moderately deep over interbedded sandstone and shale, and loamy throughout.

Most of this complex is native range and has only a moderate hazard of erosion, though runoff is medium to rapid. Cultivated crops are not suited because of the underlying bedrock and the severe hazard of erosion. (Capability unit VIe-1; Loamy Plains range site; tree planting suitability group 4)

Beckton Series

The Beckton series consists of deep, moderately well drained and somewhat poorly drained, level to gently sloping soils that occur on terraces along most of the major drainageways in the eastern three-fourths of the county. These soils developed in material deposited by water.

In a typical profile the surface layer is grayish-brown and light brownish-gray loam that is free of lime and about 6 inches thick. The subsoil is about 17 inches thick and contains spots of gypsum in the lower 13 inches. It consists of dark grayish-brown clay loam or clay in the upper part, light brownish-gray clay loam in the middle part, and grayish-brown silty clay loam in the lower part. Underlying the subsoil is a layer of calcareous, grayish-brown clay loam that contains spots of gypsum.

The Beckton soils take in water slowly but have high available water holding capacity. In many places the water table is below a depth of 8 feet. These soils are droughty because of the salt content. They are subject to flooding and to water erosion in some places. Slickspots, or barren areas, as much as one-fourth acre in size, are common. These areas are highly susceptible to soil blowing, and in some places the surface soil has blown away.

Most areas of Beckton soils are not suited to cultivated crops and should remain in grass. Where water is available, these soils can be leached of salts and used for cultivated crops under intensive management.

Typical profile of Beckton loam, 0 to 3 percent slopes, 300 feet west of bridge across Deer Trail Creek on the south side of U.S. Highway No. 36, section 4, T. 4 S., R. 59 W.:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, crumb structure; soft when dry, friable when moist; noncalcareous; clear, smooth boundary.
- A2—3 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, crumb structure; soft when dry, friable when moist; noncalcareous; abrupt, smooth boundary.
- B21t—6 to 10 inches, dark grayish-brown (10YR 4/2) heavy clay loam or clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, columnar structure that breaks to moderate, fine, subangular blocky structure; hard when dry, firm when moist; calcareous spots in lower part of horizon; clear, smooth boundary.
- B22tca—10 to 14 inches, light brownish-gray (10YR 6/2) heavy clay loam, grayish brown (10YR 5/2) when moist; weak to moderate, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; hard when dry, firm when moist; calcareous; spots of gypsum; clear, smooth boundary.
- B3ca—14 to 23 inches, grayish-brown (10YR 5/2) heavy silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure to massive (structureless); hard when dry, firm when moist; calcareous; spots of gypsum; clear, smooth boundary.
- C—23 to 60 inches, grayish-brown (2.5Y 5/2) heavy clay loam, dark grayish brown (2.5Y 4/2) when moist; massive (structureless); hard when dry, firm when moist; calcareous; spots of gypsum; somewhat stratified.

The A horizon ranges from fine sandy loam to clay loam in texture and from 1 to 6 inches in thickness. The B2t horizon ranges from clay loam to clay in texture and from 4 to 12 inches in thickness. In the B2t horizon, bleached grains of sand are visible in the upper 2 inches, and lime is visible only in the lower part, though it may occur throughout this horizon. The C horizon ranges from 10YR to 2.5Y in hue.

The Beckton soils are more strongly developed and are less clayey than the Heldt soils. Unlike the Nunn and Fort Collins soils, the Beckton soils have an A2 horizon. In contrast to Fort Collins soils, Beckton soils are more clayey in the B2t horizon and have a more strongly developed profile.

Beckton loam, 0 to 3 percent slopes. (BkB).—This soil occurs on terraces, mainly in the eastern three-fourths of the county. The upper 3 or 4 inches of the surface layer ranges from grayish brown to dark grayish brown in color. The subsoil, about 15 to 17 inches thick, ranges from clay loam to clay, contains salt throughout, and is slightly calcareous, at least in the lower part.

Included with this soil in mapping were small areas of the saline Heldt clay and of Nunn loam. Also included were small areas of loamy alluvial land in drainageways.

This soil is used mainly for pasture. It is not suited to cultivated crops. The native vegetation includes alkali sacaton, western wheatgrass, and blue grama. (Capability unit VI-2; Salt Flat range site; tree planting suitability group 5)

Bijou Series

The Bijou series consists of deep, level to gently sloping soils along major streams. These soils developed in material that washed from the Dawson formation in the Black Forest. This material contains sand and feldspar. The topography is smooth to slightly undulating; most slopes are less than 2 percent.

In a typical profile the surface layer and the subsoil consist of grayish-brown sandy loam that is free of lime. The surface layer is about 6 inches thick, and the subsoil is about 18 inches thick and contains a few clay films. The underlying material is light yellowish-brown loamy sand in the upper part and pale-brown silt loam stratified with sand in the lower part.

The Bijou soils take in water rapidly. Internal drainage is generally rapid, and available water holding capacity is moderate. In some areas a less permeable layer restricts the downward movement of water and the soil is poorly drained. Bijou soils are moderate in natural fertility, but if cultivated and not protected against erosion, they lose their fertility rapidly. They are highly susceptible to soil blowing. Surface crusting is likely in cultivated areas.

These soils are suited to grasses and to wheat and other nonirrigated crops. About half of the acreage is used for cultivated crops, mainly winter wheat. Some areas along Bijou Creek and Cherry Creek are irrigated, and alfalfa and corn grow well in these areas. Hay, native grasses, or alfalfa is grown in poorly drained areas.

Typical profile of Bijou sandy loam, 0 to 3 percent slopes, about 1,600 feet east and 1,400 feet north of the southwest corner of section 30, T. 5 S., R. 61 W.:

- Ap—0 to 6 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; very weak, thin, platy structure that breaks to weak, fine, granular structure; hard when dry, loose when moist; noncalcareous; abrupt, smooth boundary.

- B2t-6 to 12 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard when dry, very friable when moist; noncalcareous; few patchy clay films; clear, smooth boundary.
- B3-12 to 24 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium to coarse, subangular blocky structure; hard when dry, loose when moist; noncalcareous; few patchy clay films; gradual, smooth boundary.
- C1-24 to 44 inches, light yellowish-brown (2.5Y 6/4) loamy sand, light olive brown (2.5Y 5/4) when moist; massive (structureless) or single grain (structureless); hard when dry, loose when moist; noncalcareous.
- IC2-44 to 60 inches, pale-brown (10YR 6/3) silt loam stratified with sand; strata are $\frac{1}{2}$ inch to 5 inches thick; some strata are calcareous.

The A horizon ranges from loamy sand to sandy loam in texture and from 4 to 12 inches in thickness. The B2t horizon is 5 to 15 inches thick and generally is as dark as the surface layer. In the poorly drained areas, the B horizon contains gray and reddish mottles, is very hard when dry, and a clayey layer generally occurs below a depth of 4 feet and slows penetration of water.

Like the Truckton soils, the Bijou soils are much harder when dry than most sandy soils. Bijou soils have a sandier subsoil and less distinct horizons than the nearby Bresser soils. They have more distinct horizons and are less sandy throughout than the Blakeland soils. The Bijou soils are sandier throughout than the Fort Collins soils, but unlike those soils, Bijou soils do not contain lime.

Bijou sandy loam, 0 to 3 percent slopes (B/E).—This soil occurs in the western two-thirds of the county, mainly along the major streams. Slopes generally are less than 2 percent. This soil has the profile described as typical for the series.

Included with this soil in mapping were small areas of Blakeland loamy sand, of Bresser sandy loam on terraces, and of the wet Bijou sandy loam.

About one-half of the acreage of this soil is used for cultivated crops. Because soil blowing is a moderate to severe hazard, it is essential that enough crop residue is left on the surface to control soil blowing. (Capability unit IIIe-1; Sandy Foothill range site; tree planting suitability group 2)

Bijou sandy loam, wet, 0 to 3 percent slopes (BmB).—This poorly drained soil occurs in the western two-thirds of the county. The largest areas are east of West Bijou Creek and Cherry Creek, but small areas are scattered throughout the county.

The surface layer is dark-colored sandy loam to loamy sand about 10 inches thick. The subsoil is sandy loam about 24 inches thick. Gray and brown mottles occur at a depth of 8 to 24 inches. During dry periods salts are visible on the surface in some spots. The water table is high at least part of the year and is usually within 5 feet of the surface most of the time.

Included with this soil in mapping were a few small areas of Bijou sandy loam that are not wet, of Beckton loam, and of Blakeland loamy sand.

About one-half of the acreage of this soil is cultivated. Alfalfa is the most common crop. If this soil is cultivated, a cover must be maintained at all times to control soil blowing. Soil blowing on pasture or hay meadow is controlled by not grazing or cutting the grass closely in fall. Then, there is enough cover for protection in spring. (Capability unit IVw-1; Wet Meadow range site; tree planting suitability group 3)

Blakeland Series

The Blakeland series consists of nearly level to steep soils that occur as small, scattered areas throughout the western half of the county. These soils developed in wind-deposited material that was derived from the Dawson formation. The topography is undulating to hilly.

In a typical profile the surface layer is grayish-brown loamy sand that is free of lime and about 14 inches thick. The next layer consists of noncalcareous, brown sand about 7 inches thick. The underlying material is noncalcareous, yellowish-brown sand that extends to a depth of 60 inches. Below a depth of 6 inches, the soil material is very hard when dry.

The Blakeland soils are droughty. They have a rapid rate of water intake and low available water holding capacity. Unprotected areas are susceptible to water erosion and to severe soil blowing.

Most of the acreage is in native grass and is used for grazing cattle and horses. The dominant grasses include sand bluestem, sandreed, little bluestem, and needle-and-thread. These soils are also suitable for community development. They are a good source of material for road fill.

Typical profile of Blakeland loamy sand, 1 to 20 percent slopes, about 2,240 feet east and 600 feet south of the northwest corner of section 26, T. 4 S., R. 64 W.:

- A11-0 to 6 inches, grayish-brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; single grain (structureless); loose when dry or moist; noncalcareous; clear, smooth boundary.
- A12-6 to 14 inches, grayish-brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; weak, coarse or very coarse, prismatic structure that breaks to weak, coarse or very coarse, subangular blocky structure; very hard when dry, loose when moist; noncalcareous; gradual, wavy boundary.
- AC-14 to 21 inches, brown (10YR 5/3) sand, brown or dark brown (10YR 4/3) when moist; single grain (structureless); very hard when dry, loose when moist; noncalcareous; gradual, wavy boundary.
- C-21 to 60 inches, yellowish-brown (10YR 5/4) sand; single grain (structureless); hard when dry, loose when moist; noncalcareous.

The A horizon ranges from 4 to 15 inches in thickness. The AC horizon ranges from loamy sand to sand. Feldspar minerals generally occur throughout the profile. In places some dark streaks extend to a depth of 25 inches. In some places small balls of clay, 5 to 10 millimeters in diameter, occur in the AC horizon and in the C horizon. Blakeland soils are very hard and stand in vertical banks as much as 10 feet high. Depth to bed-rock ranges from a few feet to many feet.

The Blakeland soils are more sandy than the Truckton soils, and unlike them, do not have a B horizon. They are calcareous and are less silty and darker colored than Colby soils, which are limy.

Blakeland loamy sand, 1 to 9 percent slopes, eroded (BoD2).—This soil occurs in the western three-fourths of the county where topography is rolling. The surface layer is dark-brown loamy sand about 5 inches thick. It grades to lighter colored loamy sand or sand that extends to a depth of more than 5 feet.

Included with this soil in mapping were small areas of Truckton loamy sand. Also included, in areas as much as one-half acre in size, were blowouts on north- and west-facing slopes. In these areas the yellowish-brown underlying material is exposed.

This soil has been cultivated, but most of the acreage is now in grass. Because of the severe hazard of erosion, this soil should not be used for cultivated crops. (Capability unit VIe-4; Deep Sand range site; tree planting suitability group 2)

Blakeland loamy sand, 1 to 20 percent slopes (BcE).—This undulating to hilly soil occurs mainly in the western three-fourths of the county, generally in areas less than 160 acres in size. This soil has the profile described as typical for the series. Even though this soil is sandy, it is hard enough to resist digging when dry.

Included with this soil in mapping were small areas of Truckton loamy sand.

This soil is used mainly for native range. Under good management, it produces an excellent stand of forage plants, mainly mid grasses and tall grasses. This soil is not suited to cultivated crops because it is droughty and is highly susceptible to soil blowing if left without a vegetative cover. (Capability unit VIe-4; Deep Sand range site; tree planting suitability group 2)

Bresser Series

The Bresser series consists of deep, level to steep soils that occur on stream terraces and on uplands in the western three-fourths of the county. These soils developed in non-calcareous, sandy material deposited by wind and water.

In a typical profile the surface layer is dark grayish-brown sandy loam about 5 inches thick. The subsoil, about 23 inches thick, is dark-brown sandy loam in the upper part, brown sandy clay loam in the middle part, and light-brown sandy loam that contains small balls of clay in the lower part. The underlying material is light yellowish-brown loamy sand that contains a few small balls of clay.

In areas in crops or grass, the Bresser soils have a moderate to rapid rate of water intake. In bare areas, however, crusting is likely, and the intake rate is moderate or slow. The available water holding capacity is moderate. These soils are easily penetrated by roots and generally are moderate in natural fertility, but unprotected areas are highly susceptible to water erosion and to soil blowing.

These soils are used mainly for cultivated crops. Winter wheat is the principal crop, but barley and sorghums are also grown. A few small areas are irrigated, and corn and alfalfa grow well in these areas.

Typical profile of a Bresser sandy loam, 600 feet west and 100 feet south of the northeast corner of section 21, T. 5 S., R. 61 W.:

- A1—0 to 5 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark gray brown (10YR 3/2) when moist; weak, fine, granular structure; hard when dry, loose when moist; noncalcareous; clear, slightly wavy boundary.
- B2t—9 to 16 inches, brown (7.5YR 4/3) sandy clay loam, brown brown (10YR 3/3) when moist; weak, medium, prismatic structure that breaks to weak, medium, sub-angular blocky structure; hard when dry, very friable when moist; thin, patchy clay films on some pedis; noncalcareous; clear, wavy boundary.
- B2t—9 to 16 inches, brown (7.5YR 4/3) sandy clay loam, brown (7.5YR 4/3) when moist and crushed; moderate, medium and fine, prismatic structure that breaks to moderate, medium, angular blocky structure; very hard when dry, firm when moist; thin, nearly continuous clay films on pedis; nodules or spots of heavy clay; dark stains on outside of pedis; noncalcareous; clear, wavy boundary.

B3—16 to 28 inches, light-brown (7.5YR 6/3) sandy loam, brown (7.5YR 5/3) when moist; weak to moderate, coarse, prismatic structure that breaks to weak to moderate, coarse, angular blocky structure; very hard when dry, very friable when moist; thin, patchy clay films on vertical faces of pedis; balls of clay that are 5 to 15 millimeters in diameter; noncalcareous; gradual, wavy boundary.

C—28 to 50 inches, light yellowish-brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) when moist; weak, coarse, prismatic structure that breaks to massive (structureless); hard when dry, loose when moist; few balls of clay that are 5 to 10 millimeters in diameter; noncalcareous.

The A horizon generally is sandy loam but ranges from loam to loamy sand. It is 4 to 12 inches thick. The B2t horizon is sandy clay loam or clay loam and is 5 to 16 inches thick. In some places thin streaks of lime occur in the C horizon.

The Bresser soils have a more clayey subsoil and thicker and more distinct horizons than the Truckton soils. Unlike the Ascalon and Nunn soils, Bresser soils do not contain lime in their subsoil. They are harder when dry than the Ascalon soils, and their subsoil is less clayey and silty than that of Nunn soils.

Bresser loamy sand, terrace, 0 to 3 percent slopes (BtB).—This soil occurs mainly along Kiowa Creek in the central part of the county. Its loamy sand surface layer is 6 to 12 inches thick and was deposited during the flood in 1935. The subsoil is sandy clay loam about 18 inches thick. Below this is stratified loamy sand and sandy loam that extend to a depth of 60 inches or more.

Included with this soil in mapping were some small areas of Bresser sandy loam on terraces and of wet Bijou sandy loam. Also included were areas where the loamy sand surface layer is 20 inches thick.

This soil has moderate available water holding capacity and is easily penetrated by plant roots. The water table is at a depth of about 10 feet most of the year. In many areas the soil material is moist below a depth of 4 feet.

Most of this soil is cultivated, but crops are hard to establish. Alfalfa and other deep-rooted crops grow well after they are established. This soil blows easily and is low in fertility. Soil blowing can be controlled by keeping a plant cover on the surface and by stubble mulching where summer fallow is used. (Capability unit IVe-7; Sandy Foothill range site; tree planting suitability group 2)

Bresser sandy loam, terrace, 0 to 3 percent slopes (BsB).—This soil occurs along major drainageways in the western three-fourths of the county. It has a dark-colored sandy loam surface layer about 6 inches thick and a sandy clay loam subsoil about 15 inches thick. A zone of lime accumulation does not occur, but there are spots of lime below the subsoil in some places.

Included with this soil in mapping were small areas of Nunn loam, of Bijou sandy loam, and of the wet Bijou sandy loam.

This soil is used mostly for cultivated crops, mainly wheat. It is easy to work and is readily permeable to roots, air, and moisture. Runoff is slow, but soil blowing is a hazard unless enough crop residue is kept on the surface for protection. (Capability unit IIIe-1; Sandy Foothill range site; tree planting suitability group 2)

Bresser loam, gravelly subsoil variant, 1 to 3 percent slopes (BtB).—This soil occurs primarily on the terrace on the eastern side of the South Platte River. Its surface layer is very dark grayish-brown loam that is about 8

inches thick and contains some gravel. The subsoil is brown clay loam about 16 inches thick. It grades into clean sands and gravel at a depth of about 30 inches. In some places lime occurs in the lower part of the subsoil.

Included with this soil in mapping were small areas of Nunn clay loam and of Edgewater loam.

This soil is suited to the crops commonly grown in the county. Water for irrigation generally is available from streams or wells. Nearly all of the acreage is used as residential or commercial sites, for which the soil is well suited. (Capability unit IIIc-1; Loamy Foothill range site; tree planting suitability group 1)

Bresser-Stapleton sandy loams, 3 to 9 percent slopes (BuD).—This complex occurs in the southwestern part of the county, generally in areas of less than 100 acres in size. Elevations are more than 6,000 feet.

