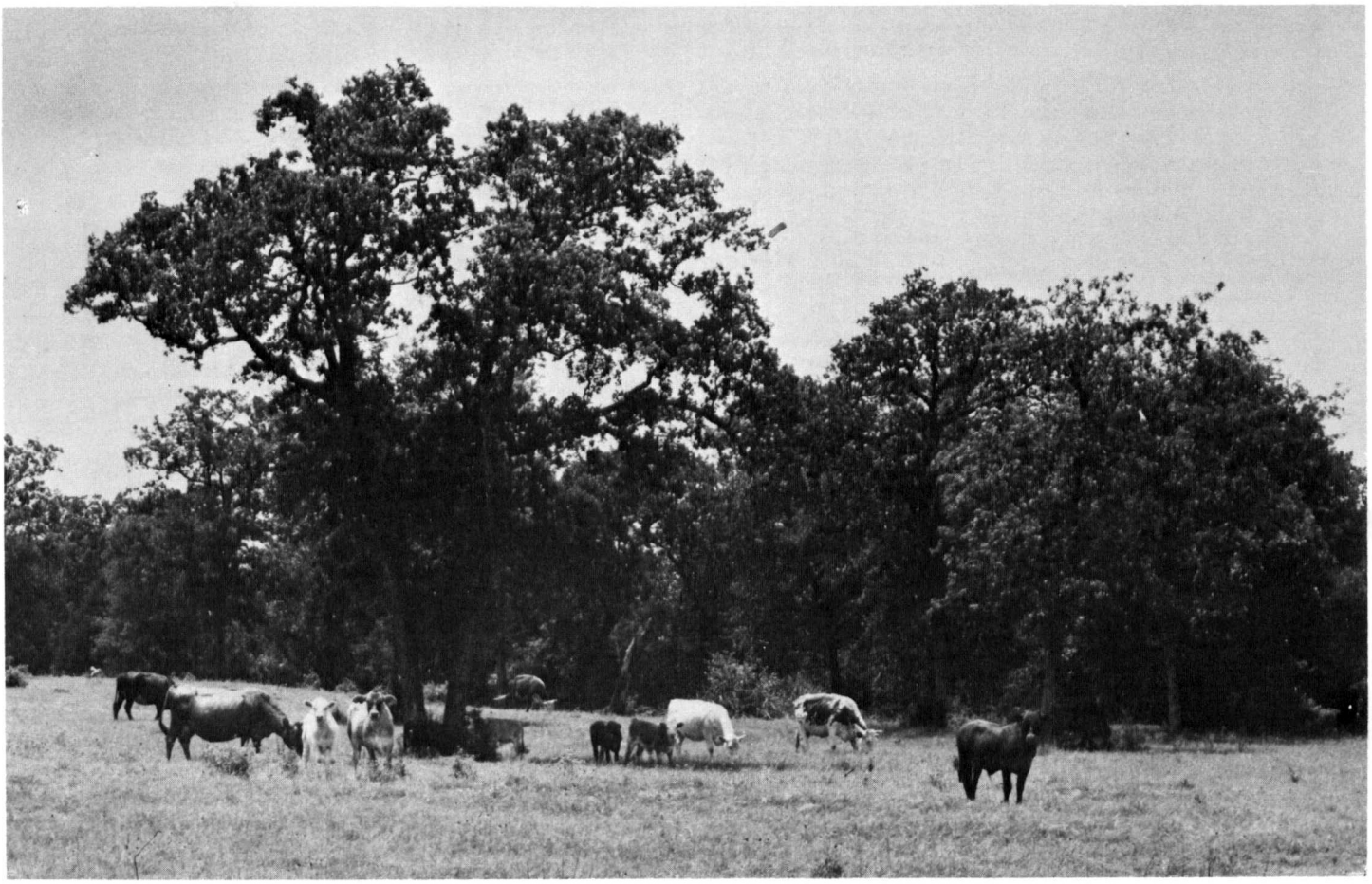
SOIL SURVEY OF

Bastrop County, Texas



United States Department of Agriculture
Soil Conservation Service
in coorporation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1960-72. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Bastrop County Soil and Water Conservation District.

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 farming, industry, and recreation.

Locating Soils

All the soils of Bastrop 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 shows the capability classification of each. It also shows the page where each soil is described and the page for the pasture and hayland group and range site to which the soil has been assigned.

Individual colored maps that show 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 that have a moderate limitation can be colored yellow, and those that have 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 descriptions of the capability units, the range sites, and the pasture and hayland groups.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "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 can read about soil properties that affect the choice of sites for dwellings and industrial buildings and for recreation areas in the sections "Engineering Uses of the Soils" and "Recreation."

Engineers and builders can find, under "Engineering Uses of the 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 the Soils."

Newcomers in Bastrop 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 information about the county given at the beginning of the publication.

Cover: Cattle grazing in a good stand of Coastal bermudagrass on Tabor fine sandy loam.

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SOIL SURVEY OF BASTROP COUNTY, TEXAS

BY FRANK E. BAKER, SOIL CONSERVATION SERVICE

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

BASTROP COUNTY is in the south-central part of Texas (fig. 1). It has an area of 891 square miles, or 570,240 acres, of which 1,418 acres is water. The elevation is 400 to 600 feet above sea level.

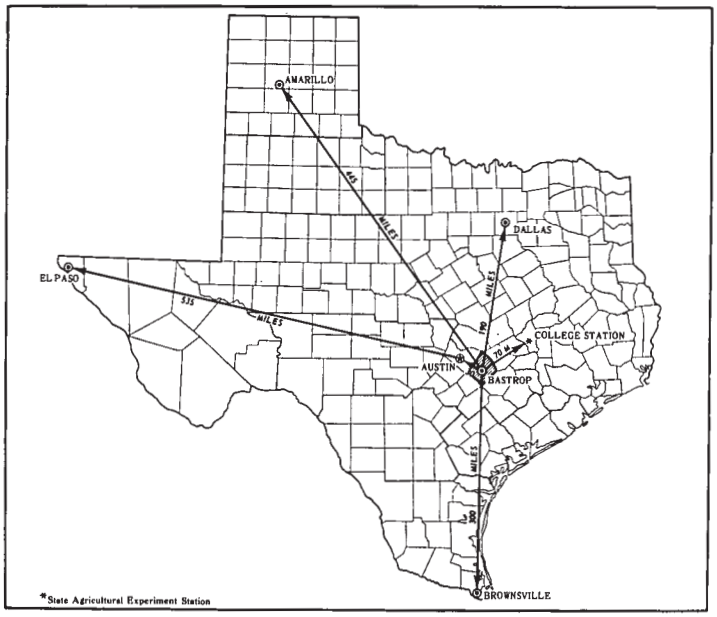

Figure 1.—**Location of Bastrop County in Texas.**

Most of the soils in the county are nearly level to gently sloping, but some soils are moderately steep. Most areas of the nearly level soils in the county are in the Colorado River Valley.

Growing cotton and grain sorghum and raising beef cattle are the main sources of income in the county. About 22 percent of the county is in crops, 25 percent is in pasture, 9 percent is in range, and 36 percent is forested. Most of the forested areas are used for pasture and recreation. About 8 percent of the acreage is used for other purposes.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Bastrop 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. 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 *soil series* and the *soil phase* are the categories of soil classification most used in a local survey

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. Houston Black and Wilson, for example, are the names of two soil series. All the soils in the United States that have 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 layer 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, Crockett gravelly sandy loam, 1 to 5 percent slopes, is one of several phases within the Crockett 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 at the back of this publication was prepared from 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 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 Bastrop County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed 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. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Axtell-Tabor complex, 1 to 8 percent slopes, is an example.

An undifferentiated 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 soil 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. An example of an undifferentiated group in Bastrop County is Lincoln soils.

While a soil survey is in progress, soil scientists take samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil 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 kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this failure to the slow permeability of the soil or to a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Bastrop County. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map that shows soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for broad planning of a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments, and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road, a building, or other structures, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The five associations in Bastrop County are described in the pages that follow.

1. Patilo-Demona-Silstid association

Gently sloping to strongly sloping soils that have a sandy surface layer and moderately slowly to moderately permeable lower layers; on uplands

This association is on a landscape that is a series of gently sloping ridgetops and gently sloping to strongly sloping side slopes (fig. 2).

This association makes up about 32 percent of the county. It is about 30 percent Patilo soils, 23 percent Demona soils, and 13 percent Silstid soils. The remaining 34 percent is the minor Crockett, Mabank, Wilson, Axtell, Jedd, Rosanky, and Tabor soils on uplands; Uhland soils on bottom lands; and Sayers soils on bottom lands in some of the larger valleys that have well-defined drainageways and bottom land that seldom floods.

Patilo soils are mostly on ridgetops and side slopes. These soils have a surface layer of fine sand that is light brownish gray in the upper part and very pale brown in the lower part. The lower layers are acid, mottled sandy clay loam.

Demona soils are mostly on foot slopes and in drainageways. In places they are on ridgetops. These soils have a surface layer of loamy fine sand that is light brownish gray in the upper part and very pale brown in the lower part. The lower layers are acid, mottled sandy clay.

Silstid soils are mostly on foot slopes and in drainageways. These soils have a surface layer of loamy fine sand that is light gray in the upper part and very pale brown in the lower part. The lower layers are acid, mottled sandy clay loam over clay loam.

Most of the acreage of this association is used for pasture, range, or wildlife habitat. A few areas are used for crops, and a few are established in improved pasture grasses.

A countywide water system, available electricity,

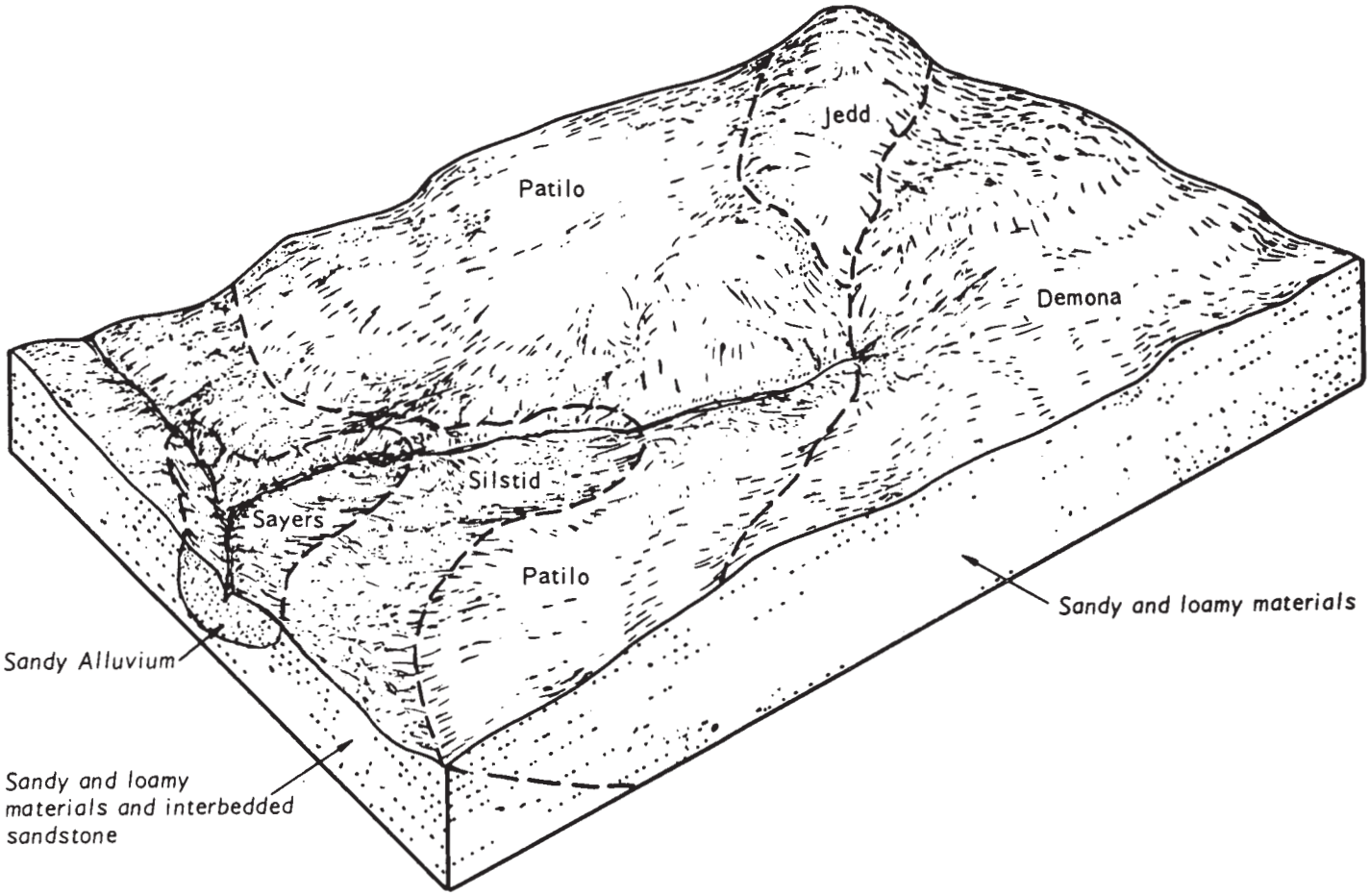

Figure 2.—**Typical pattern of soils in the Patilo-Demona-Silstid association.**

favorable climate, and proximity to large cities make this association ideal for use of weekend campers and as sites for house trailers, cottages, and cabins. Among the limitations of these soils for urban use are the sandy surface layer, permeability, and a high water table.

2. *Axtell-Tabor association*

Nearly level to strongly sloping soils that have a loamy surface layer and very slowly permeable lower layers; on stream terraces and uplands

This association is in large, irregularly shaped areas. The landscape is a series of nearly level to gently sloping, narrow to broad ridgetops and gently sloping to strongly sloping side slopes. Valleys range from narrow to broad and have well-defined drainageways (fig. 3).

This association makes up about 29 percent of the county. It is about 48 percent Axtell soils and 25 percent Tabor soils. The remaining 27 percent is the minor Crockett, Mabank, Wilson, Jedd, Rosanky, and Demona soils on uplands and Sayers and Gowen soils on bottom lands.

Axtell soils are mostly gently sloping and are on narrow ridgetops and steeper side slopes. These soils have a surface layer of fine sandy loam that is brown in the upper part and pale brown in the lower part. The lower layers are acid, mottled clay or sandy clay.

Tabor soils are nearly level to gently sloping and are on ridgetops and foot slopes and in drainageways. These soils have a surface layer of fine sandy loam that is grayish brown in the upper part and pale brown in the lower part. The lower layers are acid, mottled clay.

Most of the acreage of this association is old cropland used for native grass pasture. Many small areas are established in improved pasture grasses. A few areas are used for crops. The rest of the acreage is woodland used for range.

A countywide water system, available electricity, favorable climate, and proximity to large cities make this association ideal for use of weekend campers and as sites for mobile homes and cottages for people of the nearby cities. Among the limitations of these soils for urban use are shrink-swell potential, corrosivity, and permeability.

3. *Crockett-Wilson association*

Nearly level to strongly sloping soils that have a loamy surface layer and very slowly permeable lower layers; on uplands

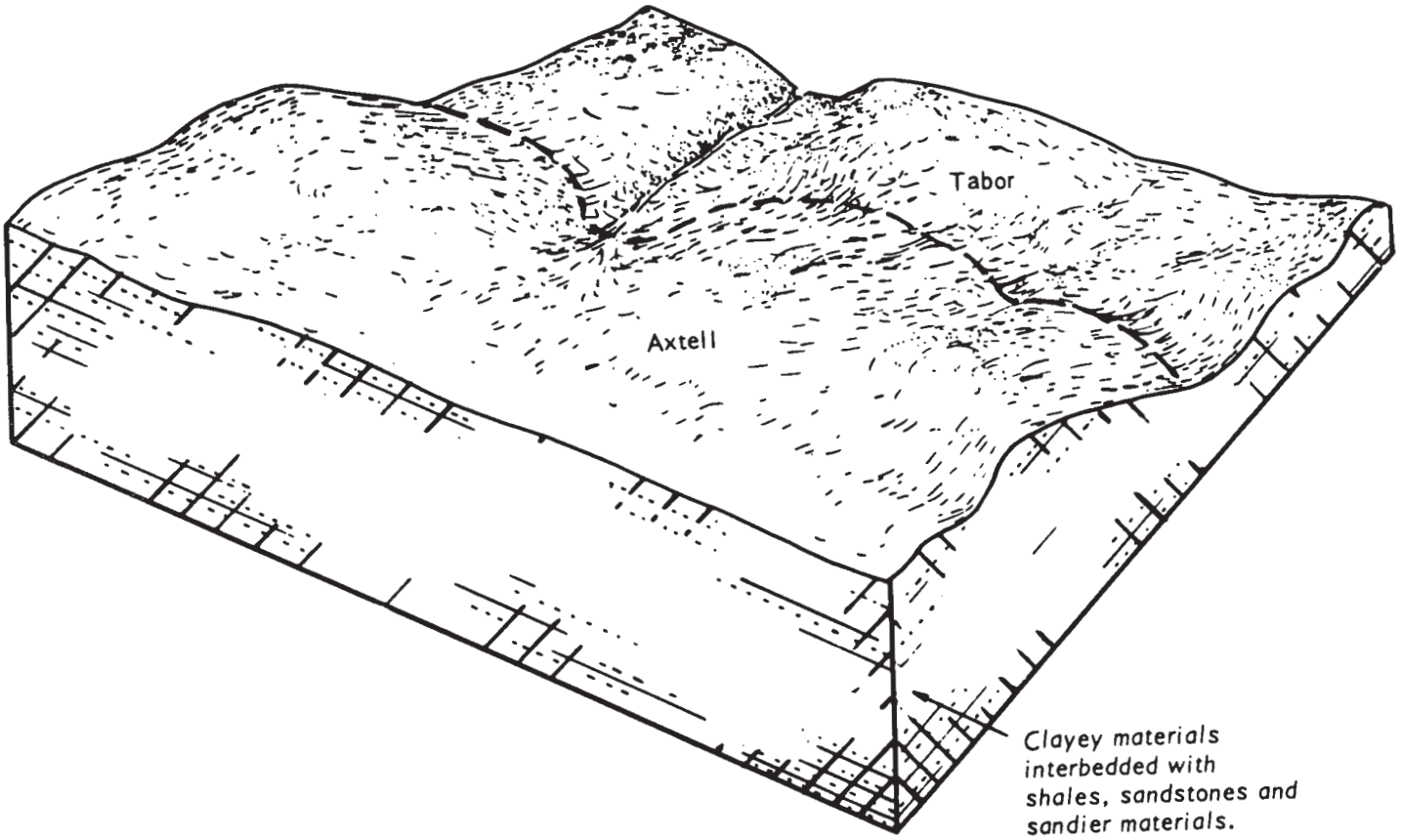

Figure 3.—**Typical pattern of soils in the Axtell-Tabor association.**

This association is in long, narrow, irregularly shaped areas. Where the Crockett and Wilson soils occur together, the Crockett soils are on side slopes and more sloping ridgetops and the Wilson soils are on less sloping, smooth ridgetops and footslopes and in drainageways (fig. 4).

This association makes up about 18 percent of the county. It is about 48 percent Crockett soils and 12 percent Wilson soils. The remaining 40 percent is the minor Axtell, Behring, Mabank, and Tabor soils on stream terraces and uplands and Gowen and Trinity soils on bottom lands.

Crockett soils are gently sloping to strongly sloping. These soils have a surface layer of brown loam. The lower layers are mottled clay.

Wilson soils are nearly level to gently sloping. These soils have a surface layer of dark-gray clay loam. The lower layers are clay that in places is mottled at lower depths.

A few areas of this association are used for crops. Most of the acreage is in pasture and range. Small areas are established in improved grasses.

A countywide water system, available electricity, favorable climate, and proximity to large cities make this association ideal for use of weekend campers and as sites for house trailers, homes, and cottages. Among the limitations of these soils for urban use are shrink-swell potential, corrosivity, and permeability.

4. *Behring-Crockett-Heiden association*

Gently sloping to strongly sloping soils that have a loamy to clayey surface layer and slowly to very slowly permeable lower layers; on uplands

This association is mostly in irregularly shaped areas. The landscape is a series of gently sloping, narrow to broad ridgetops and gently sloping to strongly sloping side slopes. Valleys range from narrow to broad, and most have alluvial soils along well-defined drainageways.

This association makes up about 11 percent of the county. It is about 28 percent Behring soils, 28 percent Crockett soils, and 14 percent Heiden soils. The remaining 30 percent is the minor Ferris, Axtell, Houston Black, Mabank, and Wilson soils on terraces and uplands and Gowen and Trinity soils on bottom lands.

Behring soils are on ridgetops and side slopes. These soils have a surface layer of dark grayish-brown clay loam. The lower layers are mottled clay.

Crockett soils are on ridgetops and side slopes. These soils have a surface layer of brown loam. The lower layers are mottled clay.

Heiden soils are mostly on side slopes and foot slopes. These soils have a surface layer of dark grayish-brown clay. The lower layers are mottled clay.

Most of the acreage of this association is used for crops. Many areas, mostly on the steeper slopes, are established in improved pasture grasses.

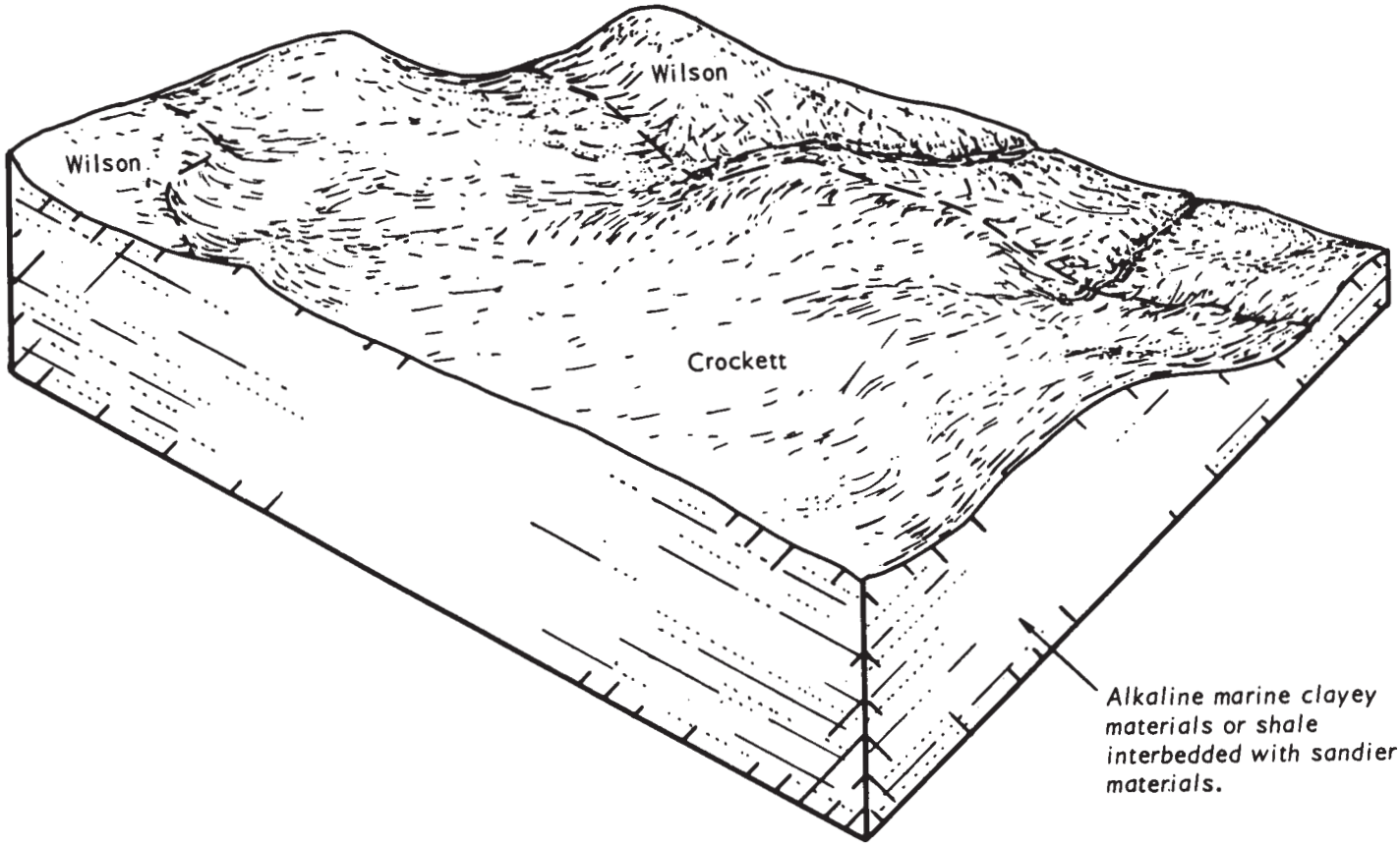

Figure 4.—**Typical pattern of soils in the Crockett-Wilson association.**

This association is used as sites for mobile homes, semipermanent homes, and weekend cabins. Among the limitations of these soils for urban use are shrink-swell potential, corrosivity, and permeability.

5. *Bosque-Smithville-Norwood association*

Nearly level soils that have a loamy surface layer and moderately permeable lower layers; on low terraces and flood plains

This association is in a long, narrow area along the Colorado River. The river valley is a smooth, nearly level plain that is broken by a few short areas that slope to the drainageways.

This association makes up about 10 percent of the county. It is about 28 percent Bosque soils, 15 percent Smithville soils, and 10 percent Norwood soils. The remaining 47 percent is the minor Krum, Ships, Lincoln, and Trinity soils on low terraces and bottom lands and small areas of Axtell, Bastrop, Mabank, and Shep soils on higher terraces and uplands.

Bosque soils are on low terraces. These soils have a dark grayish-brown surface layer that is loam in the upper part and clay loam in the lower part. The lower layers are clay loam.

Smithville soils are on low terraces. These soils have a surface layer of grayish-brown fine sandy loam over a layer of dark grayish-brown loam. The lower layers are sandy clay loam.

Norwood soils are on flood plains. These soils have a surface layer of brown silty clay loam. The lower layers are stratified silty clay loam, silt loam, and thin layers of fine sandy loam.

Most of the acreage of this association is used for crops and pasture. A few areas are in native vegetation.

The main limitation of these soils for urban use is flooding.

Descriptions of the Soils

This section describes the soil series and mapping units in Bastrop County. Each soil series is described in detail, and then, briefly, each mapping unit in that series is described. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar

to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit, pasture and hayland group, and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the *Soil Survey Manual (6)*.[1]

Axtell Series

The Axtell series consists of deep, nearly level to strongly sloping, well drained to moderately well drained, loamy soils. These soils are on stream terraces and uplands. They formed in clayey sediment interbedded in places with shale and sandstone. The native vegetation is post oak, blackjack oak, and bunchgrass.

In a representative profile the surface layer is brown fine sandy loam about 5 inches thick. The upper 10 inches of the subsoil is yellowish-red, mottled clay. The lower 30 inches of the subsoil is mottled sandy clay that is yellowish red in the upper part and light brownish gray in the lower part. The underlying material, to a depth of 60 inches, is gray, mottled sandy clay loam; and to a depth of 76 inches, it is light-gray, mottled sandy clay (fig. 5).

Permeability is very slow. Runoff is slow to rapid. The available water capacity is high.

Most of the acreage was formerly cultivated, but it is now used mainly for grazing. A few small areas are used for crops, and some are used for improved pasture. The rest is in woodland used for pasture and range.

Representative profile of Axtell fine sandy loam, 1 to 5 percent slopes, in a pasture 1.25 miles southwest on a county road from the west intersection of Loop Road 225 and U.S. Highway 290 in McDade, Texas, 165 feet east:

Ap—0 to 5 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, very friable; slightly acid; clear, smooth boundary.

A2—5 to 8 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak, fine, granular structure; hard, very friable; slightly acid; abrupt, wavy boundary.

B21t—8 to 18 inches, yellowish-red (5YR 4/6) clay, yellowish red (5YR 3/6) moist; many, medium, distinct, brown (10YR 5/3) and yellowish-brown (10YR 5/4) mottles; moderate, coarse, blocky structure; extremely

[1] Italic numbers in parentheses refer to Literature Cited, p. 71.

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

Soil	Acres	Percent
Axtell fine sandy loam, 0 to 1 percent slopes	1,580	0.3
Axtell fine sandy loam, 1 to 5 percent slopes	43,330	7.7
Axtell fine sandy loam, 2 to 5 percent slopes, eroded	33,900	6.0
Axtell fine sandy loam, 5 to 12 percent slopes, eroded	7,270	1.3
Axtell-Tabor complex, 1 to 8 percent slopes	39,600	6.9
Bastrop fine sandy loam, 0 to 1 percent slopes	1,740	.3
Bastrop fine sandy loam, 1 to 3 percent slopes	1,500	.3
Bastrop fine sandy loam, 3 to 5 percent slopes, eroded	830	.1
Behring clay loam, 1 to 3 percent slopes	9,320	1.6
Behring clay loam, 3 to 5 percent slopes, eroded	11,890	2.1
Behring clay loam, 5 to 8 percent slopes, eroded	1,210	.2
Bosque loam	16,940	3.0
Burleson clay, 1 to 3 percent slopes	1,190	.2
Crockett fine sandy loam, 1 to 3 percent slopes	16,200	2.8
Crockett gravelly sandy loam, 1 to 5 percent slopes	4,450	.8
Crockett gravelly loam, 5 to 10 percent slopes	1,110	.2
Crockett soils, 2 to 5 percent slopes, eroded	45,450	8.0
Crockett soils, 5 to 10 percent slopes, eroded	5,290	.9
Crockett soils, 3 to 8 percent slopes, severly eroded	11,510	2.0
Demona loamy fine sand, 1 to 5 percent slopes	46,600	8.2
Demona loamy fine sand, somewhat poorly drained variant	1,820	.3
Dougherty loamy fine sand, 0 to 3 percent slopes	1,340	.2
Dougherty loamy fine sand, 3 to 8 percent slopes	1,070	.2
Ferris clay, 5 to 20 percent slopes, eroded	4,880	.9
Gowen soils, frequently flooded	10,990	1.9
Heiden clay, 1 to 3 percent slopes	3,450	.6
Heiden clay, 3 to 5 percent slopes, eroded	5,990	1.0
Heiden clay, 5 to 8 percent slopes, eroded	1,700	.3
Houston Black clay, 0 to 1 percent slopes	1,460	.3
Houston Black clay, 1 to 3 percent slopes	1,520	.3
Jedd stony soils, 5 to 20 percent slopes	10,862	1.9
Krum silty clay, 0 to 1 percent slopes	2,170	.4
Lincoln soils	3,750	.6
Lincoln soils, frequently flooded	1,430	.3
Mabank loam, 0 to 1 percent slopes	6,180	1.1
Mabank loam, 1 to 3 percent slopes	6,710	1.2
Norwood loam	1,710	.3
Norwood silty clay loam	4,710	.8
Patilo complex, 1 to 12 percent slopes	59,820	10.4
Rosanky fine sandy loam, 1 to 3 percent slopes	1,070	.2
Rosanky fine sandy loam, 3 to 8 percent slopes	6,710	1.1
Sayers fine sandy loam	12,630	2.2
Sayers fine sandy loam, frequently flooded	1,570	.3
Shep clay loam, 3 to 8 percent slopes, eroded	4,880	.9
Ships silty clay	2,040	.4
Silstid loamy fine sand, 1 to 5 percent slopes	25,940	4.5
Smithville fine sandy loam	8,580	1.5
Tabor fine sandy loam, 0 to 1 percent slopes	5,400	.9
Tabor fine sandy loam, 1 to 3 percent slopes	36,630	6.4
Trinity clay	1,250	.2
Trinity clay, frequently flooded	3,180	.6
Uhland soils, frequently flooded	1,540	.3
Vernia complex, 1 to 8 percent slopes	3,460	.6
Wilson gravelly clay loam, 1 to 3 percent slopes	1,320	.2
Wilson gravelly clay loam, 3 to 5 percent slopes	4,830	.8
Wilson clay loam, 0 to 1 percent slopes	4,740	.8
Wilson clay loam, 1 to 3 percent slopes	10,580	1.9
Water areas	1,418	.3
Total	570,240	100.0

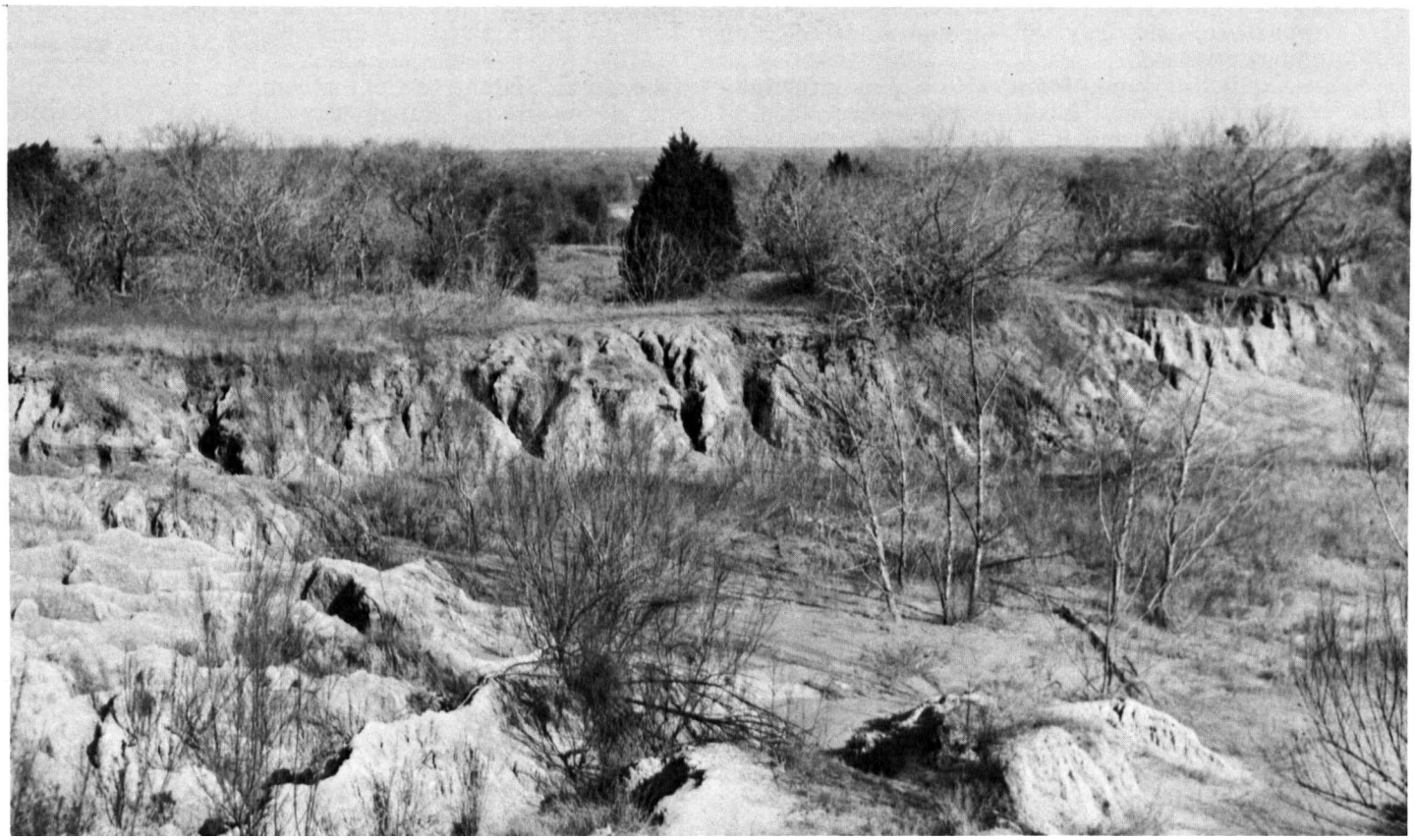

Figure 5.—**Gully erosion in an area of Axtell fine sandy loam, 2 to 5 percent slopes, eroded.**

hard, extremely firm; clay films on faces of peds; cracks filled with sandy material from A horizon; strongly acid; gradual, wavy boundary.