Bresser sandy loam makes up about 60 to 70 percent of this complex, and Stapleton sandy loam, 20 to 30 percent. Included in mapping were areas of Buick loam, of Renohill loam, and of sandy alluvium in drainageways. The included areas make up 10 to 20 percent of some mapped areas.

The Bresser soil occurs on side slopes and foot slopes. This soil is deep and has a surface layer about 10 inches thick. It is fertile, easy to work, and takes in and holds water well. The subsoil is sandy clay loam about 24 inches thick.

The Stapleton soil occurs on knobs and next to drainageways. It is moderately deep, and its surface layer is 4 to 8 inches thick. The next layer is sandy to gravelly loam about 6 to 12 inches thick.

Most of this complex is in grass, but a few pine and mountain-mahogany trees grow in some places. These soils can be used for cultivated crops, but the hazard of erosion is severe. Terracing, stripcropping, and other intensive conservation practices help to control erosion. (Capability unit IVe-4; Sandy Foothill range site; tree planting suitability group 2)



Figure 4.—An area of Bresser-Stapleton sandy loams, 9 to 20 percent slopes. The pine trees in the background are growing on the Stapleton soil. An excellent stand of intermediate wheatgrass on the Bresser soil is in the foreground.

Bresser-Stapleton sandy loams, 9 to 20 percent slopes (BuE).—This complex occurs in the southwestern part of the county at elevations above 5,900 feet. Many areas are more than 100 acres in size (fig. 4).

The Bresser and Stapleton soils are about equal in extent in this complex. Included with these soils in mapping were areas of Renohill loam, of Litle silty clay loam, and of Buick loam. Also included were areas of sandy alluvium in drainageways.

The Bresser soil occupies the higher slopes and ridgetops. It is deep and has a sandy clay loam subsoil. Shale or partly consolidated gravelly material occurs between depths of 30 and 60 inches in some places.

The Stapleton soil is on the steeper slopes next to the drainageways. It is shallow and has a surface layer 4 to 10 inches thick. Partly consolidated gravelly material is at a depth of 12 to 24 inches.

Almost all of this complex is in native grass and is used for grazing livestock or as wildlife and recreational areas. A few ponderosa pine and mountain-mahogany trees grow in some places. Because of the slope and the severe hazard of erosion, these soils are not suited to cultivated crops. Good range management is needed to prevent overgrazing and to control erosion. (Capability unit VIe-3; Sandy Foothill range site; tree planting suitability group 4)

Bresser-Truckton sandy loams, 3 to 5 percent slopes (BvC).—This complex occupies large areas throughout the western three-fourths of the county. The topography is gently sloping to rolling.

Bresser sandy loam makes up 50 to 70 percent of this complex, and Truckton sandy loam, 20 to 40 percent. Included with these soils in mapping were areas of Nunn loam and of low-lying areas called wet weather lakes. Also included were a few small areas of Truckton loamy sand and of the Nunn-Bresser-Ascalon complex, 0 to 3 percent slopes.

The Bresser soil occupies the slopes. It has a surface layer about 6 inches thick and a sandy clay loam subsoil about 20 inches thick.

The Truckton soil occurs on ridgetops and is susceptible to soil blowing. Its surface layer is about 5 inches thick. The subsoil contains more clay than the surface layer and is sandy loam about 15 inches thick.

Most of this complex is in native grass, but a few areas are used for cultivated crops. Wheat is the main crop, but sorghums and barley are also grown. Because soil blowing is a severe hazard, these soils are better suited to grass than to cultivated crops. (Capability unit IVe-3; Sandy Foothill range site; tree planting suitability group 2)

Bresser-Truckton sandy loams, 5 to 20 percent slopes (BvE).—This complex occurs mainly in the southern part of the county. It occupies large areas that extend eastward from Cherry Creek to East Bijou Creek. These areas generally are more than 100 acres in size and are dominant on the eastern side of streams.

Bresser and Truckton soils are about equal in extent in this complex. Included with these soils in mapping were small areas of Ascalon sandy loam. Also included were some areas in which outcrops of shale and sandstone occur along streams and drainageways.

The Bresser soil is on side slopes. It has the profile described as typical for the series.

The Truckton soil occurs in the higher areas. Its surface layer is about 5 inches thick. The subsoil, about 12 inches thick, is sandy loam and contains more clay than the surface layer.

Almost all of this complex is in native grass. Because of the slope, droughtiness, and a severe hazard of erosion, these soils are not suited to cultivated crops. Careful control of grazing is needed to maintain a good grass cover and to help control erosion. (Capability unit VIe-3; Sandy Foothill range site; tree planting suitability group 4)

Bresser and Truckton soils, 3 to 9 percent slopes, eroded (BwD2).—This mapping unit occurs mainly in the western three-fourths of the county. The Bresser soils make up about 50 to 70 percent of this mapping unit, and the Truckton soils, 20 to 40 percent. Included with these soils in mapping were small areas of Blakeland, Ascalon, and Stapleton soils.

The Bresser soils have a sandy loam or sandy clay loam surface layer about 4 inches thick. In most places the surface layer is light colored because soil blowing has removed organic matter from the surface soil and plowing has mixed material from the subsoil with the original surface soil. The subsoil is sandy clay loam.

The Truckton soils have a surface layer of brown sandy loam about 4 inches thick. In some places erosion has removed the original surface soil and the subsoil is exposed.

Although most areas of these soils are cultivated, cultivated crops are not suited because the hazard of soil blowing is severe. Blowouts are common on the ridgetops where slopes face west and north. In these areas most of the surface soil has been removed and the subsoil or the underlying material is exposed. Sandy loam or loamy sand several inches thick have been deposited over the original soil material where slopes face east.

A permanent plant cover is needed for the control of erosion on these soils. Diversions also help to control runoff and erosion. (Capability unit VIe-3; Sandy Foothill range site; tree planting suitability group 2)

Buick Series

The Buick series consists of deep, gently sloping to sloping soils that occur on uplands in the western three-fourths of the county. These soils developed in material deposited by wind and water.

In a typical profile the surface layer is brown loam that is free of lime and about 6 inches thick. The subsoil, about 50 inches thick, is brown and light yellowish-brown clay loam in the upper part and is very pale brown and pale-olive sandy clay loam in the lower part. The subsoil contains lime below a depth of about 12 inches. Horizons of an old buried soil occur below a depth of about 22 inches.

The Buick soils have a moderate rate of water intake and high available water holding capacity. They are moderately high in natural fertility.

These soils are suited to native grasses and to wheat and other nonirrigated crops. Most of the acreage is in native grasses. Winter wheat is the main crop.

Typical profile of Buick loam, 3 to 5 percent slopes, about 200 feet east and 1,000 feet south of the northwest corner of section 2, T. 4 S., R. 60 W.:

A1—0 to 3 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak to moderate, fine, granular structure; soft when dry, very friable when moist; medium and fine, rounded concretions, less than 5 percent by volume, of feldspar and quartz are scattered on surface and throughout horizon; noncalcareous; clear, smooth boundary.

AB—3 to 6 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft when dry, friable when moist; thin, patchy clay skins in lower inch; noncalcareous; clear, smooth boundary.

B2t—6 to 12 inches, brown (10YR 5/3) clay loam, brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to moderate or strong, fine, subangular and angular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay skins; clear, smooth boundary.

B3ca—12 to 22 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) when moist; moderate, medium, prismatic structure that breaks to moderate, medium or fine, subangular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay skins; very strongly calcareous; clear, smooth boundary.

B21cab—22 to 40 inches, very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) when moist; weak to moderate, coarse, prismatic structure; hard when dry, firm when moist; common, medium, distinct concretions of lime; very strongly calcareous; gradual, wavy boundary.

B22cab—40 to 56 inches, pale-olive (5Y 6/3) sandy clay loam, olive (5Y 5/3) when moist; vertical cleavage but no apparent structure; hard when dry, firm when moist; moderately to very strongly calcareous.

The A horizon ranges from sandy loam to loam or silt loam in texture and from 2 to 6 inches in thickness. The B2t horizon is clay loam, loam, or silt loam 5 to 15 inches thick. Depth to lime generally is about 12 inches but ranges from 5 to 16 inches. In some places the buried layers are more red and the structural peds are larger and more distinct than in the rest of the subsoil. The buried soil ranges from loam to clay and generally is gritty. Depth to shale or sandstone ranges from 4 to 6 feet.

The Buick soils are deeper to bedrock than the associated Renohill soils. The subsoil of Buick soils is less clayey and more compact in the lower part than that of the Weld soils. Buick soils have a thinner, less clayey subsoil than Fondis soils, but both kinds of soils have layers of buried soils.

Buick loam, 3 to 5 percent slopes (BxC).—This soil occurs in small, scattered areas on uplands in the western three-fourths of the county. It has the profile described as typical for the series.

Included with this soil in mapping were a few small areas of Weld silt loam, of Colby silt loam, and of Renohill loam. The Weld and Colby soils are on the crests or the highest parts of the slope, and the Renohill soils are next to drainageways.

Most of this soil is in native grass, but some of it is used for small grains. Cropping is hazardous because of the slope, low precipitation, and the hazard of soil blowing. Following winter wheat by summer fallow is a common practice. Stubble mulching and terracing help to control erosion. (Capability unit IIIe-2; Loamy Foothill range site; tree planting suitability group 1)

Buick loam, 5 to 9 percent slopes (BxD).—This soil is on uplands throughout the western three-fourths of the county. Its surface layer consists of about 5 inches of loam or silt loam. The upper part of the subsoil, about 14 inches thick, is clay loam. Lime is 5 to 12 inches below the soil surface. In many cultivated areas, material from the sub-

soil is mixed with the topsoil, and in these areas the plow layer and the subsoil are clay loam in texture. In some places small blocks of limy soil material are on the surface. Loamy to clayey, calcareous soil material extends to a depth of 4 feet or more.

Included with this soil in mapping were a few small areas of Weld silt loam, of Colby silt loam, and of Renohill loam. Also included were small areas of a loamy soil that is limy throughout the subsoil; these areas occupy the crests of hills that face north or west.

Most of this soil is in native grass, but some areas are cultivated. In cultivated areas susceptibility to soil blowing and water erosion is severe. The slope, low precipitation, and soil blowing are the major hazards. Surface runoff is moderate to rapid, and the available water holding capacity is high. Practices that help to control erosion and conserve moisture are summer fallowing and stubble-mulch tillage. (Capability unit IVe-2; Loamy Foothill range site; tree planting suitability group 1)

Clayey Alluvial Land

Clayey alluvial land (Co) occurs throughout the county in narrow drainageways and along streams and is subject to flooding every year. It generally occupies areas that are less than 500 feet wide and less than 1 mile long.

Included with this land in mapping were small areas of Loamy alluvial land and of Heldt clay.

Clayey alluvial land is variable, but commonly it has a surface layer of very dark grayish-brown, clayey soil material that has been recently deposited. This layer is about 6 inches thick and is generally calcareous. Below the surface layer is dark-brown, calcareous, stratified clay and loam that is generally thick and is lighter in color and higher in lime as depth increases. This material is easily penetrated by roots and water.

This land type is mostly in native grass. It is not suited to cultivated crops, because of the hazards of flooding and erosion. It is well drained, has high available water holding capacity, and is high in fertility. Where water spreaders are installed in the drainageways, western wheatgrass grows well, and it can be grazed or cut for hay. The water must be carefully controlled to keep gullies from forming. (Capability unit VIw-2; Overflow range site; tree planting suitability group 5)

Colby Series

The Colby series consists of deep, well-drained, gently sloping to steep soils that occur on ridgetops and on a few short steep slopes in the eastern three-fourths of the county. Most areas are less than 300 feet wide and 1 mile long.

In a typical profile the surface layer is light brownish-gray, limy silt loam about 5 inches thick. The next layer, about 7 inches thick, is pale-brown silt loam that contains much lime and is easily penetrated by roots and water. The underlying material is very pale brown and pale-brown, limy silt loam to a depth of 60 inches.

The Colby soils have a moderate rate of water intake, moderate permeability, and high available water holding capacity. They are moderate in natural fertility, but are highly susceptible to soil blowing and water erosion unless

a vegetative cover is maintained. The hazard of erosion is increased in bare areas because they tend to slicken.

These soils are suited to wheat and other nonirrigated crops if protected against soil blowing and water erosion.

Typical profile of Colby silt loam, 1 to 5 percent slopes, about 900 feet north and 1,600 feet west of the southeast corner of section 16, T. 4 S., R. 59 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; soft when dry, very friable when moist; very strongly calcareous; clear, smooth boundary.

AC—5 to 12 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist; very strongly calcareous; gradual, slightly wavy boundary.

C1ca—12 to 36 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist; very strongly calcareous; diffuse, wavy boundary.

C2—36 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive (structureless); loose when dry, very friable when moist; very strongly calcareous.

The A1 horizon is silt loam or loam and is 3 to 6 inches thick. It is generally limy at the surface but in places is free of lime to a depth of 2 inches. The AC horizon ranges from 7 to 20 inches in thickness and from loam to silt loam in texture. More visible lime occurs in this layer than in the underlying material.

In contrast to the Weld and Buick soils, which are non-calcareous in the upper part and have a distinct B horizon, the Colby soils are calcareous throughout and lack a B horizon. Colby soils are lighter colored than Weld soils, and they are not so compact in the lower part as Buick soils.

Colby silt loam, 1 to 5 percent slopes (CoC).—This soil occurs on ridgetops, less than 300 feet wide, mainly in the eastern three-fourths of the county. The areas are generally long and scattered. This soil has the profile described as typical for the series. Erosion, primarily soil blowing, has removed part of the surface layer.

Included with this soil in mapping were a few small areas of Weld silt loam. Also included, on the east side of Deer Trail Creek in the northern part of the county, were a few small areas of a Colby soil that has a limy, light-colored fine sandy loam surface layer about 4 inches thick.

About one-half of the acreage of this Colby silt loam is in native grass, but winter wheat is grown in some places and is commonly followed by summer fallow. This soil is easy to work, but it needs protection against soil blowing. Soil blowing is reduced by leaving crop residue on the surface to provide a protective cover. Stubble mulching helps to conserve moisture and to control soil blowing. (Capability unit IVe-1; Loamy Plains range site; tree planting suitability group 1)

Colby silt loam, 5 to 20 percent slopes (CoE).—This soil occupies small areas on side slopes that are generally less than 500 feet long and are in the eastern half of the county. Its light-colored, limy surface layer is about 4 inches thick, and it is underlain by limy silt loam.

Included with this soil in mapping were a few small areas of Baca loam and of Thedalund clay loam. These soils occur in the lowest areas in the landscape or in areas next to drainageways.

This soil is in native range. Because of the slope and the severe hazard of erosion, it is not suited to cultivated crops. Runoff is moderate to high. Unless a plant cover is maintained, this soil erodes easily and deep gullies form. Good management is needed to prevent overgrazing and to maintain a good grass cover. (Capability unit VIe-1; Loamy Slopes range site; tree planting suitability group 4)

Colby and Adena soils, 1 to 9 percent slopes, eroded (CyD2).—These soils occupy small areas that are scattered throughout the eastern three-fourths of the county. They have been eroded by both wind and water and have been cut by gullies that generally are 100 feet or less apart, 3 to 10 feet wide, and 6 to 18 inches deep. Soil blowing has been more severe on the ridgetops, but there are some blowouts, or small, limy, circular depressions, on the side slopes.

Colby soils make up 50 to 60 percent of this mapping unit, and Adena soils, 40 to 50 percent.

The Colby soils occur on small ridges. They have a limy silt loam surface layer about 4 inches thick. In some places the surface layer is underlain by a transitional layer that consists of limy silt loam or loam about 7 inches thick. Where this layer is missing, the surface layer lies directly on the loose, silty underlying material.

The Adena soils occur between the ridges and on slopes that face east. Their surface layer, about 4 inches thick, is brown silt loam that is spotted with lime. The subsoil is limy silty clay loam about 10 inches thick.

The soils in this mapping unit have been or are now cultivated, but they should be reseeded to grass where practical. Grazing should be avoided in reseeded areas until a good stand of grass has been established. Then it is essential to regulate grazing so as to control erosion. (Capability unit VIe-1; Loamy Plains range site; tree planting suitability group 1)

Deertrail Series

The Deertrail series consists of deep, level or nearly level soils that occur mainly in the eastern part of the county. These soils developed in material deposited by the wind.

In a typical profile the surface layer is light brownish-gray, lime-free silt loam about 2 inches thick. The subsoil, about 30 inches thick, is dark-brown, noncalcareous clay in the upper part, pale-brown, strongly calcareous silty clay in the middle part, and very pale brown and pale-brown, very strongly calcareous silty clay loam in the lower part. The underlying material is pale-brown, very strongly calcareous silt loam that extends to a depth of 55 inches.

The Deertrail soils have slow runoff and very slow water intake. Because of the high sodium content of the subsoil, the available water holding capacity is low. These soils are moderate in natural fertility but are droughty and susceptible to soil blowing.

These soils are suited to grasses and to wheat and other nonirrigated crops. Most of the acreage is used for cultivated crops, mainly winter wheat.

In Arapahoe County the Deertrail soils were mapped only with the Weld soils in a complex. For a description of this complex, see the Weld Series.

Typical profile of a Deertrail silt loam, 520 feet east, 250 feet north of the southwest corner of section 25, T. 5 S., R. 59 W.:

- A2—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; strong, fine, granular structure in upper part; soft when dry, very friable when moist; strong, thin, platy silty clay loam in lower one-half inch; noncalcareous; abrupt, smooth boundary.
- B21t—2 to 9 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 4/3) when moist and crushed; moderate, medium, columnar structure that breaks to strong, fine, angular blocky structure; very hard when dry, very firm when moist; thin, nearly continuous clay films; dark stains on upper 2 inches of peds; grains of bleached sand on columns; noncalcareous; abrupt, slightly wavy boundary.
- B22ca—9 to 12 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, angular blocky structure; hard when dry, firm when moist; thin, patchy clay films on ped surfaces; strongly calcareous; clear, smooth boundary.
- B31ca—12 to 23 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; moderate, medium, prismatic structure that breaks to moderate, fine, angular blocky structure; hard when dry, firm when moist; thin, patchy clay films on ped surfaces; very strongly calcareous; common, medium, faint concretions of lime; vesicular; clear, smooth boundary.
- B32ca—23 to 32 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; weak, medium, sub-angular blocky structure; slightly hard when dry, friable when moist; few, thin clay films on some ped faces; very strongly calcareous; few, medium, faint concretions of lime; vesicular; gradual boundary.
- C—32 to 55 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive (structureless); soft when dry, very friable when moist; vesicular; very strongly calcareous.

The A horizon ranges from silt loam to silty clay loam in texture and from 1 to 4 inches in thickness. The surface is shiny and slick after a rain because the soil runs together and forms plates an inch or more thick. The B horizon ranges from 20 to 30 inches in thickness and has lime in it 6 to 14 inches from the soil surface. The B2t horizon is dense clay or silty clay that has dark stains in the upper part. In a road cut or pit, the B horizon appears as joints about a half-inch square or as columns several inches long. If the soil is disturbed, the columns break into blocks a half-inch square.

The Deertrail soils are lighter colored than the closely associated Weld soils and have a thinner surface layer and a more clayey subsoil. They have more distinct horizons, are deeper to lime, and are more clayey below the surface layer than nearby Colby soils. The Deertrail soils have a thinner, lighter colored surface layer than the Fondis soils, which contain buried layers of an older soil.

Edgewater Series

The Edgewater series consists of poorly drained soils that occur on bottom lands of the South Platte River. These soils are moderately deep over gravel. They developed in loamy material deposited by water.

In a typical profile the surface layer is dark grayish-brown loam that is free of lime and about 18 inches thick. It is underlain by about 10 inches of grayish-brown, noncalcareous sandy clay loam that is streaked with iron. Below this layer is a layer consisting of waterworn gravel, mainly of feldspar and granite, and some sand and fine mica.

The Edgewater soils take in water well and have moderate available water holding capacity. They are likely to be flooded when the major streams are at flood stage. Free water usually is within 4 feet of the surface, and sometimes it is much higher.

These soils are suited to cultivated crops, but most areas are now used for housing or commercial development.

They are also a source of gravel. Most areas have been irrigated and are used for the crops commonly grown in the county.

Typical profile of Edgewater loam, 0 to 3 percent slopes, 200 feet west and 200 feet south of the northeast corner of section 31, T. 5 S., R. 68 W.:

- A1—0 to 18 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, fine, subangular blocky structure; slightly hard when dry, firm when moist; much mica; wormholes are common; noncalcareous; abrupt, smooth boundary.
- A1g—18 to 28 inches, grayish-brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist; few streaks of iron; noncalcareous; gradual boundary.
- H1C1—28 to 60 inches, waterworn gravel, mainly of feldspar and granite, but some sand and fine mica; water table at a depth of 60 inches.

The A1 horizon ranges from 6 to 20 inches in thickness. A few, medium, distinct mottles occur in the lower part of the A horizon. Worm casts and wormholes are numerous in the A horizon. The A1g horizon ranges from 8 to 12 inches in thickness and from sandy clay loam to clay in texture; mottles range from common to many. This horizon contains lime in some places.

The Edgewater soils are darker colored to a greater depth than the Fort Collins soils and, unlike them, show effects of wetness. Edgewater soils have more distinct layers than Wet alluvial land and are flooded less frequently.

Edgewater loam, 0 to 3 percent slopes (EdB).—This soil occupies areas along the South Platte River. Included in mapping were small areas of Wet alluvial land and of Nunn loam.

This soil is suited to the crops commonly grown in the county. Crops grow well in irrigated fields. Water for irrigation is available from wells that yield about 400 gallons or more per minute. Vegetable crops have been grown on this soil, but most of the acreage is now used as residential and commercial sites. This soil is a good source of gravel and of water. (Capability unit IVw-1; Wet Meadow range site; tree planting suitability group 3)

Fondis Series

In the Fondis series are deep, well-drained, gently sloping to sloping soils on uplands in the western half of the county (fig. 5).

In a typical profile the surface layer is about 8 inches thick and is free of lime. It is dark grayish-brown silt loam in the upper part and is dark grayish-brown silty clay loam in the lower part. The subsoil is about 84 inches thick and contains layers of an older buried soil. In the upper 24 inches is a layer of dark-brown, noncalcareous clay and a layer of pale-brown, very strongly calcareous silty clay loam. Below a depth of 32 inches are layers of an older buried soil that extend to a depth of 92 inches and contain concretions of lime. These layers are light yellowish-brown and dark-brown loam, silt loam, clay loam, and gravelly clay loam.

The Fondis soils have moderately slow permeability, slow internal drainage, and high available water holding capacity. They are high in natural fertility but are susceptible to soil blowing and to water erosion.

These soils are suited to native grasses and to wheat and other nonirrigated crops. Most of the acreage is used for



Figure 5.—Profile of a Fondis silt loam.

cultivated crops, mainly winter wheat, and for residential sites. Some areas are irrigated and are used mainly for corn and alfalfa.

Typical profile of a Fondis silt loam, 2,490 feet south and 100 feet east of the southwest corner of section 30, T. 4 S., R. 63 W.:

- A1—0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, crumb structure; soft when dry, very friable when moist; few fine pebbles on surface; fine

- pebbles make up less than 5 percent of horizon, by volume; noncalcareous; clear, smooth boundary.
- A3—4 to 8 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, blocky structure that breaks to strong, fine to very fine, subangular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay skins; grains of bleached sand; noncalcareous; clear, smooth boundary.
- B21t—8 to 17 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to strong, fine, angular blocky structure in which blocks are nearly cubes; very hard when dry, very firm when moist; thin, nearly continuous clay skins; few grains of bleached sand in upper 3 inches; noncalcareous; clear, smooth boundary.
- B22tea—17 to 32 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; moderate, medium, prismatic structure that breaks to moderate, medium and fine, angular blocky structure; hard when dry, friable when moist; thin patchy clay skins; very strongly calcareous; gradual, smooth boundary.
- B23cab—32 to 46 inches, light yellowish-brown (10YR 6/4) heavy loam or silt loam, yellowish brown (10YR 5/4) when moist; moderate, medium to coarse, prismatic structure that breaks to moderate, medium, angular blocky structure; hard when dry, very friable when moist; few thin clay skins; moderate, fine, distinct concretions of lime; very strongly calcareous; gradual, smooth boundary.
- B24cab—46 to 84 inches, dark-brown (7.5YR 4/4) clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, angular and subangular blocky structure; hard when dry, friable when moist; thin, patchy clay skins; medium, coarse, distinct concretions of lime and nodules of gypsum; very strongly calcareous; clear, smooth boundary.
- B3cab—84 to 92 inches, light yellowish-brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) when moist; weak, coarse, prismatic structure; very hard when dry, firm when moist; patchy clay skins on vertical faces of pedis; very strongly calcareous.

The A horizon ranges from silt loam and silty clay loam to clay loam in texture and from 5 to 9 inches in thickness. The B21t and B22t horizons range from 12 to 28 inches in thickness and from clay to silty clay loam in texture. Depth to lime is 12 to 20 inches.

The Fondis soils are darker colored, more clayey in the subsoil, and deeper to lime than the Buick soils. They are darker colored, deeper to lime, and have more distinct horizons than the Little soils. Fondis soils are a little darker and are more clayey than Weld soils. Unlike Weld soils, they contain horizons of an older buried soil.

Fondis silt loam, 1 to 3 percent slopes (FdB).—This soil occurs on uplands in the western part of the county. Many areas are 100 acres or more in size. The surface layer of this soil is about 7 inches thick and is abruptly over the subsoil. The upper part of the subsoil is dense clay about 20 inches thick. In the lower part of the subsoil are layers of a buried soil that consist of yellowish-brown clay loam. Depth to lime is 14 to 20 inches. This soil has moderate runoff and slow water intake. The hazards of soil blowing and water erosion are slight to moderate.

Included with this soil in mapping were a few small areas of Weld silt loam and of Fondis silt loam, 3 to 5 percent slopes. Also included were a few moderately eroded areas.

About one-half of the acreage of this soil is cultivated. The rest is in native grass or is used as residential areas. Wheat is the main crop. Summer fallowing after each crop is a common practice. If this soil is cultivated, a tillage pan forms easily. The use of crop residue helps to control soil

blowing and water erosion. (Capability unit IIIc-1; Loamy Foothill range site; tree planting suitability group 1)

Fondis silt loam, 3 to 5 percent slopes (FdC).—This soil is on uplands in the western part of the county. Its surface layer is about 6 inches thick and rests abruptly on the subsoil, which consists of dense clay about 18 inches thick. Lime is nearer the surface than in Fondis silt loam, 1 to 3 percent slopes.

Included with this soil in mapping were a few small areas of Little silty clay loam and of Colby silt loam. Also included were areas of Loamy alluvial land in drainage-ways that generally are less than 100 feet wide.

This soil is suited to cultivated crops. The acreage in cultivated crops and that used for native range and residential areas is about equal. Because of the slope, the dry climate, and the hazard of soil blowing, practices that help to conserve moisture and to control erosion are essential; effective practices include stubble mulching, terracing, and stripcropping. (Capability unit IIIe-2; Loamy Foothill range site; tree planting suitability group 1)

Fondis-Ascalon, gravelly subsoil variant, complex, 1 to 9 percent slopes (FgD).—This complex occupies small areas west of the South Platte River in the extreme western part of the county.

The Fondis soil makes up 50 to 70 percent of this complex, and the Ascalon soil, 30 to 50 percent. Included with these soils in mapping were small areas of Heldt clay and of Little silty clay loam.

The Fondis soil occurs on the smoother parts of side slopes. It has a profile similar to the one described as typical for the Fondis series, but its surface layer is loam instead of silt loam.

The Ascalon soil occurs on knobs and small humps. Its profile is similar to the one described as typical for the Ascalon series, but its surface layer is loam instead of sandy loam and pebbles and cobblestones generally occur at a depth of 18 to 40 inches. In places the layer of pebbles and cobblestones is only about a foot thick, and it rests directly on beds of shale.

Most of the acreage of this complex is used as residential sites. Because of medium to rapid runoff and the hazard of erosion, these soils are not suited to cultivated crops. The Ascalon soil generally has low available water holding capacity because it is shallow to gravel. (Capability unit VIe-1; Loamy Foothill range site; tree planting suitability group 1)

Fondis-Colby silt loams, 3 to 5 percent slopes (FoC).—This complex is in the western part of the county. It occurs as bands, 700 feet wide and a half mile or more long, around ridgetops.

Fondis silt loam makes up about 60 to 80 percent of this complex, and Colby silt loam, 20 to 40 percent. Included with these soils in mapping were small areas of Weld silt loam.

The Fondis soil has a surface layer of dark-colored, lime-free silt loam about 5 inches thick. In the subsoil, which is brown clay about 12 inches thick, lime is about 12 inches from the soil surface. The underlying material extends to a depth of 4 feet or more and is limy clay loam.

The Colby soil has a grayish-brown, limy silt loam surface layer about 4 inches thick. Below this layer is limy silt loam about 12 inches thick. The underlying material is loose, limy silt.

About one-half of the acreage of this complex is in native grass. The soils are suited to the crops commonly grown in the county, but a protective cover of growing plants or of crop residue is needed at all times. Wheat and barley are the main crops. Runoff is moderate, and the available water holding capacity is high. Practices that help to control erosion and to conserve moisture are stubble mulching, terracing, and stripcropping. (Capability unit IIIe-2; Loamy Foothill range site; tree planting suitability group 1)

Fort Collins Series

In the Fort Collins series are deep, well-drained, level to gently sloping soils that occur on terraces and fans in the eastern part of the county. These soils developed in recent alluvium.

In a typical profile the surface layer is dark grayish-brown loam that is free of lime, is about 5 inches thick, and is easily worked. The subsoil, about 9 inches thick, is grayish-brown and light brownish-gray clay loam in the upper part and is pale-brown, limy loam in the lower part. The underlying material is pale-brown, limy, stratified fine sandy loam to clay loam that extends to a depth of 60 inches and is easily penetrated by roots.

The Fort Collins soils have moderate permeability, medium internal drainage, and high available water holding capacity. They are high in natural fertility but are susceptible to soil blowing if not protected.

These soils are well suited to the crops commonly grown in the county.

Typical profile of Fort Collins loam, 0 to 3 percent slopes, about 200 feet south and 200 feet west of the northeast corner of section 4, T. 4 S., R. 60 W.:

- A1—0 to 5 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, crumb structure; soft when dry, very friable when moist; noncalcareous; clear, smooth boundary.
- B21t—5 to 8 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak to moderate, medium, prismatic structure that breaks to weak to moderate, medium, subangular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay skins; slightly calcareous; clear, smooth boundary.
- B22tea—8 to 10 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; weak to moderate, medium, prismatic structure that breaks to weak to moderate, medium, subangular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay skins; strongly calcareous; clear, smooth boundary.
- B3ca—10 to 14 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, medium to coarse, prismatic structure that breaks to weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist; very strongly calcareous; diffuse, smooth boundary.
- C—14 to 60 inches, pale-brown (10YR 6/3) stratified fine sandy loam to clay loam, brown (10YR 5/3) when moist; massive (structureless); soft to slightly hard when dry, very friable when moist; very strongly calcareous.

The A horizon is loam or sandy loam from 2 to 6 inches thick. The B horizon ranges from 5 to 15 inches in thickness. Depth to visible lime is between 8 and 30 inches and averages 14 inches.

The Fort Collins soils are less clayey in the subsoil and have less distinct horizons than the Nunn soils. They are more silty, contain more lime, and are lighter colored than Bresser soils.

Fort Collins loam, 0 to 3 percent slopes (FrB).—This soil occurs along drainageways in the eastern three-fourths of the county. Included with this soil in mapping were small areas of Bresser sandy loam and of Nunn loam. Also included were a few small areas of a Fort Collins soil that has a sandy loam surface layer about 4 inches thick.

This soil is suited to the crops commonly grown in the county. Water erosion is a slight to moderate hazard, and soil blowing is a severe hazard in unprotected areas. Stubble-mulch tillage and stripcropping are practices that help to conserve moisture and control erosion. (Capability unit IIIc-1; Loamy Plains range site; tree planting suitability group 1)

Gravelly Land

Gravelly land (Gr) occurs on side slopes above the major drainageways in the western three-fourths of the county. Slopes range from 6 to 50 percent.

The profile is variable, but commonly the surface layer is sandy loam or gravelly loam 2 to 4 inches thick. It is underlain by 10 to 20 inches of material that is sandy loam or gravelly clay loam in most places. Gravel mixed with some silt and sand occur below a depth of 3 feet. In many places shale and sandstone crop out on the lower parts of these side slopes.

Included with this land in mapping were small areas of Ascalon sandy loam and of Thedalund clay loam.

This land type is in native grass or is used as a source of gravel. It is not suited to cultivated crops, because it is shallow, droughty, and generally steep. (Capability unit VII-1; tree planting suitability group 5; no range site assigned)

Heldt Series

The Heldt series consists of deep, nearly level to gently sloping soils that occur on uplands and stream terraces throughout most of the county. These soils developed in material deposited by wind and water.

In a typical profile the surface layer is grayish-brown, lime-free clay about 4 inches thick. The subsoil, about 19 inches thick, is grayish-brown clay or silty clay that is very hard when dry. This layer contains lime in most places. It is not easily penetrated by roots. The underlying material is light olive-brown, stratified sandy loam to clay that contains lime and extends to a depth of more than 54 inches.

The Heldt soils take water in slowly and release it slowly to plants. The available water holding capacity ranges from low to moderate. Runoff is rapid because water intake is slow. These soils are droughty and are hard to work. A seedbed is difficult to prepare because the soil surface tends to seal. Flooding is a hazard in some places, and water erosion is likely in unprotected areas.

These soils are better suited to grass than to cultivated crops, but cultivated crops can be grown if management is good.

Typical profile of Heldt clay, 0 to 3 percent slopes, 1,400 feet east and 100 feet south of the northwest corner of section 30, T. 5 S., R. 61 W.:

- A1—0 to 4 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; moderate, fine, granular structure; soft when dry, firm when moist; noncalcareous; clear, smooth boundary.
- B21—4 to 6 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; thin, patchy clay films; slightly calcareous; clear, smooth boundary.
- B22—6 to 19 inches, grayish-brown (10YR 5/2) clay or silty clay, dark grayish brown (10YR 4/2) when moist; moderate, coarse, prismatic structure that breaks to moderate, fine, angular blocky structure; extremely hard when dry, very firm when moist; slightly calcareous; thin, patchy clay films or slickensides; clear, smooth boundary.
- B3ca—19 to 23 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, coarse, prismatic structure that breaks to moderate, medium, angular blocky structure; hard when dry, firm when moist; strongly calcareous; some concretions of lime and gypsum; thin, patchy clay films or slickensides; gradual boundary.
- C—23 to 54 inches +, light olive-brown (2.5Y 5/3) stratified sandy loam to clay, olive brown (2.5 4/3) when moist; massive (structureless); hard when dry, friable when moist; slightly calcareous to very strongly calcareous; strata range from one-half inch to 6 inches in thickness.

The A horizon ranges from 2 to 6 inches in thickness and is limy in some places. The B horizon ranges from 4 to 24 inches in thickness.

The Heldt soils are more clayey, have lime closer to the surface, and have less distinct horizons than the Nunn soils. They also are more clayey and have less distinct horizons than the Beckton soils. The boundary between the A and B horizons of the Beckton soils is abrupt instead of smooth, as it is in the Heldt soils.

Heldt clay, 0 to 3 percent slopes (H1B).—This soil occurs along the major drainageways in the county. It has the profile described as typical for the series. This soil takes in water slowly and is hard to work. Depth to lime ranges from about 4 to 8 inches.

Included with this soil in mapping were small areas of Beckton loam and of Nunn loam. Also included were a few small areas of Clayey alluvial land in small drainageways.

This soil is cultivated to small grains, mainly wheat and barley. It is hard to work, and seedbeds are difficult to prepare. Water erosion is a slight to moderate hazard. (Capability unit IVs-1: Clayey Foothill range site in the western part of the county; Clayey Plains range site in the eastern part; tree planting suitability group 4)

Heldt clay, saline, 0 to 3 percent slopes (HsB).—This soil occurs along the major drainageways in the eastern part of the county. The surface layer is heavy clay about 3 inches thick. In places, salts have accumulated in this layer and the surface is white when dry. The subsoil is heavy coarse clay about 10 inches thick. It commonly contains crystals of gypsum and spots of lime, particularly in the lower part. Barren, salty spots make up 20 to 60 percent of each area mapped.

Included with this soil in mapping were a few small areas of Heldt clay, of Beckton loam, and of Clayey alluvial land.