B22t—18 to 35 inches, yellowish-red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; many, large, distinct, red (2.5YR 4/6), gray (10YR 5/1), and yellowish-brown (10YR 5/4) mottles; coarse, blocky structure; extremely hard, extremely firm; continuous clay films on faces of peds; medium acid; gradual, wavy boundary.

B23t—35 to 48 inches, light brownish-gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common, medium, distinct, yellowish-red (5YR 5/6) and yellowish-brown (10YR 5/6) mottles; weak, medium, blocky structure; very hard, very firm; clay films on and between faces of peds; few, small, dark iron and magnesium and calcium carbonate concretions; medium acid; gradual, wavy boundary.

C1—48 to 60 inches, gray (10YR 6/1) sandy clay loam, gray (10YR 5/1) moist; reddish-yellow (5YR 6/6) mottles; massive; very hard, friable; few calcium carbonate concretions; clay films between some faces of peds; medium acid; gradual, wavy boundary.

C2—60 to 76 inches, light-gray (10YR 7/1) sandy clay, gray (10YR 6/1) moist; yellowish-brown (10YR 5/6) and reddish-brown (5YR 5/3) mottles; massive; very hard, very firm; few, small calcium carbonate concretions; slightly acid.

The solum ranges from 40 to 70 inches in thickness.

The A1 and A2 horizons range from 4 to 15 inches in thickness. They are fine sandy loam and gravelly sandy loam that is as much as 40 percent quartz and chert pebbles. The A1 horizon ranges from dark grayish brown, brown, grayish brown, and light gray to very pale brown. The A2 horizon is light gray, very pale brown, pale brown, or light yellowish brown. Reaction is slightly acid or medium acid.

The B21t and B22t horizons range from about 21 to 40 inches in thickness. The Bt horizon is yellowish red, light brownish gray, red, reddish brown, reddish yellow, or brown and is distinctly mottled in shades of red, brown, gray, and yellow. The red mottles decrease with increasing depth. Reaction ranges from very strongly acid to medium acid in the B21t horizon and from very strongly acid to slightly acid in the B22t horizon.

The B3t horizon ranges from 10 to 30 inches in thickness. The B3t and C horizons are gray or light-gray clay, sandy clay, or sandy clay loam. They are mottled in shades of gray, brown, yellow, and olive. Reaction ranges from medium acid to moderately alkaline.

AfA—Axtell fine sandy loam, 0 to 1 percent slopes. This nearly level soil is on old, high terraces. Areas are mostly long and narrow and range from about 15 to 70 acres in size.

The surface layer is fine sandy loam about 14 inches thick. It is grayish brown in the upper part and light gray in the lower part. The subsoil, to a depth of 34 inches, is mottled clay. It is reddish brown in the upper part and brown in the lower part. The next layer, to a depth of 60 inches, is light-gray, mottled sandy clay.

Included with this soil in mapping are small areas of Mabank, Wilson, and Bastrop soils, which make up 5 to 10 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used mostly for pasture. It is suited to

crops, but the choice of crops is limited. It is also suited to improved pasture, hay, and range. Capability unit IIIs-1; pasture and hayland group 8A; Claypan Savannah range site.

AfC—Axtell fine sandy loam, 1 to 5 percent slopes. This gently sloping soil has the profile described as representative of the series. It is on ridgetops and side slopes. Slopes are mostly 1 to 3 percent. Areas range from long and narrow to irregular in shape. They are mostly 10 to 50 acres in size but range to as much as 200 acres.

Included with this soil in mapping are small areas of Crockett and Tabor soils and areas of eroded Axtell soils. These included soils make up about 20 percent of the mapped areas.

The hazard of erosion is moderate. Some areas have a few gullies.

This soil is used mostly for improved pasture and wooded pasture. It is suited to crops, but the choice of crops is limited. It is also suited to hay and range. Capability unit IVe-3; pasture and hayland group 8A; Claypan Savannah range site.

AfC2—Axtell fine sandy loam, 2 to 5 percent slopes, eroded. This soil is on side slopes and on eroded ridgetops. Slopes are mostly 3 to 5 percent. Most areas range from 10 to 60 acres in size and average about 25 acres.

The surface layer is fine sandy loam about 6 inches thick. It is brown in the upper part and very pale brown in the lower part. The subsoil, to a depth of 36 inches, is mottled clay. It is red in the upper part and yellowish red in the lower part. The next lower layer, to a depth of 64 inches, is mottled sandy clay.

Most areas have a few widely spaced gullies and a thin surface layer. In some plowed areas a part of the clayey material in the lower layers is mixed with that in the surface layer.

Included with this soil in mapping are small areas of uneroded Axtell, Crockett, Tabor, and Demona soils that make up about 15 to 20 percent of mapped areas.

The hazard of further erosion is severe.

This soil is used mostly for improved pasture and wooded range. It is suited to crops, but the choice of crops is limited. It is also suited to hay and range. Capability unit IVe-3; pasture and hayland group 8A; Claypan Savannah range site.

AfE2—Axtell fine sandy loam, 5 to 12 percent slopes, eroded. This sloping soil is mostly in eroded areas along deeply cut drainageways. Areas are mostly long and narrow. They average about 25 acres in size but range to about 100 acres.

The surface layer is fine sandy loam about 5 inches thick that is grayish brown in the upper part and very pale brown in the lower part. The subsoil, to a depth of 32 inches, is clay that is mottled in shades of red, brown, and gray. The next lower layer, to a depth of 60 inches, is clay that is mottled in shades of gray, brown, and yellow.

Included with this soil in mapping are areas of Crockett, Rosanky, and Demona soils that make up about 15 percent of the mapped areas.

The hazard of further erosion is severe.

This soil is suited to pasture, hay, and range. It is not suited to crops. Capability unit VIe-3; pasture and hayland group 8B; Claypan Savannah range site.

AtD—Axtell-Tabor complex, 1 to 8 percent slopes. This gently sloping to sloping complex is on ridges and side slopes and in drainageways. It is about 70 percent Axtell soils, 20 percent Tabor soils, and 10 percent Demona and other soils. Areas of these soils are so small that it is not feasible to map them separately at the scale used.

The Axtell soils are gently sloping to sloping and are on ridgetops and side slopes. They have a surface layer of gravelly sandy loam about 14 inches thick. The upper part of the surface layer is light gray, and the lower part is very pale brown and contains about 40 percent siliceous pebbles. The subsoil is red, mottled clay that extends to a depth of 28 inches. The next layer, to a depth of 60 inches, is mottled sandy clay.

The Tabor soils are gently sloping and are on ridgetops and foot slopes and in drainageways. They have a surface layer of gravelly fine sandy loam about 18 inches thick. The upper part is light brownish gray, and the lower part is pale brown and contains about 40 percent siliceous pebbles. The subsoil, to a depth of 40 inches, is brownish-yellow, mottled clay. The underlying material, to a depth of 60 inches, is mottled sandy clay (fig. 6).

The hazard of erosion is slight. A few widely spaced gullies occur in the steeper areas.

This complex is used mostly for wooded range. Some areas are being planned or developed for home-

Figure 6.—A good stand of pine trees on an area of Axtell-Tabor complex, 1 to 8 percent slopes.

sites. A few small areas are in improved pasture, and others have been stripped of gravel for road building material. Capability unit IVe-3; pasture and hayland group 8A; Claypan Savannah range site.

Bastrop Series

The Bastrop series consists of deep, nearly level to gently sloping, well drained, loamy soils. These soils are on stream terraces. They formed in thick, loamy sediment. The native vegetation is mid and tall grasses and scattered post oak and live oak.

In a representative profile the surface layer is fine sandy loam about 16 inches thick. It is light brownish gray in the upper part and grayish brown in the lower part. The upper 20 inches of the subsoil is reddish-brown sandy clay loam. The lower 39 inches of the subsoil is yellowish-red sandy clay loam. The underlying material, to a depth of 85 inches, is light-brown sandy clay loam.

Permeability is moderate. Runoff is medium. The available water capacity is high.

Approximately half of the acreage is used for cultivated crops. The rest is used for pasture and hay.

Representative profile of Bastrop fine sandy loam, 0 to 1 percent slopes, in a field 0.45 mile north on Short Street from the intersection of Texas Highway 71 in Smithville, 2.65 miles east on River Loop Road, 50 feet south:

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few, fine roots; slightly acid; abrupt, smooth boundary.

A1—6 to 16 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; hard, friable; few roots; slightly acid; gradual, smooth boundary.

B21t—16 to 36 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate, fine and medium, subangular blocky structure; hard, friable; few roots; few, fine pores; patchy clay films on ped faces and in pores; slightly acid; gradual, smooth boundary.

B22t—36 to 75 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red ((5YR 4/6) moist; weak, fine, subangular blocky structure; hard, friable; few pores; few patchy clay films; few calcium carbonate films and threads in lower part; neutral in upper part, mildly alkaline in lower part; gradual, smooth boundary.

C—75 to 85 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable; few, weakly cemented calcium carbonate concretions; small shells and rounded siliceous pebbles; calcareous; moderately alkaline.

The solum is more than 62 inches thick. It is as much as 15 percent small quartz pebbles.

The A horizon ranges from 12 to 20 inches in thickness. It is light brownish gray, grayish brown, and brown, Reaction ranges from slightly acid to neutral.

The B2t horizon is more than 50 inches thick. It is reddish brown, light reddish brown, brown, strong brown, and reddish yellow to yellowish red. The B21t horizon is clay loam or sandy clay loam that ranges from 20 to 30 percent clay. Reaction ranges from slightly acid to neutral in the B21t horizon and is neutral or mildly alkaline in the B22t horizon.

The C horizon is reddish-yellow, light-brown, or light reddish-brown sandy clay loam, clay loam, or loam. In places, below a depth of 60 inches, it is about 1 to 5 percent weakly cemented concretions and soft masses of calcium carbonate.

BaA—Bastrop fine sandy loam, 0 to 1 percent slopes. This nearly level soil has the profile described as representative of the series. It is on high terraces of major rivers. Areas are mostly irregular in shape and about 50 acres in size.

Included with this soil in mapping are areas of Axtell soils. Also included are areas of soils that have a surface layer of fine sandy loam and loamy fine sand more than 20 inches thick and lower layers of sandy clay loam. These included soils make up 10 to about 15 percent of the mapped areas.

The hazard of erosion is slight.

Most of the acreage of this soil is used for crops, improved pasture, and hay. This soil is well suited to crops. It is also suited to native grasses used for range. Capability unit I-2; pasture and hayland group 8C; Sandy Loam range site.

BaB—Bastrop fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on high terraces along drainageways, slope crests, and gently sloping breaks to lower terraces. Areas are mostly long and narrow and range from 10 to 50 acres in size.

The surface layer is grayish-brown fine sandy loam about 15 inches thick. The subsoil, to a depth of 34 inches, is reddish-brown sandy clay loam. The next lower layer, to a depth of 68 inches, is yellowish-red sandy loam. The underlying material, to a depth of 75 inches, is light-brown loam.

Included with this soil in mapping are a few small areas of Dougherty soils and a soil that has a sandy surface layer more than 20 inches thick and lower layers of sandy clay loam.

The hazard of erosion is moderate.

Most of the acreage of this soil is used for crops and pasture. It is also suited to orchards and range. Capability unit IIe-3; pasture and hayland group 8C; Sandy Loam range site.

BaC2—Bastrop fine sandy loam, 3 to 5 percent slopes, eroded. This gently sloping soil is on high terraces of major rivers. Areas are mostly long and narrow and follow the contour of the breaks between the terraces. They are about 20 acres in size. There are a few widely spaced, deep gullies.

The surface layer is grayish-brown fine sandy loam that generally is about 12 inches thick but that in many places is thinner. In some cultivated areas part of the subsoil is mixed with the surface layer, and on small areas near the crest of the slope the subsoil is exposed. The subsoil, to a depth of 25 inches, is reddish-brown sandy clay loam. The next layer, to a depth of 62 inches, is sandy clay loam that is yellowish red in the upper part and reddish yellow in the lower part.

Included with this soil in mapping are small areas of Shep soils. Also included are areas of Bastrop soils that have a surface layer of loamy fine sand 10 to 20 inches thick. These included soils make up as much as 20 percent of some mapped areas.

The hazard of further erosion is moderate. Terraces and waterways are needed to control erosion.

This soil is used mostly for pasture and hay. It is also suited to crops and orchards. Capability unit IIIe-3; pasture and hayland group 8C; Sandy Loam range site.

Behring Series

The Behring series consists of deep, gently sloping to sloping, moderately well drained, loamy soils. These soils are on uplands. They formed in alkaline shaly clay. The native vegetation is mid and tall grasses and scattered elm and hackberry trees.

In a representative profile the upper 6 inches of the surface layer is dark grayish-brown clay loam. The brown clay. The next layer is grayish-brown clay. The next 12 inches of the surface layer is dark grayish-brown clay. The next layer is grayish-brown clay. The next lower layer, to a depth of 48 inches, is light yellowish-brown, mottled clay. The underlying material, to a depth of 60 inches, is mottled shaly clay.

Permeability is slow. Runoff is medium. The available water capacity is high. Water enters rapidly when the soil is dry and cracked but slowly when the soil is moist.

Most of the acreage is used for crops. The steeper areas are used mainly for pasture and hay.

Representative profile of Behring clay loam, 1 to 3 percent slopes, in a cultivated field 2.8 miles north on Texas Highway 95 from its intersection with Farm Road 1100 in the northwestern part of Elgin, Texas, 0.25 mile northwest on a county road, 100 feet north:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; very hard, firm; many, small, cemented calcium carbonate concretions and reddish-brown ironstone pebbles on surface; noncalcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 18 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; very hard, firm; few, small, cemented calcium carbonate concretions; few wormcasts; noncalcareous; moderately alkaline; gradual, wavy boundary.

B2—18 to 36 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, angular blocky structure; very hard, firm; few wormcasts; few, small, cemented dark iron and manganese and calcium carbonate concretions; shiny ped faces; few nonintersecting slickensides; noncalcareous;; moderately alkaline; gradual, wavy boundary.

B3—36 to 48 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; few, fine, faint, brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; very hard, very firm; shiny ped faces; wormcasts in upper part; many, calcareous; moderately alkaline; clear, smooth boun- small, cemented calcium carbonate concretions; nondary.

C—48 to 60 inches, mottled, light brownish-gray (2.5Y 6/2) and browish-yellow (10YR 6/6) shaly clay; massive; very hard, very firm; few, small cemented calcium carbonate concretions and few iron and manganese concretions; noncalcareous; moderately alkaline.

Reaction is typically mildly alkaline to moderately alkaline and noncalcareous, but in places calcareous strata are below a depth of 40 inches.

The A horizon ranges from 14 to 30 inches in thickness. It is grayish brown, dark grayish brown, or very dark grayish brown. The B2 and B3 horizons range from about 18 to 30 inches in thickness. They are dark grayish-brown, grayish-brown, light olive-brown, or light yellowish-brown clay or silty clay. The C horizon is mottled, light brownish-gray or yellowish-brown silty clay loam or shaly clay.

BeB—Behring clay loam, 1 to 3 percent slopes. This gently sloping soil has the profile described as representative of the series. It is on broad, irregularly shaped ridgetops and valley floors. Areas range from about 20 to 150 acres in size but are mostly about 40 acres. Small, dark-brown, angular to rounded siliceous pebbles are on the surface.

Included with this soil in mapping are small areas of Heiden, Crockett, and Wilson soils that make up as much as 15 percent of some mapped areas.

The hazard of erosion is slight.

This soil is used mostly for crops and improved pasture. It is also suited to range. Capability unit IIe-1; pasture and hayland group 7A; Blackland range site.

BeC2—Behring clay loam, 3 to 5 percent slopes, eroded. This gently sloping soil is on ridgetops and side slopes. Areas are long and narrow and follow the contour of the ridgetops. They range from 10 to 90 acres in size but are mostly about 25 acres.

The surface layer is dark grayish-brown clay loam about 6 inches thick. The next layer, about 9 inches thick, is dark grayish-brown clay. The next lower layer, to a depth of 46 inches, is clay that is grayish brown in the upper part and light yellowish brown in the lower part. The underlying material is mottled, light brownish-gray shaly clay.

Included with this soil in mapping are small areas of Heiden and Crockett soils that make up less than 15 percent of the mapped areas.

The hazard of erosion is moderate. Most areas have a few widely spaced gullies.

This soil is used mostly for crops and pasture. It is also suited to range. Capability unit IIIe-1; pasture and hayland group 7A; Blackland range site.

BeD2—Behring clay loam, 5 to 8 percent slopes, eroded. This gently sloping soil is on the sides of ridges. Areas are long and narrow and follow the contour of the ridgetops. They range from 10 to 60 acres in size.

The surface layer is dark grayish-brown clay loam about 6 inches thick. The next lower layer, to a depth of 16 inches, is dark grayish-brown silty clay. The next lower layer, to a depth of 30 inches, is grayish-brown, mottled clay. The next lower layer, to a depth of 40 inches, is light brownish-gray, mottled clay. The underlying material, to a depth of 64 inches, is light brownish-gray shaly clay.

Included with this soil in mapping are small areas of Heiden and Crocket soils that make up about 10 to 20 percent of the mapped areas.

The hazard of erosion is severe. Most areas have shallow gullies and a few deep gullies.

Most of the acreage of this soil is used for crops. It is also suited to improved pasture, hay, and range. Capability unit IVe-1; pasture and hayland group 7B; Blackland range site.

Bosque Series

The Bosque series consists of deep, nearly level, well-drained, loamy soils. These soils are on low terraces and flood plains on bottom lands. They formed in loamy alluvial sediment. The native vegetation is tall grasses and scattered elm, hackberry, pecan, and cottonwood trees.

In a representative profile the upper part of the surface layer is dark grayish-brown loam about 6 inches thick. The next 18 inches of the surface layer is dark grayish-brown clay loam, and the lower 12 inches is brown clay loam. The next lower layer, to a depth of 75 inches, is reddish-brown clay loam.

Permeability is moderate. Runoff is slow to medium. The available water capacity is high.

Most of the acreage is used for crops and improved pasture. Pecan trees are scattered throughout the pastures.

Representative profile of Bosque loam in a cultivated field 1.05 miles west on Texas Highway 71 from the new Colorado River Bridge in Bastrop, Texas, 50 feet north:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, friable; abrupt, smooth boundary

A11—6 to 24 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; hard, firm; few fine roots and pores; scattered reddish-brown spots from wormcasts in lower part; calcareous; moderately alkaline; clear, smooth boundary.

A12—24 to 38 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; strong, fine, subangular blocky structure; hard, firm; many fine pores; many dark-brown spots from wormcasts; few, fine calcareous films and threads; calcareous; moderately alkaline; gradual, smooth boundary.

B2—38 to 58 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate, fine, subangular blocky structure; hard, firm; scattered concretions of calcium carbonate and many, white to pink, calcareous threads of calcium carbonate between peds; calcareous; moderately alkaline; gradual, smooth boundary.

C—58 to 75 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 5/4) moist; massive; hard, friable; common, fine, segregated threads of lime; calcium carbonate concretions.

The A horizon ranges from 20 to 40 inches in thickness. It is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. The lower part has many wormcasts and wormholes filled with material from the B horizon. Reaction is mildly alkaline to moderately alkaline.

The B horizon ranges from 10 to 20 inches in thickness. The B and C horizons are dark-brown, reddish-brown, or light-brown loam to clay loam.

Bo—Bosque loam. This nearly level soil is on bottom lands. The areas are protected by dams, and they seldom, if ever, are subject to flooding. Slopes are mostly less than 0.5 percent. Areas are long and narrow to irregular in shape. They range from 10 to about 300 acres in size but are mostly about 60 acres.

Included with this soil in mapping are small areas of Smithville soils that make up 5 to 15 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used mostly for cultivated crops and improved pasture. It is also suited to range and wildlife habitat. Capability unit I-1; pasture and hayland group 2A; Loamy Bottomland range site.

Burleson Series

The Burleson series consists of deep, gently sloping, moderately well drained, clayey soils. These soils are on stream terraces and uplands. They formed in alkaline clayey sediments. The native vegetation is mid and tall grasses and an overstory of scattered elm and hackberry.

In a representative profile the upper part of the surface layer is dark-gray clay about 6 inches thick. The next 34 inches of the surface layer is very dark gray clay. The next lower layer, to a depth of 60 inches, is mottled, calcareous clay that is gray in the upper part and light brownish gray in the lower part.

Permeability is very slow. Runoff is slow to medium. The available water capacity is high. Water enters rapidly when the soil is dry and cracked but very slowly when the soil is moist.

Most of the acreage is used for crops. A few areas are in native range, and a few are used for improved pasture.

Representative profile of Burleson clay, 1 to 3 percent slopes, in a pasture 150 feet northwest on Farm Road 812 from its intersection with Farm Road 2430 in the western part of Bastrop County, 0.5 mile southwest on a county road, 50 feet north:

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; gray (10YR 5/1) surface crust 0.1 inch thick; moderate, fine, angular blocky structure; extremely hard, very firm; few, small quartz pebbles; neutral; clear, smooth boundary.

A1—6 to 40 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium, blocky structure; common intersecting slickensides in lower part; extremely hard, very firm; scattered, hard calcium carbonate concretions and small, dark-brown concretions; neutral; gradual, wavy boundary.

AC—40 to 54 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common, medium, distinct, grayish-brown (2.5Y 5/2) mottles; moderate, coarse, blocky structure; extremely hard, very firm; darker streaks from surface cracking; shiny ped faces; common intersecting slickensides; calcareous; moderately alkaline; gradual, wavy boundary.

C—54 to 60 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; extremely hard, very firm; scattered, small, dark-colored concretions; calcareous; moderately alkaline.

The solum ranges from 36 to 60 inches in thickness. In uncultivated areas, gilgai microrelief consists of knolls 3 to 10 inches higher than the depressions. The knolls and depressions are 5 to 15 feet apart. When the soil is dry, cracks 1 inch to 3 inches wide extend from the surface to a depth of 20 to 50 inches. Intersecting slickensides begin at a depth of 20 to 30 inches.

The A horizon ranges from 14 to 50 inches in thickness. It is gray, dark gray, or very dark gray. In places the surface layer is as much as 15 percent siliceous pebbles. Reaction is slightly acid to mildly alkaline.

The AC horizon ranges from 10 to 30 inches in thickness but is mostly 10 to 15 inches. It is mostly dark gray to gray and is mottled in shades of gray, brown, olive, or

yellow. Reaction is mildly alkaline or moderately alkaline.

The C horizon is light brownish gray, dark gray, or pale olive.

BuB—Burleson clay, 1 to 3 percent slopes. This gently sloping soil is on broad ridges and foot slopes along drainageways. Areas are irregular in shape. They range from 5 to 160 acres in size but are mostly about 30 acres. A crust about one-fourth of an inch thick forms on the surface after rain.

Included with this soil in mapping are areas of Wilson, Houston Black, and Behring soils that make up 15 to 20 percent of the mapped areas.

The hazard of erosion is slight.

This soil is suited to crops, pasture, or range. Capability unit IIe-1; pasture and hayland group 7A; Blackland range site.

Crockett Series

The Crockett series consists of deep, gently sloping to strongly sloping, well-drained, loamy soils. These soils are on uplands. They formed in alkaline marine clay, sandy clay, or shale interbedded with sandy material. The native vegetation is mid and tall grasses and a few scattered elm, hackberry, and mesquite trees.

In a representative profile the surface layer is brown loam about 4 inches thick. The subsoil, to a depth of 40 inches, is reddish-brown, light olive-brown, and light yellowish-brown, mottled clay. The next lower layer, to a depth of 60 inches, is mottled clay loam that is pale yellow in the upper part and olive yellow in the lower part.

Permeability is very slow. Runoff is slow to rapid. The available water capacity is high.

Most of the acreage was formerly cultivated, but it is now used mainly for native pasture, improved pasture, and range. A few small areas are used for row crops.

Representative profile of Crockett loam in an area of Crockett soils, 2 to 5 percent slopes, eroded, in a pasture 2.1 miles southeast on Farm Road 812 from its intersection with Texas Highway 21 in the western part of Bastrop County, 2.1 miles southwest on a county road toward Lytton Springs, 50 feet south:

A—0 to 4 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; hard, friable; few fine pores; few fine roots; slightly acid; abrupt, wavy boundary.

B21t—4 to 12 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; few, fine distinct, brown (10YR 5/3) and gray (10YR 5/1) mottles; moderate, coarse, blocky structure; extremely hard, very firm; clay films on faces of most peds; few brown streaks from surface cracking; medium acid; gradual, wavy boundary.

B22t—12 to 28 inches, distinctly mottled, light olive-brown (2.5Y 5/4) and reddish brown (5YR 5/4) clay; weak, medium, blocky structure; extremely hard, very firm; shiny ped faces; continuous clay films; brownish streaks from surface cracking; slightly acid; gradual, wavy boundary.

B23t—28 to 40 inches, light yellowish-brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few, fine, gray (10YR 5/1) and olive (5Y 5/3) mottles; weak, medium, blocky structure; extremely hard, very firm; shiny ped faces; clay films on faces of most peds; few, scattered, dark iron and manganese and calcium carbonate concretions; mildly alkaline; gradual, wavy boundary.

B3—40 to 50 inches, pale-yellow (2.5Y 7/4) clay loam, light yellowish brown (2.5Y 6/4) moist; common, medium, gray (10YR 5/1) and olive (5Y 5/3) mottles; weak, medium, blocky structure; very hard, very firm; few dark-brown (10YR 3/3) concretions; mildly alkaline; gradual, wavy boundary.

C—50 to 60 inches, olive-yellow (2.5Y 6/6) clay loam; light brownish-gray (10YR 6/2) and brownish-yellow (10YR 6/6) mottles; massive; very hard, very firm; few, small, dark concretions; few calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 40 to 65 inches in thickness. In most years cracks 0.4 inch wide occur from the top of the B21t horizon to a depth of 20 inches.

The A horizon ranges from 4 to 16 inches in thickness. It is grayish-brown, dark grayish-brown, brown, light-brown, and pale-brown fine sandy loam, loam, gravelly loam, and gravelly sandy loam. In places as much as 30 percent quartz and chert pebbles is on the surface and in the A horizon.

The B21t and B22t horizons range from 14 to 30 inches in thickness. They are clay or clay loam that is 35 to 50 percent clay in the upper 20 inches. These horizons are variable in color and are distinctly mottled in shades of red, olive, brown, yellow, and gray. The red mottles decrease with increasing depth. Reaction ranges from medium acid to slightly acid.

The B23t and B2t horizons range from 16 to more than 30 inches in thickness. They are mottled, brown, olive, yellow, gray, and red clay or clay loam. Reaction ranges from slightly acid to moderately alkaline.

The C horizon ranges from clay to clay loam. It has few to many, small, cemented bodies of calcium carbonate and soft lime.

CfB—Crockett fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on ridgetops in prairies. Areas range from 10 to more than 100 acres in size but are mostly less than 25 acres. Slopes are dominantly less than 2 percent.

The surface layer is brown fine sandy loam about 8 inches thick. The subsoil, to a depth of 36 inches, is reddish-brown, mottled clay. The next lower layer, to a depth of 60 inches, is mottled, calcareous clay.

Included with this soil in mapping are small areas of Wilson and Mabank soils that make up less than 10 percent of most mapped areas. Also included are areas of soils that are similar to this Crockett soil but that have a surface layer of clay loam. These included soils make up as much as 25 percent of some mapped areas.

The hazard of erosion is moderate.

Most of the acreage of this soil is used for crops. Many formerly cultivated areas are now used for unimproved pasture. A few areas are established in introduced species of grasses for pasture and hay. A few small areas remain in native vegetation. Capability unit IIIe-2; pasture and hayland group 8A; Claypan Prairie range site.

CgC—Crockett gravelly sandy loam, 1 to 5 percent slopes. This gently sloping soil is on ridgetops in prairies. Areas range from 5 to more than 80 acres in size but average about 30 acres.

The surface layer of this soil is thicker than that in the profile described as representative of the series, but the two profiles otherwise are similar.

The surface layer is grayish-brown gravelly sandy loam, about 16 inches thick, that is about 30 percent

siliceous pebbles. The subsoil, to a depth of 36 inches, is mottled clay. The upper part is red, and the lower part is light brown. The next layer, to a depth of 54 inches, is light yellowish-brown, mottled clay. The next layer, to a depth of 64 inches, is light-gray, mottled, calcareous clay.

Included with this soil in mapping are small areas of gravelly Burleson, Wilson, and Axtell soils, which make up less than 10 percent of the mapped areas. Also included on ridgetops are a few areas of Crockett gravelly loam, 1 to 5 percent slopes, and a few areas of soils that are similar to this Crockett soil but that have a gravelly surface layer more than 20 inches thick. These included soils are minor in extent. Also included are a few areas of Crockett gravelly sandy loam, 1 to 5 percent slopes, that has a surface layer as much as 20 inches thick.

The hazard of erosion is moderate.

Most of the acreage of this soil is used for native range. A few areas formerly used for crops have many siliceous pebbles on the surface. This soil is poorly suited to crops and hay. It is suited to pasture and range. In places areas that have a thick surface layer have been stripped for road surfacing material. Capability unit IVe-2; pasture and hayland group 8A; Claypan Prairie range site.

ChE—Crockett gravelly loam, 5 to 10 percent slopes. This sloping to strongly sloping soil is on small ridgetops and side slopes in prairies. Areas are irregular in shape and range from about 10 to 75 acres in size.

The surface layer is dark grayish-brown gravelly loam, about 10 inches thick, that is about 30 percent siliceous pebbles. The subsoil, to a depth of 32 inches, is mottled clay that is reddish brown in the upper part and light olive brown in the lower part. The next layer, to a depth of 62 inches, is mottled clay that is calcareous in the lower part.

Included with this soil in mapping are small areas of soils that have a gravelly surface layer more than 15 inches thick. Also included are small areas of nongravelly Crockett, Heiden, and Behring soils. Included soils make up about 15 percent of the mapped areas.

The hazard of erosion is severe.

This soil is used for range. It is not suited to crops. Capability unit VIe-2; pasture and hayland group 8B; Claypan Prairie range site.

CsC2—Crockett soils, 2 to 5 percent slopes, eroded. These gently sloping soils have the profile described as representative of the series. Areas are irregular in shape. They average about 30 acres in size, but some are as large as 250 acres.

The surface layer ranges from loam to fine sandy loam, but it is loam in most places. In plowed areas the clay subsoil has been mixed with the material in the surface layer. Gullies are common and can be crossed with farm machinery.

Included with these soils in mapping are areas of Behring, Heiden, and Axtell soils, which generally make up less than 15 percent of the mapped areas.

The hazard of further erosion is severe.

These soils are suited to crops. They are also suited to improved pasture, hay, and range. Capability unit IVe-2; pasture and hayland group 8A; Claypan Prairie range site.

CsE2—Crockett soils, 5 to 10 percent slopes, eroded. These sloping to strongly sloping soils are in areas that are dominantly around the heads of deeply cut drainageways. Areas average about 25 acres in size, but some are as large as 135 acres.

The surface layer is dark grayish-brown loam or fine sandy loam about 4 inches thick, but in most places it is loam. The subsoil, to a depth of 56 inches, is mottled clay. Areas of these soils that have been plowed have clay subsoil material mixed with the surface layer. Gullies are common.

Included with these soils in mapping are areas of Heiden and Behring soils and small areas of severely eroded Crockett soils. Included soils make up as much as 15 percent of the mapped areas.

The hazard of further erosion is severe.

These soils are suited to pasture, wildlife habitat, and range. They are not suited to crops. Capability unit VIe-2; pasture and hayland group 8B; Claypan Prairie range site.

CsD3—Crockett soils, 3 to 8 percent slopes, severely eroded. The areas of these gently sloping to sloping soils are mostly in abandoned cropland that is adjacent to deeply cut, V-shaped drainageways. Areas are long, narrow, and irregular in shape. They average 25 acres in size but range from 10 to 75 acres. Most of the drainageways and gullies, which make up about 30 to 40 percent of the mapped areas, are uncrossable by farm machinery.

The surface layer is mainly brown fine sandy loam 4 inches thick, but in places it is loam. The subsoil, to a depth of 52 inches, is mottled clay. The underlying layer, to a depth of 64 inches, is mottled clay loam. In plowed areas sandy clay loam or clay loam is mixed with the material in the surface layer.

Included with these soils in mapping are areas of Crockett soils, 5 to 10 percent slopes, eroded, and areas of eroded Behring and Heiden soils. These included soils make up as much as 20 percent of some mapped areas. Also included are areas of soils that have a sandy texture or weakly consolidated sandstone at a depth of about 40 inches.

The hazard of further erosion is severe.

Most of the acreage of these soils is used for grazing. These soils are suited to range, wildlife habitat, and pasture. They are not suited to crops. Capability unit VIe-2; pasture and hayland group 8B; Claypan Prairie range site.

Demona Series

The Demona series consists of deep, gently sloping, moderately well drained, sandy soils. These soils are on ridgetops and side slopes and in drainageways in uplands. They formed in sandy and loamy material. The native vegetation is blackjack oak, post oak, and bunchgrass.

In a representative profile the surface layer is light brownish-gray loamy fine sand about 5 inches thick. The next layer is very pale brown loamy fine sand 23

inches thick. The next lower layer, to a depth of 54 inches, is dark-red and red, mottled sandy clay. The next lower layer, to a depth of 62 inches, is brownish-yellow, mottled sandy clay.

Permeability is slow. Runoff is slow to medium. The available water capacity is medium. These soils have a perched water table at a depth of 24 to 36 inches after heavy rain.

Most of the acreage is used for range and wildlife habitat. Some areas have been cleared and are used for crops and improved pasture.

Representative profile of Demona loamy fine sand, 1 to 5 percent slopes, in a pasture 2 miles northeast from the intersection of Main and 3rd Streets in Elgin, Texas, 100 feet west:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; slightly acid; clear, smooth boundary.

A2—5 to 28 inches, very pale brown (10YR 8/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; slightly acid; abrupt, wavy boundary.

B21t—28 to 40 inches, red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; common, medium, distinct, yellowish-red (5YR 5/6) and light brownish-gray (10YR 6/2) mottles; weak, coarse, blocky structure; very hard, very firm; clay films on peds; strongly acid; gradual, wavy boundary.

B22t—40 to 54 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; many, medium, distinct, yellowish-brown (10YR 5/4) and light brownish-gray (10YR 6/2) mottles; weak, coarse blocky structure; very hard, very firm; continuous clay films on ped faces; strongly acid; gradual, wavy boundary.

B3t—54 to 62 inches, brownish-yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; medium, distinct, red (2.5YR 5/6) and light brownish-gray (10YR 6/6) mottles; weak, medium, blocky structure; very hard, very firm; few, fine iron and manganese concretions; patchy clay films on peds; strongly acid.

The A horizon ranges from 20 to 40 inches in thickness. It is grayish brown, light brownish gray, brown, or very pale brown. Reaction ranges from slightly acid to neutral.