This soil is suited mainly to grass. Because the high salt content of the surface layer restricts plant growth, this soil supports only a poor stand of salt-tolerant plants. The surface soil tends to crust and seal, and this reduces the intake of water. Reclamation for cropping is not practical. (Capability unit VIIs-1: Alkaline Plains range site; tree planting suitability group 5)

Litle Series

The Litle series consists of moderately deep, well-drained, gently sloping to sloping soils on uplands.

In a typical profile the surface layer is light brownish-gray silty clay loam about 3 inches thick. The subsoil, about 15 inches thick, is pale-brown clay or silty clay that contains lime. The underlying material is light yellowish-brown clay that extends to a depth of 39 inches and contains lime and some gypsum. Below this are olive to light olive-brown, partly consolidated clayey beds of shale that are very strongly calcareous.

The Litle soils have a slow rate of water intake and moderate to high available water holding capacity. Runoff is moderate to rapid, and the hazards of water erosion and of soil blowing are moderate.

These soils are used for grazing, for cultivated crops, and as homesites. Most of the acreage is in native range.

Typical profile of Litle silty clay loam. 1 to 9 percent slopes, 1,200 feet west and 1,000 feet north of the southeast corner of section 32, T. 5 S., R. 63 W.:

- A1—0 to 3 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate to strong, fine, granular structure; soft when dry, friable when moist; slightly calcareous; clear, smooth boundary.
- B2—3 to 8 inches, pale-brown (10YR 6/3) clay or silty clay, brown (10YR 5/3) when moist; weak, medium, prismatic structure that breaks to moderate, medium, angular blocky structure; hard when dry, firm when moist; few thin, patchy clay films on vertical surfaces of peds; very strongly calcareous; clear, smooth boundary.
- B3—8 to 18 inches, pale-brown (10YR 6/3) clay, brown (10YR 5/3) when moist; weak, fine, angular blocky structure; hard when dry, firm when moist; visible clay films on pressure faces; very strongly calcareous; few fine, distinct concretions of lime; clear, smooth boundary.
- C1ca—18 to 27 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) when moist; weak, medium, angular blocky structure; very hard when dry, very firm when moist; very strongly calcareous; few fine, distinct concretions of lime; clear, smooth boundary.
- C2ca—27 to 33 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) when moist; weak, medium, angular blocky structure; very hard when dry, very firm when moist; very strongly calcareous; fine, common, distinct concretions of lime and gypsum; gradual boundary.
- C3—33 to 39 inches, light yellowish-brown (2.5Y 6/3) clay, light olive brown (2.5Y 5/3) when moist; weak, coarse, subangular blocky structure; very hard when dry, very firm when moist; very strongly calcareous; many hard fragments of shale; gradual boundary.
- R—39 to 54 inches, olive to light olive-brown, partly consolidated beds of clayey shale; many fractures; very strongly calcareous.

The A horizon is silty clay loam or clay loam that ranges from 2 to 6 inches in thickness. The B2 horizon ranges from 4 to 10 inches in thickness, from heavy clay loam to clay in texture, and from brown to olive in color. Depth to calcareous shale is 20 to 40 inches.

The Litle soils have a thinner, lighter colored surface layer than the Fondis soils. They have lime closer to the surface than the Fondis and Buick soils. The Litle soils are more clayey and have less well-defined horizons than the Buick soils. They are similar to Heldt soils but are shallower to shale.

Litle silty clay loam, 1 to 9 percent slopes (LcD).—This soil occurs on uplands, mainly in the southwestern and southeastern parts of the county. It has the profile described as typical for the series.

Included with this soil in mapping were small areas of Renohill loam, of Buick loam, and of Samsil clay, gypsum. Also included were areas of Clayey alluvial land.

Nearly all of this Litle soil is in native grass. Because of the slope, rapid runoff, and slow intake of water, this soil is not suited to cultivated crops. It also erodes easily. (Capability unit VI_s-1; Alkaline Plains range site in the eastern part of the county, Clayey Foothill range site in the western part; tree planting suitability group 4)

Litle-Samsil, gypsum, silty clay loams, 3 to 9 percent slopes (L_sD).—This complex is on uplands in the extreme eastern part of the county. Slopes generally are less than 400 feet long.

Litle silty clay loam makes up about 50 to 60 percent of this complex, and Samsil clay, gypsum, 30 to 40 percent. Included with these soils in mapping were areas of Colby silt loam and small areas of Clayey alluvial land.

The Litle soil is on the upper part of slopes, and the Samsil soil occupies areas closer to the drainageways. The Colby soil is in small areas on the side slopes or ridgetops in some places.

This complex is in native grass. Because of shallowness, droughtiness, rapid runoff, and the hazard of erosion, the soils in this complex are not suited to cultivated crops. During dry years more grass grows in the drainageways than in other areas. In wet years native western wheatgrass that grows in the drainageways can be cut for hay. (Capability unit VI_s-1; Alkaline Plains range site; tree planting suitability group 5)

Loamy Alluvial Land

Loamy alluvial land (L_v) occurs along narrow drainageways and major streams throughout the county and is subject to flooding (fig. 6). It occupies areas that generally are less than 500 feet wide and more than a mile long.

The profile is variable, but commonly the surface layer is very dark grayish-brown, generally noncalcareous, stratified loam and sandy loam about 6 inches thick. Below



Figure 6.—Typical landscape of Loamy alluvial land.

this layer is dark-brown, stratified sandy loam and clay loam that ranges from 1 foot to many feet in thickness and generally is calcareous.

Included with this land in mapping were small areas of Clayey alluvial land, of Sandy alluvial land, and of Wet alluvial land.

Loamy alluvial land is not suited to cultivated crops unless it is protected from flooding. Most of the acreage is in native grass. Pasture and hay are excellent where water spreading is used and the water is carefully controlled to prevent gullying. Loamy alluvial land has moderate to high available water holding capacity and generally is well drained. It is high in natural fertility and is easily penetrated by plant roots. (Capability unit VI_w-2; Overflow range site; tree planting suitability group 1)

Nunn Series

In the Nunn series are deep, well-drained, level or nearly level soils that occur on uplands and on terraces along most of the major streams in the county. These soils developed in material deposited by wind and water.

In a typical profile the surface is grayish-brown, noncalcareous loam about 3 inches thick. The subsoil is about 19 inches thick. It is noncalcareous and is dark grayish-brown clay loam in the upper part, is grayish-brown light clay in the middle part, and is grayish-brown sandy clay loam in the lower part. The underlying material is light brownish-gray sandy loam and stratified sand and loam that extends to a depth of 60 inches and is slightly calcareous to very strongly calcareous.

The Nunn soils have moderate permeability and high available water holding capacity. Crops on them respond well to irrigation, and in irrigated areas, to additions of phosphorus and nitrogen. Unprotected areas are susceptible to soil blowing. In some areas these soils are subject to occasional flooding if not protected.

These soils are well suited to most of the crops commonly grown in the county. Some areas are irrigated and are used mainly for corn and alfalfa.

Typical profile of Nunn loam, 0 to 3 percent slopes, one-half mile south of the northeast corner of section 16, T. 5 S., R. 64 W.:

- A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, blocky structure; slightly hard when dry, friable when moist; noncalcareous; clear, smooth boundary.
- B1—3 to 5 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that breaks to moderate, very fine, angular blocky structure; slightly hard when dry, friable when moist; thin, patchy clay films; noncalcareous; clear, smooth boundary.
- B2t—5 to 18 inches, grayish-brown (10YR 5/2) light clay, dark grayish brown (10YR 4/2) when moist; moderate, fine to medium, prismatic structure that breaks to moderate to strong, fine to medium, angular blocky structure; hard when dry, firm when moist; thin, nearly continuous clay films; noncalcareous; gradual, smooth boundary.
- B3—18 to 22 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that breaks to moderate, medium, angular blocky structure; hard when dry, friable when moist; thin, patchy clay films; noncalcareous; clear, smooth boundary.

- C1ca—22 to 30 inches, light brownish-gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; hard when dry, very friable when moist; very strongly calcareous; much visible lime; clear, smooth boundary.
- C2—30 to 60 inches, light brownish-gray (10YR 6/2) stratified sand and loam, light grayish brown (10YR 5/2) when moist; massive (structureless); slightly hard when dry, very friable to loose when moist; slightly calcareous to strongly calcareous.

The A horizon is 3 to 8 inches thick. The B2t horizon ranges from clay loam to clay in texture and from 6 to 20 inches in thickness.

The Nunn soils are less clayey and are deeper to lime than the Heldt soils and have stronger structure. Nunn soils are slightly more clayey and have more distinct horizons than Fort Collins soils.

Nunn loam, 0 to 3 percent slopes (N1B).—This soil is on terraces. It has the profile described as typical for the series. Included with this soil in mapping were small areas of Beckton loam and of Fort Collins loam. Also included were a few small areas of Loamy alluvial land.

Most areas of this soil are cultivated. Some areas are used as residential sites. Under good management, suitable crops grow well on this soil. A few areas are irrigated and are used for corn and alfalfa. This soil takes in water at a moderate rate and has high available water holding capacity. Runoff is slow, and erosion is slight. (Capability unit IIIc-1; Loamy Plains range site in the eastern part of the county, and Loamy Foothill range site in the western part; tree planting suitability group 1)

Nunn-Bresser-Ascalon complex, 0 to 3 percent slopes (NrB).—This complex of undulating soils occurs mainly in the central part of the county. It is the most extensive mapping unit in the county.

The Nunn soil makes up about 50 to 70 percent of this complex, and Ascalon and Bresser soils, 25 to 45 percent. Included with these soils in mapping were low-lying areas called wet weather lakes that make up 5 percent of the area mapped.

The Nunn soil occurs on the lower parts of slopes and in the more level areas of this complex. It has a loam surface layer about 8 inches thick and a clay loam subsoil about 20 inches thick. Lime generally occurs at a depth of 18 to 24 inches.

The Ascalon and Bresser soils are intermingled and occupy the higher areas of this complex. The Bresser soil is dominant in the southern part of the county and near the streams; the Ascalon soil occurs mainly in the northern part of the county. Ascalon and Bresser soils have a sandy loam surface layer about 6 inches thick. Their subsoil is sandy clay loam about 20 inches thick. Depth to lime is 14 to 30 inches in the Ascalon soil and is more than 60 inches in the Bresser soil.

Nearly all of the acreage of this complex is cultivated. The soils in this complex are well suited to crops. They are easy to work, and they have a moderate rate of water intake. The Nunn soils have high available water holding capacity, and the Bresser and Ascalon soils have moderate available water holding capacity. Erosion is slight to moderate. The Ascalon and Bresser soils are more susceptible to soil blowing than the Nunn soil. Stripcropping and stubble mulching help to conserve moisture and to control erosion. (Capability unit IIIc-1; Loamy Foothill range site; tree planting suitability group 1)

Olney Series

The Olney series consists of deep, gently sloping to rolling soils that occur in the eastern part of the county.

In a typical profile the surface layer is grayish-brown fine sandy loam that is free of lime and about 6 inches thick. The subsoil, about 12 inches thick, also is free of lime and is brown fine sandy clay loam in the upper part and pale-brown fine sandy loam in the lower part. The underlying material is light yellowish-brown and pale-brown, very strongly calcareous and strongly calcareous fine sandy loam that extends to a depth of 42 inches.

The Olney soils have a moderate rate of water intake and moderate available water holding capacity. They are susceptible to severe water erosion and soil blowing.

These soils are suited to native grass and to wheat and other nonirrigated crops. Most of the acreage is in native grass.

Typical profile of Olney fine sandy loam, 5 to 9 percent slopes, 2,500 feet west and 350 feet south of the northeast corner of section 1, T. 4 S., R. 59 W.:

- A1—0 to 4 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, crumb structure; soft when dry, very friable when moist; noncalcareous; clear, smooth boundary.
- A3—4 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) when moist; moderate, medium, blocky structure that breaks to moderate, fine, angular blocky structure; thin, patchy clay skins; slightly hard when dry, friable when moist; noncalcareous; clear, smooth boundary.
- B2t—6 to 12 inches, brown (10YR 5/3) fine sandy clay loam, brown (10YR 4/3) when moist; moderate, fine, prismatic structure that breaks to moderate to strong, medium, subangular blocky structure; thin, nearly continuous clay skins; hard when dry, friable when moist; noncalcareous; gradual, wavy boundary.
- B3—12 to 18 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; thin, patchy clay skins; slightly hard when dry, very friable when moist; noncalcareous; gradual boundary.
- C1ca—18 to 27 inches, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) when moist; weak, medium, prismatic structure that breaks to weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist; very strongly calcareous.
- C2—27 to 42 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) when moist; massive (structureless); soft when dry, loose when moist; strongly calcareous.

The A horizon ranges from 4 to 8 inches in thickness. The B2t horizon is fine sandy clay loam or clay loam and ranges from 5 to 15 inches in thickness. Depth to lime is 10 to 30 inches. Soft sandstone is at a depth of about 50 inches.

The Olney soils are more clayey in the subsoil and have more distinct horizons than the Terry soils, which are nearby. They are less silty and more sandy than the Baca and Weld soils. Olney soils have finer sand with less feldspar than the Bresser soils.

Olney fine sandy loam, 5 to 9 percent slopes (OnD).—This gently sloping to rolling soil occurs on uplands in the eastern half of the county, mainly in the southern part. This soil has medium runoff, moderate to rapid water intake, and moderate available water holding capacity.

Included with this soil in mapping were a few small areas of Weld fine sandy loam and of Terry fine sandy loam. Also included were some areas of Loamy alluvial land in drainageways.

Most of this soil is in native grass, but a part of it is cultivated. Wheat and sorghum are the main crops. Where cultivated crops are grown, stubble-mulch tillage helps to conserve moisture and to control erosion, but this soil is better protected by reseeding it to grass. Regulating grazing and other good practices of range management are needed on range. (Capability unit VIe-3; Sandy Plains range site; tree planting suitability group 1)

Renohill Series

The Renohill series consists of moderately deep, well-drained, gently sloping to steep soils that occur on uplands, mainly in the western three-fourths of the county.

In a typical profile the surface layer is grayish-brown, noncalcareous loam about 5 inches thick. The subsoil, about 14 inches thick, is brown and light olive-brown, calcareous clay loam. The underlying material is light grayish-brown clay loam. Brown to olive-gray fractured shale is below a depth of about 26 inches.

The Renohill soils have medium internal drainage, moderately slow to slow permeability, and moderate available water holding capacity. They are moderate in natural fertility, but are susceptible to soil blowing and to water erosion.

Most of the acreage of Renohill soils is in native grass. Because of the slope and of shallowness of the rooting zone, these soils are not suited to cultivated crops.

Typical profile of Renohill loam, 3 to 9 percent slopes, 1,800 feet north and 1,100 feet west of the southeast corner of section 11, T. 5 S., R. 59 W.:

- A11—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry, friable when moist; noncalcareous; clear, smooth boundary.
- A12—3 to 5 inches, grayish-brown (10YR 5/2) loam, dark, grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; noncalcareous; clear, smooth boundary.
- B2t—5 to 10 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that breaks to moderate to strong, fine, angular blocky structure; hard when dry, firm when moist; patchy clay skins on ped surfaces; mildly calcareous; clear, smooth boundary.
- B3ca—10 to 19 inches, light olive-brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) when moist; moderate, medium, prismatic structure that breaks to strong, medium to fine, angular blocky structure; hard when dry, firm when moist; patchy clay skins on ped surfaces; strongly calcareous; gradual, smooth boundary.
- C1ca—19 to 26 inches, light grayish-brown (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) when moist and crushed; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; hard when dry, firm when moist; few fine concretions of lime; gradual, smooth boundary.
- C2—26 to 36 inches, brown (7.5YR 5/4) to olive-gray (5Y 5/2) fractured shale of clay loam texture, dark brown (7.5YR 4/4) to olive gray (5Y 4/2) when moist; structureless; slightly calcareous to very strongly calcareous.

The A horizon is loam or clay and is 2 to 6 inches thick. The B2t horizon ranges from 5 to 10 inches in thickness and from clay loam to clay in texture. When the C1ca horizon is moist, colors range from olive (5Y 5/3) to light brownish gray (2.5Y 6/2). The profile normally is free of lime in the upper 4 or 5 inches, but in a few places it is calcareous throughout. Depth to hard shale or sandstone ranges from 20 to 40

inches. In the southwestern part of the county are a few areas of a Renohill loam that is much redder than is typical for Renohill soils.

The Renohill soils are less deeply leached of lime and are more shallow over shale or sandstone than the Buick soils, which are nearby. They are deeper and have more distinct horizons than the Thedalund and Samsil soils.

Renohill loam, 3 to 9 percent slopes (RdD).—This gently sloping to sloping soil is on uplands in the western three-fourths of the county. It has the profile described as typical for the series. Surface runoff is medium to rapid. The available water holding capacity is moderate.

Included with this soil in mapping were small areas of Thedalund clay loam, of Samsil clay, and of Buick loam. Also included in cultivated areas were areas of a Renohill soil that has a clay loam surface layer because the original surface layer has been mixed with material from the subsoil.

This soil is not suited to cultivated crops, and most areas are in native grass. Good range management is needed to prevent overgrazing. (Capability unit VIe-1; Loamy Plains range site; tree planting suitability group 4)

Renohill loam, reddish variant, 5 to 20 percent slopes (ReE).—This soil occurs on uplands in the southwestern part of the county. It is scattered in areas that generally are less than 40 acres in size. Except for the slope and the reddish color of this soil, it is similar to Renohill loam, 3 to 9 percent slopes.

Included with this soil in mapping were small areas of Little silty clay loam.

This soil is mostly in native grass and is used for grazing livestock. It also is a source of clay material that is used to make bricks and tile. Because surface runoff is medium to rapid and the hazard of erosion is moderate, careful range management is needed. (Capability unit VIe-1; Loamy Foothill range site; tree planting suitability group 4)

Renohill-Buick loams, 3 to 9 percent slopes (RhD).—This complex is on uplands in the western three-fourths of the county. Drainageways are well established and generally are less than 150 feet wide.

Renohill loam makes up to 40 to 70 percent of this complex, and Buick loam, 20 to 40 percent. Included with these soils in mapping were areas of Fondis silt loam, of Little silty clay loam, and of Loamy alluvial land. Also included, along crests of ridges that face north or west, were areas of Buick soil where soil blowing has been severe. Lime is near the surface in these areas, which have shallow gullies and are lighter colored where cultivated.

The Renohill soil occurs on side slopes that generally extend to the drainageways. Its surface layer is loam to clay loam about 4 inches thick. The subsoil is calcareous clay loam to clay. Depth to shale is about 30 inches.

The Buick soil occupies the higher areas of the complex. It has a loam surface layer about 4 inches thick. In the subsoil, which is clay loam about 16 inches thick, lime is about 10 inches from the soil surface. The underlying material is clay loam that extends to a depth of 4 or 5 feet.

Most of this complex is in grass. Because of shallowness and the severe hazard of erosion, the soils in this complex are not suited to cultivated crops. (Capability unit VIe-1; Loamy Foothill range site in the western part of the county, Loamy Plains range site in the eastern part; tree planting suitability group 4)

Renohill-Buick loams, 9 to 20 percent slopes (RhE).—These soils are on uplands in the western three-fourths of the county.

Renohill loam makes up about 50 to 70 percent of this complex, and Buick loam, 10 to 30 percent. Included with these soils in mapping were areas of Samsil clay and of Loamy alluvial land.

The Renohill soil occurs on the lower parts of slopes. Except for slopes and the thinner surface layer, this soil has a profile similar to that described as typical for the series.

The Buick soil is on the upper parts of slopes. Except for the thinner surface layer and lime at a depth of about 8 inches, this soil has a profile similar to that described as typical for the series.

Surface runoff is medium to rapid, and water intake is moderate to slow.

Most of this complex is in native grass. Because of shallowness and the severe hazard of erosion, the soils in this complex are not suited to cultivated crops. (Capability unit VIe-1; Loamy Foothill range site in the western part of the county, Loamy Plains range site in the eastern part; tree planting suitability group 5)

Renohill-Buick complex, 5 to 20 percent slopes, eroded (RkE2).—This complex occurs in the western three-fourths of the county.

Renohill clay loam makes up 40 to 50 percent of this complex; Buick loam or clay loam, 20 to 40 percent; and Thedalund clay loam, about 10 to 20 percent. Included with these soils in mapping were areas of Colby soils and of Adena soils.

The Renohill soil occurs on the lower parts of slopes, the Buick soil is on the higher slopes, and the Thedalund soil occupies areas near drainageways. Most slopes are more than 500 feet long. Erosion has removed most of the original surface layer from these soils, and many gullies have formed. The gullies range from 6 inches to 2 feet in depth and from 1 to 3 feet in width; they generally are less than 300 feet apart.

The soils in this complex are used as range. They have been cultivated, but cropping has been abandoned in many areas, though some have been reseeded to grass. The recovery of plant cover, which helps to control erosion, can be accelerated by building diversions to carry runoff, by contour furrowing, and by pitting in conjunction with controlled grazing. (Capability unit VIe-2; Clayey Foothill range site; tree planting suitability group 5)

Renohill-Little clay loams, 3 to 9 percent slopes (RID).—These soils are on uplands in the southwestern part of the county.

Renohill clay loam and Little clay loam are in about equal acreages, and together they make up about 90 percent of the complex. Fondis and Buick soils make up the remaining 10 percent. Included with these soils in mapping were small areas of Loamy alluvial land along the well established drainageway. Also included were many small knobs covered with gravel.

The Renohill and Little soils are intermingled on side slopes that generally are 500 feet or more long. They are thinnest in areas next to drainageways. Each kind of soil has a profile similar to the one described for its respective series. The Fondis and Buick soils occupy the highest areas in the complex.

Most of this complex is in native grass or is used for homesites. Because of rapid runoff and the severe hazard of erosion, the soils in this complex are not suited to cultivated crops. Gullies as much as 12 inches deep are common in cultivated areas. If not protected by a plant cover, these soils are susceptible to severe soil blowing. They have a moderate to slow rate of water intake and moderate to high available water holding capacity. Pitting, contour furrowing, and diversions help to control runoff so that water can soak into the soil. (Capability unit VIe-2; Clayey Foothill range site; tree planting suitability group 4)

Renohill-Little-Thedalund complex, 9 to 30 percent slopes (RE).—This complex occurs in the western part of the county and occupies areas ranging from 20 to 320 acres in size.

Renohill loam makes up 20 to 40 percent of this complex; Little silty clay loam, 30 to 40 percent; and Thedalund loam or clay loam, 10 to 30 percent. Included with these soils in mapping were areas of Tassel soils, of Gravelly land, and of Rock outcrop that together make up as much as 15 percent of some mapped areas.

The Renohill soil has a loam surface layer about 3 inches thick and a calcareous clay loam to clay subsoil about 12 inches thick. Depth to shale is about 24 inches.

The Little soil has a silty clay loam surface layer about 3 inches thick. The next layer is calcareous clay loam to clay, and it extends to shale at a depth below 24 inches.

The Thedalund soil has a surface layer of clay loam or loam about 5 inches thick. Shale is at a depth of less than 16 inches.

The soils in this complex are too shallow and steep to be cultivated. Most of the acreage is in grass. Runoff is medium to rapid, and there are a few small gullies and small landslips. Good range practices are needed to prevent overgrazing and to control erosion. (Capability unit VIe-2; Clayey Foothill range site; tree planting suitability group 5)

Rock Outcrop

Rock outcrop (Ru) occurs near large structures in the western part of the county. The largest areas are near the runways at Buckley Air National Guard Base and near Cherry Creek Dam. In areas of Rock outcrop, the soils have been stripped so that interbedded shale and sandstone are exposed at the surface. The areas are sloping to nearly level and as much as 60 acres in size.

Shale is dominant. It varies in color and texture, but normally is olive clay loam. It is hard and platy and resists penetration of water. The sandstone is very hard and coarse grained.

Except for a few annual weeds in most areas, little vegetation grows in areas of Rock outcrop. The hazards of soil blowing and water erosion are severe. (Capability unit VIIIa-1; tree planting suitability group 5; no range site assigned)

Samsil Series

The Samsil series consists of shallow, well-drained, strongly sloping to very steep soils that occur on uplands throughout the county.

In a typical profile the surface layer is light yellowish-brown, strongly calcareous clay loam about 5 inches thick. The next layer is light brownish-gray, slightly calcareous clay about 7 inches thick. This layer is underlain by slightly calcareous, light brownish-gray to pale-olive clay shale.

The Samsil soils have a very slow rate of water intake. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

These soils are not suited to cultivated crops. Most of the acreage is in native range.

Typical profile of a Samsil clay loam, 200 feet south and one-half mile east of the northwest corner of section 25, T. 5 S., R. 59 W.:

A1—0 to 5 inches, light yellowish-brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) when moist; moderate, fine, granular structure; slightly hard when dry, firm when moist; strongly calcareous; clear, slightly wavy boundary.

AC—5 to 12 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) when moist; massive (structureless) that breaks hard to weak, coarse, subangular blocky structure; very hard when dry, very firm when moist; slightly calcareous; material from A1 horizon in cracks that extend to bottom of AC horizon.

R—12 to 20 inches, light brownish-gray to pale-olive clay shale; few vertical fractures; slightly calcareous.

The A horizon ranges from clay loam to clay in texture and from 3 to 6 inches in thickness. Depth to shale is 6 to 14 inches. In some places the profile contains much gypsum and other salts. In many places, plates or crystals of selenite (gypsum) are scattered on the surface and throughout the profile. These plates are about 6 inches long and 4 inches wide.

The Samsil soils are more shallow over shale than Renohill soils, which have a B horizon.

Samsil clay, gypsum, 5 to 20 percent slopes (ScE).—This soil occurs on uplands in the eastern part of the county. It has a surface layer of light olive-gray, calcareous silty clay 2 to 6 inches thick. Many selenite (gypsum) crystals are scattered on the surface. The next layer, 2 to 8 inches thick, is silty clay that is high in content of gypsum. The underlying material consists of dense, clayey shale that is high in gypsum and other salts.

Included with this soil in mapping were barren spots of raw shale that make up 10 to 30 percent of each area mapped. On these spots, gypsum crystals, several inches long, are common. Also included were small areas of Litle silty clay loam and of Clayey alluvial land in the drainageways.

This soil is not suited to cultivated crops. All of the acreage is in native grasses that include blue grama, alkali sacaton, saltgrass, and western wheatgrass. Because surface runoff is rapid and water intake is slow, good range management is needed for controlling erosion. On slopes of more than 8 percent, steps 6 to 18 inches high are common where the soil has slipped. (Capability unit VI-1; Alkaline Plains range site; tree planting suitability group 5)

Samsil-Litle stony clays, 20 to 50 percent slopes (SIF).—These soils are on uplands southeast of South Cherry Creek in the southwestern part of the county. Slopes generally are less than 300 feet long, and drainageways are about 50 feet wide.

This complex consists of Samsil stony clay and Litle stony clay in about equal acreages. Included with these soils in mapping were small areas of Renohill and Thedaland soils and of Clayey alluvial land in drainageways.

The Samsil soil has a surface layer about 3 inches thick. Depth to shale is about 6 to 14 inches. The Litle soil has a surface layer of stony clay or stony clay loam about 3 inches thick. It is underlain by a layer of calcareous clay about 16 inches thick that contains fewer stones than the surface layer. Depth to shale is about 20 to 30 inches. On these Samsil and Litle soils, round, waterworn cobblestones and stones of granite and quartz, 3 to 20 inches in diameter, cover 50 percent or more of the surface. They are thickest in areas that occur on knobs, and they slow runoff and help to increase water intake.

This complex is in native grasses and shrubs that include western wheatgrass, blue grama, green needlegrass, side-oats grama, junegrass, and mountain-mahogany. (Capability unit VII-1; tree planting suitability group 5; range site not assigned)

Samsil-Renohill clay loams, 3 to 20 percent slopes (SrE).—This complex occurs on uplands in the central part of the county. Most areas are large and are on slopes facing west or north. The Samsil and Renohill soils each have a profile similar to the one described as typical for its respective series.

Samsil clay loam makes up about 35 to 70 percent of this complex, and Renohill clay loam, 30 to 65 percent. Included with these soils in mapping were small areas of Buick soils, of Colby soils, and of Shale outcrop. Also included were gravelly knobs and some slick spots.

The Samsil soil is near drainageways, and the Renohill soil occurs on the smoother part of slopes.

Most of this complex is in native grass and is used for grazing livestock. The main native plants are western wheatgrass and blue grama. Surface runoff is medium to rapid. In the steeper areas, some gullies and steps have formed. The steps are 3 to 12 inches high. (Capability unit VI-2; Clayey Plains range site; tree planting suitability group 5)

Samsil-Shale outcrop complex (Ss).—In this complex are Samsil soils and outcrops of shale that occur on uplands in the western three-fourths of the county. Slopes range from 9 to 20 percent. This Samsil soil has the profile described as typical for the Samsil series.

The Samsil soil makes up 60 to 70 percent of this complex, and Shale outcrop, 30 to 40 percent. Included with this complex in mapping were small areas of Renohill loam.

This complex is in native vegetation. It supports very thin stands of blue grama, western wheatgrass, and side-oats grama. Surface runoff is rapid, and erosion is severe. Soil slips, which have exposed large areas of shale, are common. (Capability unit VII-1; Shale Breaks range site; tree planting suitability group 5)

Sand Pits

Sand pits (St) occur in nearly level areas in the western part of the county near Cherry Creek Dam. They are open excavations several feet deep and 20 acres or more in size. Pale-brown sand is visible at the border of these pits.

Sand pits are very low in natural fertility and are highly susceptible to soil blowing. Soil blowing can be reduced by a cover of weeds or by applications of straw and manure. (Capability unit VIII-1; tree planting suitability group 5; no range site assigned)

Sandy Alluvial Land

Sandy alluvial land (Su) occurs as narrow areas along the major drainageways next to the stream channels in the western three-fourths of the county.

The profile is variable, but commonly the surface layer is pale-brown, loose sand and some fine gravel. It is non-calcareous and about 10 inches thick. In this layer are roots of grasses and weeds. The next layer consists of pale-brown, loose sand and some fine gravel. It is 1 foot to many feet thick. In some places strata of loam to sandy loam that contain some lime occur below a depth of 2 feet. Water is below a depth of 5 feet in some places, and roots are below 3 feet.

Included with this land in mapping were a few small areas of Wet alluvial land and of Loamy alluvial land.

Sandy alluvial land is droughty and unstable. It is subject to yearly flooding, to deposition of sand, and to soil blowing. Growing in most places are trees, such as cottonwood, and some grasses, normally annuals. The trees protect livestock and provide cover for wildlife. (Capability unit VIIw-1; tree planting suitability group 2; no range site assigned)

Shale Outcrop

Shale outcrop (Sv) is made up of areas in which shale and some sandstone are exposed. These areas are adjacent to the major drainageways in the county. Slopes from 9 to 50 percent, and gullies, 1 foot to 20 feet deep, have formed in some places. Included with this mapping unit were small areas of Thedalund clay loam.

A good cover of grass and a few trees grow in some places along the bottoms of drainageways that contain flowing springs. The side slopes are sparsely covered with grass, mainly alkali sacaton. Because of the slope and the texture of the soil material, surface runoff is rapid and erosion is a severe hazard. (Capability unit VIIs-1; Shale Breaks range site; tree planting suitability group 5)

Stapleton Series

The Stapleton series consists of moderately deep, strongly sloping to steep soils on uplands in the southwestern part of the county. These soils developed in material that weathered from arkosic sandstone.

In a typical profile the surface layer is grayish-brown sandy loam about 8 inches thick. It contains mica and fine gravel in noticeable amounts. The next layer, about 8 inches thick, is light brownish-gray sandy loam. The underlying material extends to a depth of 25 inches and consists of pale-yellow sandy loam and partly consolidated fine gravel and siltstone in which there is much visible mica. This layer is underlain by arkosic sandstone.

The Stapleton soils have moderate to rapid water intake and low available water holding capacity. Because of the slope, runoff is rapid. These soils are susceptible to both water erosion and soil blowing, but water erosion is the more severe hazard.

These soils are in native grass and pine trees. Because these soils are only moderately deep and are droughty, they are not suited to cultivated crops.

Typical profile of Stapleton sandy loam, 9 to 30 percent slopes, 1,750 feet south and 400 feet west of northeast corner of section 30, T. 5 S., R. 65 W.:

- A1—0 to 8 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist; fine gravel and mica; non-calcareous; clear, wavy boundary.
- AC—8 to 16 inches, light brownish-gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, subangular blocky structure; slightly hard when dry, very friable when moist; horizon is a mixture of light olive-brown and grayish-brown sandy loam material in which fine gravel and mica are evident; noncalcareous; clear, smooth boundary.
- C—16 to 25 inches, pale-yellow (2.5Y 7/3) sandy loam, light olive brown (2.5Y 5/6) when moist; massive (structureless); hard when dry, very friable when moist; poorly consolidated beds of fine gravel, siltstone, and much visible mica; noncalcareous.
- R—25 inches +, arkosic sandstone.

The A horizon ranges from sandy loam to loamy sand in texture and from 3 to 10 inches in thickness. The profile contains enough mica for the soil to feel slick. Depth to sandstone ranges from 20 to 40 inches.

The Stapleton soils are lighter colored, more gravelly, and more shallow than the associated Bresser soils and have less well-defined horizons. They are similar to the Thedalund soils but have a darker colored surface layer, and they formed in material that weathered from arkosic sandstone instead of sandstone and shale.

Stapleton sandy loam, 9 to 30 percent slopes (SwE).—This soil occurs only along South Cherry Creek and its tributaries in the southwestern part of the county. Included with this soil in mapping were small areas of Bresser sandy loam and of Sandy alluvial land. Also included were a few outcrops of sandstone and shale.

This soil is in native grasses that include big bluestem, sand reedgrass, needle-and-thread, and blue grama. A few ponderosa pine grow in places. Surface runoff is rapid, and deep gullies having vertical banks 5 to 10 feet high are common along the drainageways. (Capability unit VIe-3; tree planting suitability group 5; no range site assigned)

Tassel Series

The Tassel series consists of shallow, gently sloping to steep soils that occur on uplands, mostly in the eastern half of the county.

In a typical profile the surface layer is slightly calcareous, grayish-brown fine sandy loam 3 inches thick. The next layer, 6 inches thick, is very strongly calcareous, grayish-brown fine sandy loam. The underlying material is pale-yellow, very strongly calcareous fine sandy loam. At a depth of 18 inches is soft, fine-grained sandstone.

The Tassel soils have a rapid rate of water intake and low available water holding capacity. They are low in natural fertility and are highly susceptible to soil blowing unless protected by vegetation.

These soils are in native grasses, mainly sandreed, big bluestem, sand bluestem, and little bluestem.

Typical profile of a Tassel fine sandy loam, near the center of section 26, T. 5 S., R. 58 W.:

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

AC—3 to 9 inches, grayish-brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; weak, coarse, prismatic structure that breaks to weak, coarse, subangular blocky structure; soft when dry, very friable when moist; few sandstone pebbles stained with iron; very strongly calcareous; clear, smooth boundary.

C—9 to 18 inches, pale-yellow (2.5Y 7/4) fine sandy loam, light olive brown (2.5Y 5/4) when moist; massive (structureless); slightly hard when dry, very friable when moist; few sandstone pebbles stained with iron; very strongly calcareous; gradual, smooth boundary.

R—18 inches +, soft, fine-grained sandstone.

The horizons range from fine sandy loam to loamy fine sand in texture. Depth to soft, fine-grained sandstone is 12 to 18 inches.

The Tassel soils are shallower to sandstone than the Terry soils.

Tassel-Rock outcrop complex (Tc).—This complex consists of steep soils on broken slopes in the eastern part of the county. It occurs mostly as narrow bands along the eastern side of Deer Trail Creek.

The Tassel soil makes up about 70 to 80 percent of this complex, and Rock outcrop, 20 to 30 percent.

The Tassel soil has the profile described as typical for the series. Rock outcrop is fine-grained sandstone.

This complex provides limited grazing. Good range management is needed to prevent overgrazing and to control erosion. Water intake is rapid, but erosion is a severe hazard because the soil material holds little water and slopes are steep. (Capability unit VII-1; Sandstone Breaks range site; tree planting suitability group 4)

Terrace Escarpments

Terrace escarpments (Tc) occur throughout the county next to streams and drainageways. They consist of areas in which nearly vertical banks as much as 20 feet high have been cut. The soil material is deep, clayey to sandy, and generally is stratified and calcareous. Included with this land type in mapping were small areas of Loamy alluvial land.