The B2t horizon ranges from 20 to 35 inches in thickness. It is red or light-gray clay or sandy clay that is mottled in shades of red, yellow, brown, and gray. Reaction ranges from strongly acid to slightly acid. The B3t horizon is 8 to 15 inches thick. It is brownish-yellow or light-gray sandy clay or sandy clay loam that is mottled in shades of red, yellow, brown, and gray. Reaction ranges from strongly acid to slightly acid.

The C horizon is sandy clay loam, fine sandy loam, or loamy fine sand. It ranges from red to reddish yellow to brownish yellow and is mottled in shades of brown, gray, and yellow. Reaction ranges from slightly acid to strongly acid.

DeC—Demona loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is on ridgetops and side slopes and in drainageways. Areas range from 30 to 300 acres in size but are mostly about 30 acres.

Included with this soil in mapping are areas of Axtell and Tabor soils on ridgetops and in drainageways. Also included are areas of Patilo and Silstid soils. These included soils make up as much as 20 percent of some mapped areas. Also included are small areas of Demona loamy fine sand that has slopes of 5 to 8 percent.

The hazard of erosion is moderate.

This soil is mostly used for range and wildlife habitat. A few small areas have been cleared and used for crops, and a few areas have been cleared and planted to improved pasture grasses. Capability unit IIIe-5; pasture and hayland group 9A; Sandy range site.

Demona Variant

The Demona variant consists of deep, nearly level, moderately well drained, sandy soils. These soils are on foot slopes and in drainageways in the uplands. They formed in basal sand and sandy clay. The native vegetation is blackjack oak, post oak, and bunchgrass.

In a representative profile the surface layer is light brownish-gray loamy fine sand about 6 inches thick. The next layer is very pale brown loamy fine sand about 24 inches thick. The next layer, about 10 inches thick, is brownish-yellow clay. The next lower layer, about 14 inches thick, is brownish-yellow sandy clay. Below this, and extending to a depth of 62 inches, is light-gray sandy clay.

Permeability is moderately slow. Runoff is slow. The available water capacity is medium. These soils have a perched water table at a depth of 20 to 30 inches after heavy rain.

Most of the acreage is used for range. A few areas are used for crops, and a few are used for improved pasture.

Representative profile of Demona loamy fine sand, somewhat poorly drained variant, in a pasture 2.6 miles southeast of Paige on Farm Road 2104, 1,000 feet east:

A1—0 to 6 inches, light brownish-gray (10YR 6/2) loamy fine sand, brown (10YR 4/3) moist; single grained; loose; slightly acid; clear, smooth boundary.

A2—6 to 30 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; few brown spots in lower part; slightly acid; abrupt, wavy boundary.

B21t—30 to 40 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; many, medium, distinct, light-gray (10YR 7/1) mottles; moderate, medium, blocky structure; extremely firm; slightly darker clayey coatings on face of peds; few, small, dark-brown concretions; strongly acid; gradual, wavy boundary.

B22t—40 to 54 inches, brownish-yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; many, medium, distinct, light-gray (10YR 7/2) and red (2.5YR 5/6) mottles; weak, medium, blocky structure; very hard, very firm; darker colored clay films on outside of peds; medium acid; gradual, wavy boundary.

B3—53 to 62 inches, light-gray (10YR 7/1) sandy clay, gray (10YR 6/1) moist; shades of yellowish-brown (10YR 5/6) mottles and few reddish-brown (5YR 5/4) mottles; weak, medium, blocky structure; very hard, very firm; few small iron and manganese and calcium carbonate concretions; medium acid.

The A horizon ranges from 20 to 40 inches in thickness. It is light gray, light brownish gray, and pale brown to brown, light yellowish brown, or very pale brown. Reaction is medium or slightly acid.

The B2t horizon ranges from 20 to 35 inches in thickness. It is yellowish-brown, brownish-yellow, or yellow clay or sandy clay that is mottled in shades of yellow, gray, brown, or red. Reaction ranges from strongly acid to medium acid. The B3 horizon ranges from brownish-yellow, light-gray, or yellowish-brown clay to sandy clay loam that is mottled with red, yellow, brown, or gray. Reaction ranges from slightly acid to neutral.

Dm—Demona loamy fine sand, somewhat poorly drained variant. This nearly level soil is on uplands. Slopes are 0 to 1 percent. Areas range from 5 to 75 acres in size but average about 20 acres.

Included with this soil in mapping are areas of Tabor soils and a few areas of soils that are similar to this Demona soil but are gray or grayish brown within 30 inches of the surface. Also included are small areas of Patilo soils. These included soils make up less than 20 percent of any mapped area.

Overwash is a hazard on these soils. The hazard of erosion is slight.

This soil is used mostly for pasture. A few areas are used for crops and range. Capability unit IIIe-5; pasture and hayland group 9A; Sandy range site.

Dougherty Series

The Dougherty series consists of deep, nearly level to sloping, well-drained soils. These soils are on uplands. They formed in acid sandy or loamy sediment. The native vegetation is blackjack oak, post oak, hickory, and bunchgrass.

In a representative profile the upper 6 inches of the surface layer is pale-brown loamy fine sand. The next 20 inches of the surface layer is light-brown loamy fine sand. The next lower layer, to a depth of 44 inches, is reddish-brown sandy clay loam. The next lower layer, to a depth of 64 inches, is light reddish-brown fine sandy loam.

Permeability is moderate. Runoff is slow. The available water capacity is low.

Most of the acreage has been cleared of trees. A few areas are used for crops, but most of the acreage is used for pasture.

Representative profile of Dougherty loamy fine sand, 0 to 3 percent slopes, in a pasture 2 miles west of Bastrop, Texas, on Texas Highway 71 to its intersection with Texas Highway 304, 4.7 miles southeast on Texas Highway 304, 50 feet south:

A1—0 to 6 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak, fine, granular structure; soft, very friable; few, small, rounded quartz pebbles, mostly less than 1 inch in diameter; neutral; clear, smooth boundary.

A2—6 to 26 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak, fine, granular structure; soft, very friable; few, fine roots and small, rounded siliceous pebbles; slightly acid; clear, smooth boundary.

B2t—26 to 44 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak, medium, subangular blocky structure; very hard, friable; clay films on most peds; slightly acid; diffuse, smooth boundary.

B3—44 to 64 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) moist; weak, medium, granular structure; slightly hard, very friable; few, small, rounded quartz pebbles; medium acid.

The solum ranges from about 45 to more than 60 inches in thickness. In many areas it has siliceous pebbles scattered throughout.

The A horizon ranges from 20 to 34 inches in thickness. It is pink, grayish brown, light brownish gray, pale brown, light brown, light yellowish brown, or very pale brown. Reaction ranges from neutral to slightly acid.

The B2t and B3 horizons range from 20 to 46 inches in thickness. They are reddish-brown, red, yellowish-red, light reddish-brown, or reddish-yellow sandy clay loam or fine sandy loam that is 18 to 35 percent clay in the upper 20 inches. Reaction ranges from slightly acid to strongly acid.

DoB—Dougherty loamy fine sand, 0 to 3 percent slopes. This nearly level to gently sloping soil has the profile described as representative of the series. It is on high terraces and ridgetops. Areas are oblong to irregular in shape and range from 15 to 20 acres in size.

Included with this soil in mapping are small areas of Silstid, Patilo, and Demona soils that make up less than 20 percent of any mapped area.

The hazard of erosion is slight.

This soil is used mostly for pasture. A few small areas are used for crops. The soil is also suited to range. Capability unit IIIe-5; pasture and hayland group 9A; Sandy range site.

DoD—Dougherty loamy fine sand, 3 to 8 percent slopes. This gently sloping to sloping soil is on uplands. Areas are long and narrow to irregular in shape and are about 20 acres in size.

The surface layer is loamy fine sand about 24 inches thick. It is pale brown in the upper part and light brown in the lower part. The next lower layer, to a depth of 40 inches, is red sandy clay loam. The next lower layer is yellowish-red fine sandy loam.

Included with this soil in mapping are small areas of soils that are similar to this Dougherty soil, but they have a sandy surface layer less than 20 inches thick. Also included are areas of Silstid soils and unmottled, red, clayey soils that have scattered to many quartz pebbles in the lower part. These included soils make up less than 20 percent of most mapped areas.

The hazard of erosion is slight.

This soil is used mostly for pasture. A few small areas are used for crops and range. The soil is well suited to improved pasture and hay. Capability unit IVe-5; pasture and hayland group 9A; Sandy range site.

Ferris Series

The Ferris series consists of deep, sloping to moderately steep, well-drained, clayey soils. These soils are on uplands. They formed in weakly consolidated, moderately alkaline marine sediments. The native vegetation is tall and mid grasses and scattered elm and hackberry trees.

In a representative profile the surface layer is olive clay about 6 inches thick. The next lower layer, to a depth of 48 inches, is mottled clay that is olive in the upper part and olive yellow in the lower part. The underlying material, to a depth of 62 inches, is light brownish-gray, mottled shaly clay.

Permeability is very slow. Runoff is rapid. The available water capacity is high. Water enters rapidly when the soil is dry and cracked but very slowly when the soil is wet.

These soils are used for pasture and range.

Representative profile of Ferris clay, 5 to 20 percent

slopes, eroded, in a field 2.0 miles west on Texas Highway 71 from its intersection with Pope Bend Road in the western part of Bastrop County, 0.5 mile northeast on a county road, 100 yards east:

A1—0 to 6 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; moderate, fine, granular structure and medium, angular blocky structure; extremely hard, very firm; many, broken shell fragments and few calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

AC—6 to 34 inches, olive (5Y 5/4) clay, olive (5Y 4/4) moist; few, light-gray (5Y 6/1) and pale-olive (5Y 6/3) mottles; moderate, fine, angular blocky structure; extremely hard, very firm; shiny pressure faces; intersecting slickensides below a depth of 24 inches; darker streaks from surface cracking; many, soft, cemented calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

C1—34 to 48 inches, olive-yellow (2.5Y 6/6) clay, light olive brown (2.5Y 5/6) moist; few, fine and medium, gray and olive mottles; massive; extremely hard, very firm; dark streaks from surface cracks; shiny pressure faces; common intersecting slickensides that have peds tilted more than 10 degrees; shaly fragments in lower part; calcareous; moderately alkaline; gradual, wavy boundary.

C2—48 to 62 inches, light brownish-gray (2.5Y 6/2) shaly clay, grayish brown (2.5Y 5/2) moist; common, medium, distinct, light olive-brown (2.5Y 6/4) and brownish-yellow (10YR 6/8) mottles; massive; extremely hard, very firm; calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness. It is calcareous, moderately alkaline clay.

The A horizon ranges from 3 to 12 inches in thickness. It ranges from grayish brown or light olive brown to olive. The AC horizon ranges from 24 to 50 inches in thickness. It is yellowish brown or pale olive and in places is mottled in shades of gray, brown, yellow, or olive.

The C horizon is olive yellow or light brownish gray and is mottled in shades of gray, brown, yellow, and olive. It is clay or shaly clay.

FeF2—Ferris clay, 5 to 20 percent slopes, eroded. This sloping to moderately steep soil is on uplands. Areas range from 10 to 350 acres in size but are mostly about 50 acres. Most of the areas are cut by many natural drainageways, some of which are deeply gullied, and the original surface layer between the drainageway is thin.

Included with this soil in mapping are a few small areas of sloping Heiden and Behring soils. Included soils make up less than 15 percent of most mapped areas, but some areas of deeply gullied Heiden soils are larger.

The hazard of erosion is severe.

This soil is not suited to crops. It is suited to pasture, hay, and range. Capability unit VIe-1; pasture and hayland group 7B; Eroded Blackland range site.

Gowen Series

The Gowen series consists of deep, nearly level, well-drained, loamy soils. These soils are on flood plains on bottom lands. They formed in loamy alluvial sediment. The native vegetation is hackberry, elm, and pecan trees and an understory of grasses and shrubs.

In a representative profile the surface layer is dark grayish-brown clay loam about 30 inches thick. The next lower layer, to a depth of 60 inches, is dark grayish-brown clay loam that is thinly stratified with fine sandy loam.

Permeability is moderate. Runoff is slow to medium. The available water capacity is high. These soils are frequently subject to flooding.

Most of the acreage is used for pasture and pecan orchards.

Representative profile of Gowen clay loam in an area of Gowen soils, frequently flooded, in a pecan bottom 1.3 miles northwest on Farm Road 535 from its intersection with Farm Road 20, 100 yards southwest:

A11—0 to 16 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure breaking to moderate, fine, granular; hard, firm, neutral; clear, smooth boundary.

A12—16 to 30 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; hard, firm; neutral; clear, smooth boundary.

C—30 to 60 inches, dark grayish-brown (10YR 4/2) clay loam thinly stratified with brown (10YR 5/3) fine sandy loam; massive; hard, firm; few, yellowish-brown (10YR 5/4) stains below a depth of 50 inches; mildly alkaline.

The A horizon ranges from 24 to more than 40 inches in thickness. It is dark-gray, dark grayish-brown, and grayish-brown loam, clay loam, and sandy clay loam. Reaction ranges from neutral to mildly alkaline.

The C horizon is dominantly clay loam thinly stratified with fine sandy loam, loam, sandy clay loam, and clay. It is dark gray, dark grayish brown, brown, and yellowish brown. Reaction ranges from neutral to mildly alkaline.

Gs—Gowen soils, frequently flooded. This nearly level soil is on bottom lands. Slopes are mostly less than 0.5 percent. Areas range from 100 to 600 feet in width and are several miles long. Areas along the longer streams are several hundred acres in size. This soil is subject to flooding one to several times each year, resulting in frequent scouring and deposition patterns.

The surface layer is clay loam, sandy clay loam, loam, or fine sandy loam.

Included with this soil in mapping are some areas of soils that do not flood annually. Also included are small areas of Trinity and Uhland soils. These included soils make up less than 10 percent of the mapped areas.

Flooding is so frequent that cultivated crops are not suitable. Some areas are subject to washing. Soil material and debris deposited on the field and on the crops are damaging. The hazard of erosion is slight.

Most of the acreage of this soil is used for improved pasture, hay, or a combination of pasture and pecan orchards. Capability unit Vw-2; pasture and hayland group 2A; Loamy Bottomland range site.

Heiden Series

The Heiden series consists of deep, gently sloping to sloping, well-drained, clayey soils. These soils are on uplands. They formed in clayey marine sediment. The native vegetation is mid and tall grasses.

In a representative profile the surface layer is dark grayish-brown clay about 16 inches thick. The next layer, to a depth of 46 inches, is light olive-brown clay

mottled with pale olive. The next lower layer, to a depth of 60 inches, is pale-olive, mottled clay.

Permeability is very slow. Runoff is rapid. The available water capacity is high. Water enters rapidly when the soil is dry and cracked but very slowly when the soil is moist.

The gently sloping areas are used mainly for crops. The steeper areas are used for pasture and range.

Representative profile of Heiden clay, 3 to 5 percent slopes, eroded, in a field 6.2 miles west on Texas Highway 71 from its intersection with Farm Road 1209, 100 feet north:

Ap—0 to 6 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, subangular blocky structure; very hard, very firm; few, small calcium carbonate concretions; calcareous; moderately alkaline; abrupt, clear boundary.

A1—6 to 16 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, angular blocky structure; extremely hard, very firm; shiny ped faces; few, small calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

AC—16 to 46 inches, light olive-brown (2.5Y 5/4) clay, olive (2.5Y 4/4) moist; common, small and medium, olive (5Y 5/4) mottles; parallelipipeds tilted more than 10 degrees that form slickensides; extremely hard, very firm; shiny faces on peds; dark streaks from surface cracking; few, small calcium carbonate and iron and manganese concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

C—46 to 60 inches, pale-olive (5Y 6/4) clay, olive (5Y 5/4) moist; common, medium, light olive-gray (5Y 6/2) and brownish-yellow (10YR 6/6) mottles; massive; extremely hard, very firm; many, soft, cemented calcium carbonate masses; calcareous; moderately alkaline.

The solum ranges from 40 to 65 inches in thickness.

The Ap and A1 horizons range from 12 to 30 inches in thickness. They range from very dark grayish brown or dark grayish brown to olive brown.

The AC horizon ranges from 20 to 40 inches in thickness. It is grayish brown, yellowish brown, light olive brown, olive, and olive gray and is mostly mottled in shades of brown, gray, olive, or yellow.

The C horizon is clay or shaly clay that is mottled in shades of olive, yellow, and gray. It has few to many, cemented calcium carbonate concretions; soft calcium carbonate masses; and scattered iron and manganese concretions.

HeB—Heiden clay, 1 to 3 percent slopes. This gently sloping soil is on ridgetops and in a few areas on foot slopes near drainageways. There are shallow ditches in places. Areas range from 5 to 80 acres in size but are mostly only about 15 acres.

The surface layer is dark grayish-brown clay about 18 inches thick. The next lower layer, to a depth of 48 inches, is light olive-brown, mottled clay. The next lower layer, to a depth of 60 inches, is pale-olive, mottled clay.

Included with this soil in mapping are small areas of Houston Black, Burleson, and Wilson soils. These included soils are less than 5 acres in size. They make up less than 15 percent of the mapped areas.

The hazard of erosion is moderate.

This soil is used mostly for cultivated crops and improved pasture. It is also suited to range. Capability unit IIe-1; pasture and hayland group 7A; Blackland range site.

HeC2—Heiden clay, 3 to 5 percent slopes, eroded. This gently sloping soil has the profile described as representative of the series. It is on areas near drainageways. Areas are irregular to elongated in shape and are dominantly about 20 acres in size. Gullies are mostly 1 foot to 4 feet deep. They are about 10 to 30 feet wide and 100 to 500 feet apart. Most are crossable with farm machinery.

Included with this soil in mapping are areas of Behring and Crockett soils that make up less than 15 percent of most mapped areas.

The hazard of erosion is moderate.

This soil is used mostly for cultivated crops and improved pasture. It is also suited to range. Capability unit IIIe-1; pasture and hayland group 7A; Blackland range site.

HeD2—Heiden clay, 5 to 8 percent slopes, eroded. This sloping soil is in areas near drainageways. Areas are elongated in shape and average about 25 acres in size. Gullies are 2 to 6 feet deep. They are about 15 to 40 feet wide and 50 to 500 feet apart. Most are crossable with farm machinery.

The surface layer is dark grayish-brown, calcareous clay about 15 inches thick. The next lower layer, to a depth of 54 inches, is olive, calcareous clay that is distinctly mottled in the lower part. The next lower layer, to a depth of 64 inches, is calcareous shaly clay.

Included with this soil in mapping are areas of eroded Behring and Ferris soils. These included soils are mostly less than 5 acres in size. They make up less than 15 percent of the mapped areas.

The hazard of erosion is severe.

This soil is used mostly for crops. A few areas are used for pasture and range. The soil is well suited to pasture and range. Capability unit IVe-1; pasture and hayland group 7B; Blackland range site.

Houston Black Series

The Houston Black series consists of deep, nearly level to gently sloping, moderately well drained, clayey soils. These soils are on uplands. They formed in calcareous clay and marl. The native vegetation is tall and mid prairie grasses and scattered elm, hackberry, and mesquite trees.

In a representative profile the surface layer is dark-gray clay about 40 inches thick. The next lower layer, to a depth of 70 inches, is grayish-brown, mottled clay.

Permeability is very slow. Runoff is slow to rapid. The available water capacity is high. Water enters rapidly when the soil is dry and cracked but very slowly when the soil is moist.

Most of the acreage is used for crops. Some small areas are used for pasture and hay.

Representative profile of Houston Black clay, 1 to 3 percent slopes, in a field 2 miles southwest on the Travis-Bastrop County (boundary line) road from its intersection with Farm Road 812, 0.4 mile southeast on farm field road, 50 feet north:

A11—0 to 8 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; compound moderate, medium, angular blocky structure breaking to moderate, fine, granular; extremely hard, very firm; few, small, rounded quartz pebbles less than 1 inch in diam-

eter; calcareous; moderately alkaline; clear, smooth boundary.

A12—8 to 24 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium subangular blocky structure; extremely hard, very firm; shiny ped faces and intersecting slickensides in the lower part; calcareous; moderately alkaline; gradual, wavy boundary.

A13—24 to 40 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; very fine, angular blocky structure; extremely hard, very firm; shiny ped faces and intersecting slickensides; scattered, cemented calcium carbonate concretions; few, rounded quartz pebbles less than 1 inch in diameter; few wormcasts; calcareous; moderately alkaline; gradual, wavy boundary.

AC1—40 to 56 inches, grayish-brown (2.5YR 5/2) clay, very dark grayish brown (2.5YR 4/2) moist; common, medium, distinct, light yellowish-brown (2.5YR 6/4) mottles; weak, medium, angular blocky structure; extremely hard, very firm; streaks of dark gray (10YR 4/1) from surface cracking; shiny peds and intersecting slickensides; many, fine calcium carbonate concretions and soft, powdery masses of calcium carbonate; moderately alkaline; diffuse, wavy boundary.

AC2—56 to 70 inches, grayish-brown (2.5YR 5/2) clay, dark grayish brown (2.5YR 4/2) moist; common, medium, distinct, olive-yellow (2.5YR 6/6) mottles; weak, medium, angular blocky structure; extremely hard, very firm; intersecting slickensides; few, dark iron and manganese concretions; soft calcium carbonate concretions and powdery masses of calcium carbonate.

The A horizon ranges from 12 to 50 inches in thickness. It is very dark gray, dark gray, or gray. The AC horizon ranges from grayish brown to dark grayish brown and is mottled in shades of gray, brown, olive, and yellow.

HoA—Houston Black clay, 0 to 1 percent slopes. This nearly level soil is on ridgetops and foot slopes in the uplands. Slopes are less than 1 percent. Areas range from about 10 to 50 acres in size.

The surface layer is dark-gray, calcareous clay about 44 inches thick. The next lower layer, to a depth of 64 inches, is grayish-brown, mottled, calcareous clay.

Included with this soil in mapping are small areas of Behring, Krum, Burleson, and Wilson soils that make up 5 to 15 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used mostly for crops and improved pasture. A few small areas are used for range. Capability unit IIw-1; pasture and hayland group 7A; Blackland range site.

HoB—Houston Black clay, 1 to 3 percent slopes. This gently sloping soil has the profile described as representative of the series. It is on broad uplands. Areas are irregular in shape and range from about 10 to 60 acres in size. The surface has a mulch of fine, very hard aggregates. Gilgai microrelief is apparent in undisturbed areas but not in cultivated fields.

Included with this soil in mapping are areas of Burleson, Heiden, and Behring soils. These included soils are less than 5 acres in size. They make up less than 10 percent of any mapped area.

The hazard of erosion is moderate.

This soil is used mostly for cultivated crops and pasture. A few areas are used for range. Capability unit IIe-1; pasture and hayland group 7A; Blackland range site.

Jedd Series

The Jedd series consists of a moderately deep, sloping to moderately steep, well-drained, stony, loamy soils. These soils are on small, narrow ridges in the uplands. They formed in clayey sediment that is underlain by weakly consolidated sandstone. The native vegetation is post oak and blackjack oak and an understory of yaupon, mulberry, and bunchgrass.

In a representative profile (fig. 7) the surface layer is grayish-brown gravelly sandy loam about 4 inches thick that has scattered cemented sandstone fragments. The next layer is light-brown gravelly sandy loam about 8 inches thick that has cemented sandstone fragments. The subsoil, to a depth of 22 inches, is red clay. The lower 10 inches of the subsoil is yellowish-red, mottled sandy clay that rests abruptly upon cemented yellowish-brown sandstone.

Permeability is moderately slow. The available water capacity is medium.

Most of the acreage is in woodland used for range and wildlife habitat.

Representative profile of Jedd gravelly sandy loam in an area of Jedd stony soils, 5 to 20 percent slopes, west of Rosanky, Texas, in a pasture 2.4 miles west on Farm Road 535 from its intersection with Texas Highway 304, 100 feet south:

Figure 7.—**Profile of Jedd gravelly sandy loam.**

A1—0 to 4 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; slightly hard, friable; 15 to 20 percent, by volume, scattered, strongly cemented sandstone pebbles on surface that range from 2 millimeters to 3 inches in diameter but are mostly less than 1 inch; slightly acid; clear, smooth boundary.

A2—4 to 12 inches, light-brown (7.5YR 6/4) gravelly sandy loam, brown (7.5YR 5/4) moist; weak, fine, granular structure; soft, very friable; 20 to 30 percent cemented sandstone pebbles, mostly less than 1 inch in diameter; slightly acid; clear, smooth boundary.

B21t—12 to 22 inches, red (2.5YR 5/6) clay, red (2.5 YR 4/6) moist; moderate, medium, subangular blocky structure; very hard, very firm; continuous clay films on faces of peds; strongly acid; clear, smooth boundary.

B22t—22 to 32 inches, yellowish-red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; few, distinct, yellowish-brown (10YR 5/6) and red (2.5YR 4/6) mottles; weak, medium, blocky structure; very hard, firm; clay films on some peds; strongly acid; abrupt boundary.

R—32 inches, yellowish-brown (10YR 5/4), cemented sandstone; strongly acid.

Depth to sandstone ranges from 20 to 40 inches.

The A horizon ranges from 10 to 18 inches in thickness. It is light-brown, pale-brown, grayish-brown, light yellowish-brown, or brown gravelly sandy loam to loamy sand. Reaction is medium acid or slightly acid.

The B2t horizon ranges from 6 to 24 inches in thickness. It is red, yellowish-red, or reddish-brown clay or sandy clay that in places is mottled in shades of brown, red, and yellow. Reaction is medium acid to strongly acid.

The R layer ranges from weakly cemented to strongly cemented sandstone. It is various shades of yellow, brown, and red.

JeF—Jedd stony soils, 5 to 20 percent slopes. These sloping soils are on small ridgetops and short, hilly side slopes. Areas are oval to long and narrow in shape and range from 5 to 80 acres in size.

The surface layer ranges from gravelly sandy loam to gravelly loamy sand. It ranges from 30 to 70 percent small siliceous pebbles and is as much as 35 percent platy sandstone cobbles and stones. Also, it is about 5 to 10 percent sandstone outcrops.

Included with these soils in mapping are small areas of Axtell, Rosanky, and Demona soils on ridgetops and Dougherty and Patilo soils along the foot slopes. These included soils make up about 10 to 15 percent of the mapped areas.

The hazard of erosion is severe.

These soils are used for wildlife habitat and wooded range. They are too steep and have too much gravel and too many stones for crops. A few areas have been stripped of stones and gravel for road building material. Capability unit VIe-4; pasture and hayland group 8D; Sandstone Hills range site.

Krum Series

The Krum series consists of deep, nearly level, well-drained, clayey soils. These soils are on stream terraces. They formed in thick beds of unconsolidated, calcareous clayey sediment. The native vegetation is tall and mid grasses and a few scattered live oak, elm, and pecan trees.

In a representative profile the surface layer is dark grayish-brown silty clay about 28 inches thick. The next lower layer, to a depth of 42 inches, is brown silty clay. The next layer, to a depth of 60 inches, is reddish-brown silty clay.

Permeability is moderately slow. Runoff is slow. The available water capacity is high.

Most of the acreage is used for crops. Smaller areas are used for pasture and hay.

Representative profile of Krum silty clay, 0 to 1 percent slopes, in a cultivated field 0.4 mile east on Farm Road 153 from the entrance to Buescher State Park, 0.2 mile north:

A—0 to 28 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, firm; few fine roots; many fine pores; few, broken snail shells and calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B—28 to 42 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 4/2) moist; moderate, fine, subangular blocky structure; hard, very firm; few fine roots; few fine pores; dark streaks and spots from surface cracking and earthworm activity; scattered, broken snail shells; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—42 to 60 inches, reddish-brown (5YR 5/4) silty clay, reddish brown (5YR 4/4) moist; massive; hard, firm; 3 to 5 percent calcium carbonate concretions and soft spots; calcareous; moderately alkaline.

The A horizon ranges from about 20 to 36 inches in thickness. It is very dark grayish brown, dark grayish brown, and dark brown.

The B horizon ranges from 12 to about 30 inches in thickness. It is brown, light-brown, light yellowish-brown, and reddish-brown clay or silty clay.

The C horizon is brown, light-brown, reddish-yellow, reddish-brown, and light reddish-brown clay or silty clay.

KrA—Krum silty clay, 0 to 1 percent slopes. This nearly level soil is in old drainageways of terraces. Slopes are about 0.5 percent. Areas are mostly long and narrow in shape and range from about 15 to 80 acres in size.

Included with this soil in mapping are narrow areas of Houston Black and Burleson soils that make up about 15 percent of the mapped areas.

The hazard of erosion is slight.

Most of the acreage of this soil is used for crops. A few areas are used for improved pasture. Capability unit IIs-1; pasture and hayland group 7C; Clay Loam range site.

Lincoln Series

The Lincoln series consists of deep, nearly level, excessively drained, sandy soils. These soils are on crescent-shaped flood plains in bends of the river on bottom lands. They formed in sandy, mixed sediment of Recent age. The native vegetation is coarse bunchgrasses and scattered willow and cottonwood trees.

In a representative profile the surface layer is grayish-brown fine sand about 10 inches thick. The next lower layer, to a depth of 60 inches, is slightly stratified loose fine sand. It is pink in the upper part and light brown in the lower part.

Permeability is rapid. Runoff is slow. The available water capacity is low, but in low-lying areas the water table is at a depth of 3 to 8 feet.

Most of the acreage is used for native and improved pasture.

Representative profile of Lincoln fine sand in an area of Lincoln soils, in a pasture 1.6 miles southeast on Texas Highway 71 from its intersection with Loop Road 150 in the southeastern part of Bastrop County, 3 miles south on county road to Colorado River bottom land, west to river and south 2.1 miles on field road, 50 feet west:

A1—0 to 10 inches, grayish-brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; few, small, rounded quartz pebbles; broken shell frements; calcareous; moderately alkaline; clear, smooth boundary.

C1—10 to 28 inches, pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose; finely stratified with lighter colored and darker colored strata of fine sandy loam and loam; broken shell fragments; few, small, rounded quartz pebbles; calcareous; moderately alkaline; clear, smooth boundary.

C2—28 to 60 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose, few, thin strata of dark colored fine sandy loam, mostly less than 1 inch thick; calcareous; moderately alkaline.

The A horizon ranges from 6 to 15 inches in thickness. It ranges from brown, light-brown, and grayish-brown to pale-brown fine sand and loamy fine sand and smaller areas of fine sandy loam and silty clay loam.

The C horizon, to a depth of more than 60 inches, is dominantly loamy fine sand and fine sand thinly stratified with finer textured material between depths of 10 and 40 inches. It ranges from pink, light brown, brown, pale brown, and very pale brown to light yellowish brown. There are scattered quartz pebbles in most places, and in many areas gravelly strata are below a depth of 40 inches. Siliceous pebbles range from a few to 15 percent.

Ls—Lincoln soils. These nearly level to gently sloping, sandy soils have the profile described as representative of the series. They are on bottom lands. The areas are protected by dams, and they seldom are subject to flooding. Slopes range from 0 to 5 percent but are mostly less than 1 percent. Areas are long and narrow to crescent in shape. The crescent-shaped areas are on the inside curves of the river. Areas average about 40 acres in size.

The surface layer ranges from fine sand, loamy fine sand, and fine sandy loam to silty clay loam.

Included with these soils in mapping are areas of Lincoln soils, frequently flooded. Also included are as much as 20 percent areas of Norwood soils and a few scattered areas of Bosque soils.

The hazard of erosion is slight.

These soils are used for pasture. A few small areas are used for crops. The soils are better suited to improved pasture and hay than to other uses. In a few areas they are strip mined for sand and gravel to be used for road and other building materials. Capability unit IVs-1; pasture and hayland group 3A; Sandy Bottomland range site.

Lw—Lincoln soils, frequently flooded. These nearly level to gently sloping, sandy soils are on bottom lands. Slopes range from 0 to 5 percent but are mostly less than 2 percent. Areas are crescent in shape on the lower flood plains. They range from 10 to 200 acres in size. These soils are subject to flooding once to several times each year.

The surface layer is mostly grayish-brown fine sandy loam about 8 inches thick. It ranges from fine sand, loamy fine sand, and fine sandy loam to silty clay loam. The areas are not uniform and occur without regularity. The next lower layer, to a depth of 40 inches, is pale-brown loamy fine sand that has a few thin strata of fine sandy loam. The next lower layer, to a depth of 60 inches, is very pale brown fine sand that has thin, darker colored strata of fine sandy loam and is about 5 to 15 percent waterworn siliceous pebbles.

Included with these soils in mapping are areas of Lincoln soils that are not subject to annual flooding. Also included are small areas of Norwood soils and areas of soils that have small, waterworn quartz pebbles in places and are as much as 85 percent gravel, by volume. All these included soils make up less than 20 percent of any mapped area.

The hazard of erosion is slight.

These soils are used mostly for pasture. A few areas are in native vegetation and are used for range. Several areas are strip mined for road and other building materials. The soils are not suited to crops. Capability unit Vw-3; pasture and hayland group 3A; Sandy Bottomland range site.

Mabank Series

The Mabank series consists of deep, nearly level to gently sloping, somewhat poorly drained, loamy soils. These soils are in drainageways and on uplands. They formed in old, alkaline marine clay and shale. The native vegetation is tall prairie grasses and scattered hackberry and mesquite trees.

In a representative profile the surface layer is gray loam about 6 inches thick. The subsoil, to a depth of 46 inches, is clay that is dark gray in the upper part and gray with a few brownish mottles in the lower part. The next lower layer, to a depth of 64 inches, is mottled clay. It is light brownish gray in the upper part and light gray in the lower part.

Permeability is very slow. Runoff is very slow to medium. The available water capacity is medium. These soils have a perched water table at a depth of 6 to 12 inches after heavy rain.

Most of the acreage is used for crops. The rest is used mainly for pasture, but a few areas are planted to introduced grasses.

Representative profile of Mabank loam, 1 to 3 percent slopes, in a pasture 4.4 miles north on Farm Road 696 from its intersection with U.S. Highway 290, 0.6 mile northwest on county road, 100 feet north:

A1—0 to 6 inches, gray (10YR 5/1) loam, dark gray (10YR 4/1) moist; massive; hard, very friable; few fine roots; few fine pores; slightly acid; abrupt, wavy boundary.

B21tg—6 to 30 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, blocky structure; extremely hard, extremely firm; few dark-brown concretions; few, brownish, sandy streaks from surface cracking; scattered calcium carbonate concretions; clay films on faces of peds; mildly alkaline; gradual, wavy boundary.

B22tg—30 to 46 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, brownish mottles; mod-

erate, medium, blocky structure; extremely hard, extremely firm; clay films on most peds; few, soft calcium carbonate bodies and concretions; few dark-brown concretions; mildly alkaline; gradual, wavy boundary.

B23t—46 to 56 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; few, fine and medium, distinct, olive-yellow (2.5Y 6/6) mottles; weak, medium, blocky structure; extremely hard, very firm; patchy clay films on peds; few dark-brown concretions; many, soft calcium carbonate bodies and concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B3—56 to 64 inches, light-gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; mottled in shades of brown, olive, and yellow; weak, medium, blocky structure; extremely hard, very firm; few, soft calcium carbonate bodies and some concretions; shale fragments in lower part; calcareous; moderately alkaline.

The solum ranges from 60 to more than 70 inches in thickness.

The A horizon ranges from 4 to 11 inches in thickness. It is gray, grayish brown, dark grayish brown, or light brownish gray. In places there is a thin, light-colored A2 horizon less than 1 inch thick. Reaction is slightly acid to neutral.

The upper part of the B2tg horizon is clay or clay loam 20 to 50 inches thick. It is gray, dark gray, or very dark gray and in places has a few brownish mottles in the lower part. Reaction is slightly acid to mildly alkaline. The B23tg horizon is 8 to 18 inches thick. It is gray, light brownish-gray, grayish-brown, or olive-brown clay, clay loam, or silty clay. It is mottled in shades of gray, brown, olive, and yellow. It is calcareous and has few to many calcium carbonate concretions. Reaction ranges from neutral to moderately alkaline. The B3 horizon is clay, clay loam, or silty clay. It is mottled in shades of gray, brown, olive, and yellow. It has few to many soft bodies and calcium carbonate concretions.

MaA—Mabank loam, 0 to 1 percent slopes. This nearly level soil is mostly along old streambanks and on ridgetops. Areas are long and narrow and range from about 8 to 80 acres in size.

The surface layer is grayish-brown loam about 6 inches thick. The subsoil, to a depth of 48 inches, is clay. It is dark gray in the upper part and is gray and has a few mottles in the lower part. The next lower layer, to a depth of 64 inches, is gray, calcareous clay.

Included with this soil in mapping are small areas of Wilson clay loam.

The hazard of erosion is slight.

This soil is used mostly for crops. A few areas are used for pasture. The soil is suited to improved pasture and range. Capability unit IIIw-1; pasture and hayland group 8A; Claypan Prairie range site.

MaB—Mabank loam, 1 to 3 percent slopes. This gently sloping soil has the profile described as representative of the series. It is on broad ridgetops and in drainageways in prairies. Slopes are mostly less than 2 percent. Areas range from about 5 to 50 acres in size.

Included with this soil in mapping are small areas of Wilson and Crockett soils.

The hazard of erosion is moderate.

This soil is used mostly for crops. A few areas are used for pasture and native range. Capability unit IIIe-2; pasture and hayland group 8A; Claypan Prairie range site.

Norwood Series

The Norwood series consists of deep, nearly level, well-drained, loamy soils. These soils are on protected flood plains on bottom lands along the river. They formed in calcareous, loamy alluvial sediment of mixed origin. The native vegetation is pecan, elm, oak, cottonwood, and hackberry trees and an understory of bunchgrass.

In a representative profile the surface layer is brown silty clay loam about 12 inches thick. The next lower layer, to a depth of 24 inches, is light-brown silty clay loam. The next lower layer, to a depth of 60 inches, is light-brown silt loam thinly stratified with fine sandy loam.

Permeability is moderate. Runoff is slow. The available water capacity is high.

Most of the acreage is used for crops. The rest is used for pasture and native range.

Representative profile of Norwood silty clay loam, in a pasture 0.3 miles southeast on Texas Highway 71 from its intersection with Loop Road 150, 1.4 miles southwest on county road, 50 feet north:

A1—0 to 12 inches, brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; moderate, medium, subangular and angular blocky structure; hard, firm; many fine pores and wormcasts; calcareous; moderately alkaline; clear, smooth boundary.

C1—12 to 24 inches, light-brown (7.5YR 6/4) silty clay loam thinly stratified with fine sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, firm; many fine pores; few wormcasts and shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

C2—24 to 60 inches, light-brown (7.5YR 6/4) silt loam thinly stratified with fine sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; weak bedding planes; shell fragments; calcareous; moderately alkaline.

The A horizon ranges from 10 to 18 inches in thickness. It is brown and grayish-brown silty clay loam and loam.

The C horizon, to a depth of 60 inches, is silty clay loam or silt loam thinly stratified with silty clay, loam, and fine sandy loam. It is brown, light brown, or reddish-brown.

Nd—Norwood loam. This nearly level soil is on bottom lands. The areas are protected by dams, and they are seldom subject to flooding. Slopes are mostly less than 1 percent. Areas are long and narrow and range from 10 to more than 100 acres in size.

The surface layer is brown loam about 16 inches thick. The next lower layer, to a depth of 36 inches, is reddish-brown silty clay loam. The next lower layer, to a depth of 60 inches, is reddish-brown silt loam that has a few, thin strata of fine sandy loam.

Included with this soil in mapping are a few, narrow areas of Norwood loam that is frequently subject to flooding. These included soils make up less than 10 percent of any mapped area. Also included are areas that are as much as 15 percent Lincoln and Bosque soils.

The hazard of erosion is slight.

This soil is used for crops, pasture, and hay. There are scattered pecan trees. The soil is suited to native range grasses, but it is not used for range. Capability unit I-1; pasture and hayland group 2A; Loamy Bottomland range site.

No—Norwood silty clay loam. This nearly level soil has the profile described as representative of the series. It is on bottom lands. The areas are protected by dams, and they are seldom subject to flooding. Slopes are mostly less than 0.5 percent. Areas are mostly long

and narrow, and they parallel the stream. They range from about 30 to 300 acres in size.

Included with this soil in mapping are narrow areas of Norwood silty clay loam that is frequently subject to flooding and small areas of Bosque, Lincoln, and Ships soils. Included soils make up less than 10 percent of any mapped area.

The hazard of erosion is slight.

This soil is used mostly for crops. A few areas are used for improved pasture and pecan orchards. Also, a few small areas are used for range. Capability unit I-1; pasture and hayland group 2A; Loamy Bottomland range site.

Patilo Series

The Patilo series consists of deep, gently sloping to strongly sloping, moderately well drained, sandy soils. These soils are on uplands. They formed in thick, sandy and loamy material that appears to be reworked by wind. The native vegetation is post oak, blackjack oak, and coarse bunchgrass.

In a representative profile the upper part of the surface layer is light brownish-gray, loose fine sand about 5 inches thick. The next 47 inches of the surface layer is very pale brown, loose fine sand. The next lower layer, to a depth of 70 inches, is light-gray, mottled sandy clay loam.

Permeability is moderately slow. Runoff is slow. The available water capacity is low. These soils have a perched water table at a depth of 48 to 72 inches for short periods after heavy rain.

Most of the acreage is used for range. A few areas are used for pasture and crops.

Representative profile of Patilo fine sand in an area of Patilo complex, 1 to 12 percent slopes, 1.95 miles northwest on U.S. Highway 290 from its intersection with Farm Road 696, 100 feet south:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose; few fine roots; neutral; clear, smooth boundary.

A2—5 to 52 inches, very pale brown (10YR 8/4) fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose; few fine roots in upper part; few, small, rounded siliceous pebbles less than 1 inch in diameter; few, reddish-yellow stains on some peds in lower part; slightly acid; clear, wavy boundary.

B2t—52 to 70 inches, distinctly mottled, light-gray (10YR 7/1), reddish-yellow (7.5YR 6/6), and brownish-yellow (10YR 6/6) sandy clay loam; weak, coarse, blocky structure; very hard, friable; strongly acid.

The solum ranges from 65 to more than 80 inches in thickness.

The A horizon is loamy fine sand or fine sand. Reaction is neutral to slightly acid. The A1 horizon ranges from 2 to 8 inches thick. It is brown, grayish brown, light brownish gray, pale brown, and very pale brown. The A2 horizon ranges from 38 to 72 inches thick. It is pale brown, very pale brown, and white.

The B2t horizon ranges from 8 to 26 inches in thickness. It and the B3t horizon, where present, range from sandy clay loam to fine sandy loam; these horizons are 18 to 35 percent clay. They are light brownish gray, light gray, brownish yellow, and reddish yellow and are distinctly mottled in shades of brown, gray, red, or yellow. Reaction ranges from slightly acid to strongly acid.

PaE—Patilo complex, 1 to 12 percent slopes. This gently sloping to strongly sloping complex is on uplands. Slopes are mostly 1 to 8 percent, but they range to 12 percent. Areas are irregular in shape and range from 5-acre areas on ridgetops to large areas several hundred acres in size.

Included with these soils in mapping are areas of soils that have a thick, billowy, sandy surface layer more than 30 inches thick and lower layers of mottled, red, yellow, brown, and gray sandy clay loam. These included soils make up 50 to 100 percent of that part of the mapped areas where slopes are more than 8 percent and 20 to 50 percent of that part of mapped areas where slopes are less than 8 percent. Also included are areas that range from 0 to 20 percent Demona and Silstid soils.

The hazard of erosion is slight.

This complex is used mostly for wooded range. It is suited to range, woodland, and crops. It is also suited to improved pasture, hay, and wildlife habitat. Capability unit IVe-5; pasture and hayland group 9B; Deep Sand range site.

Rosanky Series

The Rosanky series consists of deep, gently sloping to sloping, well-drained, loamy soils. These soils are on convex areas of upland ridges. They formed in weakly consolidated sandstone or packsand. The native vegetation is post oak, blackjack oak, and an understory of yaupon and bunchgrass.

In a representative profile the surface layer is brown fine sandy loam about 5 inches thick. The next layer is light-brown fine sandy loam 3 inches thick. The upper part of the subsoil, to a depth of 30 inches, is red clay. The next part of the subsoil, to a depth of 46 inches, is reddish-yellow sandy clay loam. The next lower layer, to a depth of 64 inches, is reddish-yellow fine sandy loam that is mottled in the lower part. The underlying material, to a depth of 70 inches, is weakly consolidated sandstone.

Permeability is moderately slow. Runoff is medium to rapid. The available water capacity is medium.

Most of the acreage is in woodland used for native range and wildlife habitat. A small acreage is used for crops.

Representative profile of Rosanky fine sandy loam, 3 to 8 percent slopes, in a pasture 2.7 miles south on Texas Highway 304 from its intersection with Farm Road 535, 0.5 mile south on county road, 50 feet east:

Ap—0 to 5 inches, brown (10YR 5/3) fine sandy loam, loam, brown (7.5YR 5/4) moist; weak, fine, granular structure; slightly hard, very friable; common roots; few, fine siliceous pebbles; slightly acid; clear, smooth boundary.

A2—5 to 8 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, fine, granular structure; slightly hard, very friable; common roots; common, fine siliceous pebbles; slightly acid; abrupt, smooth boundary.

B21t—8 to 20 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; strong, fine, angular blocky structure; very hard, firm; few roots; patchy clay films; strongly acid; gradual, smooth boundary.

B22t—20 to 30 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, fine, angular blocky structure; very hard, firm; few roots; patchy clay films; strongly acid; gradual, wavy boundary.

B23t—30 to 46 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, fine, subangular blocky structure parting to weak, fine, granular; hard, friable; patchy clay films; strongly acid; gradual, wavy boundary.

B3—46 to 56 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak, fine, granular structure; hard, friable; strongly acid; gradual, wavy boundary.

C1—56 to 64 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; common, medium, distinct, brownish-yellow (10YR 6/6) and gray (10YR 6/1) mottles; massive; hard, friable; strongly acid; clear, wavy boundary.

C2—64 to 70 inches, gray (10YR 5/1) and yellowish-brown (10YR 5/4), stratified, weakly consolidated sandstone; extremely hard, extremely firm and brittle; medium acid.

The Ap horizon ranges from 4 to 6 inches in thickness. It is dark brown, brown, and grayish brown to yellowish brown. The A2 horizon is 0 to 6 inches thick. It is brown, light-brown, reddish-yellow, or pink fine sandy loam or loamy fine sand. Reaction ranges from slightly acid to neutral in the A horizon.

The B21t horizon ranges from 8 to 18 inches in thickness. It is red or yellowish-red clay or sandy clay. The B22t horizon is 8 to 14 inches thick. It is red or yellowish-red clay, sandy clay, or sandy clay loam that is mottled in shades of red, yellow, or brown. The upper 20 inches of the B2t horizon ranges from 35 to 50 percent clay, but the content of clay decreases by more than 20 percent of the maximum within 60 inches of the surface. Reaction is medium acid or strongly acid. The lower part of the B horizon is red, yellowish-red, reddish-yellow, or yellowish-brown sandy clay loam or fine sandy loam. In places it is mottled in shades of red, brown, or olive.

The C1 horizon is sandy clay loam or fine sandy loam. The C2 horizon is weakly cemented sandstone or sandy ironstone. The C horizon is reddish yellow, yellowish red, gray, or yellowish brown and is mottled in shades of gray, yellow, brown, red, or olive. Reaction is medium acid to strongly acid.

RoB—Rosanky fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on long and narrow to oval ridgetops. Slopes are mostly 2 to 3 percent. Areas range from about 10 to 50 acres in size but average about 15 acres.

The surface layer is fine sandy loam about 8 inches thick that has a few to 15 percent small, dark-colored, siliceous pebbles and fragments of platy sandstone. It is brown in the upper part and light brown in the lower part. The subsoil, to a depth of 36 inches, is red sandy clay. The next lower layer, about 10 inches thick, is yellowish-red sandy clay loam. The next lower layer, to a depth of 60 inches, is reddish-yellow fine sandy loam.

Included with this soil in mapping are small areas of Axtell and Demona soils that make up about 15 percent of the mapped areas.

The hazard of erosion is moderate.

This soil is used mostly for wildlife habitat and wooded range. A few small areas are used for improved pasture. Capability unit IIe-2; pasture and hayland group 8C; Sandy Loam range site.

RoD—Rosanky fine sandy loam, 3 to 8 percent slopes. This sloping soil has the profile described as representative of the series. It is on long, narrow side slopes and oval ridgetops. Areas range from about 10 to 60 acres in size but average about 25 acres. The surface layer is as much as 15 percent small siliceous pebbles and fragments of platy sandstone.

Included with this soil in mapping are small areas of Axtell, Jedd, and Demona soils on side slopes and ridgetops and areas of Tabor soils on foot slopes. These included soils make up 5 to 20 percent of the mapped areas.

The hazard of erosion is severe.

This soil is used mostly for wildlife habitat and wooded range. A few small areas are used for improved pasture. Capability unit IVe-4; pasture and hayland group 8C; Sandy Loam range site.

Sayers Series

The Sayers series consists of deep, nearly level, excessively drained, sandy soils. These soils are on flood plains on bottom lands. They formed in recent sandy alluvium. The native vegetation is tall grasses, elm, and cottonwood.

In a representative profile the surface layer is brown fine sandy loam about 10 inches thick. The next lower layer, to a depth of 24 inches, is pale-brown, slightly stratified loamy fine sand. The next lower layer, to a depth of 60 inches, is pale-brown fine sand.

Permeability is rapid. Runoff is slow. The available water capacity is low. These soils have a perched water table at a depth of 60 to 120 inches during spring and fall.

Most of the acreage is in wooded pasture used for livestock and wildlife habitat. A few small areas are used for crops. The wider bottoms have been cleared of trees and are used for native range and improved pasture.

Representative profile of Sayers fine sandy loam, in a creek bottom 1.7 miles north on Texas Highway 95 from its intersection with Farm Road 2336, 1.8 miles southwest on a county road down Big Sandy Creek, 350 feet southeast:

A1—0 to 10 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, friable; few fine roots; slightly acid; clear, smooth boundary.

C1—10 to 24 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; massive; soft, very friable; few, thin strata of brown (10YR 5/3) fine sandy loam; slightly acid; clear, smooth boundary.

C2—24 to 60 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; massive; loose, very friable; many, very pale brown (10YR 7/3) strata below a depth of 42 inches; slightly acid.

Reaction ranges from slightly acid to neutral in the solum.

The A horizon ranges from 6 to 18 inches in thickness. It ranges from grayish brown and brown to pale brown.

The C horizon is brown, pale-brown, and very pale brown loamy fine sand and fine sand that in places are thinly stratified with finer textured material.

Sa—Sayers fine sandy loam. This nearly level soil has the profile described as representative of the series. It is on bottom lands. Slopes are less than 1 percent.

Areas are 100 to 500 feet wide, and some are several miles long.

Included with this soil in mapping are some areas of Sayers fine sandy loam that is frequently subject to flooding. Also included are small areas of soils that have a surface layer of loam, loamy fine sand, or fine sand. In the mixed sediment areas, small areas of Uhland soils are also included. All of these included soils make up less than 15 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used mostly for pasture and wooded range. A few small areas are used for crops. The soil is well suited to improved pasture and hay. Capability unit IVs-1; pasture and hayland group 3A; Sandy Bottomland range site.

Sb—Sayers fine sandy loam, frequently flooded. This nearly level soil is on bottom lands. Areas are long and narrow and as much as several miles long. They are subject to flooding one or two times each year, which results in shifting, scouring, and depositional patterns.

The surface layer is brown fine sandy loam about 10 inches thick. The next layer, to a depth of 54 inches, is pale-brown loamy fine sand thinly stratified with fine sand. The next layer, to a depth of 64 inches, is very pale brown, mottled fine sand.

Included with this soil in mapping are areas of Sayers fine sandy loam that is not subject to annual flooding. Also included are areas of soils that have a surface layer of loam or loamy fine sand. These included soils make up less than 15 percent of any mapped area.

The hazard of erosion is slight.

This soil is used mostly for wooded pasture for cattle and wildlife. A few areas are used for improved pasture. Capability unit Vw-3; pasture and hayland group 3A; Sandy Bottomland range site.

Shep Series

The Shep series consists of deep, gently sloping to sloping, well-drained, loamy soils. These soils are on uplands near major drainageways. They formed in calcareous, loamy, old alluvial sediment. The native vegetation is mid and short grasses.

In a representative profile the surface layer is brown, calcareous clay loam about 4 inches thick. The next lower layer, to a depth of 20 inches, is light reddish-brown, calcareous clay loam. The next lower layer, to a depth of 60 inches, is light-brown clay loam.

Permeability is moderate. Runoff is medium. The available moisture capacity is high.

The acreage is used for improved pasture and range.

Representative profile of Shep clay loam, 3 to 8 percent slopes, eroded, in a cultivated field 2.2 miles south-southwest on a county road from the intersection of Pecan Street and Texas Highway 71 in Bastrop, Texas, 100 yards east:

A1—0 to 4 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; moderate, medium, subangular blocky and granular structure; hard, friable; many calcium carbonate concretions less than 1 inch in diameter on the surface; few, scattered siliceous pebbles; calcareous; moderately alkaline; clear, smooth boundary.

B2—4 to 20 inches, light reddish-brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; moderate, medium, subangular blocky structure; hard, friable; common wormcasts; common calcium carbonate films and threads and soft masses; scattered calcium carbonate concretions; few, small siliceous pebbles less than 1 inch in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

C1ca—20 to 40 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; many wormcasts; about 20 percent fine and medium calcium carbonate concretions and soft masses; calcareous; moderately alkaline; gradual, smooth boundary.

C2ca—40 to 60 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; many calcium carbonate films, threads, and a few concretions; calcareous; moderately alkaline.

The A horizon ranges from 4 to 10 inches in thickness. It is brown, pale brown, or reddish brown.

The B2 horizon ranges from 12 to 32 inches in thickness. It is brown, light-brown, pink, light reddish-brown, and yellowish-brown clay loam or loam.

The C1ca and C2ca horizons, to a depth of 60 inches, are clay loam, loam, and fine sandy loam. In places the lower part is 0 to 25 percent siliceous pebbles. These horizons are light brown, light reddish brown, reddish yellow, and brown. The Cca horizon contains an estimated 5 to 20 percent carbonates in the form of soft masses, films, threads, and concretions.

SeD2—Shep clay loam, 3 to 8 percent slopes, eroded. This gently sloping to sloping soil is on uplands. Areas are long and narrow and about 25 acres in size.

Included with this soil in mapping are areas of Bastrop soils that make up as much as 25 percent of the mapped areas. Also included are areas that are as much as 10 percent Bosque and Smithville soils on crests and foot slopes. Also included are narrow areas of moderately steep, eroded soils on escarpments between the different terrace levels. These included soils make up as much as 25 percent of the mapped areas.

The hazard of erosion is severe.

The soil is used mostly for range. A few areas of the less sloping soils are used for improved pasture. Capability unit VIe-5; pasture and hayland group 7D; Sandy Loam range site.

Ships Series

The Ships series consists of deep, nearly level, somewhat poorly drained, clayey soils. These soils are in backwater areas adjacent to terraces on bottom lands of major drainageways. They formed in clayey alluvial sediment. The native vegetation is mid and tall grasses and a few scattered hackberry, live oak, and mesquite trees.

In a representative profile the surface layer, about 45 inches thick, is dark brown. It is silty clay in the upper part and clay in the lower part. The underlying material, to a depth of 60 inches, is reddish-brown silty clay.

Permeability is very slow. Runoff is slow. The available water capacity is high.

Most of the acreage is used for crops. The rest is used for pasture and hay.

Representative profile of Ships silty clay, in a cultivated field 0.5 mile north on the old Bastrop Highway from the Legion Hall in Smithville, Texas, 0.5 mile east:

A11—0 to 18 inches, dark-brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate, fine, subangular blocky structure; very hard, firm; few fine roots; many fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

A12—18 to 45 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, fine subangular blocky structure; very hard, firm; dark streaks and spots from surface cracking and earthworm activity; few small slickensides and shiny ped faces; few, thin, darker colored strata in lower part; calcareous; moderately alkaline; gradual, smooth boundary.

C—45 to 60 inches, reddish-brown (5YR 4/3) silty clay, dark reddish brown (5YR 3/3) moist; massive; very hard, firm; few slickensides that do not intersect; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness.

The A horizon ranges from 24 to 50 inches in thickness. It is brown, dark brown, reddish brown, or dark reddish gray. Between depths of 10 and 40 inches, it is about 60 to 70 percent clay.

In places there is a B horizon. It is brown, reddish brown, light reddish brown, or light brown.

The C horizon ranges from reddish-brown to light reddish-brown clay or silty clay.

Sg—Ships silty clay. This nearly level soil is on bottom lands. Most of the areas are protected by dams, and they are seldom subject to flooding. Slopes are mostly less than 1 percent. Areas are long and narrow and range from 15 to 110 acres in size.

Included with this soil in mapping are small areas of Trinity and Norwood soils in mostly long, narrow areas. These included soils make up less than 15 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used for crops, improved pasture, or a combination of pasture and pecan orchards. It is adequately drained for cultivated crops. Capability unit IIs-2; pasture and hayland group 1A; Clayey Bottomland range site.

Silstid Series

The Silstid series consists of deep, gently sloping, well-drained, sandy soils. These soils are on uplands. They formed in material weathered from sandy and loamy sediment interbedded with sandstone. The native vegetation is blackjack oak, post oak, and yaupon and an understory of mid and tall grasses.

In a representative profile the surface layer is light-gray, loose loamy fine sand about 10 inches thick. The next layer is very pale brown loamy fine sand 18 inches thick. The next lower layer, to a depth of 40 inches, is brownish-yellow and yellowish-brown, mottled sandy clay loam. The next layer, to a depth of 70 inches, is mottled, strongly acid clay loam. The next layer, to a depth of 80 inches, is mottled, strongly acid fine sandy loam.

Permeability is moderate. Runoff is slow. The available water capacity is medium.

Most of the acreage is used for range and wildlife habitat. A few areas are used for crops and improved pasture.

Representative profile of Silstid loamy fine sand, 1 to 5 percent slopes, in a pasture 0.1 mile northwest on U.S. Highway 290 from its intersection with Farm Road 2336 at McDade, Texas, 1.4 miles northeast following county road to intersection, 1.4 miles southeast on county road, 150 feet south:

A1—0 to 10 inches, light-gray (10YR 7/2) loamy fine sand, grayish brown (10YR 5/2) moist; weak, fine granular structure; soft, very friable; common roots; slightly acid; clear, wavy boundary.

A2—10 to 28 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; weak, fine, granular structure; few fine roots; slightly acid; clear, wavy boundary.

B21t—28 to 40 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common, medium, distinct, yellowish-red (5YR 5/6) mottles and few brown and gray mottles in the lower part; weak, medium, subangular blocky structure; hard, friable; patchy clay films; strongly acid; gradual, wavy boundary.

B22t—40 to 56 inches, distinct, medium, red (2.5YR 4/6), light brownish-gray (10YR 6/2), and strong-brown (7.5YR 5/6), mottled clay loam; weak, medium, subangular blocky structure; very hard, very firm; clay films on faces of peds; strongly acid; gradual, wavy boundary.

B23t—56 to 70 inches, distinct, coarse, light-gray (10YR 7/1), dark-red (2.5YR 3/6), and yellowish-brown, mottled clay loam; moderate, medium, angular and subangular blocky structure; extremely hard, very firm; continuous clay films on faces of peds; strongly acid; gradual, wavy boundary.

B3—70 to 80 inches, distinct, coarse, light-gray (10YR 7/1), yellowish-red (2.5YR 5/6), and brown (7.5YR 5/4), mottled fine sandy loam; weak, medium, subangular blocky structure; hard, friable; strongly acid.

The solum is more than 60 inches thick. Reaction ranges from slightly acid to neutral in the A horizon and from medium acid to strongly acid in the Bt horizon.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon ranges from light gray and light brownish gray to pale brown. The A2 horizon ranges from pale brown to very pale brown.

The B21t horizon ranges from 5 to 16 inches in thickness. It is yellowish brown, yellow, or brownish yellow and is mottled in shades of brown, red, and yellow. The B22t horizon ranges from 10 to 20 inches in thickness. It is red, reddish-brown, yellowish-red, or brownish-yellow clay loam or sandy clay loam. It is mottled in shades of brown, gray, red, and yellow. The B23t and B3 horizons range from clay loam and sandy clay loam to fine sandy loam. Mottled colors are in shades of red, gray, brown, and yellow but are dominantly yellow and gray.

SkC—Silstid loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is on uplands. Areas are irregular in shape and average about 30 acres in size.

Included with this soil in mapping are areas that are as much as about 20 percent Patilo and Demona soils and as much as about 10 percent Tabor and Rosanky soils. Also included are a few areas of eroded soils that have slopes of as much as 8 percent.

The hazard of erosion is moderate.

This soil is used mostly for range and wildlife habitat. A few small areas are used for crops and improved pasture. The soil is well suited to wildlife habitat and recreation. Capability unit IIIe-5; pasture and hayland group 9A; Sandy range site.

Smithville Series

The Smithville series consists of deep, nearly level, well-drained, loamy soils. These soils are on bottom lands. They formed in calcareous, stratified, loamy

alluvium. The native vegetation is mid and tall grasses and a few scattered trees.

In a representative profile the upper 6 inches of the surface layer is grayish-brown fine sandy loam. The next 10 inches of the surface layer is dark grayish-brown loam. The next lower layer, to a depth of 50 inches, is reddish-brown sandy clay loam. The next lower layer, to a depth of 62 inches, is reddish-yellow, calcareous fine sandy loam.

Permeability is moderate. Runoff is slow. The available water capacity is high.

Most of the acreage is used for crops and improved pasture. Native and introduced pecan trees are scattered throughout the area.

Representative profile of Smithville fine sandy loam, in a field 0.55 mile southeast on Texas Highway 71 from its intersection with Farm Road 153, 100 feet west:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; hard, very friable; few fine roots; many fine pores; mildly alkaline; clear, smooth boundary.

A1—6 to 16 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; hard, friable; many fine roots; many fine pores; few wormcasts; mildly alkaline; gradual, smooth boundary.

B21t—16 to 30 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium, subangular blocky structure; very hard, firm; common wormcasts; patchy clay films; few small calcium carbonate concretions and fragments of shells; calcareous; mildly alkaline; gradual, smooth boundary.

B22t—30 to 50 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate, fine, subangular blocky structure; hard, friable; few wormcasts; patchy clay films; few calcium carbonate concretions and broken fragments of shells, few calcium carbonate films and threads; calcareous; moderately alkaline; clear, smooth boundary.

Cca—50 to 62 inches, reddish-yellow (5YR 6/6) fine sandy loam and a few, thin, faintly evident strata of loam, yellowish red (5YR 5/6) moist; massive; hard, very friable; few calcium carbonate concretions, films, and threads; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Depth to visible secondary carbonates ranges from 15 to 36 inches.

The A horizon is 10 to 20 inches thick. It is grayish brown, dark grayish brown, brown, or dark brown. Reaction is neutral or mildly alkaline.

The B21t horizon is brown, dark-brown, or reddish-brown sandy clay loam or loam that ranges from 18 to 32 percent clay. Reaction is neutral to moderately alkaline. The B22t horizon is brown, strong-brown, reddish-brown, or yellowish-red sandy clay loam, loam, or fine sandy loam.

The Cca horizon is reddish-yellow or light-brown loam or fine sandy loam. In places it is as much as 15 percent siliceous or limestone pebbles. The B22t and Cca horizons in places range from 1 to 10 percent visible secondary carbonates in the form of threads, films, and soft masses and calcium carbonate concretions.

Sm—Smithville fine sandy loam. This nearly level soil is on bottom lands. The areas are protected by dams, and they are seldom, if ever, subject to flooding. Slopes are mostly less than 0.5 percent. Areas are long and narrow to irregular in shape. They range from about 10 to 150 acres in size.

Included with this soil in mapping are small, narrow areas that are as much as 15 percent Bosque soils. Also included are areas of soils that are similar to this Smithville soil but that have slopes of as much as 1.5 percent. These included soils are around drainageways and on slopes to the bottom lands. Also included are areas of Bastrop soils. Included soils make up as much as 10 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used for crops and pasture. Scattered pecan trees are growing throughout the areas and are used for shade and production of nuts. Capability unit I-2; pasture and hayland group 2A; Loamy Bottomland range site.

Tabor Series

The Tabor series consists of deep, nearly level to sloping, moderately well drained, loamy soils. These soils are on broad uplands. They formed in acid to alkaline clay or sandy clay interbedded with sandier material. The native vegetation is bunchgrass and post oak, blackjack oak, elm, and hackberry trees.

In a representative profile the surface layer is grayish-brown fine sandy loam 6 inches thick. The subsurface layer is pale-brown fine sandy loam 9 inches thick. The subsoil, to a depth of 38 inches, is brownish-yellow clay. The next lower layer, to a depth of 63 inches, is mottled clay that is yellow in the upper part and light gray in the lower part.

Permeability is very slow. Runoff is slow to medium. The available water capacity is high.

Most of the acreage is used for pasture and range. Small areas are used for crops.

Representative profile of Tabor fine sandy loam, 1 to 3 percent slopes, in a pasture 2.0 miles east on Texas Highway 21 from its intersection with Loop Road 150 at the Bastrop State Park, 1.4 mile north on a county road, 0.3 mile northwest:

A1—0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; hard, very friable; few, small quartz pebbles; slightly acid; clear, smooth boundary.

A2—6 to 15 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak, fine, granular structure; hard, very friable; few, small quartz pebbles and small, dark-colored concretions; slightly acid; abrupt, wavy boundary.

B21t—15 to 26 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; common, medium, distinct, light brownish-gray (10YR 5/2) and yellowish-red (5YR 5/6) mottles; moderate, coarse, blocky structure; extremely hard, extremely firm; clay films on most peds; medium acid; gradual, wavy boundary.

B22t—26 to 38 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; few, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-red (5YR 5/6) mottles; moderate, coarse, blocky structure; extremely hard, extremely firm; clay films on peds; strongly acid; gradual, wavy boundary.

B3t—38 to 50 inches, yellow (10YR 7/6) clay, brownish yellow (10YR 6/6) moist; common, medium, distinct mottles in shades of gray, brown, and yellow; weak, coarse, blocky structure; extremely hard, very firm; patchy clay films; few, small, dark-colored concretions; neutral; gradual, wavy boundary.

C—50 to 63 inches, light-gray (2.5Y 7/0) clay, gray (2.5Y 6/0) moist; common, medium and large, yellowish-brown (10YR 5/8) mottles; massive; extremely hard, very firm; few small calcium carbonate concretions; horizontal cleavage planes; mildly alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

The A horizon is 8 to 22 inches thick from the crests to the troughs of the wavy B21t horizon. It is fine sandy loam or gravelly fine sandy loam that is as much as about 40 percent quartz and chert pebbles. The A1 horizon is grayish brown, light brownish gray, brown, or pale brown. The A2 horizon is lighter colored. Reaction is slightly acid to medium acid.

The B2t horizon ranges from 18 to 40 inches in thickness. It is clay or clay loam that is as much as 35 to 50 percent clay in the upper 20 inches. It ranges from pale brown, brownish yellow, light yellowish brown, and yellowish brown to light olive brown and is mottled in shades of gray, brown, yellow, red, and olive. Reaction is strongly acid to medium acid.

The B3t horizon ranges from 10 to 20 inches thick. The B3t and C horizons are clay, sandy clay, or clay loam. They are light gray, gray, yellow, or olive and have mottles in shades of gray, brown, olive, and yellow. Reaction ranges from medium acid to mildly alkaline.

TfA—Tabor fine sandy loam, 0 to 1 percent slopes. This nearly level soil is on broad ridgetops and foot slopes and in drainageways. Areas are oblong to irregular in shape and range from 10 to about 250 acres in size.

The surface layer is fine sandy loam about 16 inches thick. It is light brownish gray in the upper part and light gray in the lower part. The subsoil, to a depth of 52 inches, is light yellowish-brown, mottled clay in the upper part and yellowish-brown, mottled clay in the lower part. The underlying material, to a depth of 70 inches, is light-gray, mottled clay loam.

Included with this soil in mapping are areas of Axtell, Crockett, and Demona soils. Also included are areas of a soil that is similar to this Tabor soil but that has a grayish-colored subsoil. These included soils make up as much as 15 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used mostly for pasture and range. A few small areas are used for crops. Capability unit IIIs-1; pasture and hayland group 8A; Sandy Loam range site.

TfB—Tabor fine sandy loam, 1 to 3 percent slopes. This gently sloping soil has the profile described as representative of the series. It is on ridgetops and foot slopes and in drainageways. Areas are narrow to broad and irregular in shape. They average about 30 acres in size but range from 10 to 60 acres.

Included with this soil in mapping are areas that are as much as 10 percent Axtell, Crockett, and Demona soils. Also included are a few small areas of Wilson and Tabor soils. Areas of included soils are mostly less than 5 acres in size.

The hazard of erosion is moderate.

This soil is used for pasture and range. A few small areas are used for crops. Capability unit IIIe-4; pasture and hayland group 8A; Sandy Loam range site.

Trinity Series

The Trinity series consists of deep, nearly level, somewhat poorly drained, clayey soils. These soils are on flood plains. They formed in clayey alluvium. The native vegetation is elm, hackberry, oak, and ash trees and an understory of bunchgrass.

In a representative profile the surface layer is dark-gray clay about 52 inches thick. The underlying material, to a depth of 64 inches, is grayish-brown, mottled, stratified clay and clay loam.

Permeability and runoff are very slow. The available water capacity is high. These soils have a water table at a depth of 10 to 30 inches in winter. Most areas are frequently subject to flooding.

Most of the acreage is used for pasture. A few higher lying areas are used for crops.

Representative profile of Trinity clay, frequently flooded, in the Cedar Creek bottom 3 miles west on Texas Highway 21 from its intersection with Farm Road 812, 0.5 mile southeast:

A11—0 to 26 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, granular and subangular blocky structure; very hard, firm; few fine roots; few fine pores; shiny ped faces; calcareous; moderately alkaline; diffuse, smooth boundary.

A12—26 to 52 inches, dark-gray (10YR 4/1) clay and few thin strata of clay loam, very dark gray (10YR 3/1) moist; moderate, medium, subangular blocky structure; few fine pores; few slickensides that do not intersect; shiny ped faces; few, small quartz pebbles and small calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

C—52 to 64 inches, grayish-brown (2.5Y 5/2), stratified clay and clay loam, dark grayish brown (2.5Y 4/2) moist; common, medium, prominent, light olive-brown (2.5Y 5/6) mottles, and darker colored dark-gray (10YR 4/1) spots; massive; very hard, very firm; scattered calcium carbonate concretions; few to common quartz pebbles, mostly less than 2 inches in diameter; calcareous; moderately alkaline.

The A horizon ranges from 24 to more than 60 inches in thickness. It ranges from dark gray to very dark gray.

The C horizon, to a depth of more than 60 inches, is stratified clay and clay loam. The strata are gray, dark gray, and grayish brown and are mottled in shades of gray, brown, and olive.