Terrace escarpments are suitable for limited grazing. Erosion, mainly water erosion, is a severe hazard, and soil slipping and sloughing are common. Because the slips and sloughs can be stabilized by vegetation, grazing should be carefully controlled. (Capability unit VII-1; tree planting suitability group 5; no range site assigned)

Terry Series

The Terry series consists of moderately deep, rolling to hilly soils on uplands in the eastern part of the county. These soils developed in material weathered from sandstone.

In a typical profile the surface layer is grayish-brown, noncalcareous fine sandy loam about 8 inches thick. The subsoil, about 12 inches thick, is light yellowish-brown, noncalcareous fine sandy loam. The underlying material is light-gray, very strongly calcareous fine sandy loam to a depth of 26 inches and is light brownish-gray decomposed sandstone below. Hard sandstone occurs at a depth of 50 inches.

The Terry soils have a rapid rate of water intake and low available water holding capacity. These soils are low

to moderate in fertility and are subject to severe erosion. Unprotected areas are highly susceptible to soil blowing.

These soils are not suited to cultivated crops. Most of the acreage is in native grass.

Typical profile of Terry fine sandy loam, 5 to 20 percent slopes, 300 feet north and 1,440 feet east of the center of section 6, T. 4 S., R. 58 W.:

A1—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry, loose when moist; noncalcareous; clear, smooth boundary.

A3—5 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that breaks to weak, coarse, subangular blocky structure; soft when dry, very friable when moist; noncalcareous; clear, smooth boundary.

B2t—8 to 13 inches, light yellowish-brown (2.5Y 6/4) fine sandy loam, olive brown (2.5Y 4/4) when moist; weak, medium, prismatic structure that breaks to moderate, medium, subangular blocky structure; slightly hard when dry, very friable when moist; few thin clay films on vertical faces of peds; noncalcareous; clear, smooth boundary.

B3—13 to 20 inches, light yellowish-brown (2.5Y 6/4) fine sandy loam, light olive brown (2.5Y 5/4) when moist; weak, coarse, prismatic structure that breaks to weak, medium, subangular blocky structure; soft when dry, very friable when moist; few thin, patchy clay films on vertical faces of peds; noncalcareous; clear, smooth boundary.

C1ca—20 to 26 inches, light-gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) when moist; weak, coarse, prismatic structure that breaks to weak, coarse, subangular blocky structure; soft when dry, very friable when moist; very strongly calcareous; some mica visible; gradual boundary.

C2—26 to 50 inches, light brownish-gray (2.5Y 6/2), partly decomposed sandstone.

R—50 inches, hard sandstone.

The A horizon ranges from 3 to 8 inches in thickness and from loamy fine sand to fine sandy loam in texture. The B2t horizon ranges from 5 to 10 inches in thickness. Flat fragments of sandstone, as much as 2 inches in diameter, are common and increase with depth. Lime occurs at a depth of 8 to 26 inches. The hard sandstone generally is noncalcareous.

The Terry soils are more shallow and more sandy than the associated Olney soils and have less distinct horizons. They are deeper over sandstone, less limy, and more sandy than the nearby Thedalund soils.

Terry fine sandy loam, 5 to 20 percent slopes (Tde).—This rolling to hilly soil occurs in large areas on uplands in the southeastern part of the county. These areas are on the eastern side of Deer Trail Creek. This soil has the profile described as typical for the series. Surface runoff is slow to medium, water intake is rapid, and available water holding capacity is low.

Included with this soil in mapping were a few small areas of Thedalund loam, of Olney fine sandy loam, and of Sandy alluvial land in drainageways. Outcrops of sandstone make up less than 10 percent of the area mapped.

This soil is in native grass, or it has been seeded to grass in formerly cultivated areas. Soil blowing is a severe hazard where the plant cover is sparse. A good stand of grass can be maintained and soil blowing controlled by deferring grazing periodically. (Capability unit VIe-3; Sandy Plains range site; tree planting suitability group 2)

Terry-Olney-Thedalund sandy loams, 5 to 20 percent slopes (TeE).—This complex occurs on uplands in the eastern part of the county. Runoff is moderate to rapid.

In some places small slips or steps occur on the Thedalund soil.

Terry sandy loam makes up 40 to 50 percent of this complex; Olney sandy loam, 20 to 30 percent; and Thedalund sandy loam, 20 to 30 percent. Outcrops of sandstone make up about 10 percent of the area mapped. Included with these soils in mapping were small areas of Baca loam and of Tassel sandy loam.

Most of this complex is rangeland. Because the soils are steep and are severely susceptible to erosion, they are not suited to cultivated crops. The few areas that were cultivated have been severely eroded and, in places, the subsoil has been exposed. Numerous gullies, 6 to 12 inches deep and 20 to 100 feet apart, have formed. In most places, however, the formerly cultivated areas have been reseeded to grass. Good range management, including regulation of grazing, is essential in controlling erosion. (Capability unit VIe-3; Sandy Plains range site; tree planting suitability group 4)

Thedalund Series

The Thedalund series consists of moderately deep, strongly sloping to steep soils on uplands throughout the county. These soils developed in material weathered from interbedded sandstone and shale.

In a typical profile the surface layer is light olive-brown, noncalcareous light clay loam about 5 inches thick. Below this is a layer of light olive-brown, strongly calcareous light clay loam about 4 inches thick. The underlying material is very strongly calcareous and consists of light yellowish-brown silty clay loam to a depth of 13 inches and of light yellowish-brown disintegrated shale and sandstone below. Consolidated shale that contains crystals and seams of gypsum and strata of sandstone and siltstone are at a depth of about 30 inches.

The Thedalund soils have moderate to rapid water intake and moderate available water holding capacity. They are droughty, moderate to low in natural fertility, and susceptible to severe water erosion and soil blowing.

These soils are used mainly for native pasture. Because of droughtiness, low fertility, and the severe hazards of water erosion and soil blowing, they are not suited to cultivated crops.

Typical profile of Thedalund clay loam, 9 to 20 percent slopes, 800 feet east of the southwest corner of section 12, T. 5 S., R. 58 W.:

- A11—0 to 1 inch, light olive-brown (2.5Y 5/4) light clay loam, olive brown (2.5Y 4/4) when moist; weak, medium, crumb structure that breaks to weak, medium, platy structure; soft when dry, friable when moist; noncalcareous; abrupt, smooth boundary.
- A12—1 to 5 inches, light olive-brown (2.5Y 5/4) light clay loam, olive brown (2.5Y 4/4) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, very friable when moist; noncalcareous; small, flat fragments of sandstone common; clear, smooth boundary.
- AC—5 to 9 inches, light olive-brown (2.5Y 5/4) light clay loam, olive brown (2.5Y 4/4) when moist; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; strongly calcareous; small, flat fragments of sandstone common; clear, smooth boundary.

C1ca—9 to 13 inches, light yellowish-brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) when moist; weak, medium, prismatic structure; slightly hard when dry, friable when moist; concretions of lime and mottles of iron; very strongly calcareous; more fragments of sandstone than in the AC horizon; clear, smooth boundary.

C2—13 to 30 inches, light yellowish-brown (2.5Y 6/4) disintegrated shale and sandstone; some concretions of iron and lime; very strongly calcareous.

R—30 inches +, consolidated shale containing crystals and seams of gypsum and strata of sandstone and siltstone; strongly calcareous.

The A horizon ranges from 2 to 5 inches in thickness and from light clay loam to heavy sandy loam in texture. The C horizon is 15 to 35 inches thick. The texture of the strata within the C horizon ranges from clay loam to sand, but is generally loam.

The Thedalund soils contain more clay than the Terry soils, which have a B horizon. They are coarser textured, generally are deeper, and support more vegetation than Samsil soils.

Thedalund clay loam, 9 to 20 percent slopes (ThE).—This soil is on uplands, mainly in the eastern part of the county along Badger Creek. Areas generally are less than 160 acres in size. Runoff is rapid, water intake is moderate, and available water holding capacity is moderate. This soil has the profile described as typical for the series.

Included with this soil in mapping were a few small areas of Baca loam and of Samsil clay, gypsum. Outcrops of barren, hard sandstone, less than 50 feet across, make up a small percentage of any area mapped.

All of this soil is native range. Some of the grasses are blue grama, western wheatgrass, and needlegrass. Cultivated crops are not suited, but a few fields have been cultivated and then abandoned. These areas can be stabilized by seeding grasses and controlling grazing. (Capability unit VIe-1; Loamy Slopes range site; tree planting suitability group 5)

Thedalund clay loam, 9 to 20 percent slopes, eroded (ThE2).—This soil is mainly along drainageways and in old abandoned fields in the eastern part of the county. It occurs within and adjacent to areas of Thedalund clay loam, 9 to 20 percent slopes.

In the abandoned fields, erosion has removed all of the original surface soil, and in many places the underlying shale and sandstone are exposed. Along drainageways the soil has slipped and gullies have formed, and in many places the underlying material has been exposed. This soil has a moderate rate of water intake and low available water holding capacity, and it erodes easily and tends to slip during periods of heavy rains.

Included with this soil in mapping were a few areas of Baca loam and of Samsil clay, gypsum. Also included, in areas generally less than 50 feet in diameter, were barren knobs of hard sandstone, but these make up only a small percentage of the area mapped.

Most of this Thedalund soil is in grass. Much more grass grows on the deep loamy alluvium in the drainageways than grows on the side slopes. (Capability unit VIe-2; Clayey Plains range site; tree planting suitability group 5)

Truckton Series

The Truckton series consists of deep, rolling to hilly soils that occur on uplands in the western three-fourths of the county. These soils developed in sandy material deposited by wind.

In a typical profile the surface layer is dark grayish-brown, lime-free loamy sand about 6 inches thick. The subsoil, about 24 inches thick, also is free of lime and consists of grayish-brown, brown, and pale-brown sandy loam that is hard or very hard when dry. The underlying material is very pale brown, noncalcareous loamy sand that extends to a depth of 50 inches.

Except in bare areas, the Truckton soils have rapid water intake but only moderate available water holding capacity. In bare areas, the surface tends to crust. Crusting reduces water intake and increases the hazard of water erosion. These soils are droughty, moderate in natural fertility, and highly susceptible to soil blowing.

Truckton soils are suited to grasses and to small grains and sorghums. Most of the acreage is in native grass. Wheat is the main cultivated crop.

Typical profile of a Truckton loamy sand, about 1,100 feet north and 300 feet west of the southeast corner of section 25, T. 5 S., R. 60 W.:

- A1—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure to massive (structureless); slightly hard when dry, loose when moist; noncalcareous; clear, wavy boundary.
- B1—6 to 10 inches, grayish-brown (10YR 5/2) light sandy loam, dark grayish brown (10YR 4/2) when moist and crushed; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; hard when dry, very friable when moist; tongues of very dark grayish brown (10YR 3/2) when moist, extend through horizon; noncalcareous; clear, wavy boundary.
- B2t—10 to 20 inches, brown (10YR 5/3) sandy loam, brown (10YR 4/3) when moist and crushed; weak, medium, prismatic structure that breaks to weak, medium, subangular blocky structure; hard to very hard when dry, friable when moist; thin, patchy clay skins on faces of peds; tongues of dark grayish brown (10YR 4/2), when moist, extend to base of horizon; noncalcareous; clear, wavy boundary.
- B3—20 to 30 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) when moist and crushed; weak, medium to coarse, subangular blocky structure; hard when dry, friable when moist; tongues of brown (10YR 4/3), when moist, extend into horizon; noncalcareous; clear, smooth boundary.
- C—30 to 50 inches, very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) when moist; massive (structureless); slightly hard when dry, loose when moist; noncalcareous.

The A horizon ranges from 4 to 12 inches in thickness and from loamy sand to sandy loam in texture. The B2t horizon is 6 to 18 inches thick and is more clayey than the A horizon. Dark streaks or tongues are common in the B horizon.

The Truckton soils have less clay and more sand than the Bresser soils and thinner, less distinct horizons. They have more clay and less sand than the Blakeland soils and more distinct horizons.

Truckton loamy sand, 1 to 5 percent slopes (TrC).—

This undulating soil occurs on uplands mainly in the western part of the county, just east of Cherry Creek. It has the profile described as typical for the series. Runoff is slow, the intake of water is rapid, and available water holding capacity is moderate.

Included with this soil in mapping were a few small areas of Blakeland loamy sand and of Bresser sandy loam. Also included were a few severely eroded areas, less than 100 feet in diameter, that are on crests of ridges on slopes facing west.

Most of this soil is cultivated. Winter wheat, barley, and sorghum are commonly grown. Stubble mulch tillage and

strip-cropping are practices that help to protect this soil from blowing. (Capability unit IVE-5; Sandy Foothill range site; tree planting suitability group 2)

Truckton loamy sand, 5 to 20 percent slopes (TrE).—

This rolling to hilly soil is on uplands in the western three-fourths of the county. It occurs in scattered areas, generally on the eastern side of major drainageways. The surface layer is about 5 inches thick and the subsoil is sandy loam about 12 inches thick.

Included with this soil in mapping were a few small areas of Blakeland loamy sand and of Bresser sandy loam. Also included were a few small areas of Samsil-Shale outcrop complex at the base of slopes or in gullies.

Most of this soil is in native grass. Because of droughtiness and a severe hazard of erosion, this soil is not suited to cultivated crops. A few deep gullies have formed, and shale and sandstone are exposed in many places. (Capability unit VIe-3; Sandy Foothill range site; tree planting suitability group 4)

Weld Series

The Weld series consists of deep, well-drained, level to gently sloping soils that occur on uplands throughout most of the county. These soils developed in material deposited by the wind.

In a typical profile the surface layer is grayish-brown, noncalcareous silt loam about 5 inches thick. The subsoil, about 21 inches thick, is brown clay loam in the upper part, grayish-brown silty clay in the middle part, and light yellowish-brown, limy silty clay loam in the lower part. The underlying material is light yellowish-brown, very strongly calcareous silt loam that extends to a depth of more than 60 inches and is easily penetrated by roots.

The Weld soils have a moderate rate of water intake and high available water holding capacity. They are high in natural fertility but are susceptible to erosion if not protected.

These soils are well suited to cultivated crops. Winter wheat and other small grains are suitable crops.

Typical profile of Weld silt loam, 0 to 3 percent slopes, about 800 feet north and 1,000 feet west of the southeast corner of section 16, T. 4 S., R. 59 W.:

- A1—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, very fine, granular structure; soft when dry, very friable when moist; noncalcareous; abrupt, smooth boundary.
- B21t—5 to 8 inches, brown (10YR 5/3) heavy clay loam, dark brown (10YR 3/3) when moist; moderate to strong, medium, prismatic structure that breaks to moderate, fine, subangular blocky structure; thin, nearly continuous clay films on surfaces of peds; noncalcareous; clear, smooth boundary.
- B22t—8 to 14 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, prismatic structure that breaks to moderate to strong, fine, angular and subangular blocky structure; very hard when dry, friable when moist; thin, nearly continuous clay films on surfaces of peds; noncalcareous; clear, wavy boundary.
- B3ca—14 to 26 inches, light yellowish-brown (2.5Y 6/3) silty clay loam, light olive brown (2.5Y 5/3) when moist; moderate, fine, prismatic structure that breaks to moderate to strong, fine, angular and subangular blocky structure; hard to very hard when dry, friable when moist; thin, patchy clay films on both horizontal and vertical faces of peds; moderate accumulation of

calcium carbonate in form of concretions and thin seams and streaks; very strongly calcareous; gradual, wavy boundary.

Cea—26 to 60 inches +, light yellowish-brown (2.5Y 6/3) silt loam, light olive brown (2.5Y 5/3) when moist; massive (structureless); hard when dry, very friable when moist; weak accumulation of calcium carbonate in form of concretions and thin seams and streaks; very strongly calcareous.

The A horizon ranges from 3 to 9 inches in thickness and from fine sandy loam to silt loam in texture. The B_{2t} horizon is 8 to 20 inches thick.

The Weld soils are more clayey below the surface soil and they have more distinct horizons than the Colby soils and are deeper to lime. They lack the slick spots that are common in the associated Deertrail soils.

Weld fine sandy loam, 1 to 5 percent slopes (WdC).—

This soil is on uplands near Deer Trail Creek in the eastern part of the county. Its surface layer is grayish brown and about 7 inches thick. The subsoil is brown clay loam to clay about 20 inches thick. Lime occurs at about 16 inches from the soil surface.

Included with this soil in mapping were a few small areas of Adena fine sandy loam, of Colby fine sandy loam, and of Olney fine sandy loam.

About half of this soil is cultivated, and the rest is range. This soil is easily worked. It is suited to most of the crops commonly grown in the county. Wheat is the most common crop. This soil is more likely to blow than the Weld silt loams because not many clods form on the surface. Stripcropping and stubble mulching help to control soil blowing and to conserve moisture. (Capability unit IVe-6; Loamy Plains range site; tree planting suitability group 1)

Weld silt loam, 0 to 3 percent slopes (WeB).—This soil occurs on uplands in the northern and eastern parts of the county. In many places it has the profile described as typical for the series. In broad depressions and near the foot of slopes, however, the surface soil is about 8 inches thick and the subsoil is about 30 inches thick. Lime occurs at a depth of 18 to 22 inches.

Included with this soil in mapping were small areas of Deertrail silt loam and of Weld silt loam, 3 to 5 percent slopes.

Most of this soil is cultivated. Wheat is the most common crop. This soil has a moderate rate of water intake and high available water holding capacity. The hazard of soil blowing is more severe than that of water erosion. Terracing, stubble mulching, and stripcropping help to control erosion and to conserve moisture. (Capability unit IIIc-1; Loamy Plains range site; tree planting suitability group 1)

Weld silt loam, 3 to 5 percent slopes (WeC).—This soil occurs on uplands. Slopes generally are more than 500 feet long, and drainageways are well established. Except for its thinner surface layer and subsoil, this soil has a profile similar to the one described as typical for the series.

Included with this soil in mapping were a few small areas of Adena silt loam and of Colby silt loam. Also included were a few areas of Loamy alluvial land along drainageways.

This soil is mostly cultivated, though it is more susceptible to soil blowing and to water erosion than Weld silt loam, 0 to 3 percent slopes. Practices that help to control erosion and to conserve moisture are terracing, stubble mulching, stripcropping, and the use of diversions and

grassed waterways. (Capability unit IIIe-2; Loamy Plains range site; tree planting suitability group 1)

Weld-Deertrail silt loams, 0 to 3 percent slopes (WrB).—These soils occur on uplands, mainly in the eastern three-fourths of the county.