Tr—Trinity clay. This nearly level soil is on bottom lands. Slopes are about 0.5 percent across the flood plains. Most areas are narrow in shape and range from 10 to 150 acres in size. They are occasionally subject to flooding.

The surface layer is dark-gray, calcareous clay about 30 inches deep. The next lower layer, to a depth of 64 inches, is grayish-brown clay.

Included with this soil in mapping are small areas of Gowen soils and areas of soils that have deposits of clayey or loamy material from higher lying soils.

The hazard of erosion is slight.

This soil is used mostly for pasture. A few areas are used for crops. Capability unit IIw-2; pasture and hayland group 1A; Clayey Bottomland range site.

Tw—Trinity clay, frequently flooded. This nearly level soil has the profile described as representative of the series. It is on flood plains. Slopes are about 0.5 percent across the flood plains. Most areas range from 100 to 500 feet wide and are several miles long. These soils are subject to flooding several times each year, which results in continual change of scouring and depositional patterns.

Included with this soil in mapping are a few areas of soils that are not subject to annual flooding. Also included are areas of soils that have deposits of clayey and loamy sediment from higher lying soils.

The hazard of erosion is slight.

This soil is used for pasture or a combination of pasture and pecan orchards. Capability unit Vw-1; pasture and hayland group 1A; Clayey Bottomland range site.

Uhland Series

The Uhland series consists of deep, nearly level, somewhat poorly drained soils. These soils are on flood plains on bottom lands of some of the larger creeks. They formed in alluvial sediment of mixed origin. The native vegetation is mid and tall grasses and oak, elm, and willow trees.

In a representative profile the surface layer is grayish-brown clay loam about 6 inches thick. The next layer, to a depth of 18 inches, is brown, mottled fine sandy loam. The next lower layer, to a depth of 40 inches, is grayish-brown, mottled loam. The next lower layer, to a depth of 60 inches, is mottled fine sandy loam.

Permeability is moderately slow. Runoff is slow. The available water capacity is medium. These soils have a water table within 20 inches of the surface during wet periods. They are frequently subject to flooding for short periods, mostly in spring.

Most of the acreage is used for pasture and range.

Representative profile of Uhland clay loam in an area of Uhland soils, frequently flooded, in west Yegua Creek bottom 1.1 miles northeast of McDade, Texas, 100 feet west:

A1—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few, fine, faint mottles in shades of brown; weak, fine, subangular blocky structure; very hard, firm; few fine roots; few fine pores; neutral; abrupt, smooth boundary.

IIC1—6 to 18 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few, thin, darker colored strata that have fine mottles in shades of gray and brown; massive; hard, very friable; few fine roots; neutral; abrupt, smooth boundary.

IIC2—18 to 40 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; few, fine, distinct, gray and yellowish-brown mottles; massive; very hard, friable; neutral; abrupt, smooth boundary.

IIC3—40 to 60 inches, distinctly mottled light brownish-gray (10YR 6/2) and light yellowish-brown (10YR 6/4) fine sandy loam thinly stratified with mottled gray, brown, and yellow loam; massive; hard, friable; slightly acid.

The A horizon ranges from 4 to 12 inches in thickness. It ranges from clay loam and sandy clay loam to loam. It is dark grayish brown, grayish brown, brown, and dark brown and is mottled with gray, brown, or yellow in places.

The lower layers, to a depth of 60 inches, are stratified and range from fine sandy loam, loam, and sandy clay loam to loamy fine sand but are dominantly fine sandy loam. They are grayish brown, light brownish gray, dark grayish brown, brown, pale brown, light yellowish brown, and yellowish brown and have faint to distinct mottles in shades of gray, brown, and yellow. Reaction of all strata ranges from slightly acid to mildly alkaline.

Uh—Uhland soils, frequently flooded. These nearly level, loamy soils are on bottom lands. Slopes are less than 1 percent. Areas are mostly less than 500 feet wide and 2 or 3 miles long. This soil has a high water table. It is subject to flooding frequently during spring and occasionally at other periods of the year. Flooding results in frequent changing of the scouring and deposition patterns. The water table is about 20 to 30 inches from the surface during wet periods.

The surface layer is mostly clay loam, but in places it is sandy clay loam or loam.

The hazard of erosion is slight.

Most of this soil is used for pasture and range. Capability unit Vw-2; pasture and hayland group 2A; Loamy Bottomland range site.

Vernia Series

The Vernia series consists of deep, gently sloping to sloping, well-drained, very gravelly sandy soils. These soils are on ancient stream terraces in the uplands. They formed in thick beds of sand and gravel. The native vegetation is blackjack oak, post oak, and hickory and an understory of mid and tall bunchgrass.

In a representative profile (fig. 8) the surface layer

Figure 8.—Profile of a Vernia soil showing deep gravelly material.

is grayish-brown very gravelly loamy sand about 5 inches thick that is about 40 percent rounded siliceous pebbles. The next lower layer, to a depth of 48 inches, is pink very gravelly sand that is about 80 percent, by volume, rounded siliceous pebbles. The next lower layer, to a depth of 62 inches, is light-gray, mottled very gravelly sandy clay loam that is about 75 percent, by volume, quartz pebbles.

Permeability is rapid in the surface layer but moderate in the lower layers. Runoff is slow. The available water capacity is low.

Most of the acreage is used for range. Some areas have been stripped for road and building materials. Others are planned for building sites.

Representative profile of Vernia very gravelly loamy sand in an area of Vernia complex, 1 to 8 percent slopes, 0.7 mile south on Farm Road 1209 from its intersection with Texas Highway 71 in the western part of Bastrop County, 500 feet west into a wooded area:

A1—0 to 5 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; hard, very friable; few fine roots; about 40 percent, by volume, rounded siliceous pebbles, mostly 0.25 to 1 inch in diameter; slightly acid; clear, smooth boundary.

A2—5 to 48 inches, pink (7.5YR 7/4) very gravelly sand, light brown (7.5YR 6/4) moist; single grained; loose; few fine roots; about 80 percent, by volume, rounded siliceous pebbles that range from 0.25 inch to 3.0 inches in diameter; thin coatings of sand, silt, and clay on most pebbles; slightly acid; clear, smooth boundary.

B2t—48 to 62 inches, light-gray (10YR 7/1) very gravelly sandy clay loam; common, medium, distinct, yellowish-red (5YR 5/6) and brownish-yellow (10YR 6/6) mottles; weak, medium, blocky structure; very hard, friable; about 75 percent rounded siliceous pebbles, mostly less than 2 inches in diameter; clay, silt, and sand on pebbles; strongly acid.

The solum is more than 60 inches thick.

The A horizon ranges from 40 to more than 60 inches in thickness. It is very gravelly loamy sand or very gravelly sand that is 50 to 85 percent, by volume, siliceous pebbles and cobbles. The A1 horizon is 4 to 18 inches thick. It is grayish brown, light brownish gray, brown, or pale brown. The A2 horizon ranges from 36 to 70 inches thick and is pink, light brown, or very pale brown. Reaction ranges from slightly acid to neutral.

The B2t horizon ranges from 8 to more than 14 inches in thickness. It is gravelly or very gravelly sandy clay loam to gravelly or very gravelly sandy loam that is 20 to 32 percent clay in the upper 20 inches. It is 35 to 80 percent, by volume, siliceous pebbles. It is light gray or light brownish gray and is mottled in shades of red, gray, yellow, and brown. Reaction is strongly acid to very strongly acid.

VeD—Vernia complex, 1 to 8 percent slopes. This gently sloping to sloping soil is on uplands. Slopes are mostly 1 to 3 percent, but they range to 8 percent. Areas are oval to irregular in shape and average about 30 acres in size.

Included with this soil in mapping are areas of Axtell, Tabor, Demona, and Patilo soils. Included soils make up as much as 10 percent of the mapped areas.

The hazard of erosion is slight.

This soil is used mostly for range. During wet periods bermudagrass pasture has been established on this soil. A few areas have been stripped for sand and gravel, and some areas are planned for use as homesites. Capability unit IVs-2; pasture and hayland group 9B; Gravelly range site.

Wilson Series

The Wilson series consists of deep, nearly level to gently sloping, somewhat poorly drained, loamy to clayey soils. These soils are on broad terraces and uplands. They formed in old, alkaline alluvium and marine clay. The native vegetation is mid and tall prairie grasses and a few scattered elm and mesquite trees.

In a representative profile the surface layer is dark-gray clay loam about 6 inches thick. The subsoil, to a depth of 42 inches, is clay that is dark gray in the upper part and gray in the lower part. The next lower layer, to a depth of 65 inches, is mottled, calcareous clay. The upper part is grayish brown, and the lower part is light brownish gray.

Permeability is very slow. Runoff is very slow to medium. The available water capacity is high. These soils have a perched water table at a depth of 6 to 12 inches after heavy rain.

About half of the acreage is used for crops. The rest is used mostly for pasture and range.

Representative profile of Wilson clay loam, 1 to 3 percent slopes, in a field 0.5 mile east on Texas Highway 21 from its intersection with Farm Road 812, 80 feet south:

A1—0 to 6 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; very hard, very firm; few fine roots; few fine pores; few, small siliceous pebbles; slightly acid; abrupt, wavy boundary.

B21tg—6 to 28 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, blocky structure; extremely hard, very firm; vertical cracks filled with material from A1 horizon; clay films on faces of peds; slightly acid; gradual, wavy boundary.

B22tg—28 to 42 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, brownish-colored mottles; weak, medium, blocky structure; extremely hard, very firm; clay films on most peds; few calcium carbonate and dark-brown concretions; mildly alkaline; gradual, wavy boundary.

B3g—42 to 56 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few, fine, brownish-colored mottles; weak, medium, blocky structure; extremely hard, very firm; patchy clay films on peds; few dark-brown concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—56 to 65 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; mottled in shades of brown, olive, and yellow; massive; extremely hard, very firm; few, soft calcium carbonate bodies and concretions; few shale fragments in lower part; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The B21tg horizon is saturated with water at some season during most years, but in most years during dry periods cracks form, 0.5 inch wide, from the top of the B21tg horizon to a depth of 30 inches.

The A horizon ranges from 4 to 10 inches in thickness. It is clay loam and gravelly clay loam. In places it ranges from 15 to 40 percent, by volume, siliceous pebbles. It is gray, dark gray, grayish brown, very dark gray, and dark grayish brown. Reaction ranges from slightly acid to neutral in the A and B21tg horizons.

The B2tg horizon ranges from 22 to 52 inches in thickness. It ranges from clay to clay loam that is 35 to 50 percent clay. It ranges from very dark gray and dark gray to gray and has mottles that range from none to common in shades of brown and yellow. To a depth of 30 inches, it has chroma of 1 or less throughout 60 percent of the matrix.

The B3g horizon ranges from 8 to 20 inches in thickness. It is gray, light gray, dark gray, grayish brown, and light brownish gray. It has common to many, distinct mottles in shades of brown, yellow, olive, and in places red. Reaction ranges from neutral to moderately alkaline.

The C horizon ranges from clay and silty clay to clay marl. It is gray, yellowish red, and light brownish gray and is mottled in shades of gray, brown, yellow, and olive. Reaction ranges from mildly alkaline to moderately alkaline.

WgB—Wilson gravelly clay loam, 1 to 3 percent slopes. This gently sloping soil is on ridgetops. Areas are oval. They range from 5 to 100 acres in size but are mostly 25 acres or less.

The surface layer is gray gravelly clay loam about 6 inches thick that is about 25 percent, by volume, rounded, siliceous pebbles. The subsoil, to a depth of 30 inches, is dark-gray clay. The next lower layer, to a depth of 58 inches, is gray, mottled clay. The next lower layer, to a depth of 64 inches, is light brownish-gray, mottled clay.

Included with this soil in mapping are small areas of Crockett, Mabank, and Burleson soils that make up 5 to 15 percent of the mapped areas.

The hazard of erosion is moderate.

This soil is used mostly for pasture and range. A few areas are used for crops. Capability unit IIIe-2; pasture and hayland group 7H; Claypan Prairie range site.

WgC—Wilson gravelly clay loam, 3 to 5 percent slopes. This gently sloping soil is mostly on sides of drainageways but is also on ridgetops. Areas are mostly below the ridgetops in irregular patterns. They range from 10 to 200 acres in size but average about 40 acres.

The surface layer is dark-gray gravelly clay loam about 8 inches thick that is about 20 percent, by volume, rounded siliceous pebbles. The subsoil, to a depth of 36 inches, is clay. It is very dark gray in the upper part and dark gray in the lower part. The next lower layer, to a depth of 64 inches, is mottled clay. It is grayish brown in the upper part and light brownish gray in the lower part.

Included with this soil in mapping are areas of Crockett and Burleson soils. The included Crockett soils make up as much as 15 percent of some mapped areas, and the Burleson soils as much as 25 percent. Also included, mostly in small areas near the ridgetops, are areas of soils that have slopes of 6 to 8 percent. These included soils make up less than 15 percent of the mapped areas.

The hazard of erosion is moderate.

This soil is used mostly for pasture and range. Capability unit IVe-2; pasture and hayland group 7H; Claypan Prairie range site.

WsA—Wilson clay loam, 0 to 1 percent slopes. This nearly level soil is on terraces and in low drainageways of the uplands. Areas are mostly long and narrow, but on the broader ridgetops they are somewhat oval. Most areas range from 5 to 70 acres in size.

The surface layer is dark-gray clay about 6 inches thick. The subsoil, to a depth of 26 inches, is dark-gray clay. The next lower layer, to a depth of 50 inches, is gray clay. The next lower layer, to a depth of 62 inches, is mottled, calcareous clay.

Included with this soil in mapping are small areas of Burleson clay and Mabank and Crockett soils. Included soils make up as much as 10 to 15 percent of some mapped areas.

The hazard of erosion is slight.

This soil is used mostly for crops. Some areas are used for pasture and range. Capability unit IIIw-1; pasture and hayland group 7H; Claypan Prairie range site.

WsB—Wilson clay loam, 1 to 3 percent slopes. This gently sloping soil has the profile described as representative of the series. It is on broad ridgetops and in drainageways. Areas are long and narrow to oval in shape and range from 5 to 130 acres in size.

Included with this soil in mapping are small areas of Burleson, Behring, and Mabank soils. These included soils are in areas of less than 5 acres and make up less than 15 percent of any mapped area.

The hazard of erosion is slight.

This soil is used mostly for crops. Some areas are used for pasture, and other areas are used for range. Capability unit IIIe-2; pasture and hayland group 7H; Claypan Prairie range site.

Use and Management of the Soils

Major uses, limitations, and management needs of the soils of Bastrop County are described in this section. The system of capability grouping used by the Soil Conservation Service is explained, and the management of the soils by capability units is discussed. Predicted yields for the principal crops are shown. The management of the soils for pasture and hay, range, woodland, and wildlife habitat is also described. The properties and features that affect engineering practices are shown, mainly in tables.

Management of the Soils for Crops

In Bastrop County about 22 percent of the acreage is used for crops. Most of the acreage is in the Colorado River valley and on prairies in the western part of the county.

The main crops grown are grain sorghum, cotton, oats, corn, and forage sorghum. In Bastrop County management is needed that controls erosion, conserves moisture, and maintains fertility and tilth. In the following paragraphs the main practices used to accomplish these purposes are described.

Use of crop residue.—A sufficient amount of residue left on the surface of the soil helps to control erosion and conserve moisture. Crop residue also helps maintain or improve soil fertility and tilth.

Terraces farmed on the contour.—Terraces farmed

on the contour help to control erosion. They also conserve more of the rainfall by slowing runoff.

Use of cover crops.—Cover crops furnish protective cover during seasons of heavy rainfall. Including small grain in the cropping system is the main practice used in this county. Critical erosion periods are from March to May and from September to November.

Maintaining soil fertility.—Crops respond to fertilizers when soil moisture is sufficient. In most years use of fertilizer has proven economical on most soils under dryland farming. Under irrigation, fertilizer must be used in order to maintain adequate growth of crops. A soil test should be made to determine the kind and amounts of fertilizer to apply. Information about soil testing and application of fertilizers can be obtained from the Soil Conservation Service or the Agricultural Extension Service.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming 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 that require 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, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These groups are described in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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 habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture, range, woodland, or wildlife habitat. (None in Bastrop County.)

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes. (None in Bastrop County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is manitained; *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 some parts of the United States but not in Bastrop County, 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, although they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, 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, IIe-3 or IIIe-5. 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 paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Bastrop County are described, and suggestions for the use and management of the soils are given.

CAPABILITY UNIT I-1

This unit consists of deep, nearly level soils on bottom lands and low terraces. These soils have a loamy surface layer and loamy lower layers.

Permeability is moderate. The available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops. A few areas have scattered pecan trees (fig. 9). Small grain and forage sorghum are grown for temporary grazing and hay.

Maintaining or improving soil fertility, soil tilth, and organic-matter content and conserving moisture are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT I-2

This unit consists of deep, nearly level soils on stream terraces and bottom lands. These soils have a loamy surface layer and loamy lower layers.

Permeability is moderate. The available water capacity is high. The hazard of erosion is slight.

Figure 9.—Scattered native pecan trees on Norwood silty clay loam.

Cotton and grain sorghum are the main crops. Small grain and forage sorghum are grown for temporary pasture and hay. Scattered pecan trees on these soils are used for shade and production of nuts.

Maintaining or improving soil fertility, soil tilth, and organic-matter content and conserving moisture are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT IIe-1

This unit consists of deep, gently sloping soils on uplands. These soils have a loamy or clayey surface layer and clayey lower layers.

Permeability is slow to very slow, and the movement of water and air and the growth of plant roots are restricted. Water enters the soil rapidly through surface cracks when the soil is dry and slowly to very slowly when it is wet. The available water capacity is high. The hazard of erosion is slight to moderate.

Cotton and grain sorghum are the main crops. Small grain and forage sorghum are grown for temporary pasture and hay.

Controlling erosion, conserving moisture, and improving or maintaining soil tilth are the main concerns of management. Terracing and contour farming help to control erosion and to conserve moisture. Keeping crop residue on the surface of the soil helps to maintain or improve soil tilth.

CAPABILITY UNIT IIe-2

Only Rosanky fine sandy loam, 1 to 3 percent slopes, is in this unit. It is a deep, gently sloping soil on uplands. This soil has a loamy surface layer and clayey or loamy lower layers.

Permeability is moderately slow. The available water capacity is medium. The hazard of erosion is moderate.

Most areas of these soils are used for range or pasture. A few small areas are used for crops. Grain sorghum and forage are the main crops.

Conserving moisture and organic-matter content, controlling erosion, and maintaining soil tilth are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain organic-matter content and soil tilth.

CAPABILITY UNIT IIe-3

Only Bastrop fine sandy loam, 1 to 3 percent slopes, is in this unit. It is a deep, gently sloping soil on terraces. This soil has a loamy surface layer and loamy lower layers.

Permeability is moderate. Available water capacity is high. The hazard of erosion is moderate.

Cotton and grain sorghum are the main crops.

Conserving moisture, maintaining soil tilth, and controlling erosion are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain soil tilth.

CAPABILITY UNIT IIs-1

Only Krum silty clay, 0 to 1 percent slopes, is in this unit. It is a deep, nearly level soil on stream terraces. This soil has a clayey surface layer and clayey lower layers.

Permeability is moderately slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. Water enters the soil rapidly through surface cracks when the soil is dry but moderately slowly when it is wet. The available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops.

Maintaining or improving soil tilth is the main concern of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT IIs-2

Only Ships silty clay is in this unit. It is a deep, nearly level soil on bottom lands. This soil has a clayey surface layers and clayey lower layers.

Permeability is very slow, and the movement of water and air and the growth of plant roots are restricted. Water enters the soil rapidly through surface cracks when the soil is dry but very slowly when it is wet. The available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops.

Maintaining soil tilth is the main concern of management. Keeping crop residue on the surface of the soil helps to maintain or improve soil tilth.

CAPABILITY UNIT IIw-1

Only Houston Black clay, 0 to 1 percent slopes, is in this unit. It is a deep, nearly level soil on uplands. This soil has a clayey surface layer and clayey lower layers.

Permeability is very slow, and the movement of water and air and the growth of plant roots are restricted. Water enters the soil rapidly through surface cracks when the soil is dry but very slowly when it is wet. The available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops (fig. 10).

Maintaining good tilth and improving internal drainage are the main concerns of management. Proper row direction may help to remove excess surface water. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IIw-2

Only Trinity clay is in this unit. It is a deep, nearly level soil on bottom lands. This soil has a clayey surface layer and clayey lower layers.

Permeability is very slow, and the movement of water and air and the growth of plant roots are restricted. Water enters this soil rapidly through surface cracks when the soil is dry but very slowly when it is wet. The available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops.

Maintaining good soil tilth and improving internal drainage are the main concerns of management. Proper row direction may help to remove excess water. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IIIe-1

This unit consists of deep, gently sloping soils on uplands. These soils have a loamy to clayey surface layer and clayey lower layers.

Permeability is slow to very slow, and the movement of water and air and the growth of plant roots are restricted. Water enters this soil rapidly through deep surface cracks when the soil is dry but slowly to very slowly when it is wet. The available water capacity is high. The hazard of erosion is moderate. Rills, gullies, and sheet erosion occur on the eroded soils in this unit.

Cotton and grain sorghum are the main crops.

Controlling erosion, conserving moisture, and maintaining good soil tilth are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IIIe-2

This unit consists of deep, gently sloping soils on uplands. These soils have a loamy surface layer and clayey to loamy lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. The available water capacity is medium to high. The hazard of erosion is moderate.

Corn and grain sorghum are the main crops.

Controlling erosion, maintaining soil tilth, and conserving moisture are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain soil tilth.

CAPABILITY UNIT IIIe-3

Only Bastrop fine sandy loam, 3 to 5 percent slopes, eroded, is in this unit. It is a deep, gently sloping soil on stream terraces. This soil has a friable, loamy surface layer and loamy lower layers.

Permeability is moderate. The available water ca-

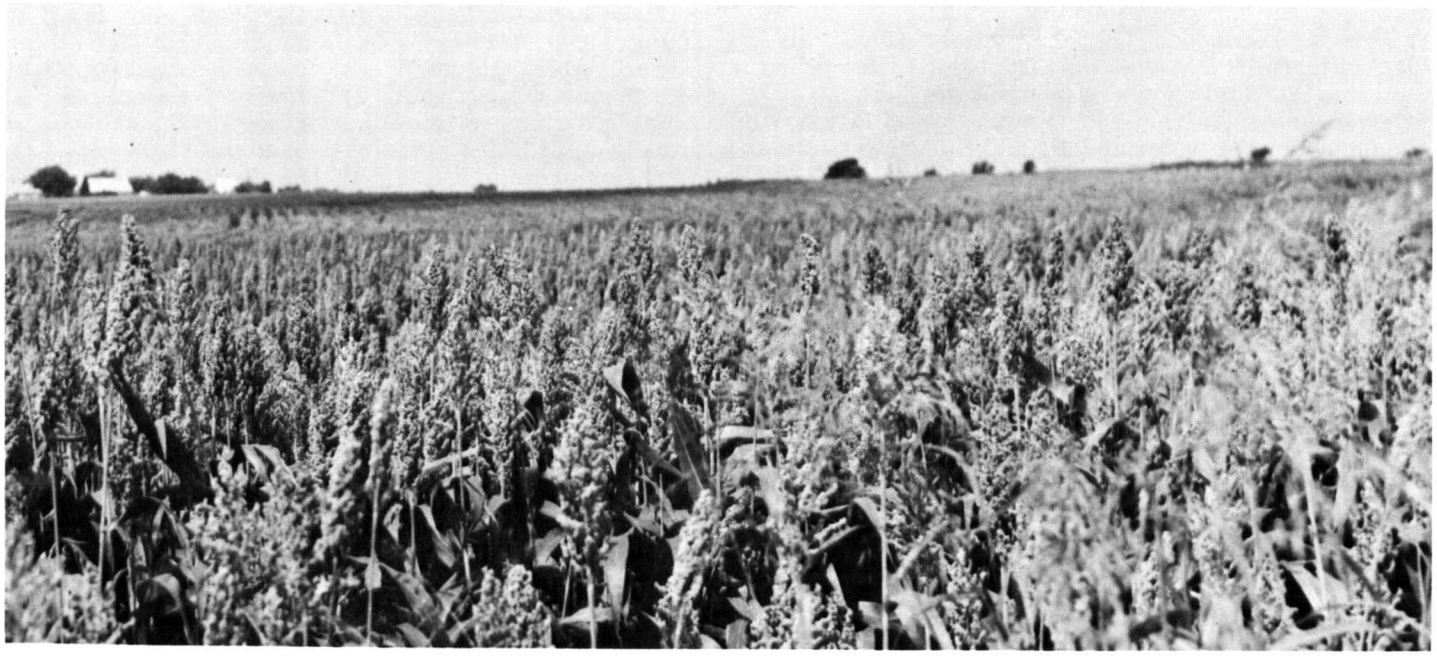

Figure 10.—**A good stand of grain sorghum on Houston Black clay.**

pacity is high. The hazard of erosion is moderate.

Cotton and grain sorghum are the main crops.

Controlling erosion, conserving moisture, and maintaining good soil tilth are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IIIe-4

Only Tabor fine sandy loam, 1 to 3 percent slopes, is in this unit. It is a deep, gently sloping soil on uplands. This soil has a loamy surface layer and clayey lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. The available water capacity is high. The hazard of erosion is slight.

A few areas of this soil are used for crops. Cotton and grain sorghum are the main crops.

Controlling erosion, conserving moisture, and maintaining soil tilth are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IIIe-5

This unit consists of deep, nearly level to gently sloping soils on uplands. These soils have a sandy surface layer and loamy to clayey lower layers.

Permeability of these soils is moderately slow to moderate. The available water capacity is low to medium. The hazard of erosion is slight to moderate.

Peanuts and truck crops are the main crops.

Maintaining or improving soil tilth and fertility and controlling erosion are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT IIIs-1

This unit consists of deep, nearly level soils on stream terraces and uplands. These soils have a loamy surface layer and clayey to loamy lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. The available water capacity is high. The hazard of erosion is slight.

Corn and grain sorghum are the main crops.

Maintaining soil tilth and conserving moisture are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT IIIw-1

This unit consists of deep, nearly level soils on uplands. These soils have a loamy surface layer and clayey lower layers.

Permeability is very slow in the lower layers. The available water capacity is medium to high. The hazard of erosion is slight.

Grain sorghum and corn are the main crops.

Maintaining soil tilth is the main concern of management. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IVe-1

This unit consists of deep, sloping soils on uplands. These soils have a loamy to clayey surface layer and clayey lower layers.

Permeability is slow to very slow, and the movement of water and air and the growth of plant roots are restricted. Water enters this soil rapidly through surface cracks when the soil is dry but slowly to very slowly when it is wet. The available water capacity is high. The hazard of erosion is severe. Rills and gullies are in many places.

A few areas of this soil are used for crops. Cotton and grain sorghum are the main crops.

Controlling erosion and maintaining soil tilth are the main concerns of management. Terraces and contour farming help to control erosion. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IVe-2

This unit consists of deep, gently sloping soils on uplands. These soils have a loamy to gravelly loamy surface layer and clayey to loamy lower layers.

Permeability is very slow, and the movement of water and air and the growth of plant roots are restricted. The available water capacity is high. The hazard of erosion is moderate to severe.

A few areas of these soils are used for crops. Corn and grain sorghum are the main crops.

Controlling erosion, conserving moisture, and maintaining soil tilth are the main concerns of management. Terraces and contour farming help to control erosion and conserve moisture. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IVe-3

This unit consists of deep, gently sloping to sloping soils on upland stream terraces. These soils have a surface layer of loam to gravelly loam and clayey to loamy lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. Available water capacity is high. The hazard of erosion is moderate to severe.

A few areas of these soils are used for crops. Corn and grain sorghum are the main crops.

Controlling erosion and maintaining soil tilth are the main concerns of management. Terraces and contour farming help to control erosion and to conserve moisture. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IVe-4

Only Rosanky fine sandy loam, 3 to 8 percent slopes, is in this unit. It is deep, gently sloping to sloping soil on uplands. This soil has a loamy surface layer and clayey to loamy lower layers.

Permeability is moderately slow. The available water capacity is medium. The hazard of erosion is severe.

Grain and forage sorghum are the main crops.

Controlling erosion is the main concern of management. Terraces and contour farming help to control

erosion. Keeping crop residue on the surface of the soil helps to maintain good tilth.

CAPABILITY UNIT IVe-5

This unit consists of deep, gently sloping to strongly sloping soils on uplands. These soils have a sandy surface layer and loamy lower layers.

Permeability is moderate to moderately slow. The available water capacity is low. The hazard of erosion is slight. These soils are droughty during part of the growing season.

A few areas of this soil are used for crops. Peanuts and truck crops are the main crops.

Maintaining or improving soil tilth, controlling erosion, and conserving moisture are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT IVs-1

This unit consists of deep, nearly level to gently sloping soils on bottom lands. These soils have a sandy to loamy surface layer and sandy lower layers.

Permeability is rapid. The available water capacity is low. The hazard of erosion is slight. These soils are seldom to occasionally subject to flooding and have little scouring or deposition.

These soils are used mostly for pasture, range, and recreation.

Maintaining soil tilth and controlling erosion are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT IVs-2

Only Vernia complex, 1 to 8 percent slopes, is in this unit. It is a gently sloping to sloping soil on uplands. This soil has a very gravelly sandy surface layer and very gravelly loamy lower layers.

Permeability is moderate. The available water capacity is slow. The hazard of erosion is slight.

This soil is mostly in woodland used for range.

Maintaining soil tilth and controlling erosion are the main concerns of management. Keeping crop residue on the surface of the soil is beneficial.

CAPABILITY UNIT Vw-1

Only Trinity clay, frequently flooded, is in this unit. It is a deep, nearly level soil on bottom lands. This soil has a clayey surface layer and clayey lower layers.

Permeability is very slow. The available water capacity is high. The hazard of erosion is slight.

Flooding makes this soil unsuitable for crops. It is better suited to range, pasture, and wildlife habitat than to other uses.

CAPABILITY UNIT Vw-2

This unit consists of deep, nearly level soils on bottom lands. These soils have a loamy surface layer and loamy lower layers.

Permeability is moderate to moderately slow. The available water capacity is medium to high. The hazard of erosion is slight. These soils are frequently subject to flooding by runoff from surrounding higher lying soils or by overflow from the streams. During flooding, these soils are subject to scouring and deposition of fresh alluvial sediments on the flood plains of these streams.

Frequent flooding makes these soils unsuitable for cultivation. They are better suited to range, pasture, and wildlife habitat than to other uses.

CAPABILITY UNIT Vw-3

This unit consists of deep, nearly level to gently sloping soils on bottom lands. These soils have a loamy to sandy surface layer and sandy lower layers.

Permeability is rapid. The available water capacity is low. The hazard of erosion is slight. These soils are frequently subject to flooding and to scouring and deposition of fresh alluvial material during each overflow.

Frequent flooding makes these soils unsuitable for cultivation. They are better suited to pasture, range, recreation, and wildlife habitat than to other uses.

CAPABILITY UNIT VIe-1

Only Ferris clay, 5 to 20 percent slopes, eroded, is in this unit. It is a deep, sloping to moderately steep soil on uplands. This soil has a clayey surface layer and clayey lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. Water enters this soil rapidly through surface cracks when the soil is dry but very slowly when it is wet. The available water capacity is high. The hazard of erosion is severe.

This soil is too steep and too eroded to be suitable for cultivation. It is better suited to pasture and range than to other uses.

CAPABILITY UNIT VIe-2

This unit consists of deep, gently sloping to strongly sloping soils on uplands. These soils have a loamy to gravelly loamy surface layer and clayey to loamy lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. The available water capacity is high. The hazard of erosion is severe.

These soils are too steep and too eroded to be suitable for cultivation. They are better suited to pasture, range, and wildlife habitat than to other uses.

CAPABILITY UNIT VIe-3

Only Axtell fine sandy loam, 5 to 12 percent slopes, is in this unit. It is a deep, sloping to strongly sloping soil on stream terraces and uplands. This soil has a loamy surface layer and clayey lower layers.

Permeability is very slow in the lower layers, and the movement of water and air and the growth of plant roots are restricted. The available water capacity is high. The hazard of erosion is severe.

This soil is too steep and too eroded to be suitable for cultivation. It is better suited to pasture, range, and wildlife habitat.

CAPABILITY UNIT VIe-4

Only Jedd stony soils, 5 to 20 percent slopes, is in this unit. They are moderately deep, sloping to moderately steep soils on uplands. These soils have a stony gravelly loamy surface layer and clayey lower layers.

Permeability is moderately slow in the lower layers. The available water capacity is medium. The hazard of erosion is severe.

These soils are too steep, too gravelly, and too stony to be suitable for cultivation. They are better suited to range and wildlife habitat.

CAPABILITY UNIT VIe-5

Only Shep clay loam, 3 to 8 percent slopes, eroded, is in this unit. It is a deep, gently sloping to sloping soil on uplands. This soil has a loamy surface layer and loamy lower layers.

Permeability is moderate. The available water capacity is high. The hazard of erosion is severe.

This soil is too steep and too eroded to be suitable for cultivation. It is better suited to pasture, range, and wildlife habitat than to other uses.

Predicted yields

Table 2 lists predicted yields of the principal crops grown in Bastrop County. The predictions are based on estimates made by farmers, soil scentists, and others who have knowledge of yields in the county and on information taken from research data. The predicted yields are average yields per acre that can be expected by good commercial farmers at the level of management that tends to produce the highest economic returns. The yields shown are for dryland soils. Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because their acreage is small or reliable data on yields are not available.

A high level of management for dryland soils in Bastrop County includes the following practices:

1. Rainfall is effectively used and conserved.
2. Surface and subsurface drainage systems are installed.
3. Crop residue is managed to maintain good tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Suited crop varieties are used at optimum seeding rates.

Pasture and Hayland

Most farms in Bastrop County have some improved pasture. These pastures are made up of different kinds of grasses, but common or improved bermudagrass is the dominant perennial grass in most pastures.

The major management practices needed on pasture should be applied according to plant needs, the level of production desired, and the results of soil tests. Weeds can be controlled by mechanical means, such as mowing or shredding, or by use of weed control herbicides. Weed control on well-managed pasture is less of a problem than it is on overused, poorly managed pasture.

Temporary pasture is often used to supplement permanent pasture or for hay. Sudangrass, johnsongrass, and sorghum-sudangrass mixtures make good supplemental summer pasture. Small grain provides good supplemental winter forage.

In Bastrop County hay is made largely from the temporary and permanent grasses that follow periods of excessive rainfall. Under good management, yields range from 3 to 6 tons or more per acre, depending upon the soil, the grass used, the amount of fertilizer applied, and the amount and distribution of rainfall during the growing season.

Management considerations for hay are generally the same as those for good pasture. Hay should be cut at a height that has been proved best for the grass used. Cutting too close to the ground or too frequently damages hay in the same way that overgrazing damages pasture.

Pasture and hayland groups

The soils in Bastrop County have been placed in 14 pasture and hayland groups, according to their suitability for the production of forage. The soils in each group are enough alike to be suited to the same grasses, have similar limitations and hazards, require similar management, and have similar productivity and other responses to management.

The pasture and hayland groups in Bastrop County are described in the following pages. They are identified by symbols, such as "7A." These symbols, which are made up of a number and letter, are part of a Statewide system. Not all groups of the system are represented by the soils of Bastrop County; therefore, the numbers and letters are not consecutive. The names of the soils in any one group can be found by referring to the Guide to Mapping Units at the back of this survey. An adequate supply of water for livestock is needed for all pastures.

PASTURE AND HAYLAND GROUP 1A

In this group are deep, nearly level, clayey soils on bottom lands.

These soils crack and take in water rapidly when they are dry, but they expand and are very slowly permeable when wet. Available water capacity is high.

Preparing a seedbed is difficult. Fertilizer is needed for sustained forage production. Some areas receive extra water and fertilizer from occasional or frequent overflow.

Suited pasture grasses are common bermudagrass, Coastal bermudagrass, johnsongrass, and kleingrass. Coastal bermudagrass and johnsongrass are suitable for hay.

PASTURE AND HAYLAND GROUP 2A

In this group are deep, nearly level, loamy soils on bottom lands and low terraces.

Permeability is moderately slow to moderate. Available water capacity is medium to high.

TABLE 2.—*Predicted average acre yields of principal crops*

[Absence of entry indicates the crop is not suited to or is not commonly grown on the soil]

Soil	Cotton	Corn	Grain sorghum	Peanuts	Tame pasture
	Lbs of lint	*Bu*	*Lbs*	*Lbs*	*AUM*[1]
Axtell fine sandy loam, 0 to 1 percent slopes	250	35	2,500		6.0
Axtell fine sandy loam, 1 to 5 percent slopes	200	25	1,500		5.0
Axtell fine sandy loam, 2 to 5 percent slopes, eroded	150	20	1,200		4.0
Axtell fine sandy loam, 5 to 12 percent slopes, eroded					4.0
Axtell-Tabor complex, 1 to 8 percent slopes					4.5
Bastrop fine sandy loam, 0 to 1 percent slopes	400	60	4,000		7.0
Bastrop fine sandy loam, 1 to 3 percent slopes	350	50	3,250		6.0
Bastrop fine sandy loam, 3 to 5 percent slopes, eroded	300	40	2,500		4.5
Behring clay loam, 1 to 3 percent slopes	350	40	4,500		7.0
Behring clay loam, 3 to 5 percent slopes, eroded	300	30	2,750		6.0
Behring clay loam, 5 to 8 percent slopes, eroded	250	30	2,250		5.5
Bosque loam	450	60	3,750		7.5
Burleson clay, 1 to 3 percent slopes	350	45	4,500		7.0
Crockett fine sandy loam, 1 to 3 percent slopes	350	40	3,000		7.0
Crockett gravelly sandy loam, 1 to 5 percent slopes					6.0
Crockett gravelly loam, 5 to 10 percent slopes					5.0
Crockett soils, 2 to 5 percent slopes, eroded	200	30	2,500		5.5
Crockett soils, 5 to 10 percent slopes, eroded					5.0
Crockett soils, 3 to 8 percent slopes, severly eroded					4.5
Demona loamy fine sand, 1 to 5 percent slopes			1,750	1,200	6.0
Demona loamy fine sand, somewhat poorly drained variant			1,750	1,300	6.0
Dougherty loamy fine sand, 0 to 3 percent slopes	250		1,750	1,300	5.0
Dougherty loamy fine sand, 3 to 8 percent slopes			1,500	1,100	5.0
Ferris clay, 5 to 20 percent slopes, eroded					4.0
Gowen soils, frequently flooded					8.0
Heiden clay, 1 to 3 percent slopes	400	50	4,500		8.0
Heiden clay, 3 to 5 percent slopes, eroded	350	45	2,750		6.0
Heiden clay, 5 to 8 percent slopes, eroded			1,750		4.0
Houston Black clay, 0 to 1 percent slopes	500	60	5,000		8.0
Houston Black clay, 1 to 3 percent slopes	450	45	4,750		8.0
Jedd stony soils, 5 to 20 percent slopes					3.5
Krum silty clay, 0 to 1 percent slopes	450		4,000		8.0
Lincoln soils					5.5
Lincoln soils, frequently flooded					5.5
Mabank loam, 0 to 1 percent slopes	350	40	3,000		6.0
Mabank loam, 1 to 3 percent slopes	300	35	2,750		6.0
Norwood loam	400	75	3,750		8.0
Norwood silty clay loam	450	80	4,000		8.0
Patilo complex, 1 to 12 percent slopes				1,000	4.0
Rosanky fine sandy loam, 1 to 3 percent slopes	300	30	2,750		5.0
Rosanky fine sandy loam, 3 to 8 percent slopes			2,000		4.5
Sayers fine sandy loam		20	1,500	1,000	6.0
Sayers fine sandy loam, frequently flooded					6.5
Shep clay loam, 3 to 8 percent slopes, eroded					4.5
Ships silty clay	550		5,000		9.0
Silstid loamy fine sand, 1 to 5 percent slopes			1,750	1,200	5.0
Smithville fine sandy loam	450	70	4,500		8.0
Tabor fine sandy loam, 0 to 1 percent slopes		40	3,000		6.0
Tabor fine sandy loam, 1 to 3 percent slopes		40	3,000		6.0
Trinity clay	450	60	5,000		8.0
Trinity clay, frequently flooded					8.0
Uhland soils, frequently flooded					8.0
Vernia complex, 1 to 8 percent slopes					3.0
Wilson clay loam, 0 to 1 percent slopes	350	45	3,000		5.5
Wilson clay loam, 1 to 3 percent slopes	300	40	2,750		5.5
Wilson gravelly clay loam, 1 to 3 percent slopes					5.0
Wilson gravelly clay loam, 3 to 5 percent slopes					5.0

[1] AUM stands for animal-unit-month, a term used to express the carrying capacity of pasture. It is the number of months that one animal unit can graze 1 acre without injury to the pasture. An animal unit is one cow, one steer, one horse, five hogs, or seven sheep.

Establishing grasses on these soils is difficult where flooding occurs. The flooded areas are subject to scouring and deposition. Fertilizer is needed for sustained production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common bermudagrass, kleingrass, weeping lovegrass, switchgrass, and Kle-

Figure 11.—Stacks of hay harvested on Smithville fine sandy loam.

berg, Gordo, King Ranch, and Medio bluestem. Coastal bermudagrass, kleingrass, weeping lovegrass, and johnsongrass are suitable for hay (fig. 11).

PASTURE AND HAYLAND GROUP 3A

In this group are deep, nearly level to gently sloping, sandy to loamy soils on bottom lands along creeks and rivers. Most areas have several short slopes created by entrenching waterways.

Permeability is rapid. Available water capacity is low.

Establishing grasses by seeding presents special concerns in management. Preparing a firm seedbed is difficult, and seedlings that emerge from a clean seedbed can be cut down by blowing sand or wither from lack of moisture. Frequent applications of fertilizer are needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common bermudagrass, Coastal bermudagrass, and weeping lovegrass. Coastal bermudagrass and weeping lovegrass are suitable for hay.

PASTURE AND HAYLAND GROUP 7A

In this group are deep, nearly level to gently sloping, loamy to clayey soils on terraces and uplands. Some areas of these soils are eroded.

These soils crack and take in water rapidly when they are dry, but they expand and are slowly permeable or very slowly permeable when wet. Available water capacity is high.

Preparing a seedbed is difficult. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common bermudagrass, Coastal bermudagrass, kleingrass, and King Ranch and Kleberg bluestem. Kleberg bluestem, johnsongrass, and Coastal bermudagrass are suitable for hay.

PASTURE AND HAYLAND GROUP 7B

In this group are deep, sloping to moderately steep, clayey soils on uplands. These soils are eroded.

These soils crack and take in water rapidly when they are dry, but they expand and are slowly permeable or very slowly permeable when wet. Available water capacity is high.

Preparing a seedbed is difficult. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are King Ranch and Kleberg bluestem, johnsongrass, kleingrass, and common and Coastal bermudagrass. Coastal bermudagrass is suitable for hay.

PASTURE AND HAYLAND GROUP 7C

Only Krum silty clay, 0 to 1 percent slopes, is in

this group. It is a deep, nearly level, clayey soil on stream terraces.

Permeability is moderately slow. During dry periods the soil cracks and takes in water rapidly. Available water capacity is high.

Preparing a seedbed is difficult. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses include such species as common and Coastal bermudagrass, kleingrass, and johnsongrass. All but common bermudagrass are suitable for hay.

PASTURE AND HAYLAND GROUP 7D

Only Shep clay loam, 3 to 8 percent slopes, eroded, is in this group. It is a deep, loamy soil on uplands.

Permeability is moderate. Available water capacity is high.

Preparing a seedbed presents no special concern in management. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suitable pasture grasses are King Ranch and Kleberg bluestem, weeping lovegrass, common and Coastal bermudagrass, and kleingrass. Kleingrass, johnsongrass, and Coastal bermudagrass are suitable for hay.

PASTURE AND HAYLAND GROUP 7H

In this group are deep, nearly level to gently sloping, loamy to gravelly loamy soils on uplands.

Permeability is very slow. Available water capacity is high.

Preparing a seedbed is rather difficult because of the crusting and rapid loss of surface moisture. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common and Coastal bermudagrass, kleingrass, and King Ranch and Kleberg bluestem. Kleingrass, johnsongrass, and Coastal bermudagrass are suitable for hay.

PASTURE AND HAYLAND GROUP 8A

In this group are deep, nearly level to sloping, loamy to gravelly loamy soils on terraces and uplands.

Permeability is very slow. Available water capacity ranges from medium to high.

Preparing a seedbed presents no special concern in management. Fertilizer is needed for sustained forage production.

Yields from pasture or hay vary according to the level of management and the amount of rainfall. Suited pasture grasses are common and Coastal bermudagrass and kleingrass. Coastal bermudagrass and kleingrass are suitable for hay.

PASTURE AND HAYLAND GROUP 8B

In this group are deep, gently sloping to strongly sloping, loamy to gravelly loamy soils on uplands.

Permeability is very slow. Available water capacity is high.

Preparing a seedbed presents no special concerns in management. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common and Coastal bermudagrass, kleingrass, and King Ranch bluestem. Coastal bermudagrass and kleingrass are suitable for hay.

PASTURE AND HAYLAND GROUP 8C

In this group are deep, nearly level to sloping, loamy soils on terraces and uplands.

Permeability is moderately slow to moderate. Available water capacity ranges from medium to high.

Preparing a seedbed presents no special concern in management. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common and Coastal bermudagrass, kleingrass, and weeping lovegrass. All but common bermudagrass are suitable for hay.

PASTURE AND HAYLAND GROUP 8D

Only Jedd stony soils, 5 to 20 percent slopes, is in this group. They are moderately deep, sloping to moderately steep, stony gravelly soils on uplands.

Permeability is moderately slow. Available water capacity is medium.

Preparing a seedbed is very difficult on the rolling to hilly areas of these soils. Fertilizer is needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common and Coastal bermudagrass, weeping lovegrass, and King Ranch bluestem. Because of the hilly topography and content of pebbles and stones, these soils are marginal for hay. Coastal bermudagrass and weeping lovegrass are suitable for hay.

PASTURE AND HAYLAND GROUP 9A

In this group are deep, nearly level to sloping, sandy soils on uplands.

Permeability is moderate to moderately slow. Available water capacity ranges from low to medium.

Preparing a firm seedbed is difficult, and seedlings that emerge from a clean seedbed can be cut down by blowing sand or wither from lack of moisture. Frequent applications of fertilizer are needed for sustained production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture grasses are common and Coastal bermudagrass and weeping lovegrass. Coastal bermudagrass and weeping lovegrass are suitable for hay.

PASTURE AND HAYLAND GROUP 9B

In this group are deep, gently sloping to strongly sloping, sandy to very gravelly sandy soils on uplands.

Permeability is moderate to moderately slow. Available water capacity is low.

Preparing a firm seedbed is difficult, and seedlings that emerge from a clean seedbed can be cut down by blowing sand or wither and die from lack of moisture. Small, frequent applications of fertilizer are needed for sustained forage production.

Yields from pasture and hayland vary according to the level of management and the amount of rainfall. Suited pasture and hay grasses are Coastal bermudagrass and weeping lovegrass. These gravelly soils are marginal for hay.

Woodland[2]

Originally, Bastrop County was mainly wooded. Today commercial forest land is of minor extent, but about 36 percent of the county is forest land. About 65 percent of the soils in the county are capable of growing timber.

About 38,000 acres of the "Lost Pines" is in Bastrop County. This area of commercial loblolly pine is about 100 miles west of the western extremity of the East Texas pine belt. The county has an average yearly rainfall of approximately 37 inches, which is 8 to 20 inches less than the average of the pine-growing areas to the east. Growing pine trees in this area of lower rainfall is possible because of a combination of factors:

1. The loblolly pine that grows in Bastrop County is a more efficient user of water than the longleaf and shortleaf species that grow in the areas of higher rainfall.
2. The soils of the Texas Claypan in Bastrop County are acid.
3. Approximately 80 percent of the annual rainfall occurs during the growing season.
4. The humidity is higher along and near the Colorado River.
5. After the yearly evaporation and transpiration moisture has been subtracted, the effective precipitation (P.E.) is higher along and north of the river.
6. The deep, sandy-surface soils where the better pine trees are growing effectively catch the rainfall, and little is lost to runoff.

Most of the commercial loblolly pine is in the area of Bastrop and Buescher State Parks, but scattered stands occur throughout the Texas Claypan and creek soils of the county. Needleleaf forest types grow most frequently on the hills, and broadleaf types generally predominate on the bottoms along the rivers and creeks.

Pine tree test plots, which are located in the Boy Scout area near the northeastern edge of Lake Bastrop, have grown rapidly in the 6½ years since the trees were planted. The loblolly pines (*Pinus taeda*) average 23.4 feet in height and are 5.0 inches in diameter at breast height (DBH). The slash pines (*Pinus elliottii*) have grown more rapidly. These trees average 27.6 feet in height and are 5.4 inches in diameter. These plots are located on Axtell fine sandy loam. By local borings on the native loblolly trees, the site index on the Axtell soils is only 60 feet. Evidently, the growth of these selected varieties should exceed that of the native pine trees.

From a cash crop standpoint, pecan and eastern redcedar are perhaps the most profitable trees in Bastrop County. The pecan trees that grow on the creek and river soils throughout the county produce nuts for home and commercial use. Eastern redcedar is used for posts by most of the farmers and ranchers. It is also marketed commercially for posts, lumber, and other cedar products.

The areas in pine trees in the county are far more valuable for real estate than for raw wood products. However, the potential for wood products can be substantial if the acreage of commercial trees is increased. These areas also provide grazing, wildlife habitat, recreation, natural beauty, and conservation of soil and water.

This section explains how soils affect tree growth and management in the county. In table 3 the potential productivity and management problems of the soils in Bastrop County are listed. Only those soils capable of growing trees are listed in the table.

In the first column the soils are listed by their mapping unit symbols under the series name to which they belong. If a mapping unit contains the names of two series, as in a complex or an association, the component soils are listed and evaluated separately under each series name.

The next column shows the woodland suitability group. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity.

Each woodland suitability group is identified in a 3-part symbol. The first part of the symbol indicates the relative productivity of the soils: *1* means very high, *2* means high, *3* means moderately high, *4* means moderate, and *5* means low. The second part of the symbol, a letter, indicates the important soil property that imposes a moderate or severe hazard or limitation in managing the soils for wood production: *x* shows that the main limitation is stoniness or rockiness; *w* shows that excessive water in or on the soil is the chief limitation; *t* shows that toxic substances in the soil are the chief limitation; *d* shows that the rooting depth is restricted; *c* shows that clay in the upper part of the soil is a limitation; *s* shows that the soils are sandy; *f* shows that the soils have large amounts of coarse fragments; *r* shows that the soils have steep slopes; and *o* shows that the soils have no significant restrictions or limitations for woodland use or management. The third element in the symbol indicates the degree of management problems and the general suitability of the soils for certain kinds of trees.

In the third column is a list of some of the commercially important trees that are adapted to the soil. These are the trees woodland managers will generally favor in intermediate or improvement cuttings. Also shown is the potential productivity of these trees in terms of site class. The site class is the average height of dominant trees, in feet, at age 30 for cottonwood; at age 35 for sycamore; at age 25 for planted pines; and at age 50 for all other species or types.

The limitations in management evaluated in the next four columns are plant competition, erosion haz-

[2] EDWARD D. HOLCOMB, State forester, Soil Conservation Service, helped to prepare this section.

TABLE 3.—*Potential productivity and limitations in management of soils for woodland*

Soil series and map symbols	Woodland group	Tree species	Site class	Limitations in management				Trees suitable for planting
				Plant competition	Erosion hazard	Equipment limitations	Seedling mortality	
Axtell:								
AfA	4c2	Loblolly pine	70	Slight	Slight	Slight	Moderate	Loblolly pine or slash pine.
AfC	4c2	Loblolly pine	70	Moderate	Slight	Slight	Moderate	Loblolly pine or slash pine.
AfC2, AfE2	4c2	Loblolly pine	70	Moderate	Slight	Moderate	Moderate	Loblolly pine or slash pine.
AtD	5c3	Loblolly pine	60	Severe	Slight	Moderate	Severe	Loblolly pine or slash pine.
For Tabor part of AtD, see Tabor series.								
Demona: DeC	4s3	Loblolly pine	70	Moderate	Slight	Moderate	Severe	Loblolly pine or slash pine.
Demona variant: Dm	4s3	Loblolly pine	70	Moderate	Slight	Moderate	Severe	Loblolly pine or slash pine.
Dougherty: DoB, DoD	4s3	Loblolly pine	70	Moderate	Slight	Slight	Severe	Loblolly pine or slash pine.
Gowen: Gs	4w5	Pecan	50	Moderate	Slight	Moderate	Moderate	Pecan.
		Water and willow oak	40					
Jedd: JeF	5f3	Loblolly pine	60	Severe	Moderate	Moderate	Severe	Loblolly pine or slash pine.
Lincoln: Ls, Lw	4w5	Pecan	50	Moderate	Slight	Moderate	Moderate	Pecan.
		Water and willow oak	40					
Norwood: Nd, No	2o4	Pecan	70	Slight	Slight	Slight	Slight	Pecan.
		Cottonwood or sycamore	80					
Patilo: PaE	4s3	Loblolly pine	70	Moderate	Slight	Slight	Severe	Loblolly pine or slash pine.
Rosanky:								
RoB	4c2	Loblolly pine	70	Slight	Slight	Slight	Moderate	Loblolly pine or slash pine.
RoD	4c2	Loblolly pine	70	Moderate	Slight	Moderate	Moderate	Loblolly pine or slash pine.
Sayers: Sa, Sb	4w5	Pecan, willow oak	50	Moderate	Slight	Moderate	Moderate	Pecan.
		Water oak	50					
Ships: Sg	4w5	Pecan	50	Moderate	Slight	Moderate	Moderate	Pecan.
		Cottonwood	60					
		Water and willow oak	40					
Silstid: SkC	4s3	Loblolly pine	70	Moderate	Slight	Slight	Severe	Loblolly pine or slash pine.
Smithville: Sm	4o4	Pecan	50	Slight	Slight	Slight	Slight	Pecan.
Tabor:								
TfA, TfB	5c2	Loblolly pine	60	Slight	Slight	Slight	Moderate	Loblolly pine or slash pine.
Tabor part of AtD	5c3	Loblolly pine	60	Severe	Slight	Moderate	Severe	Loblolly pine or slash pine.
Trinity: Tr, Tw	4w5	Pecan	50	Moderate	Slight	Moderate	Moderate	Pecan.
		Water oak and willow oak	50					
Uhland: Uh	4w5	Pecan	50	Moderate	Slight	Moderate	Moderate	Pecan.
		Water oak and willow oak	50					
Vernia: VeD	5f3	Loblolly pine	60	Severe	Slight	Moderate	Severe	Loblolly pine or slash pine.

ard, equipment limitations, and seedling mortality.

Plant competition reflects the rate of invasion by unwanted trees and shrubs on different kinds of soils when openings are made in the canopy. A rating of *slight* indicates that the understory plants would not prevent the establishment or normal development of a new stand of desirable trees. A rating of *moderate* indicates that establishment or development of a new stand of desirable trees may be delayed by plant competition. A rating of *severe* indicates that adequate establishment and development would be prevented without intensive site preparation or special management practices.

Erosion hazard measures the risk of soil losses in well-managed woodland. Erosion hazard is *slight* if expected soil loss is small, *moderate* if some measures to control erosion are needed in logging and construction, and *severe* if intensive treatment or special equipment and methods are needed to prevent excessive soil losses.

Equipment limitation ratings reflect the soil conditions that restrict the use of equipment normally used in woodland management or harvesting. A rating of *slight* indicates equipment use is not limited to kind or time of year. A rating of *moderate* indicates a seasonal limitation or need for modification in methods or equipment. A rating of *severe* indicates the need for specialized equipment or operations.

Seedling mortality ratings indicate the degree of expected mortality of planted seedlings when plant competition is not a limiting factor. Normal rainfall, good planting stock, and proper planting are assumed. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate* indicates a 25- to 50-percent loss; and *severe* indicates more than a 50-percent loss of seedlings.

In the last column is a list of trees that are suitable for planting for commercial wood production.

Range[3]

About half of the land in Bastrop County produces native vegetation. This land provides grazing for livestock, food and cover for deer and other wildlife, as well as wood, watershed, scenery, and recreation.

The natural potential vegetation on most of the range is a savannah of little bluestem, indiangrass, purpletop, beaked panicum, and uniola associated with post oak, blackjack oak, pine, elm, cedar, and shrubs. The trees and shrubs have increased greatly as a result of controlled grazing and reduction of wildfires. This type of vegetation occupies about 36 percent of the county.

About 9 percent of the county is in natural grassland. This grassland is clayey soils in the western part of the county.

The raising of cattle provides the greatest farm income in the county. Forage for cattle is produced by range, fertilized pasture, and cultivated crops, such as sorghum and oats.

[3] By R. J. PEDERSON, range conservationist, Soil Conservation Service.

Growth in spring and early in summer normally is 60 to 70 percent of the total amount of forage produced each year. Another season of growth usually occurs during August, September, and October. The deeper soils also produce such plants as Texas wintergrass, wildrye, and forbs, which are valuable for grazing in winter and early in spring.

The success of the stockman depends largely upon keeping good forage plants abundant, vigorous, and productive. This is done mainly by managing the time and intensity of grazing and by applying needed treatment practices to permit re-establishment and growth of the natural plant community for each soil used as range.

Most of the native grassland has been heavily grazed since it was first settled in the 1830's, and plant competition has been materially altered. Intense grazing, fire, and drought have resulted in a thick understory of yaupon, juniper, mesquite, American beautyberry, and greenbrier in many areas. As these undesirable practices continued, splitbeard bluestem, broomsedge bluestem, windmillgrass, red lovegrass, paspalums, low panicums, sedges, and annual grasses and weeds replaced many of the better grasses.

Livestock farming and ranching are the most important enterprises in the county. They occur throughout the county; approximately 1,300 units are mainly engaged in livestock operations. The average size of the farms and ranches is about 400 acres.

Livestock operations in the county are of the cow-calf and stocker cattle type. The cow-calf enterprises are the most common. Several ranches specialize in breeding and selling registered purebreds and crossbreds.

In the eastern part of the county and along the Colorado River Valley, the ranchers may rotate the animals between improved or introduced pasture and the grazed woodland. At times the woodland grazing may be deferred for winter use and supplemented by hay, concentrated protein supplements, or small grain for grazing. In other woodland grazing areas, the ranchers have some cultivatable fields. These fields are used mostly for hay or supplemental grazing crops, such as grain sorghum, small grain, and hybrid sorghum, to supplement the woodland grazing.

Grasslands managed as range in the western part of the county are mostly in mesquite and elm brush and scattered hardwood trees. Cow-calf operations are the most common enterprise on these units. Cattle are wintered mostly on cool-season grasses and small grain, supplemented by hay and concentrated protein foods.

Generally speaking, with other factors constant, the forage production on a woodland soil varies inversely with the density of tree canopy or the percentage of ground shaded at midday. Thus, a soil in the open-canopy class produces approximately 90 to 100 percent of its possible total annual forage yield; a soil in a sparse-canopy class produces 70 to 90 percent; a soil in the medium-canopy class produces 40 to 70 percent; and a soil in the dense-canopy class produces only 10 to 40 percent, which is low-quality forage. Therefore,

if the soil or range site of a woodland grazing area is known and the canopy class estimated, the total annual production and the stocking rate of the grazing area can be calculated by using proper conversion percentages.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change so long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there. A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand; in *good* condition if the percentage is 51 to 75; in *fair* condition if the percentage is 26 to 50; and in *poor* condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep range in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. The main management concern is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

In the following pages the range sites of Bastrop County are described and the climax plants and principal invaders on the sites are named. Also shown is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

BLACKLAND RANGE SITE

This site consists of deep, nearly level to sloping, clayey soils on uplands.

Permeability is rapid when the soils are dry but slow to very slow when they are wet. Available water capacity is high.

The climax plant community is a mixture of tall and mid grasses and forbs and scattered trees mostly along the drainageways. The approximate species composition, by weight, of the potential (climax) plant community is 50 percent little bluestem; 25 percent indiangrass and big bluestem; 13 percent eastern gamagrass, switchgrass, wildrye, and other grasses; 2 percent live oak and elm; and 10 percent forbs, such as fern acacia, sensitivebrier, Englemann daisy, Maximillian sunflower, and gayfeather.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 4,000 pounds per acre in years of unfavorable growing conditions and 7,000 pounds per acre in favorable years. Of this, approximately 95 percent is from plants that furnish forage for cattle.

Under continued heavy grazing by cattle, the more palatable grasses decrease and silver bluestem, Texas wintergrass, tall dropseeds, and side-oats grama increase. If overgrazing is prolonged, woody plants, mesquite, elm, and grasses and weeds, such as Texas gamagrass, buffalograss, tumblegrass, broomweed, bluebonnet, and other annual plants, invade the site and total production decreases.

CLAY LOAM RANGE SITE

This site consists of deep, nearly level, clayey soils on stream terraces.

Permeability is moderately slow. Available water capacity is high.

The climax plant community is true prairie. A few live oak, elm, hackberry, and pecan trees are scattered throughout the site. Many forbs, including perennial legumes, occur with the tall and mid grasses. The

approximate species composition, by weight, of the potential (climax) plant community is 45 percent little bluestem, 25 percent indiangrass, 5 percent Virginia wildrye and Texas wintergrass, 5 percent vine-mesquite and side-oats grama, 10 percent other grasses, 5 percent perennial forbs, and 5 percent trees.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 4,000 pounds per acre in years of unfavorable growing conditions and 6,500 pounds per acre in favorable years. Of this, approximately 90 percent is from plants that furnish forage for cattle.

Under continued heavy grazing, the tall grasses decrease and such plants as silver bluestem, Texas wintergrass, and less palatable forbs increase. If overgrazing is prolonged, buffalograss and annual forbs and grasses invade the site.

CLAYEY BOTTOMLAND RANGE SITE

This site consists of deep, nearly level, clayey soils on bottom lands that are subject to overflow.

Permeability is rapid when the soils are dry but very slow when they are wet. Available water capacity is high. Some of the lower areas are frequently subject to flooding and deposition of sediment. Unless protected by a plant cover, the soils are subject to cutting and scouring.

The climax plant community is an open stand of trees, grasses, and forbs. The approximate species composition, by weight, of the potential (climax) plant community is 15 percent Virginia wildrye; 5 percent switchgrass; 5 percent indiangrass; 5 percent big and little bluestem; 5 percent rusty seed paspalum; 15 percent beaked and other panicums; 5 percent eastern gamagrass; 10 percent longleaf and broadleaf uniola; 15 percent sedges; 10 percent oak and elm; 5 percent hackberry, willow, and vines; and 5 percent forbs, such as lespedeza and tickclover.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 5,000 pounds per acre in years of unfavorable growing conditions and 7,500 pounds in favorable years. Of this, approximately 85 percent is from plants that furnish forage for cattle.

Under continued heavy grazing by cattle, the trees and other woody vegetation increase and such shade-tolerant plants as beaked panicum, Virginia wildrye, rusty seed paspalum, uniolas, and sedges increase. If overgrazing is prolonged, bermudagrass, buffalograss, smut and carpetgrasses, cocklebur, prairie coneflower, and other annual grasses and weeds invade the site. Such woody shrubs as osageorange and baccharis may also invade.

CLAYPAN PRAIRIE RANGE SITE

This site consists of deep, nearly level to strongly sloping, loamy to gravelly loamy soils on uplands.

Permeability is very slow in the lower layers. Available water capacity is medium to high.

The climax plant community is a mixture of mid and tall grasses, forbs, and scattered oak, elm, and hackberry trees along the drainageways. The approximate species composition, by weight, of the potential (climax) plant community is 50 percent little bluestem; 15 percent indiangrass; 5 percent big bluestem; 5 percent Virginia wildrye; 5 percent switchgrass; 5 percent Texas wintergrass; 5 percent elm, hackberry, live oak, and post oak; and 10 percent forbs, such as Maximillian sunflower, sensitivebrier, tickclover, and gayfeather.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 2,500 pounds per acre in years of unfavorable growing conditions and 5,500 pounds in favorable years. Of this, approximately 90 percent is from plants that furnish forage for cattle.

Under continued heavy grazing, silver bluestem, meadow dropseed, Texas wintergrass, side-oats grama, and bluebonnet gradually increase in the plant community. If overgrazing is prolonged, mesquite, pricklypear, greenbrier, buffalograss, Texas gamagrass, windmillgrass, and weedy forbs invade the site and total production decreases.

CLAYPAN SAVANNAH RANGE SITE

This site consists of deep, nearly level to strongly sloping, loamy soils on stream terraces and uplands.

Permeability is very slow in the lower layers. Available water capacity is high.

The climax plant community is an open stand of oak trees, grasses, and scattered forbs. The approximate species composition, by weight, of the potential (climax) plant community is 40 percent little bluestem; 10 percent indiangrass; 10 percent brownseed paspalum; 5 percent purpletop; 5 percent switchgrass; 5 percent species of paspalum and panicum; 5 percent silver bluestem; 10 percent blackjack oak, post oak, and elm; 5 percent yaupon, elbowbush, greenbrier, and other shrubs; and 5 percent forbs, such as lespedeza, tickclover, gayfeather, and yellow neptunia.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 2,000 pounds per acre in years of unfavorable growing conditions and 5,000 pounds in favorable years. Of this, approximately 85 percent is from plants that furnish forage for cattle.

Under heavy grazing by cattle, the woody vegetation increases. If overgrazing is prolonged, red lovegrass, broomsedge bluestem, tumblegrass, bittersneeze weed, and annual forbs and grasses invade the site and total production decreases. In most areas such woody plants as baccharis, mesquite, and eastern redcedar also invade the site.

DEEP SAND RANGE SITE

This site consists of deep, gently sloping to strongly sloping, sandy soils on uplands.

Permeability is moderately slow in the lower layers. Available water capacity is low. The thick, loose sandy surface layer makes these soils too droughty for most plants.

The climax plant community is an open stand of oak trees, grasses, and forbs. The approximate species composition, by weight, of the potential (climax) plant

community is 40 percent little bluestem; 10 percent indiangrass; 5 percent switchgrass; 5 percent purpletop; 10 percent paspalum and panicums; 10 percent other grasses; 10 percent blackjack oak and post oak; 5 percent yaupon, briers, and vines; and 5 percent forbs, such as lespedeza and tickclover.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 1,000 pounds per acre in years of unfavorable growing conditions and 3,000 pounds in favorable years. Of this, approximately 90 percent is from plants that furnish forage for cattle.

Under heavy grazing by cattle, the woody vegetation increases and such shade-tolerant grasses as beaked panicum, purpletop, sand and red lovegrasses, crinkleawn, three-awns, and other panicums and paspalums replace the more palatable grasses. If overgrazing is prolonged, broomsedge bluestem, bullnettle, snakecotton, yankeeweed, sandburs, and annual grasses and weeds invade the site and total production decreases.

ERODED BLACKLAND RANGE SITE

This site consists of deep, sloping to moderately steep, clayey soils on uplands.

Permeability is very slow. Available water capacity is high. These soils are eroded.

The climax plant community is tall grass prairie. Although the climax vegetation has been destroyed by cultivation and the productive ability of the site reduced by erosion, the site will produce vegetation similar to that of the Blackland range site. The approximate species composition, by weight, of the potential (climax) community is 50 percent little bluestem; 20 percent indiangrass and big bluestem; 15 percent Canada wildrye, side-oats grama, meadow dropseed, Texas wintergrass, and silver bluestem; 5 percent shrubs and trees, such as hackberry, oak, and elm; and 10 percent forbs, such as half-shrub sundrop, bundleflower, sensitivebrier, and snoutbean.

If this site is in good to excellent condition, the average annual yield of air-dry herbage is about 3,500 pounds per acre in years of unfavorable growing conditions and 5,500 pounds in favorable years. Of this, approximately 95 percent is from plants that furnish forage for cattle.

Most of this site is in a stage of secondary plant succession and has not reached its potential plant community. Seeding can be used to hasten the reestablishment of the climax plants.

GRAVELLY RANGE SITE

This site consists of deep, gently sloping to sloping, very gravelly loamy soils on uplands.

Permeability is moderate in the lower layers. Available water capacity is low.

The climax plant community is an open stand of oak trees and a sparse stand of grasses and forbs. The approximate species composition, by weight, of the potential (climax) plant community is 50 percent little bluestem; 5 percent beaked panicum; 5 percent indiangrass; 5 percent purpletop; 10 percent blackjack oak and post oak; 5 percent greenbrier, vines, and shrubs; 5 percent forbs, such as lespedeza, snoutbean, and tickclover; 10 percent crinkleawn and brownseed paspalum; and 5 percent other grasses.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 2,500 pounds per acre in years of unfavorable growing conditions and 4,000 pounds in favorable years. Of this, approximately 90 percent is from plants that furnish forage for cattle.

Under heavy grazing by cattle, the woody vegetation increases. If overgrazing is continued, red lovegrass, windmillgrass, three-awn, and annual grasses and forbs invade, and such woody shrubs as baccharis, eastern redcedar, yaupon, American beautyberry, and greenbrier increase or invade the site.

LOAMY BOTTOMLAND RANGE SITE

This site consists of deep, nearly level, loamy soils on bottom lands and low terraces.

Permeability is moderate to moderately slow. Available water capacity is medium to high. Most areas are subject to overflow.

The climax plant community varies, depending upon the frequency of overflow and kind of soil; but it is mostly an open stand of trees, grasses, and forbs. The approximate species composition, by weight, of the potential (climax) plant community is 10 percent Virginia wildrye; 5 percent switchgrass; 10 percent indiangrass; 10 percent big and little bluestem; 5 percent rusty seed paspalum; 15 percent beaked and other panicums and paspalums; 5 percent eastern gamagrass; 5 percent sedges; 10 percent long and broadleaf uniola; 15 percent pecan, oak, elm, and other trees; 5 percent greenbrier, grapevines, and other shrubs; and 5 percent forbs, such as tickclover and lespedezas.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 4,000 pounds per acre in years of unfavorable growing conditions and 8,000 pounds in favorable years. Of this, approximately 90 percent is from plants that furnish forage for cattle.

Under continued heavy grazing by cattle, trees, shrubs, and vines increase and such shade-tolerant plants as Virginia wildrye, sedges, rusty seed paspalum, and low panicums increase. If overgrazing is prolonged, broomsedge bluestem, cocklebur, sunflower, giant ragweed, and annual grasses and weeds invade and crowd out the grasses. Such woody shrubs as baccharis and winged elm may also invade.

SANDSTONE HILLS RANGE SITE

This site consists of moderately deep, sloping to moderately steep, stony gravelly loamy soils on uplands (fig. 12).

Permeability is moderately slow in the lower layers. Available water capacity is medium.