Weld silt loam makes up 60 to 90 percent of this complex, and Deertrail silty clay loam, 10 to 40 percent.

This Weld soil has a profile similar to the one described as typical for the series. In cultivated areas the Deertrail soil has a silty clay loam surface layer about 4 inches thick, but in sodded areas its surface layer is silt loam about 2 inches thick. The subsoil, about 24 inches thick, is clay in the upper part and is silt loam or silty clay loam in the lower part. Lime occurs at a depth of 5 to 14 inches. The Deertrail soil generally occurs as circular areas, or in slight depressions, less than 1 acre in size. Crops grown on the Deertrail soils are stunted (fig. 7).

Most of this complex is used for cultivated crops. Runoff is slight, and the hazard of soil blowing is moderate. Water intake is moderate on the Weld soil and slow on the Deertrail soil. The Deertrail soil appears as light colored spots in cultivated areas, and crops grown on them are stunted (fig. 8). Practices that help to control erosion and to conserve moisture are stubble mulching and stripcropping. (Capability unit IVs-1; Weld soil is in Loamy Plains range site, and Deertrail soil is in Alkaline Plains range site; tree planting suitability group 4)

Wet Alluvial Land

Wet alluvial land (Wt) occupies nearly level areas next to stream channels throughout the county. It generally is flooded each spring. The soil material is dark colored and occurs in thin layers that range from loam to sand. This material extends to a depth of $\frac{1}{2}$ feet or more and normally becomes more sandy as depth increases. Wet alluvial land is wet below a depth of 3 feet most of the time, and often it is wet at the surface.

Included with this land in mapping were a few small areas of Edgewater loam, of Loamy alluvial land, and of Sandy alluvial land.

This land is not suited to cultivated crops, but it is well suited to grass grown for hay and pasture. Cottonwoods and willows grow in most areas. Some areas along the South Platte River are excellent sources of gravel. (Capability unit VIw-1; Wet Meadow range site; tree planting suitability group 3)

Use and Management of Soils

The soils of Arapahoe County are used extensively for crops, pasture, and range. In some parts of the county cropland is rapidly being replaced by residential and other nonfarm development. In addition to crops, pasture, and range, this section tells how the soils can be managed for nonfarm use, wildlife, recreational areas, and for building highways, farm ponds, and other engineering structures.

In presenting information about the use of soils for crops and pasture, trees, and range, the procedure is to describe a group of similar soils that are suitable for those purposes and to suggest use and management for the group. To determine the soils in each capability unit, range site, and tree planting suitability group, refer to the



Figure 7.—Wheat grown on Weld-Deertrail silt loams, 0 to 3 percent slopes. The wheat on the left was grown on the Deertrail soil and that on the right was grown on the Weld soil.



Figure 8.—Wheatfield on Weld-Deertrail silt loams, 0 to 3 percent slopes.

“Guide to Mapping Units” at the back of this survey. In the subsection on engineering, the soils are not grouped but are placed in tables so that properties significant to engineering work can be given readily. In the subsection on nonfarm uses, the soils are rated according to their limitations for selected uses.

Crops and Pasture ²

This subsection discusses general practices of managing soils for nonirrigated and irrigated crops, explains the system of capability classification used by the Soil Conservation Service, and suggests management by capability groups of soils. Also, a table lists predicted yields of principal nonirrigated crops on arable soils under two levels of management.

General practices of management for nonirrigated and irrigated crops

Farming in Arapahoe County consists mainly of growing nonirrigated winter wheat, barley, and plants that supply supplemental winter feed for livestock. About 60

² JAMES G. BRUNER, conservation agronomist, Soil Conservation Service, assisted in preparing this section.

percent of the acreage is in native range and is grazed by cattle and sheep. About 175,000 acres are used for nonirrigated crops, and only about 2,200 acres are irrigated.

Wheat is the main nonirrigated crop grown in the western part of the county, which is slightly higher, cooler, and wetter than the eastern part. In the eastern part of the county, the principal crops are sorghums and small grains.

In Arapahoe County management practices are particularly needed that conserve moisture, maintain tilth and soil structure, and control soil blowing and water erosion. Most practices used in the county accomplish more than one of these purposes.

Conserving moisture by summer fallowing.—Fallowed soils accumulate moisture and nitrates that can be used by the next crop. In Arapahoe County, 2 years of moisture generally are needed to mature an annual crop. To eliminate vegetation, the soils are worked at about the time weeds or volunteer grains start to grow.

A blade, sweep, or chisel implement is best for tilling fallowed soils, for it leaves on the surface crop residue that protects the soil from soil blowing and helps to keep it porous so that more moisture is absorbed.

Fallowed soils without enough plant cover for protection may require emergency tillage, because they are sus-

ceptible to soil blowing and water erosion. Implements that roughen the surface, bring up clods, and form ridges are effective. Chisels are most effective on the Baca, Fondis, and other loams and silt loams, and listers are most effective on Bijou, Truckton, and other sandy loams and loamy sands.

Maintaining soil tilth and structure.—Crop growth can be maintained or increased by practices that favor or improve soil tilth and structure. In this county the natural structure of most of the soils is favorable for plant growth, but plant growth and water intake are reduced if the structure of the surface layer is destroyed.

Where the soil has been tilled for a long time and most of the crop residue has been removed, soil aggregates of the original structure break into single grains. The sandy loams and loamy sands are then particularly susceptible to soil blowing and to restricted penetration of water and air, and the silt loams also are susceptible.

The tilth of many kinds of soils can be improved by allowing the crop residue to decompose on or near the surface. The decomposed residue helps to form the soil into aggregates that make it mellow and porous. This practice is stubble-mulch farming.

Most of the sandy loams and loamy sands of the county, such as Bijou and Truckton, respond well to nitrogen fertilizer. By applying fertilizer containing nitrogen on these soils, plant growth is increased, more crop residue can be returned to the soil, and soil tilth and structure are improved.

Controlling erosion.—Basic practices that help to control erosion are stubble mulching, leaving crop residue on or near the surface as a protective cover and to improve structure, and seeding permanent grass on steep slopes, in waterways, and in other areas susceptible to erosion.

Stubble-mulch tillage should be practiced on most cultivated soils in the county. Although the Heldt soils are clayey and cloddy, and their surface clods reduce the hazard of soil blowing, residue management may be needed

so as to control water erosion and to maintain tilth of the surface layer.

Exposed knobs of Truckton, Colby, and Bresser soils should be seeded to permanent grass because they are subject to severe soil blowing. If grazing is controlled, permanent grass also protects steep soils not suitable for cultivation.

Where water concentrates, grassed waterways should be established. If a good grass cover is not maintained, terrace outlets and drainageways are subject to gullyng. In addition to controlling erosion, the grass can be used for hay or pasture.

Stripcropping by using strips as much as 165 feet wide and by alternating a crop and summer fallow helps to control erosion (fig. 9). Contour tillage and terraces that have grassed waterways are desirable on loamy soils where slopes are more than 3 percent.

Seeding cropland to permanent grass may be the most effective way to control erosion, and in many places this change is most beneficial to the soils. Other uses that may be suited to nearly all cultivated fields in the county are woodland, windbreaks, shelterbelts, wildlife habitat, and recreational areas.

IRRIGATED CROPLAND

The 2,200 acres of irrigated land in Arapahoe County make up less than 1 percent of the total acreage. In the central part of the county, the irrigated land is in small areas along drainageways and is used to grow plants that furnish supplemental feed for livestock. In the western part of the county, a few, small pastures for horses are irrigated with ditchwater from the South Platte River. Much of the irrigated land is rapidly being converted to homesites, and the water is used for domestic purposes.

In the central part of the county, most of the water used for irrigation is from wells that are 50 to 150 feet deep. These wells produce 100 to 400 gallons per minute, and the water is of good to excellent quality for irrigation. Both sprinklers and surface ditches are used. The principal irrigated crops are corn, alfalfa, and pasture. As much as 20 tons of silage per acre is obtained from corn, and annual yields of alfalfa range from 3 to 5 tons per acre.

Adequate fertilizer is required for good growth of irrigated crops. Land leveling, ditch lining, water control structures, and overnight storage ponds help to conserve moisture, to make irrigation easier, and to increase the acreage that can be irrigated.

Most of the soils of the survey area could be irrigated if water were available. The soils most suitable for irrigation are silt loams, loams, and sandy loams in the Bresser, Fondis, Nunn, Fort Collins, Weld, or Bijou series. Among the soils that are difficult to irrigate are the Heldt clays, Samsil clays, Litle silty clay loams, and Truckton loamy sands. These soils contain a large percentage of clay, are sandy, or are shallow.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landform-



Figure 9.—Stripcropping by alternating wheat and fallow helps to control soil blowing. The soils are Fondis-Colby silt loams, 3 to 5 percent slopes.

ing that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

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

- Class I soils have few limitations that restrict their use. (None in Arapahoe County.)
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. (None in Arapahoe County.)
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Arapahoe County.)
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-2 or IVe-1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

The soils of Arapahoe County have been placed in 23 capability units. The soils in each unit have about the same limitations, are subject to similar risks of damage, need about the same kind of management, and respond to management in about the same way. Because the annual precipitation is low in this county, the use of the soils for non-irrigated crops is limited. The soils are only in capability classes III, IV, VI, VII, or VIII. Because only a small acreage is irrigated in this county, none of the soils has been placed in irrigated capability units.

In the following pages each capability unit is described, and management for each is discussed. To determine the soils in each capability unit, refer to the "Guide to Mapping Units" at the back of this survey. Also, the capability unit assigned to any soil is listed at the end of the description of that soil in the section "Descriptions of the Soils."

CAPABILITY UNIT IIIe-1

This unit consists of nearly level to gently sloping, deep soils that occur along major streams and drainageways throughout the county. These soils have a surface layer of sandy loam and a subsoil of sandy loam to sandy clay loam.

The soils in this unit take in water well and have moderate available water holding capacity. They are easy to work but are susceptible to soil blowing if not protected.

These soils are suited to the crops commonly grown in the county. In the western part of the county, winter wheat is the main crop and it is followed by a season of fallow. Farther east some barley and some sorghum are grown for feed. If the content of soil moisture is favorable, sorghum is often planted as a catch crop, as a cover crop, or after wheat is harvested.

The soils in this unit blow unless they are protected. Stubble or crop residue left on the surface through April protects these soils from soil blowing through the windy season. Other practices effective against soil blowing are stripcropping, stubble mulching, minimum tillage, and contour farming.

These soils are well suited to permanent pasture. Suitable pasture plants are smooth brome, wheatgrass, sand lovegrass, and sweetclover.

CAPABILITY UNIT IIIe-2

In this unit are deep, well-drained, gently sloping soils on uplands. These soils have a loamy surface layer and a clayey subsoil.

The soils in this unit absorb water well and have high available water holding capacity. They are easy to work, but erosion and soil blowing are moderate hazards.

These soils are suited to the crops commonly grown in the county. In the western part of the county, winter wheat is the main crop and it is followed by a season of fallow. In the eastern part of the county, sorghum is grown for feed and grain. If moisture is favorable in spring, sorghum is planted as a cover crop, as a catch crop, or after wheat is harvested.

Water erosion and soil blowing are reduced by keeping stubble or crop residue on the surface through spring, and by contour stripcropping. Other practices that help to control erosion are terracing, contour farming, stubble mulching, and wind stripcropping. Grassed waterways are needed as outlets for terraces or in areas where gullies tend to form.

These soils are well suited to permanent pasture. Suitable pasture plants are crested wheatgrass, pubescent wheatgrass, intermediate wheatgrass, and Russian wildrye.

CAPABILITY UNIT IIIc-1

In this unit are deep, well-drained, nearly level to gently sloping soils. These soils have a loamy surface layer and a clayey to loamy subsoil.

The soils in this unit are easily worked. They absorb water well and have moderate to high available water holding capacity. Water erosion is only a slight hazard, but in unprotected areas the hazard of soil blowing is more severe.

These soils are suited to the crops commonly grown in the county. In the southwestern part of the county, low precipitation and a short growing season limit the growth of some crops. Wheat is commonly grown, and it is followed by a season of fallow. Alfalfa and spring barley are also grown.

Runoff and erosion are reduced by keeping crop residue on the surface until early in April. Soil blowing is reduced in spring by planting crops in strips at right angles to the prevailing wind. Other practices for reducing erosion are stubble mulching and terracing.

These soils are well suited to permanent pasture. Suitable pasture plants are smooth brome, wheatgrass, Russian wildrye, and sweetclover.

CAPABILITY UNIT IVe-1

This unit consists of deep, nearly level to gently sloping soils that occur on uplands in the eastern part of the county. These soils have a loamy surface layer and a silt loam to clay loam subsoil.

The soils in this unit are easily worked, absorb water slowly, have rapid runoff, and have high available water holding capacity. Soil blowing and water erosion are severe hazards in unprotected areas.

Sorghum and wheat are the most common crops, but some barley is grown. Generally, wheat is grown for 1 year, and it is followed by 1 year of fallow. Sorghum is sometimes planted after the wheat is harvested, or as a catch crop or a cover crop when the wheat crop fails.

Planting row crops in narrow contour strips or in terraced areas helps to control washing. Essential if a wheat-fallow cropping system is used is careful stubble mulching or contour stripcropping combined with good management of crop residue.

The soils in this unit are better suited to permanent pasture than to cultivated crops. Grasses suitable for seeding pasture are crested wheatgrass, pubescent wheatgrass, intermediate wheatgrass, and Russian wildrye. Native range plants also can be used. Under good management, grazing is regulated so that at least 2 inches of stubble is left on pasture seeded with crested wheatgrass and 3 inches of stubble is left where the pasture is seeded with pubescent wheatgrass and intermediate wheatgrass.

CAPABILITY UNIT IVe-2

Buick loam, 5 to 9 percent slopes, is the only soil in this unit. It is deep and has a clayey subsoil. This soil occurs on uplands in the western three-fourths of the county.

This soil is fairly difficult to work. It absorbs water slowly and has rapid runoff. Water erosion is a severe hazard, and soil blowing is a moderate one.

A large part of the acreage is in native grass, but cultivated crops are grown in some areas. Winter wheat is the main crop, and it is followed by a season of fallow.

Either stubble mulching or terracing combined with contour farming and crop residue management is needed if cultivated crops are grown. Planting crops in narrow, contour strips helps to control soil blowing and water erosion.

Permanent pasture is a good use for this soil. Suitable pasture plants are smooth brome, the wheatgrasses, and Russian wildrye. Native grasses also can be used. Under good management, grazing is regulated so that at least 2 inches of stubble is left in areas in smooth brome, crested wheatgrass, and Russian wildrye and 4 inches is left in areas in other grasses.

CAPABILITY UNIT IVe-3

Only Bresser-Truckton sandy loams, 3 to 5 percent slopes, is in this unit. These soils occur on uplands in the western three-fourths of the county. They are deep and have a sandy loam to sandy clay loam subsoil.

The soils in this unit are easily worked. They absorb water readily and have moderate available water holding capacity. In cultivated areas these soils tend to crust when they dry after a rain. Soil blowing is a severe hazard.

Most of the acreage is in native grass, but some areas are used for cultivated crops. Wheat is the main crop, but sorghum and barley are also grown.

If the soils in this unit are used for cultivated crops, practices are needed that help to control soil blowing and water erosion. Among the practices are keeping stubble or crop residue on the surface through the middle of April, minimum tillage, contour stripcropping, and stubble mulching. Crop residue left on the surface reduces crusting.

These soils are well suited to permanent grass. Suitable pasture plants are smooth brome and the wheatgrasses. Native grasses are also suitable for reseeding. In good pasture management about 3 inches of stubble is left on the surface after grazing.

CAPABILITY UNIT IVe-4

This unit consists of deep and moderately deep, gently sloping soils on uplands. These soils have a sandy loam surface layer and a sandy loam or sandy clay loam subsoil.

The soils in this unit are easy to work. They take in water readily and have moderate available water holding capacity. Because of the slope, some water is lost through runoff. If these soils are cultivated, both soil blowing and water erosion are hazards.

Most of the acreage is in native grass, but some areas are cropped. Wheat is commonly grown, and it is followed by a season of fallow. Sorghum and sudangrass are also grown.

Intensive management is needed to control soil blowing and water erosion in cultivated areas. Terracing, contour farming, keeping crop residue on the surface through the windy season, and stubble mulching are practices needed to reduce soil blowing and water erosion.

These soils are well suited to permanent pasture. Crested wheatgrass, pubescent wheatgrass, and Russian wildrye are suitable for planting. Pasture is maintained by regulating grazing so that at least 2 inches of stubble is left in areas in crested wheatgrass and 3 inches is left in areas in other grasses.

CAPABILITY UNIT IVe-5

Truckton loamy sand, 1 to 5 percent slopes, is the only soil in this unit. This soil is on uplands in the western part of the county. It has a sandy loam subsoil.

This soil is easy to work, and it absorbs water readily. Unless it is protected, however, it is highly susceptible to soil blowing.

Winter wheat, barley, sorghum, and sudangrass are the principal crops grown on this soil, but a small acreage is used for broomcorn and alfalfa.

This soil needs the protection of growing crops or crop residue at all times. Fallowing is of little benefit and is dangerous. Crops respond well to additions of nitrogen. Practices that protect this soil against soil blowing are stubble mulching and planting crops in extremely narrow strips.

This soil is well suited to permanent native or introduced grasses. Suitable pasture plants are sand lovegrass and bromegrass. Sweetclover also grows well and adds nitrogen to the soil. Under good management, grazing is controlled so that at least 4 inches of stubble is left on the pasture.

CAPABILITY UNIT IVe-6

In this unit are deep, well-drained, nearly level to gently sloping soils on uplands, mainly in the eastern part of the county. These soils have a fine sandy loam surface layer and a clay loam and silt loam subsoil.

The soils in this unit are easy to till. They take in water readily and have high available water holding capacity. Water erosion is a moderate hazard, but in unprotected areas the hazard of soil blowing is severe.

Most areas of these soils are in native grass or seeded pasture, but some cultivated crops are grown, mainly wheat, barley, and sorghum. A year of fallow is needed between crops. Soil blowing is reduced by keeping stubble or crop residue on the surface through April 15 and wind stripcropping, or by stubble mulching.

These soils are suited to permanent native or seeded pasture. Suitable pasture plants are the wheatgrasses, Russian wildrye, and smooth brome. Regulating grazing so that at least 3 inches of stubble is kept on the surface extends the life and productivity of the pasture.