The climax plant community is an open stand of oak trees, grasses, and scattered forbs. The approximate species composition, by weight, of the potential (climax) plant community is 60 percent little bluestem; 10 percent indiangrass; 5 percent purpletop; 10 percent sandhill lovegrass; 10 percent blackjack oak and post oak; and 5 percent forbs, such as sensitivebrier, snoutbean, western indigo, gayfeather, and annual forbs.

Figure 12.—**Sandstone Hills range site in an area of a Jedd soil.**

If this site is in excellent condition, the average annual yield of air-dry herbage is about 2,000 pounds per acre in years of unfavorable growing conditions and 4,000 pounds in favorable years. Of this, approximately 95 percent is from plants that furnish forage for cattle.

Under heavy grazing by cattle, the woody vegetation increases and such shade-tolerant grasses as purpletop, sand lovegrass, and beaked panicum increase. If overgrazing is prolonged, red lovegrass, broomsedge bluestem, windmillgrass, and annual grasses and weeds invade the site. Such woody shrubs as baccharis and eastern redcedar also often invade the site.

SANDY RANGE SITE

This site consists of deep, nearly level to gently sloping, sandy soils on uplands.

Permeability is moderate to moderately slow in the lower layers. Available water capacity is low to medium.

The climax plant community is a savannah of an open stand of oak trees and grasses and scattered forbs. The approximate species composition, by weight, of the potential (climax) plant community is 50 per cent little bluestem; 5 percent indiangrass; 5 percent switchgrass; 10 percent fringeleaf paspalum, purpletop, and sedges; 5 percent sand lovegrass; 5 percent three-awns and other grasses; 10 percent post oak and blackjack oak; 5 percent yaupon, briers, and vines; and 5 percent forbs, such as lespedeza, tickclover, snoutbean, and dayflower.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 2,500 pounds per acre in years of unfavorable growing conditions and 5,000 pounds in favorable years. Of this, approximately 90 percent is from plants that furnish forage for cattle.

Under heavy grazing by cattle, the woody vegetation increases and the tall grasses decrease. If overgrazing is prolonged, red lovegrass, bullnettle, croton, sandbur, snakecotton, and yankeeweed invade the site and total production decreases.

SANDY BOTTOMLAND RANGE SITE

This site consists of deep, nearly level to gently sloping, loamy to sandy soils on bottom lands.

Permeability is rapid in the lower layers. Available water capacity is low. Most areas are subject to overflow.

The climax plant community is an open stand of trees and grasses and forbs. The approximate species composition, by weight, of the potential (climax) plant community is 25 percent switchgrass; 15 percent indiangrass, big bluestem, and little bluestem; 10 percent Virginia wildrye and sedges; 15 percent broad and longleaf uniolas, beaked and other species of panicum, and paspalum; 10 percent purpletop; 20 percent oak, elm, sycamore, vines, and shrubs; and 5 percent tickclover, snoutbean, and other forbs.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 2,000 pounds per acre in years of unfavorable growing conditions and 5,000 pounds in favorable years. Of this, approximately 5 percent is from plants that furnish forage for livestock.

Under heavy grazing by cattle, shrubs, vines and other woody vegetation and such shale-tolerant grasses as beaked panicums, purpletop, Virginia wildrye, sedges, and uniolas increase. If overgrazing is prolonged, such grasses and weeds as broomsedge bluestem, vaseygrass, bloodweed, beebalm, and yankeeweed invade the site. The woody invaders are yaupon, winged elm, and baccharis.

SANDY LOAM RANGE SITE

This site consists of nearly level to sloping, loamy soils on stream terraces and uplands.

Permeability is moderate to very slow. Available water capacity is medium to high.

The climax plant community is an open stand of oak trees and grasses and scattered forbs. The approximate species composition, by weight, of the potential (climax) plant community is 55 percent little bluestem; 5 percent beaked panicum; 5 percent indiangrass; 5 percent purpletop; 10 percent sand lovegrass and brownseed paspalum; 10 percent post oak, blackjack oak, elm, hackberry, and hickory; 5 percent greenbrier, wild grape, and shrubs; and 5 percent forbs, such as lespedeza, tickclover, gayfeather, and bundleflower.

If this site is in excellent condition, the average annual yield of air-dry herbage is about 3,000 pounds per acre in years of unfavorable growing conditions and 5,000 pounds in favorable years. Of this, approximately 90 percent is from plants that furnish forage for livestock.

Under heavy grazing, the woody vegetation and such shade-tolerant grasses as purpletop, beaked panicum, and sand lovegrass increase. If overgrazing is pro-

longed, splitbeard bluestem, red lovegrass, windmillgrass, and annual grasses and weeds invade the site. In many areas such woody shrubs as baccharis and eastern redcedar invade the site. These invading grasses, weeds, and woody plants replace the overgrazed palatable grasses, resulting in a decrease in production of quality forage for cattle.

Wildlife

Soils directly influence the kinds and amount of vegetation and the amount of water available, and in this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are thickness of soil useful to crops, surface texture, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, hazard of flooding, slope, and permeability of the soil to air and water.

In table 4 the soils of Bastrop County are rated for producing six elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements.

The meanings of the suitability ratings used in table 4 are as follows: a rating of *good* means that habitat generally is easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *fair* means that habitat can be created, improved, or maintained in most places. A moderate intensity of management and fairly frequent attention may be required for satisfactory results.

A rating of *poor* means that limitations for the designated use are rather severe. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *very poor* means that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitat on soils that have this rating.

Each soil is rated in table 4 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as wildlife habitat requires inspection at the site.

The significance of the subheadings in table 4 under "Elements of Wildlife Habitat" and "Kinds of Wildlife" are explained in the following paragraphs.

Grain and seed crops.—These crops are annual grain-producing plants, such as corn, sorghum, millet, and soybeans.

Grasses and legumes.—These are domestic grasses and legumes that are established by planting and provide food and cover for wildlife. Grasses include bahiagrass, ryegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and other clovers.

Wild herbaceous upland plants.—This group consists of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass are typical examples. On range, typical plants are bluestem, grama, perennial forbs, and legumes.

Shrubs.—These plants are shrubs that produce wildlife food in the form of fruits, nuts, buds, catkins, or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. Typical species in this category are yaupon, French mulberry, and mesquite.

Wetland food and cover plants.—These are annual and perennial herbaceous plants that grow wild on moist and wet sites and furnish food and cover mostly for wetland wildlife. Typical examples are smartweed, wild millet, spikerush and other rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatics are not included in this category.

Shallow-water areas.—These areas are impoundments or excavations for controlling water, generally no more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submersed aquatics.

Table 4 also rates soils according to their suitability as habitat for the three kinds of wildlife in the county—open-land, rangeland, and wetland wildlife. These ratings are related to ratings made for the elements of habitat For example, soils rated very poor for shallow water developments are rated very poor for wetland wildlife.

Open-land wildlife are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail rabbits, and foxes are typical examples of open-land wildlife.

Rangeland wildlife are birds and mammals that normally live in rangeland. Wild turkey, deer, squirrels, and raccoons are typical examples of rangeland wildlife.

Wetland wildlife are birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, geese, rails, shore birds, herons, mink, and muskrat are typical examples of wetland wildlife.

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 5 the soils of Bastrop County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 5 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, design, or special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small

TABLE 4.—*Suitability of soils for producing elements of wildlife habitat and for kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow-water areas	Open-land	Rangeland	Wetland
Axtell:									
AfA, AfC, AfC2, AtD	Fair	Good	Good	Good	Poor	Very poor	Fair	Good	Very poor.
For Tabor part of AtD, see Tabor series.									
AfE2	Poor	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor.
Bastrop:									
BaA, BaB	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
BaC2	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Behring:									
BeB	Good	Good	Good	Fair	Poor	Poor	Good	Fair	Poor.
BeC2, BeD2	Fair	Good	Good	Fair	Poor	Very poor	Good	Fair	Very poor.
Bosque: Bo	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Burleson: BuB	Good	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Crockett:									
CfB, CgC, CsC2	Fair	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CsE2, CsD3, ChE	Poor	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor.
Demona: DeC	Fair	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Demona variant: Dm	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Dougherty: DoB, DoD	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Ferris: FeF2	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor.
Gowen: Gs	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Fair	Very poor.
Heiden:									
HeB	Good	Good	Fair	Fair	Poor	Very poor	Good	Fair	Very poor.
HeC2, HeD2	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Houston Black: HoA, HoB	Good	Good	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
Jedd: JeF	Poor	Fair	Good	Fair	Very poor	Very poor	Fair	Fair	Very poor.
Krum: KrA	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Lincoln:									
Ls	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Lw	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Mabank: MaA, MaB	Fair	Good	Good	Fair	Fair	Fair	Good	Fair	Fair.
Norwood: Nd, No	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Patilo: PaE	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Rosanky:									
RoB	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
RoD	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.

Sayers:									
Sa	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Sb	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Shep: SeD2	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor.
Ships: Sg	Good	Good	Fair	Fair	Poor	Poor	Good	Fair	Poor.
Silstid: SkC	Poor	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor.
Smithville: Sm	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Tabor:									
TfA, TfB	Fair	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Tabor part of AtD	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Trinity:									
Tr	Good	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Poor.
Tw	Very poor	Poor	Fair	Fair	Poor	Fair	Poor	Fair	Poor.
Uhland: Uh	Very poor	Poor	Fair	Fair	Fair	Fair	Poor	Fair	Fair.
Vernia: VeD	Poor	Poor	Poor	Fair	Poor	Very poor	Poor	Poor	Very poor.
Wilson:									
WgB, WsB	Fair	Good	Good	Fair	Fair	Poor	Good	Fair	Poor.
WgC	Fair	Good	Good	Poor	Poor	Very poor	Fair	Fair	Very poor.
WsA	Fair	Good	Good	Fair	Fair	Fair	Fair	Fair	Fair.

trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increase cost of leveling sites or of building access roads.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded no more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering Uses of the Soils[4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compressibility, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.

[4] JERRY E. HOLLIGAN, area engineer, Soil Conservation Service, helped prepare this section.

TABLE 5.—*Degree and kinds of limitations of soils for recreational development*

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails
Axtell:				
AfA, AfC, AfC2	Severe: percs slowly	Severe: percs slowly	Slight	Slight.
AfE2	Severe: percs slowly	Severe: percs slowly	Moderate: slope	Slight.
AtD	Severe: percs slowly	Severe: percs slowly	Moderate: small stones	Moderate: small stones.
For Tabor part, see Tabor series.				
Bastrop:				
BaA, BaB	Slight	Slight	Slight	Slight.
BaC2	Slight	Moderate: slope	Slight	Slight.
Behring:				
BeB, BeC2	Moderate: percs slowly; too clayey.	Moderate: percs slowly; too clayey.	Moderate: too clayey	Moderate: too clayey.
BeD2	Moderate: percs slowly; too clayey.	Severe: slope	Moderate: too clayey	Moderate: too clayey.
Bosque: Bo	Moderate: floods	Slight	Slight	Slight.
Burleson: BuB	Severe: percs slowly; too clayey.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: too clayey.
Crockett:				
CfB, CsC2	Severe: percs slowly	Severe: percs slowly	Slight	Slight.
CgC, ChE	Severe: percs slowly	Severe: percs slowly; slope; small stones.	Moderate: small stones	Moderate: small stones.
CsE2, CsD3	Severe: percs slowly	Severe: percs slowly; slope.	Moderate: slope	Slight.
Demona: DeC	Moderate: too sandy	Severe: too sandy	Moderate: too sandy	Moderate: too sandy.
Demona variant: Dm	Moderate: too sandy	Severe: too sandy	Moderate: too sandy	Moderate: too sandy.
Dougherty:				
DoB	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
DoD	Moderate: too sandy	Severe: slope	Moderate: too sandy	Moderate: too sandy.
Ferris: FeF2	Severe: percs slowly; too clayey.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: too clayey.
Gowen: Gs	Severe: floods	Severe: floods	Moderate: floods; too clayey.	Moderate: floods; too clayey.
Heiden: HeB, HeC2, HeD2	Severe: percs slowly; too clayey.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: too clayey.
Houston Black: HoA, HoB	Severe: percs slowly; too clayey.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: too clayey.
Jedd: JeF	Severe: large stones	Severe: large stones; slope.	Moderate: large stones	Moderate: large stones.
Krum: KrA	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Lincoln:				
Ls	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Lw	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Mabank: MaA, MaB	Severe: percs slowly; wet.	Severe: percs slowly; wet.	Moderate: wet	Moderate: wet.
Norwood: Nd, No	Severe: floods	Moderate: floods; too clayey.	Moderate: floods; too clayey.	Moderate: too clayey.
Patilo: PaE	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Rosanky:				
RoB	Moderate: percs slowly	Moderate: percs slowly	Slight	Slight.
RoD	Moderate: percs slowly	Severe: slope	Slight	Slight.
Sayers:				
Sa	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Sb	Severe: floods	Severe: floods	Moderate: floods	Moderate: floods.

TABLE 5.—*Degree and kinds of limitations of soils for recreational development*—Continued

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails
Shep: SeD2	Moderate: too clayey	Severe: slope	Moderate: too clayey	Moderate: too clayey.
Ships: Sg	Severe: percs slowly; too clayey.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: too clayey.
Silstid: SkC	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Smithville: Sm	Severe: floods	Slight	Slight	Slight.
Tabor: TfA, TfB	Severe: percs slowly	Severe: percs slowly	Moderate: wet	Slight.
Trinity: Tr, Tw	Severe: floods; percs slowly; wet.	Severe: floods; percs slowly; wet.	Severe: too clayey	Severe: too clayey.
Uhland: Uh	Severe: floods	Severe: floods	Moderate: floods; wet	Moderate: floods; wet.
Vernia: VeD	Severe: small stones	Severe: small stones	Severe: small stones	Severe: small stones.
Wilson: WgB, WgC, WsA, WsB.	Severe: percs slowly; wet.	Severe: percs slowly; wet.	Moderate: too clayey; wet.	Moderate: too clayey; wet.

3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 6, 7, and 8, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 6 and 7, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering classification systems

The two systems most commonly used to classify samples of soils for engineering are the Unified soil classification system (*2*), used by the Soil Conservation Service, Department of Defense, and other agencies, and the AASHTO system, adopted by the American Association of State Highway and Transportation Officials (*1*).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups that range from A-1 to A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b; A-2-4, A-2-5, A-2-6, A-2-7; and A-7-5, A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 8; the estimated classification, without group index numbers, is shown in table 6 for all soils mapped in the county.

Estimated soil properties significant to engineering

Estimates of several soil properties significant in engineering are shown in table 6. The estimates are made for typical soil profiles, by layers sufficiently

TABLE 6.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two for this reason it is necessary to follow carefully the instructions for referring to other series that

Soil series and map symbols	Hydrologic group	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—	
					Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)
		In	*In*				*Pct*		
*Axtell: AfA, AfC, AfC2, AfE2.	D	>60	0–8	Fine sandy loam	SM, ML, SM–SC, CL–ML	A–2–4, A–4		90–100	85–100
			8–48	Clay sandy clay	CH, CL	A–7–6		95–100	90–100
			48–76	Sandy clay loam, sandy clay.	CL, SC	A–6 A–7–6		85–100	80–100
AtD. For Tabor part, see Tabor series.	D	>60	0–14	Gravelly sandy loam	GM, SM, SM–SC, GM–GC	A–2–4 A–4	0–10	50–75	45–75
			14–60	Clay, sandy clay	CH, CL	A–7–6		95–100	90–100
Bastrop: BaA, BaB, BaC2.	B	>60	0–16	Fine sandy loam	ML, SM, CL–ML, SM–SC	A–4		95–100	95–100
			16–75	Sandy clay loam	CL, SC	A–6		95–100	95–100
Behring: BeB, BeC2, BeD2.	D	>60	0–6	Clay loam	CL, CH	A–7–6		95–100	95–100
			6–36	Clay	CL, CH	A–7–6		95–100	95–100
			36–48	Clay	CH	A–7–6		90–100	85–100
			48–60	Shaly clay	CH	A–7–6		85–100	85–100
Bosque: Bo	B	>60	0–24	Loam, clay loam	CL	A–6, A–7–6		100	95–100
			24–75	Clay loam	CL	A–6, A–7–6		100	95–100
Burleson: BuB	D	>60	0–40	Clay	CH	A–7–6		99–100	98–100
			40–60	Clay	CH	A–7–6		95–100	90–100
Crockett: CfB, CsC2, CsE2, CsD3.	D	>60	0–4	Loam	SM–SC, SM, ML, CL–ML	A–4, A–6		95–100	95–100
			4–60	Clay, clay loam	CH or CL	A–7–6		95–100	95–100
CgC, ChE	D	>60	0–16	Gravelly sandy loam	SM, SC, SM–SC	A–4, A–6	0–10	65–85	60–80
			16–64	Clay	CH, CL	A–7–6		95–100	95–100
Demona: DeC	C	24–36	0–28	Loamy fine sand	SM, SP–SM, SM–SC	A–2–4		90–100	90–100
			28–62	Sandy clay	CL, CH	A–7–6		90–100	90–100
Demona variant: Dm	C	20–30	0–30	Loamy fine sand	SM, SP–SM, SM–SC	A–2–4		85–100	85–100
			30–62	Clay, sandy clay	CL, CH	A–7–6		90–100	90–100
Dougherty: DoB, DoD.	A	>60	0–26	Loamy fine sand	SM	A–2–4		100	100
			26–44	Sandy clay loam	SC, CL	A–6		100	100
			44–64	Fine sandy loam	SM, ML, SC, CL, SM–SC, CL–ML	A–6, A–4		100	100
Ferris: FeF2	D	>60	0–62	Clay	CH	A–7–6		95–100	95–100
Gowen: Gs	B	>60	0–30	Clay loam	CL	A–6		100	100
			30–60	Clay loam	CL	A–6		100	100
Heiden: HeB, HeC2, HeD2.	D	>60	0–60	Clay	CH	A–7–6		95–100	95–100
Houston Black: HoA, HoB.	D	>60	0–70	Clay	CH	A–7–6		95–100	95–100

significant to engineering

or more kinds of soil. The soils in such mapping units may have different properties and limitations, and appear in the first column of this table. The symbol > means greater than; the symbol < means less than]

Percentage less than 3 inches passing sieve—Cont.		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
		Pct		*In per hr*	*In per in of soil*	*pH*			
75–90	30–60	<30	[1]NP–7	0.6–2.0	0.11–0.15	5.6–6.5	Low	Low	Moderate.
80–100	51–75	45–55	25–35	<0.06	0.16–0.18	4.5–6.5	High	High	Moderate.
75–90	36–85	35–45	15–25	0.6–2.0	0.15–0.18	5.6–8.4	Moderate	Moderate	Moderate.
30–65	20–49	<20	NP–4	0.6–2.0	0.04–0.08	5.6–6.5	Low	Low	Moderate.
80–100	51–75	45–55	25–35	<0.06	0.16–0.18	4.5–6.5	High	High	Moderate.
80–100	40–70	18–22	3–6	2.0–6.0	0.11–0.17	6.1–7.3	Low	Low	Low.
80–100	40–70	26–38	11–22	0.6–2.0	0.15–0.19	6.1–8.4	Low	Moderate	Low.
90–100	75–95	40–55	20–30	0.06–0.2	0.15–0.20	7.4–8.4	Moderate	Low	Low.
90–100	75–95	45–65	25–46	0.06–0.2	0.15–0.20	7.4–8.4	High	High	Low.
85–100	75–100	51–75	30–50	0.06–0.2	0.15–0.20	7.4–8.4	High	High	Low.
80–100	75–100	51–75	30–53	<0.06	0.05–0.10	7.4–8.4	High	High	Low.
90–100	60–80	30–42	11–25	0.6–2.0	0.15–0.20	7.9–8.4	Low	High	Low.
95–100	60–80	30–45	11–25	0.6–2.0	0.15–0.18	7.9–8.4	Low	High	Moderate.
85–100	80–95	51–75	30–55	<0.06	0.15–0.18	6.1–7.8	High	High	Low.
75–95	70–95	55–80	40–55	<0.06	0.15–0.18	7.4–8.4	High	High	Low.
95–100	36–60	15–35	2–15	0.6–2.0	0.13–0.17	6.1–6.5	Low	Moderate	Low.
95–100	65–90	45–55	25–35	<0.06	0.14–0.18	6.1–8.4	High	High	Low.
55–65	36–49	15–35	3–15	0.6–2.0	0.05–0.10	6.1–6.5	Low	Moderate	Low.
95–100	65–90	45–55	25–35	<0.06	0.14–0.18	6.1–8.4	High	High	Low.
60–95	15–30	<25	NP–5	2.0–6.0	0.05–0.10	6.1–7.3	Very low	Low	Moderate.
90–100	50–85	42–60	24–40	0.2–0.6	0.15–0.18	5.1–6.5	Moderate	High	Moderate.
60–90	10–30	<25	NP–5	2.0–6.0	0.05–0.10	5.6–6.5	Very low	Low	Moderate.
90–100	60–80	45–60	25–40	0.2–6.0	0.15–0.18	5.1–7.3	Moderate	High	Moderate.
90–100	15–35		NP	2.0–6.0	0.07–0.09	6.1–7.3	Low	Low	Moderate.
90–100	40–60	30–35	10–15	0.6–2.0	0.12–0.16	5.1–6.5	Low	Low	Moderate.
90–100	36–60	<26	NP–15	0.6–2.0	0.11–0.17	5.1–6.5	Low	Low	Moderate.
80–95	75–95	51–70	30–45	<0.06	0.15–0.18	7.9–8.4	Very high	High	Low.
85–100	60–80	30–40	11–20	0.6–2.0	0.15–0.20	6.6–7.8	Moderate	Moderate	Low.
85–100	55–80	25–40	10–20	0.6–2.0	0.15–0.20	6.6–7.8	Moderate	Moderate	Low.
80–95	75–95	55–80	30–50	<0.06	0.15–0.20	7.9–8.4	Very high	High	Low.
95–100	85–100	55–90	30–65	<0.06	0.15–0.20	7.5–8.2	Very high	High	Low.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—	
					Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)
		In	*In*				*Pct*		
Jedd: JeF	C	>60	0–12	Gravelly sandy loam	GM, SM, SM–SC, GP–GM, SP–SM, GM–SC	A–2–4	5–70	45–91	35–90
			12–32	Clay, sandy clay	CL, SC	A–7–6, A–6	0–30	90–100	90–100
			32	Cemented sandstone.					
Krum: KrA	C	>60	0–42	Silty clay	CH	A–7–6		95–100	95–100
			42–60	Silty clay	CH	A–7–6		85–100	75–100
Lincoln: Ls, Lw	A	36–96	0–10	Fine sand	SM, SP–SM	A–2–4, A–3		100	100
			10–60	Fine sand	SM	A–2–4		100	90–100
Mabank: MaA, MaB	D	6–12	0–6	Loam	CL, ML, SM, SC, CL–ML, SM–SC	A–4		95–100	95–100
			6–64	Clay	CL, CH	A–7–6		95–100	95–100
Norwood: Nd, No	B	>60	10–12	Silty clay loam, loam	CL	A–6, A–7–6		100	100
			12–24	Silty clay loam	CL	A–6, A–7–6		100	100
			24–60	Silty loam	CL	A–6, A–7–6		100	100
Patilo: PaE	B	48–72	0–52	Fine sand	SM, SP–SM	A–2–4, A–3		100	95–100
			52–70	Sandy clay loam	SC	A–6, A–2–6		90–100	90–100
Rosanky: RoB, RoD	C	>60	0–8	Fine sandy loam	SM, SM–SC	A–4, A–2–4	0–2	80–95	75–90
			8–30	Clay	CL	A–6, A–7–6	0–2	85–100	85–100
			30–64	Sandy clay loam, fine sandy loam.	SM, SC, CL, ML	A–4, A–6		85–100	85–100
			64–70	Weakly consolidated sandstone.					
Sayers: Sa, Sb	A	60–120	0–10	Fine sandy loam	SM–SC, SC, CL–ML, CL	A–4, A–6	0–5	90–100	80–100
			10–60	Loamy fine sand, fine sand.	SM, SP–SM	A–2–4	0–5	90–100	80–100
Shep: SeD2	B	>60	0–20	Clay loam	CL, SC	A–4, A–6		85–100	85–100
			20–60	Clay loam	CL, SC	A–4, A–6		85–100	80–100
Ships: Sg	D	>60	0–45	Clay, silty clay	CH	A–7–6		100	100
			45–60	Silty clay	CH	A–7–6		100	100
Silstid: SkC	A	>60	0–20	Loamy fine sand	SM	A–2–4		95–100	95–100
			28–56	Sandy clay loam, clay loam.	SC, CL	A–4, A–6, A–2–4, A–2–6		95–100	95–100
			56–80	Clay loam, fine sandy loam.	SC, CL	A–6, A–2–6		95–100	85–100
Smithville: Sm	B	>60	0–6	Fine sandy loam	SC, CL, CL–ML, SM–SC	A–4, A–2–4		95–100	95–100
			6–16	Loam	SC, CL	A–6		100	95–100
			16–50	Sandy clay loam, loam.	CL	A–6		100	95–100
			50–62	Fine sandy loam	CL, SC	A–4, A–6		90–100	75–100
Tabor: TfA, TfB	D	>60	0–15	Fine sandy loam	ML, CL–ML, SM, SM–SC	A–4, A–2–4		85–100	75–100
			15–50	Clay	CH	A–7–6		95–100	95–100
			50–63	Clay	CH	A–7–6		95–100	95–100
Tabor part of AtD	D	>60	0–18	Gravelly fine sandy loam.	GM, SM, SM–SC, GH–GC	A–1, A–2–4	0–10	50–80	45–75
			18–60	Clay, sandy clay	CH	A–7–6		95–100	95–100

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Cont.		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
		Pct		*In per hr*	*In per in of soil*	*pH*			
25–87	6–23	15–30	2–6	0.6–2.0	0.04–0.14	5.6–6.5	Low	High	Moderate.
70–98	45–60	35–48	15–28	0.2–0.6	0.13–0.17	5.1–6.0	Moderate	High	Moderate.
95–100	85–95	51–65	25–40	0.2–0.6	0.15–0.20	7.9–8.4	High	High	Low.
70–95	65–90	51–50	30–38	0.2–0.6	0.15–0.20	7.9–8.4	High	High	Low.
75–100	8–35		NP	6.0–20	0.06–0.09	7.9–8.4	Low	Low	Low.
75–100	15–35		NP	6.0–20	0.05–0.09	7.9–8.4	Low	Low	Low.
80–95	40–70	<30	NP–10	0.6–2.0	0.11–0.15	6.1–7.3	Low	Moderate	Moderate.
95–100	70–85	42–65	25–40	<0.06	0.12–0.16	6.1–8.4	High	High	Moderate.
95–100	85–95	30–45	15–25	0.6–2.0	0.18–0.21	7.9–8.4	Low	Moderate	Low.
90–100	70–95	30–45	11–25	0.6–2.0	0.15–0.22	7.9–8.4	Low	High	Low.
95–100	70–95	30–45	11–25	0.6–2.0	0.17–0.22	7.9–8.4	Low	High	Low.
85–100	8–20	<25	NP–4	6.0–20	0.05–0.08	6.1–7.3	Very low	Low	Low.
90–100	25–49	22–35	11–20	0.2–0.6	0.14–0.18	5.1–6.5	Low	High	Moderate.
75–90	32–49	<30	NP–7	0.6–2.0	0.08–0.11	6.1–7.3	Very low	Moderate	Low.
80–100	62–80	30–49	19–30	0.2–0.6	0.11–0.17	5.1–6.0	Moderate	High	Moderate.
80–100	36–60	25–40	2–19	0.2–0.6	0.10–0.16	5.1–6.0	Low	Moderate	Moderate.
80–100	40–60	20–30	4–12	2.0–6.0	0.11–0.15	6.1–7.3	Low	Low	Low.
80–100	5–35	<27	NP–4	6.0–20	0.05–0.10	6.1–7.3	Low	Low	Low.
75–95	40–75	20–35	8–20	0.6–2.0	0.15–0.19	7.9–8.4	Low	High	Low.
75–95	40–75	20–35	8–20	0.6–2.0	0.13–0.17	7.9–8.4	Low	High	Low.
100	95–100	55–70	35–50	<0.06	0.14–0.19	7.9–8.4	Very high	Very high	Low.
100	85–100	51–65	32–45	<0.06	0.14–0.20	7.9–8.4	Very high	Very high	Low.
90–96	15–25	<22	NP–3	6.0–20	0.05–0.10	5.1–6.0	Low	Very low	Moderate.
80–98	30–55	20–35	9–22	0.6–2.0	0.12–0.17	5.1–5.5	Low	Moderate	Moderate.
70–95	22–55	20–35	15–22	0.6–2.0	0.10–0.16	5.1–5.5	Low	Moderate	Moderate.
75–100	25–60	20–25	4–10	0.6–2.0	0.13–0.18	6.6–7.8	Low	Moderate	Low.
95–100	36–70	26–40	12–20	0.6–2.0	0.13–0.18	6.6–7.8	Low	Moderate	Low.
80–100	51–80	26–40	15–25	0.6–2.0	0.15–0.19	7.4–8.4	Moderate	Moderate	Low.
60–100	40–70	20–35	8–19	0.6–2.0	0.13–0.18	7.9–8.4	Low	Moderate	Low.
70–85	30–55	<25	NP–7	0.6–2.0	0.13–0.15	5.6–6.5	Low	Low	Moderate.
90–100	65–90	51–60	28–36	<0.06	0.14–0.18	5.1–7.8	High	High	High.
75–100	65–90	51–60	28–35	<0.06	0.14–0.18	5.6–7.8	High	High	Moderate.
30–65	15–25	<20	NP–5	0.6–2.0	0.04–0.10	5.1–7.8	High	High	High.
75–100	65–90	51–60	28–35	<0.06	0.14–0.18	5.6–7.8	High	High	Moderate.

TABLE 6.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—	
					Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)
		In	*In*				*Pct*		
Trinity: Tr, Tw	D	10–30	0–64	Clay	CH	A–7–6		100	98–100
Uhland: Uh	B	20–30	0–6	Clay loam	CL	A–6, A–7–6	0–10	95–100	95–100
			6–60	Fine sandy loam, loam.	CL, SC, CL–ML, SM–SC	A–4, A–6	0–10	95–100	90–100
Vernia: VeD	A	>60	0–48	Very gravelly sand, very gravelly loamy sand.	GP–GM, GM	A–1, A–2–4	5–10	15–40	15–34
			48–62	Very gravelly sandy clay loam.	GC, SC	A–2–6, A–2–7	2–5	30–65	13–50
Wilson:									
WgB, WgC	D	6–12	0–6	Gravelly clay loam	CL, SC	A–4, A–6	0–5	75–100	50–85
			6–64	Clay	CL, CH	A–7–6		95–100	95–100
WsA, WsB	D	6–12	0–6	Clay loam	CL	A–4, A–6		95–100	95–000
			6–42	Clay	CL, CH	A–7–6		95–100	95–100
			42–65	Clay	CL, CH	A–7–6		95–100	95–100

[1] NP means nonplastic.

TABLE 7.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or this reason it is necessary to follow carefully the instructions for referring to other series that appear in

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill[1]	Local roads and streets
*Axtell:						
AfA	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Slight	Severe: low strength; shrink-swell.
AfC, AfC2	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Slight	Severe: low strength; shrink-swell.
AfE2, AtD	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Severe: low strength; shrink-swell.	Moderate: slope.	Severe: low strength; shrink-swell.
For Tabor part of AtD, see Tabor series.						
Bastrop: BaA, BaB, BaC2.	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Slight	Moderate: low strength.
Behring:						
BeB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
BeC2, BeD2	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Bosque: Bo	Moderate: percs slowly.	Moderate: seepage.	Moderate: floods; too clayey.	Severe: floods	Moderate: floods.	Moderate: low strength.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Cont.		Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
		Pct		*In per hr*	*In per in of soil*	*pH*			
85–100	80–95	51–60	30–38	<0.06	0.15–0.20	7.9–8.4	High	High	Low.
90–100	70–90	35–45	18–25	0.2–0.6	0.15–0.20	6.1–7.8	Moderate	High	Low.
80–100	36–65	22–35	5–12	0.2–0.6	0.10–0.14	6.1–7.8	Low	Moderate	Low.
10–30	5–25	<25	NP–4	6.0–20	0.03–0.05	6.1–7.8	Low	Low	Low.
13–45	13–31	35–45	18–30	0.6–2.0	0.08–0.13	4.5–6.0	Low	Moderate	Moderate.
50–80	45–60	25–35	9–17	0.2–0.6	0.10–0.15	6.1–7.3	Low	High	Moderate.
90–100	70–90	41–55	25–35	<0.06.	0.15–0.20	6.6–8.4	High	Very high	Moderate.
95–100	60–85	25–35	9–17	0.2–0.6	0.15–0.20	6.1–7.3	Low	High	Moderate.
95–100	70–90	41–55	25–35	<0.06	0.15–0.20	6.6–8.4	High	Very high	Moderate.
90–100	70–90	41–55	25–35	<0.06	0.12–0.15	7.4–8.4	High	Very high	Low.

properties of the soils

more kinds of soil. The soils in such mapping units may have different properties and limitations, and for the first column of this table. Seepage, percs slowly, and other terms used in this table are defined in the Glossary]

Degree and kind of limitation for—Cont.		Suitability as source of—		Soil features affecting—		
Pond reservoir areas	Embankments, dikes, and levees	Roadfill	Topsoil	Drainage of crops and pasture	Irrigation	Terraces and diversions
Slight	Moderate: unstable fill.	Poor: low strength; shrink-swell.	Poor: thin layer.	Percs slowly	Percs slowly; slow intake.	Erodes easily; percs slowly.
Slight	Moderate: unstable fill.	Poor: low strength; shrink-swell.	Poor: thin layer.	Percs slowly	Percs slowly; slow intake.	Erodes easily; percs slowly.
Slight	Moderate: unstable fill.	Poor: low strength; shrink-swell.	Poor: thin layer.	Percs slowly	Percs slowly; slow intake.	Erodes easily; percs slowly.
Moderate: seepage.	Moderate: piping.	Fair: low strength.	Fair: thin layer.	Not needed	Favorable	Favorable.
Slight	Moderate: unstable fill.	Poor: low strength.	Fair: too clayey.	Percs slowly	Percs slowly; slow intake.	Favorable.
Slight	Moderate: unstable fill.	Poor: low strength.	Fair: too clayey.	Percs slowly	Percs slowly; slope.	Favorable.
Moderate: seepage.	Moderate: compressible.	Fair: low strength.	Fair: too clayey.	Not needed	Favorable	Favorable.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill[1]	Local roads and streets
Burleson: BuB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
Crockett:						
CfB, CgC, CsC2	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
ChE, CsE2, CsD3	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Demona: DeC	Severe: percs slowly.	Severe: seepage.	Severe: cutbanks cave; wet.	Moderate: wet	Moderate: wet	Moderate: shrink-swell.
Demona variant: Dm	Severe: percs slowly.	Severe: seepage.	Severe: cutbanks cave; wet.	Moderate: wet	Moderate: wet	Moderate: shrink-swell.
Dougherty: DoB, DoD.	Slight	Severe: seepage.	Moderate: cutbanks cave.	Slight	Severe: seepage.	Moderate: low strength.
Ferris: FeF2	Severe: percs slowly; slope.	Severe: slope	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Gowen: Gs	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods
Heiden:						
HeB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
HeC2, HeD2	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Houston Black: HoA, HoB.	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Jedd: JeF	Severe: depth to rock; percs slowly.	Severe: depth to rock.	Severe: large stones.	Severe: large stones.	Severe: depth to rock; large stones.	Moderate: large stones.
Krum: KrA	Severe: percs slowly.	Slight	Severe: cutbanks cave; too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Lincoln: Ls, Lw	Severe: floods	Severe: floods; seepage.	Severe: cutbanks cave; floods.	Severe: floods	Severe: floods; seepage.	Severe: floods
Mabank: MaA, MaB	Severe: percs slowly; wet.	Severe: wet	Severe: too clayey; wet.	Severe: shrink-swell; wet.	Severe: too clayey.	Severe: low strength; shrink-swell.
Norwood: Nd, No	Moderate: floods; percs slowly.	Severe: floods	Moderate: floods.	Severe: floods	Moderate: floods.	Severe: low strength.
Patilo: PaE	Moderate: percs slowly; slope.	Severe: seepage; slope.	Severe: cutbanks cave.	Slight	Moderate: too sandy.	Slight
Rosanky: RoB, RoD	Severe: percs slowly.	Moderate: slope.	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.

properties of the soils—Continued

Degree and kind of limitation for—Cont.		Suitability as source of—		Soil features affecting—		
Pond reservoir areas	Embankments, dikes, and levees	Roadfill	Topsoil	Drainage of crops and pasture	Irrigation	Terraces and diversions
Slight	Moderate: hard to pack; unstable fill.	Poor: shrink-swell.	Poor: too clayey.	Percs slowly	Slow intake	Percs slowly.
Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: thin layer.	Not needed	Percs slowly	Erodes easily; percs slowly.
Slight	Moderate: compressible; unstable fill.	Poor: low strength; unstable fill.	Poor: thin layer.	Not needed	Percs slowly; slope.	Erodes easily; percs slowly.
Moderate: seepage.	Moderate: erodes easily.	Fair: low strength.	Poor: too sandy.	Cutbanks cave; percs slowly.	Fast intake; soil blowing.	Erodes easily; piping.
Moderate: seepage.	Moderate: erodes easily.	Fair: low strength.	Poor: too sandy.	Cutbanks cave; percs slowly.	Fast intake; soil blowing.	Erodes easily; piping.
Severe: seepage	Moderate: piping; unstable fill.	Fair: low strength.	Poor: too sandy.	Not needed	Erodes easily; fast intake; seepage.	Erodes easily; too sandy.
Slight	Moderate: unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Not needed	Percs slowly; slope.	Percs slowly; slope.
Moderate: seepage.	Moderate: compressible.	Poor: low strength.	Fair: too clayey.	Not needed	Floods	Floods.
Slight	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Not needed	Slow intake	Percs slowly.
Slight	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Not needed	Slow intake; slope.	Percs slowly; slope.
Slight	Moderate: compressible; unstable fill.	Poor: shrink-swell; unstable fill.	Poor: too clayey.	Percs slowly	Slow intake	Percs slowly.
Severe: depth to rock.	Moderate: piping.	Poor: large stones; thin layer.	Poor: large stones.	Not needed	Rooting depth; slope.	Large stones; rooting depth; slope.
Moderate: seepage.	Moderate: low strength.	Poor: low strength; shrink-swell.	Poor: too clayey.	Not needed	Slow intake	Erodes easily; percs slowly.
Severe: seepage	Moderate: piping; unstable fill.	Good	Poor: too sandy.	Floods	Fast intake; seepage.	Not needed.
Slight	Moderate: unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Percs slowly; slow intake.	Percs slowly.
Moderate: seepage.	Moderate: piping.	Poor: low strength.	Fair: too clayey.	Floods	Floods	Not needed.
Severe: seepage	Moderate: piping; seepage.	Good	Poor: too sandy.	Cutbanks cave	Fast intake; soil blowing.	Erodes easily; piping; slope.
Moderate: seepage.	Moderate: piping; unstable fill.	Fair: shrink-swell.	Poor: thin layer.	Percs slowly; slope.	Percs slowly; slope.	Percs slowly; slope.