CAPABILITY UNIT IVe-7

Bresser loamy sand, terrace, 0 to 3 percent slopes, is the only soil in this unit. It occurs in nearly level areas, mainly along Kiowa Creek. The subsoil is sandy clay loam.

This soil blows unless it is protected at all times. It absorbs water readily but has only moderate available water holding capacity.

Sorghum and sudangrass are the main crops grown on this soil, but some wheat is grown. Alfalfa grows well but is hard to establish. Crops grown each year help to protect the soil from blowing. Nitrogen is generally beneficial to crops.

If the field is fallowed, it should be carefully stubble mulched or crops should be planted in extremely narrow strips at right angles to the prevailing wind. If annual crops are grown, stubble should be left on the surface until the next crop is planted.

This soil is better suited to permanent grass than to cultivated crops. Plants suitable for pasture are sand lovegrass, bromegrass, and yellow sweetclover. Regulating grazing so that at least 4 inches of stubble is left helps to control erosion and to keep the pasture productive.

CAPABILITY UNIT IVw-1

This unit consists of deep, poorly drained, nearly level to gently sloping soils that occur along major streams in the western part of the county. These soils have a sandy loam or loam surface layer and a sandy loam to clay loam subsoil.

The soils in this unit have a high water table at least part of the year. Unless they are protected, those soils that have a sandy loam surface layer are susceptible to severe soil blowing. Small areas in which salts have accumulated are common.

Some areas in this unit are irrigated, and crops grow well in these areas. Alfalfa is the main nonirrigated crop, but some winter wheat is grown.

If wheat is followed by a season of fallow, stripcropping or stubble mulching is needed to check soil blowing.

The soils in this unit are well suited to permanent grass. Suitable grasses for seeding meadow or pasture are reed canarygrass, tall wheatgrass, intermediate wheatgrass, and tall fescue. Good management requires that grazing be regulated so that at least 4 inches of stubble is left on the surface.

CAPABILITY UNIT IVs-1

In this unit are deep, level to nearly level soils that have a surface layer of clay or silt loam and a subsoil that is clayey or contains a thin layer of silt loam underlain by clay.

The soils in this unit that have a clay surface layer are difficult to work. They absorb water slowly, have high available water holding capacity, and at times are ponded in low areas. The hazards of water erosion and soil blowing are moderate to slight. The soils that have a silt loam surface layer are easy to work, absorb water well, and have high available water holding capacity.

Winter wheat and barley are the main crops grown on these soils. Generally a crop is grown for 1 year and is followed by 1 year of fallow.

On these soils, keeping crop residue on or near the surface is an important practice. The residue increases the intake of water, and it aids in the preparation of seedbeds.

Stubble mulching and stripcropping are practices effective in controlling water erosion and soil blowing.

These soils are well suited to permanent pasture or range. Russian wildrye and the wheatgrasses are suitable pasture plants. Helpful in maintaining the pasture and controlling erosion is the regulation of grazing so that 2 inches of stubble is kept in areas in crested wheatgrass and 3 inches is kept in areas in other grasses.

CAPABILITY UNIT VIe-1

In this unit are moderately deep and deep, gently sloping to steep, loamy soils. These soils take in water well, but they lose a large amount of it through runoff. They erode easily if not protected by a good cover of grass.

The hazard of erosion is so severe that these soils cannot be cultivated safely. They are, however, suited to grass. Most of the acreage is used for grazing, but a part of it is in cultivated crops, and a few areas that were cultivated have been allowed to grow up in annual weeds.

Erosion can be reduced and the plant cover improved by building diversions above areas where gullies have formed, by furrowing on the contour, and by pitting. If the cultivated areas or old fields are reseeded to grass, a cover crop of sorghum or sudangrass should first be established; then suitable grasses can be seeded in the stubble. Suitable pasture plants are crested wheatgrass, intermediate wheatgrass, and pubescent wheatgrass. Suitable range plants are blue grama, side-oats grama, little bluestem, and western wheatgrass. Grazing should be regulated so that at least 2 inches of stubble is left on pasture seeded to crested wheatgrass and 3 inches of stubble is left on pasture seeded to the other grasses.

CAPABILITY UNIT VIe-2

This unit consists of gently sloping to steep soils that have a clay loam surface layer and range from a few inches to several feet in thickness.

These soils take in water slowly, and they lose a large amount of water through runoff. Their surface layer has high available water holding capacity, but generally water from the summer rains moistens only the top 8 to 10 inches of soil.

The soils in this unit are not suited to cultivated crops, but they produce moderate amounts of forage for grazing. Almost all of the acreage is in grass. Cultivated crops are grown in a few small areas, and there are a few bare areas that have been cultivated.

Good management is needed in areas used for grazing. Erosion can be reduced and the plant cover improved by building diversions, by pitting, and by furrowing on the contour. Areas that are now cultivated or that have been cultivated should be seeded to grass. The grass can be seeded in a cover of sorghum stubble. Suitable pasture plants are crested wheatgrass and pubescent wheatgrass. Suitable range plants include blue grama and western wheatgrass. Grazing should be regulated so that at least 2 inches of stubble is left on pasture seeded to crested wheatgrass and 3 inches of stubble is left on pasture seeded to pubescent wheatgrass.

CAPABILITY UNIT VIe-3

In this unit are moderately deep and deep, gently sloping to steep soils. These soils have a surface layer of sandy

loam or loamy sand and a subsoil that is mainly sandy clay loam or sandy loam.

The soils in this unit have moderate available water holding capacity. They absorb water rapidly unless the plant cover is poor and the surface soil is compacted. These soils are susceptible to erosion if not protected by a good cover of grass.

Most of the acreage of these soils is used for grazing, but a few areas are cultivated. Areas that are now cultivated should be seeded to permanent pasture or to range. In these areas grass can be seeded in a cover of sorghum or sudangrass stubble. Suitable pasture plants are sand lovegrass and smooth brome. Bluestem and side-oats grama grow well if seeded for range. Because these soils blow, mechanical practices are hazardous and generally are not effective. Careful management of the pasture is necessary for good growth of nutritious forage plants. Under good management, grazing is regulated so that at least 3 inches of stubble is left on the surface.

CAPABILITY UNIT VIe-4

This unit consists of deep, undulating to hilly soils that have a surface layer of loamy sand underlain by loamy sand and sand.

These soils absorb water rapidly but have low available water holding capacity. There is little runoff from these soils, and water erosion is only a slight hazard. In unprotected areas, however, the hazard of soil blowing is severe.

Most of the acreage of this unit is used for range. The soils are too sandy for cultivated crops. Bare areas or areas that are now cultivated should be seeded to range or pasture, but sorghum should be planted first to stabilize the soils, and then the seed can be planted in the stubble. Suitable plants for reseeding range are side-oats grama and the bluestems. Suitable pasture plants include sand lovegrass, smooth brome, and yellow sweetclover. Grazing should be regulated so that at least 4 inches of stubble is left in areas in pasture.

CAPABILITY UNIT VIw-1

Only Wet alluvial land is in this unit. It occupies nearly level areas and is subject to flooding. The soil material is deep to moderately deep alluvium that ranges from loam to sand in texture. It is wet below a depth of 3 feet most of the time, and in many places it is wet at the surface.

This land generally is too wet for cultivated crops, but it is well suited to permanent grass grown for hay or pasture. It is also used as native range. Many areas are an excellent source of gravel.

Suitable pasture plants are tall wheatgrass, tall fescue, intermediate wheatgrass, and reed canarygrass. Switchgrass, indiagrass, and bluestem are suitable for reseeding range. Grazing should be regulated so that at least 3 inches of stubble is left in areas in pasture.

CAPABILITY UNIT VIw-2

This unit consists of deep, nearly level soils. These soils occur along drainageways and major streams and are subject to flooding. They have a moderately fine textured to medium-textured surface layer. Below the surface layer is stratified sandy loam and clay loam or stratified clay and loam.

The soils in this unit take in water well and have moderate to high available water holding capacity. Gullying is a severe hazard in unprotected areas.

These soils are well suited to native range or to permanent pasture. They are not suited to cultivated crops because flooding and erosion are hazards. Barren areas and areas that are now cultivated should be reseeded to grass. Suitable range plants are western wheatgrass and switchgrass. Plants suitable for seeding pasture are tall wheatgrass, intermediate wheatgrass, tall fescue, and sweetclover. Grazing should be regulated so that at least 3 inches of stubble is left in areas in pasture.

CAPABILITY UNIT VI_s-1

In this unit are deep and shallow, level to steep, saline soils that occur on stream terraces and uplands. These soils have a clayey surface layer and subsoil. They are underlain by shale at a depth of 6 inches to 3 feet or more. They take in water slowly and lose large amounts of water through runoff.

The soils in this unit are too clayey, too saline, and too shallow or too steep to be used as cropland, but they produce a moderate amount of grass. Nearly all of the acreage is in native grass and should remain so. Barren or critical areas can be reseeded to western wheatgrass, side-oats grama, green needlegrass, and other native grasses, as well as to introduced grasses that include crested wheatgrass and Russian wildrye. Grazing should be regulated so that at least 2 inches of stubble is left in areas where the introduced grasses are seeded.

CAPABILITY UNIT VI_s-2

Beckton loam, 0 to 3 percent slopes, is the only soil in this unit. This soil occurs on low terraces, mainly in the eastern part of the county. It is deep, saline, and clayey. Most areas receive water from adjacent areas.

Most of the acreage is in native grass and should remain so. Larger amounts of grass grow in the areas that receive extra moisture through runoff than in other areas. This soil is not suited to cultivated crops because it is clayey and saline. Barren areas should be seeded to alkali sacaton, western wheatgrass, green needlegrass, and other native grasses, or to tall wheatgrass, intermediate wheatgrass, tall fescue, and other suitable pasture plants. Grazing should be regulated so that at least 3 inches of stubble is left in areas in pasture.

CAPABILITY UNIT VII_w-1

This unit consists only of Sandy alluvial land. The soil material is loose sand and fine gravel. In some places strata of loam and sandy loam occur below a depth of 2 feet. Water occurs at a depth of 5 feet or more. This land type is subject to flooding, to deposition of sand, and to severe soil blowing.

Sandy alluvial land is mostly in annual grasses, cottonwood trees, and weeds. It produces very little forage for grazing, but the tall brush or trees growing on this land protect livestock in winter and provide shade in summer. Many areas are suitable as wildlife habitat and recreational areas.

Management of this land type for grazing generally is not feasible unless it is necessary to protect adjacent better soils. Seeding or mechanical treatment of these areas is difficult and has little lasting value.

CAPABILITY UNIT VII_s-1

This unit consists of shallow, gently sloping to steep soils that are gravelly, sandy, or clayey. These soils generally occur in rough, broken areas where erosion has been active for a long time. Outcrops of sandstone and shale are common.

In this unit the gravelly and sandy soils absorb water rapidly, have low available water holding capacity, and are highly susceptible to soil blowing. The clayey soils absorb water slowly, but large amounts are lost through runoff. Water erosion is a severe hazard.

The soils in this unit are mainly in native grasses and shrubs. They produce only a limited amount of forage for grazing. A protective cover of vegetation is needed at all times to control soil blowing and water erosion. Grazing should be controlled, but seeding or mechanical practices are extremely difficult and have little lasting value.

CAPABILITY UNIT VIII_s-1

This unit consists of nearly level to sloping areas. These areas are made up of barren, interbedded shale and sandstone, or of deep sands, and they range from 20 to 60 acres in size. Soil blowing and water erosion are severe hazards.

Except for a few annual weeds, little or no vegetation grows in the areas that make up this unit. Without major reclamation this land is not suited to any agricultural use, but it can be developed as wildlife habitat. Sand blown from these areas may damage soils in adjacent areas. In some areas it may be necessary to provide a protective cover of mulch, manure, straw, hay, or netted and mastic material to protect the adjacent, more productive soils. Wildlife can be attracted to some areas by planting shrubs and hardy trees and by maintaining the brush piles.

Predicted yields

The predicted average yields per acre of the principal crops grown on the major nonirrigated soils in Arapahoe County are given in table 2 under two levels of management. Predictions are made for nonirrigated soils only. These predictions are based mainly on information obtained from farmers and from other agricultural workers who are familiar with the soils and crops of the county.

Yields in columns A are those expected under the management commonly followed by some farmers in the county. This management does not always include planned cropping systems or conservation practices, such as summer fallow, especially following barley and sorghum; adding fertilizer of any kind; timely tillage; or weed control. The stubble is not left on the surface, and the surface soil may be too fine or pulverized at planting time for soil blowing to be controlled.

Yields expected under improved management are listed in columns B. Improved management includes timely tillage; summer fallow; adequate fertilization; controlling soil blowing; choosing the best crop varieties; and planting pure, clean seeds that have been tested and treated. If these practices are followed and rainfall is above average, yields may be 25 percent or more higher than those shown in columns B of the table. Following these practices may enable crops to survive droughts.

As crop varieties and management techniques improve, yields probably will increase accordingly. Yields may be decreased by dry weather, diseases, or insects.

TABLE 2.—Predicted average yields per acre for the principal nonirrigated crops under two levels of management

[Yields in columns A are those to be expected under common management; yields in columns B are those to be expected under improved management]

Soil	Winter wheat		Barley		Forage sorghum	
	A	B	A	B	A	B
Adena-Colby fine sandy loams, 1 to 5 percent slopes.....	Bu. 14	Bu. 17	Bu. 15	Bu. 19	Tons 1.0	Tons 2.5
Adena-Colby silt loams, 1 to 5 percent slopes.....	14	17	15	19	1.0	2.5
Ascalon sandy loam, 5 to 9 percent slopes.....	11	14	11	14	.5	1.5
Baca loam, 3 to 5 percent slopes.....	11	15	12	16	1.0	2.5
Bijou sandy loam, 0 to 3 percent slopes.....	14	17	15	18	1.5	3.0
Bijou sandy loam, wet, 0 to 3 percent slopes.....	16	18	15	18	1.5	3.0
Bresser loamy sand, terrace, 0 to 3 percent slopes.....	12	14	10	12	1.0	2.0
Bresser sandy loam, terrace, 0 to 3 percent slopes.....	16	18	14	16	1.5	3.0
Bresser loam, gravelly subsoil variant, 1 to 3 percent slopes.....	14	17	15	18	1.0	2.5
Bresser-Stapleton sandy loams, 3 to 9 percent slopes.....	12	16	10	12	1.0	2.0
Bresser-Truckton sandy loams, 3 to 5 percent slopes.....	12	16	10	12	1.0	2.0
Buick loam, 3 to 5 percent slopes.....	14	18	15	19	1.0	2.5
Buick loam, 5 to 9 percent slopes.....	12	16	13	17	.5	1.5
Colby silt loam, 1 to 5 percent slopes.....	11	13	11	13	.5	1.5
Edgewater loam, 0 to 3 percent slopes.....	14	17	15	18	1.5	3.0
Fondis silt loam, 1 to 3 percent slopes.....	16	19	17	20	2.0	4.0
Fondis silt loam, 3 to 5 percent slopes.....	14	18	15	19	1.5	3.0
Fondis-Colby silt loams, 3 to 5 percent slopes.....	13	16	13	16	1.0	2.5
Fort Collins loam, 0 to 3 percent slopes.....	15	17	13	16	1.5	3.0
Heldt clay, 0 to 3 percent slopes.....	13	15	13	15	.75	1.5
Nunn loam, 0 to 3 percent slopes.....	16	19	17	20	2.0	4.0
Nunn-Bresser-Ascalon complex, 0 to 3 percent slopes.....	15	18	16	18	1.5	3.0
Truckton loamy sand, 1 to 5 percent slopes.....	11	14	11	14	1.5	3.0
Weid fine sandy loam, 1 to 5 percent slopes.....	16	19	17	20	1.5	3.5
Weid silt loam, 0 to 3 percent slopes.....	16	19	17	20	2.0	4.0
Weid silt loam, 3 to 5 percent slopes.....	14	18	15	19	1.5	3.0
Weid-Deertrail silt loams, 0 to 3 percent slopes.....	12	15	13	16	1.0	2.0

Nonfarm Uses of Soils³

The expanding metropolitan area of Denver has affected land use in Arapahoe County (fig. 10). The population in the western 15 percent of the county is now about 1,000 people per square mile. As the population expands more areas are used for residential and other nonfarm purposes.

In this county it is very important that the availability of dependable water be determined before planning the use of soils for many nonfarm purposes. The most dependable water for domestic and industrial uses is that piped from municipal water systems. Areas along the major drainageways, particularly along the South Platte River and Cherry Creek, obtain water from wells less than 100 feet deep. In some areas of the uplands, however, a limited amount of water is available from wells that are 300 to 2,500 feet deep. The water from new wells should be tested before it is used for domestic consumption.

In table 3 most of the soils of Arapahoe County are given a rating of *slight*, *moderate*, or *severe* according to the degree of their limitations when used as foundations for small buildings, for homesites, for leaching fields and lagoons, for the disposal of sewage effluent, for streets, for recreational areas, and for landscape plantings. Some of the limiting soil features are also given in the table. The information given in tables 6 and 7 in the section "Engineering Uses of Soils" was used to help evaluate the limitations

³ R. D. ANDERSON, State resource conservationist, Soil Conservation Service, assisted in preparing this section.

given in table 3. None of the tables, however, eliminate the need for an investigation at the site of the specified use.

In table 3 a rating of *slight* indicates that a soil has no important limitations to the specified use. A rating of *moderate* shows that the soil has some limitations to the selected use, but these limitations can normally be overcome. A rating of *severe* indicates that the soil has major limitations to the specified use. Some limitations are difficult and expensive to overcome. Areas subject to flooding generally need major and very costly flood control structures before they are used for houses or other buildings, but these areas can be used for parks and other recreational areas. Some limitations can be overcome or corrected. For example, removing and replacing the shaly topsoil in areas of Samsil, Litle, and Renohill soils help in establishing good lawns on those soils.

The nonfarm uses of soils that are listed in table 3 are discussed in the following paragraphs. For the use of a soil as foundations for homes and other small buildings, the ratings in table 3 are based on the soil features requiring special considerations. For example, Fondis and other soils having a high shrink-swell potential generally need specially designed foundations.

The ratings for homesites with public sewage systems are for residential areas, sites for churches, and the like. Slope is a less serious limitation for homesites than for light industrial structures. Some steep soils having slopes that face west, northwest, or southwest are used as homesites in this county because they have an unobstructed view of the Rocky Mountains.