TABLE 7.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill[1]	Local roads and streets
Sayers: Sa, Sb	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods
Shep: SeD2	Slight	Severe: seepage	Slight	Slight	Slight	Moderate: low strength.
Ships: Sg	Severe: percs slowly.	Severe: floods	Severe: too clayey.	Severe: floods; low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Silstid: SkC	Slight	Moderate: seepage; slope.	Moderate: cutbanks cave.	Slight	Slight	Slight
Smithville: Sm	Moderate: floods; percs slowly.	Severe: floods	Moderate: floods.	Severe: floods	Moderate: floods.	Moderate: floods; shrink-swell.
Tabor: TfA, TfB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Trinity: Tr, Tw	Severe: floods; percs slowly.	Severe: floods	Severe: floods; wet.	Severe: floods; shrink-swell; wet.	Severe: floods	Severe: floods; shrink-swell.
Uhland: Uh	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods
Vernia: VeD	Slight	Moderate: seepage; slope.	Severe: small stones.	Slight	Severe: small stones.	Slight
Wilson: WgB, WgC, WsB	Severe: percs slowly.	Moderate: slope.	Severe: wet	Severe: shrink-swell; wet.	Severe: small stones; too clayey.	Severe: shrink-swell.
WsA	Severe: percs slowly.	Slight	Severe: wet	Severe: shrink-swell; wet.	Severe: too clayey.	Severe: shrink-swell.

[1] Onsite study of the underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water is needed for landfills deeper than 5 or 6 feet.

different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 6.

Hydrologic soil groups indicate the runoff potential of rainfall. Four major soil groups are used. The soils are grouped on the basis of intake of water at the end of storms of long duration that occur after prior wetting and opportunity for swelling and without the protective effects of vegetation. The major hydrologic soil groups are described as follows:

Group A: (Low runoff potential) These soils have a high infiltration rate even when thoroughly wetted. They are mostly deep, well-drained to excessively drained sands or gravels. They have a high rate of water transmission, and water readily passes through them.

Group B: These soils have a moderate infiltation rate when thoroughly wetted. They are mostly moderately deep to deep, moderately well drained to well drained soils that are moderately fine textured to moderately coarse textured. They have a moderate rate of water transmission.

Group C: These soils have a slow infiltration rate when thoroughly wetted. They are mostly soils that have a layer that impedes the downward movement of water or soils that are moderately fine textured to fine textured. They have a slow rate of water transmission.

Group D: (High runoff potential) These soils have a very slow infiltration rate when thoroughly wetted. They are mostly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. They have a very slow rate of water transmission.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 6 in the standard terms used by the United States Department of Agri-

properties of the soils—Continued

Degree and kind of limitation for—Cont.		Suitability as source of—		Soil features affecting—		
Pond reservoir areas	Embankments, dikes, and levees	Roadfill	Topsoil	Drainage of crops and pasture	Irrigation	Terraces and diversions
Severe: seepage	Moderate: piping.	Good	Fair: thin layer.	Floods	Floods	Not needed.
Severe: seepage	Moderate: piping.	Fair: low strength.	Fair: too clayey.	Not needed	Slope	Slope.
Slight	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Percs slowly	Percs slowly; slow intake.	Not needed.
Moderate: seepage.	Moderate: piping.	Good	Poor: too sandy.	Not needed	Erodes easily; fast intake.	Too sandy.
Severe: seepage	Moderate: piping.	Fair: shrink-swell.	Good	Favorable	Favorable	Not needed.
Slight	Moderate: unstable fill.	Poor: low strength; shrink-swell.	Fair: thin layer.	Not needed	Slow intake	Percs slowly.
Slight	Moderate: compressible; unstable fill.	Poor: low strength; shrink-swell.	Poor: too clayey.	Floods: percs slowly.	Floods; percs slowly; wet.	Floods; percs slowly; wet.
Moderate: seepage	Moderate: piping; unstable fill.	Fair: wet	Fair: too clayey.	Floods	Floods	Not needed.
Moderate: seepage	Moderate: seepage.	Good	Poor: small stones.	Not needed	Droughty	Not needed.
Slight	Moderate: compressible.	Poor: shrink-swell.	Poor: small stones; too clayey.	Percs slowly; wet.	Percs slowly	Percs slowly.
Slight	Moderate: compressible.	Poor: shrink-swell.	Poor: too clayey.	Percs slowly; wet	Percs slowly	Percs slowly.

culture (USDA). These terms take into account the relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary at the back of this survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to the plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil is plastic. Liquid limit and plasticity index are estimated in table 6, but in table 8 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 6 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH value and terms used to describe soil reaction are explained in the Glossary.

TABLE 8.—*Engineering*

[Tests performed by Texas Highway Department, Materials

Soil name and location	Parent material	Report number	Depth	Volume shrinkage	Shrinkage ratio	Shrinkage limit[1]	Linear shrinkage
			In	*Pct*	*Pct*	*Pct*	*Pct*
Bastrop fine sandy loam:							
3.1 miles northeast on Short Street and River Loop Road from the intersection of Texas Highway 71 in Smithville, Texas; 50 feet south in a field. (Modal)	Nearly level, old, high terrace of the Colorado River.	69–136R	0–6	6.5	1.77	17	2.2
		69–137R	6–16	6.5	1.74	17	2.2
		69–138R	16–36	24.1	1.85	17	8.8
		69–139R	36–75	28.1	1.89	14	10.4
Behring clay loam:							
3.2 miles north on Texas Highway 95 from the intersection of U.S. 290 at the western edge of Elgin, Texas; 0.2 mile north on Travis-Bastrop County line road; 100 feet east in a cultivated field. (Modal)	Marl of the Eocene	68–551R	0–6	35.1	1.91	14	13.5
		68–552R	6–16	42.8	2.02	11	17.0
		68–553R	16–32	45.9	2.00	12	18.5
		68–554R	32–34	50.7	1.93	15	21.0
		68–555R	44–60	53.8	1.93	15	22.5
Bosque loam:							
0.8 mile west on Texas Highway 71 from the west end of the new Colorado River bridge at Bastrop, Texas; 100 feet north in field. (More clayey than Modal)	Nearly level, low terrace of the Colorado River.	69–175R	0–6	28.3	1.88	15	10.5
		69–176R	6–24	33.0	1.88	16	12.5
		69–177R	24–38	36.6	1.97	13	14.1
		69–178R	38–60	31.4	1.92	14	11.8
Crockett fine sandy loam:							
2.8 miles south from the intersection of U.S. 290 at the railroad overpass in southwestern part of Elgin, Texas; 175 feet east in field. (Modal)	Erosional upland	69–106R	0–8	5.3	1.64	20	1.8
		69–107R	8–18	44.3	1.90	13	17.7
		69–108R	18–36	41.6	1.91	14	16.4
		69–109R	36–50	40.3	2.04	11	15.8
Jedd stony soils:							
2.4 miles west on Farm Road 535 from the intersection of Texas highway 304; 100 feet south in pasture. (Modal)	Strongly sloping, erosional upland plain.	69–194R	0–4	3.6	1.51	23	1.2
		69–195R	4–12	1.8	1.62	21	0.6
		69–196R	12–22	31.4	1.80	17	11.8
		69–197R	22–32	25.9	1.82	16	9.5
Krum silty clay:							
0.5 mile south on a country road from its intersection with Farm Road 153 at the Buescher Park entrance; 0.3 mile east in a cultivated field. (Modal)	Alluvium of Colorado River.	69–179R	0–28	46.9	2.02	12	19.0
		69–180R	28–42	46.9	1.97	14	19.0
Patilo fine sand:							
0.5 mile northeast on Short Street from its intersection with Texas Highway 71 in Smithville; 0.4 mile east on Colorado River Loop Road; 50 feet south in field. (Modal)	Old, high terrace of Colorado River.	69–152R	0–12	1.5	1.66	19	0.5
		69–153R	12–48	0.6	1.71	19	0.2
Rosanky fine sandy loam:							
2.7 miles south on Texas Highway 304 from its intersection with Farm Road 585; 0.7 mile south on a county road from its intersection with Texas highway 304; 50 feet east in a pasture. (Modal)	Sloping, erosional upland.	69–116R	0–5	8.2	1.58	23	2.8
		69–117R	5–8	10.4	1.61	22	3.6
		69–118R	8–20	32.1	1.80	17	12.1
		69–119R	20–30	23.4	1.71	20	8.5
		69–120R	30–46	13.4	1.65	22	4.7
		69–121R	46–56	7.9	1.58	24	2.7
		69–122R	56–64	4.4	1.56	24	1.5
Sayers fine sandy loam:							
1.7 miles north on Texas Highway 95 from its intersection with Farm Road 2336; 1.8 miles southwest on county road down Big Sandy Creek; 350 feet southeast into creek bottom. (Modal)	Mixed sandy alluvium	71–250R	0–10	7.8	1.69	20	2.6
		71–251R	10–24	1.8	1.65	21	0.6
		71–252R	24–42	.....	1.68	21	0
		71–253R	42–60	.....	1.65	22	0

test data

and Testing Division, Camp Hubbard, Austin, Texas]

Mechanical analysis[2]											Liquid limit[1]	Plasticity index[1]	Classification[3]	
Percentage passing sieve—								Percentage smaller than—					AASHTO[4]	Unified[5]
1¼ in.	⅞ in.	⅝ in.	⅜ in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
											Pct			
					100	97	53	41	9	6	20	4	A–4(4)	CL–ML
					100	97	53	43	12	8	19	3	A–4(4)	ML
					100	98	68	58	31	29	34	20	A–6(11)	CL
					100	99	66	59	31	29	34	20	A–6(11)	CL
			100	99	98	96	85	74	38	32	43	27	A–7–6(15)	CL
				100	99	97	89	81	46	39	49	31	A–7–6(18)	CL
			100	99	97	96	89	83	47	42	54	37	A–7–6(19)	CH
					100	97	94	90	59	50	68	46	A–7–6(20)	CH
					100	99	98	92	64	53	75	53	A–7–6(20)	CH
					100	99	78	71	33	24	36	19	A–6(12)	CL
					100	99	79	72	41	34	42	25	A–7–6(14)	CL
					100	99	78	72	44	37	42	24	A–7–6(14)	CL
				100	99	98	74	70	40	35	38	23	A–6(12)	CL
			100	99	98	95	57	37	11	10	23	3	A–4(4)	ML
					100	99	87	84	57	55	55	32	A–7–6(19)	CH
				100	99	94	84	79	48	48	51	33	A–7–6(19)	CH
					100	95	72	67	44	39	45	30	A–7–6(16)	CL
100	96	95	94	91	88	87	16	13	4	2	27	4	A–2–4(0)	SM
[6]98	90	85	82	76	72	70	11	8	2	1	24	3	A–2–4(0)	SP–SM
			100	99	99	98	59	59	54	52	42	21	A–7–6(10)	CL
				100	99	98	45	44	39	33	36	19	A 6(5)	SC
					100	99	93	89	56	48	55	34	A–7–6(19)	CH
				100	99	98	94	94	59	50	59	38	A–7–6(20)	CH
				100	99	89	13	9	4	2	22	3	A–2–4(0)	SM
				100	99	88	11	8	4	2	23	4	A–2–4(0)	SP–SM
100	98	98	97	93	88	86	48	28	3	2	29	5	A–4(3)	SM
		100	97	92	85	81	46	25	5	3	29	6	A–4(2)	SM
				100	99	99	75	62	50	48	44	23	A–7–6(14)	CL
							64	53	38	36	38	19	A–6(10)	CL
							51	43	24	22	32	10	A–4(3)	CL
							44	33	18	16	30	7	A–4(2)	SM
							39	29	14	13	27	2	A–4(1)	SM
						100	50	39	16	13	25	4	A–4(3)	SM–SC
						100	28	15	8	7	26	3	A–2–4(0)	SM
						100	12	8	5	5	24	3	A–2–4(0)	SP–SM
						100	5	3	2	2	26	3	A–2–4(0)	SP–SM

TABLE 8.—*Engineering*

Soil name and location	Parent material	Report number	Depth	Volume shrinkage	Shrinkage ratio	Shrinkage limit[1]	Linear shrinkage
			In	*Pct*	*Pct*	*Pct*	*Pct*
Ships silty clay:							
0.5 mile north on the Old Bastrop Highway from the Legion Hall on the north side of the Colorado River in Smithville, Texas; 0.5 mile east in a cultivated field. (Modal)	Nearly level flood plain of the Colorado River.	69–88R	0–18	47.4	1.89	17	19.3
		69–89R	18–45	47.4	1.95	15	19.3
		69–90R	45–60	44.9	1.94	14	18.0
Smithville fine sandy loam:							
0.55 mile southeast on Texas Highways 71 and 95 from the intersection of Farm Road 153; 100 feet west in a cultivated field. (Modal)	Nearly level, low terrace of the Colorado River.	71–371R	0–6	8.8	1.83	15	3.0
		71–372R	6–16	12.0	1.84	16	6.1
		71–373R	16–30	23.2	1.83	17	8.5
		71–374R	30–50	23.8	1.85	16	8.7
		71–375R	50–60	12.8	1.86	16	4.5

[1] Laboratory test procedures may cause minor discrepancies in shrinkage limit, liquid limit, and the computed plasticity index.
[2] Mechanical analyses according to the AASHTO Designation T 88 (*1*). Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The me-

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material that has this rating.

Corrosivity, as used in table 6, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity to concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations made entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer. This column was not included in table 6 because bedrock is many feet below the soil surface in all but Jedd soils, where it is at a depth of 20 to 40 inches.

Interpretations of engineering properties of the soils

The estimated interpretations in table 7 are based on the engineering properties of soils shown in table 6, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Bastrop County. In table 7 ratings are used to summarize limitation or suitability of the soils for all listed purposes other than drainage for crops and pasture, irrigation, and terraces and diversions. For these particular uses, table 7 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use, or in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special design, or intensive maintenance.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 7.

Septic tank absorption fields are subsurface sys-

test data—Continued

Mechanical analysis[2]											Liquid limit[1]	Plasticity index[1]	Classification[3]	
Percentage passing sieve—								Percentage smaller than—					AASHTO[4]	Unified[5]
1¼ in.	⅞ in.	⅝ in.	⅜ in.	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
											Pct			
							99	99	78	56	64	39	A–7–6(20)	CH
							98	97	76	56	61	38	A–7–6(20)	CH
							99	96	66	51	56	34	A–7–6(19)	CH
						100	51	40	15	12	20	5	A–4(3)	ML–CL
						100	55	8	23	20	27	15	A–6(6)	CL
					100	99	57	50	30	27	34	19	A–6(8)	CL
					100	99	58	51	20	26	34	19	A–6(8)	CL
			100	99	99	98	47	40	21	16	24	9	A–4(2)	SC

canical analyses used in this table are not suitable for use in naming textural classes of soil.
[3] Unified and AASHTO classification made by SCS personnel.
[4] Based on AASHTO Designation M 145-49 (*1*).
[5] Based on the Unified Soil Classification System (*2*).
[6] 100 percent of material passed the 1¾ inch sieve.

tems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a floor that is nearly level and sides or embankments of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope. If the floor needs to be leveled, depth to bedrock is important. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified soil classification, and the amount of stones, if any, which influences the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings without basements, as rated in table 7, are no more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 7 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but

regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 7, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly of asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among the factors that are unfavorable.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope, depth to bedrock or other unfavorable material, presence of stones, permeability, and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Sand and gravel columns were not included in the table because the soils of Bastrop County are not good sources.

Engineering test data

Table 8 contains engineering test data for some of the major soil series in Bastrop County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Volume shrinkage is the volume change that occurs when the moisture content is reduced from the liquid limit to the shrinkage limit. It is expressed as a percentage.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when oven-dry.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as has been explained for table 6.

Formation and Classfication of the Soils

This section describes the major factors of soil formation as they have existed in Bastrop County. It also explains the system of classification currently used and classifies each soil series in the county according to that system.

Factors of Soil Formation

The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and

existed since accumulation; (3) the plant and animal life on and in the soil; (4) the topography, or lay of the land; and (5) the length of time the factors of soil formation have acted on the soil material.

Climate and vegetation are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and bring about the development of genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed, and in extreme instances, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. Generally, a long time is required for the development of distinct horizons.

Climate

The humid, subtropical climate of Bastrop County is influenced mostly by the tropical Maritime airmasses from the Gulf of Mexico, but the climate is modified by the polar airmasses.

In most years rainfall is heavy enough to cause some leaching. Because the rainfall is well distributed, the soils are alternately wet and dry. When dry, most of the clayey soils, such as Houston Black soils, crack severely, and the cracks fill with water when it rains. Thus, these clayey soils are wet to a greater depth than the other soils. After the soils become wet, the cracks close. On the deeper, sandy surfaced soils, little runoff occurs. Rainfall is absorbed and drains through, and it leaches the soil and alters the underlying parent material.

Winters are not severe enough in Bastrop County for freezing to affect soil formation. The temperature of the soil remains high enough so that microorganisms are active at all times. In most winters the surface layer of the soil freezes only to a depth of an inch or so and seldom stays frozen more than 2 or 3 days.

Living organisms

Plants, animals, insects, bacteria, and fungi are important in the formation of soil. In prairie soils, grasses had more influence than other plants on soil formation. These tall grasses provided litter that protected the surface and added organic matter to the soil. The roots reached deep into the soil and took up the minerals. When the plants died, large amounts of these minerals were left on or near the surface. As the years passed, the prairie soils formed as a result of the decomposition of the grasses, which returned lime, other minerals, and organic matter to the soils. When the plants decomposed, the roots left channels that increased the water intake and aeration. Earthworms and other organisms fed on the decomposed roots, and the boring of the earthworms also helped to channel water and air through the soil profile.

Many of the same animals and plants lived, developed, and died in the timbered soils, but they had less effect than on the prairie soils.

Parent material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil (*3*).

The parent material in Bastrop County ranges from Cretaceous to Recent in age and consists mainly of clay, sand, silt, and sandstone. Except for the alluvium along the Colorado River, the outcrops of geologic formations lie in more or less parallel bands that trend roughly northeasterly. The older stratigraphic units are exposed near the northwestern limits of the county. Younger bedrock units are exposed in sequence in a generally southeastward direction.

The Kemp Clay Formation (Navarro Group) of Cretaceous age is exposed along the northwestern county line south of the Colorado River. The Kemp Clay is mostly clay, silt, and some lenses of bluish sandstone. The Heiden and Houston Black series are the dominant soils within this outcrop.

Strata of the Tertiary System are represented by the Midway, Wilcox, and Claiborne Groups (Eocene Series) in the county.

The Midway Group, which consists of the Kemp Clay and Kincaid Formations, extends across Bastrop County near the northwestern county line. This group, which has a maximum thickness of 800 feet, consists of clay, silt, glauconitic sand, and thin beds of limestone and sandstone. These materials have weathered to form Behring, Crockett, and Wilson soils.

The Wilcox Group (undivided) crops out across the western part of the county in a belt that ranges from about 9 to 15 miles wide and in a narrow belt that extends from Elgin to the Cedar Creek community and southwestward into Caldwell County. The Wilcox Group is mostly fine to coarse sand and a smaller amount of clay, sandy clay, sandstone, and silty shale and a few lenses of limestone and lignite. This is the most important water-bearing unit in the county and yields small to large quantities of water to many wells for domestic and livestock use, public supply, industrial use, and irrigation (*4*). Strata of this unit furnish all the water used by the cities of Bastrop and Elgin and about half of the total ground water used for irrigation in the county. The principal soils that formed in strata of the Wilcox Group are those in the Wilson, Crockett, Axtell, Tabor, and Mabank series.

The Claiborne Group is exposed in the eastern part of the county and consists of, in order of outcrop from west to east, the Carrizo Sand, Reklaw, Queen City Sand, Weches, Sparta Sand, Cook Mountain, and Yegua Formations. These formations are mostly sand, silt, clay, and thin beds of sandstone. The Cook Mountain Formation is characterized by a few thin lenses of limestone, glauconite, and gypsum. Patilo, Silstid, and Demona are the principal soils that formed in the Carrizo Sand, Queen City Sand, and Sparta Sand Formations. Strata of the Reklaw, Weches, and Yegua Formations have weathered to form Rosanky, Jedd, Axtell, and Tabor soils. Crockett and Heiden soils formed in the clayey material of the Cook Mountain Formation.

The Colorado River flows from the northwest to the southeast across the central part of the county. Deposits of Pleistocene and Recent age of the Quarter-

nary System occur on flood plains and terraces of the Colorado River and its major tributaries. Materials are mainly gravel, sand, silt, and clay. Examples of soils on bottom lands and low terraces are those in the Bosque, Smithville, Norwood, Krum, Ships, Lincoln, and Trinity series. Typical soils that formed on the higher terraces include those in the Axtell, Bastrop, Mabank, and Shep series.

Topography

Topography, or lay of the land, accounts for variations in elevation and affects soil formation within a local area. Because of its influence on runoff and drainage, relief may favor some processes of horizon development and inhibit others. In Bastrop County the soils are nearly level to moderately steep.

The degree of development in a soil profile depends mainly on the amount of moisture in the soil, providing the other factors of soil formation are equal. Sloping soils take in less moisture, and their profiles have less distinctively developed horizons. As a result, soils on the more sloping topography are shallow.

Relief affects the soil temperature. Slopes that face south and west have more exposure to sunlight than those that face north and east. Slopes on the south and west are warmer and drier than those on the north and east. For these reasons, the adapted vegetation differs on similar slopes in relation to the amount of sunlight received.

Time

The length of time that climate, living organisms, parent material, and relief or drainage have had to work determines to a great extent the kind of soil that forms. Young soils have little development. The soil material has not been in place long enough for well-defined, genetically related horizons to form.

The Trinity and Gowen soils on flood plains are examples of young soils. The older soils, which have well-defined horizons, have been in place a long time. They have approached equilibrium with the environment. These older soils are generally well drained or moderately well drained and have nearly level to gently sloping topography. Crockett soils are an example of an older soil in Bastrop County.

Processes of Horizon Differentiation

The differentiation of soil horizons is the result of several processes. These processes include accumulation of organic matter, leaching of the carbonates and salts, reduction and transfer of iron, and the translocation of the clay minerals. In most soils more than one of these processes have been active in the development of the horizons.

Accumulation of organic matter in the upper part of the profile has been important in the formation of an A1 horizon. The soils in the western part of Bastrop County have a dark-colored surface layer and are higher in organic-matter content. These soils formed under an organic-rich system of mid and tall grasses. Other soils, in the central and eastern parts of the county, formed under a hardwood or grassland savannah system. Their surface layer ranges from light to dark in color and has a corresponding organic-matter content.

Some leaching of carbonates and bases has occurred in nearly all the soils. Most of the soils in the county are slightly to moderately leached, and this has contributed to the development of horizons. Leaching of carbonates has occurred in the Burleson, Crockett, and Wilson soils; all of them are noncalcareous in the upper part. In the calcareous Houston Black and Heiden soils only a slight amount of leaching has occurred, and carbonates occur throughout the profiles of these soils.

Reduction and transfer of iron, a process known as gleying, is evident in the poorly drained soils. Grayish colors in the subsoil indicate the reduction and loss of iron. Mottles and iron-manganese concretions indicate iron segregation. The B horizon of the Crockett soils shows evidences of this process.

Tabor and Silstid soils are examples of soils that have a translocation of clay minerals. The B horizon has an accumulation of clay, which has leached from the A horizon. Clay is carried downward by water into the B horizon and deposited as clay films in pores and on the faces of peds. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of Bastrop County.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*7*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*5*).

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that soils of similar genesis, or mode of origin, are grouped. In table 9,

TABLE 9.—*Classification of soil series*

Series	Family	Subgroup	Order
Axtell	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Bastrop	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Behring	Fine, montmorillonitic, thermic	Udertic Haplustolls	Mollisols.
Bosque	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Burleson	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Crockett	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Demona	Clayey, mixed, thermic	Aquic Arenic Paleustalfs	Alfisols.
Demona variant	Clayey, mixed, thermic	Aquic Arenic Paleustalfs	Alfisols.
Dougherty	Loamy, mixed, thermic	Arenic Haplustalfs	Alfisols.
Ferris	Fine, montmorillonitic, thermic	Udorthentic Chromusterts	Vertisols.
Gowen	Fine-loamy, mixed, thermic	Cumulic Hapludolls	Mollisols.
Heiden	Fine, montmorillonitic, thermic	Udic Chromusterts	Vertisols.
Houston Black	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Jedd	Fine, mixed, thermic	Ultic Paleustalfs	Alfisols.
Krum	Fine, mixed, thermic	Vertic Haplustolls	Mollisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Mabank	Fine, montmorillonitic, thermic	Vertic Albaqualfs	Alfisols.
Norwood	Fine-silty, mixed (calcareous), thermic	Typic Udifluvents	Entisols.
Patilo	Loamy, siliceous, thermic	Grossarenic Paleustalfs	Alfisols.
Rosanky	Fine, mixed, thermic	Ultic Paleustalfs	Alfisols.
Sayers	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Shep	Fine-loamy, mixed, thermic	Typic Ustochrepts	Inceptisols.
Ships	Very fine, mixed, thermic	Udertic Haplustolls	Mollisols.
Silstid	Loamy, siliceous, thermic	Arenic Paleustalfs	Alfisols.
Smithville	Fine-loamy, mixed, thermic	Pachic Argiustolls	Mollisols.
Tabor	Fine, montmorillonitic, thermic	Aquic Paleustalfs	Alfisols.
Trinity	Fine, montmorillonitic, (calcareous), thermic	Vertic Haplaquolls	Mollisols.
Uhland	Coarse-loamy, mixed, nonacid, thermic	Aquic Ustifluvents	Entisols.
Vernia	Loamy-skeletal, mixed, thermic	Grossarenic Paleustalfs	Alfisols.
Wilson	Fine, montmorillonitic, thermic	Vertic Ochraqualfs	Alfisols.

the soil series of Bastrop County are placed in three categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables, ending in *sol* (Ent-i-sol). The five soil orders in Bastrop County are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols have a light-colored surface layer that is low in organic-matter content, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent. *Entisols* have little or no evidence of development of pedogenic horizons. *Inceptisols* have a light-colored surface layer that is low in organic-matter content, but they do not have a clay-enriched B horizon. *Mollisols* have a dark-colored surface layer that is high in organic-matter content and have a base saturation of more than 50 percent. *Vertisols* are clayey soils that have deep, wide cracks during part of most years.

SUBORDER. Each order is divided into suborders, based mainly on those soil characteristics that seem to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences that result from climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent (Aqu,* meaning water or wet; and *ent,* from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Haplaquents (Hapl,* meaning simple horizons; *aqu,* for wetness or water; and *ent,* from Entisols).

SUBGROUP. Each great group is divided into subgroups, one that represents the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives in front of the name of the great group. An example is *Typic Haplaquents* (a typical Haplaquent).

FAMILY. Soil families are established within a sub-

group mainly on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 9). An example is the coarse-loamy, siliceous, acid, thermic family of Typic Haplaquents.

Climate[5]

The climate of Bastrop County is humid and subtropical. Summers are hot. Tropical Maritime airmasses predominate throughout spring, summer, and fall. Modified polar airmasses are dominant in winter and provide a continental climate characterized by considerable variations in temperature. Average annual temperature is 68° F. Average annual precipitation is 37.18 inches. Maximum rainfall, in the form of thundershowers, occurs in June and September. The wettest year of record is 1957, when a total of 59.35 inches fell at Smithville. Only 19.78 inches fell in 1954, the driest year of record. The prevailing winds are southerly all year. The average annual relative humidity at Smithville is 83 percent at 6:00 a.m., 55 percent at noon, and 52 percent at 6:00 p.m. Seasonal variations in relative humidity are small. Smithville receives approximately 62 percent of the total possible sunshine annually.

Winter temperatures are sufficiently mild to cause little or no interference with outdoor work or recreation. The season is not marked by any prolonged periods of cold weather but rather by short cold spans of 36 to 72 hours. There is considerable variety in the day-to-day weather as conditions fluctuate between warm, dry periods and cool, wet periods. Cloudiness often persists through the morning hours, dissipating by noon, and skies are mainly clear to partly cloudy in the afternoon. Precipitation most often occurs as light rain or drizzle. The arithmetic mean is not a useful statistic for estimating expected snowfall, because it is biased by infrequent heavy snows. For example, measurable snow has fallen in the month of January at Smithville in only 2 of the past 30 years. A total of 6 inches fell in January 1944, and 2 inches fell in January 1940.

Summer temperatures are high in the daytime. Thundershowers occur in June, but the months of July and August are hot and relatively dry, and there is little variation in the weather from day to day.

Spring and fall are pleasant seasons characterized by mild days and cool nights. March is the driest month of the year. Thundershower activity increases significantly in April. Considerable early morning cloudiness continues in spring but dissipates more quickly than in winter. The early part of fall is relatively wet, but precipitation decreases in October. Often in fall there are long periods of uninterrupted fair weather and light winds.

The average length of the warm season (freeze-free period) at Smithville is 268 days. The average dates of the last occurrence of 32° or below in spring and the first occurrence of 32° or below in fall are March 6 and November 29, respectively. The average annual lake evaporation is 55 inches. Thunderstorms occur on an average of 43 days annually. Destructive winds and damaging hailstorms are infrequent. Table 10 shows a climatological summary for Bastrop County.

[5] By ROBERT B. ORTEN, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature*

[Data from Smithville, for period 1939-68;

Month	Temperature[1]				Precipitation				
	Average daily high	Average monthly high	Average daily low	Average monthly low	Average total[1]	Probability of receiving selected amounts during month			
						0 or trace	0.50 inch or more	1.00 inch or more	2.00 inches or more
	°F	°F	°F	°F	In	Pct	Pct	Pct	Pct
January	62.6	79.7	37.7	20.4	2.55	<1	88	74	48
February	65.5	82.4	41.6	26.0	2.91	<1	95	83	57
March	72.6	87.3	47.6	29.7	1.98	<1	91	75	45
April	80.5	91.0	57.4	40.3	3.90	<1	95	85	65
May	86.9	95.2	65.0	51.8	3.91	<1	97	92	75
June	92.7	98.8	70.6	62.3	4.44	<1	93	80	60
July	96.7	102.3	72.7	67.2	2.31	<1	90	80	50
August	97.8	104.2	72.0	65.3	2.62	5	84	70	44
September	91.5	100.3	66.9	54.3	4.30	<1	90	80	60
October	84.0	93.7	57.4	41.6	2.61	3	80	80	46
November	72.6	87.0	46.4	29.9	3.07	<1	86	70	45
December	63.1	81.6	40.0	24.6	2.58	<1	95	85	60
Year	80.5		56.3		37.18				

[1] Average length of record, 30 years.
[2] Average length of record, 13 years.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Compressible. Decrease in soil volume excessive under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

and precipitation data

elevation 324 feet. The symbol < means less than]

Precipitation—Cont.									
Probability of receiving selected amounts during month—Cont.				Average number of days with[2]			Snow and sleet		
3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more	0.10 inch or more	0.50 inch or more	1.00 inch or more	Average total[1]	Maximum monthly[1]	Greatest depth[2]
Pct	*Pct*	*Pct*	*Pct*				*In*	*In*	*In*
30	18	12	7	5	2	1	0.3	6.0	0
34	18	10	6	5	2	1	.1	2.5	1
27	16	9	5	4	1	(3)	(4)	(4)	0
45	32	22	13	5	2	1	0	0	0
55	40	30	20	5	2	2	0	0	0
42	28	21	15	5	3	1	0	0	0
30	19	10	5	3	1	1	0	0	0
30	16	10	8	4	1	1	0	0	0
44	33	23	15	6	4	2	0	0	0
36	25	18	12	4	2	1	0	0	0
28	16	10	7	5	2	1	(4)	(4)	(4)
38	20	10	5	6	2	1	0	0	0
				57	24	13	.4	6.0	1

[3] Less than one-half day.
[4] Trace, amount too small to measure.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Cutbanks cave. Walls of cuts not stable.

Depth to rock. Bedrock too close to surface.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erodes easily. Water erodes soil easily.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fast intake. Water infiltrates rapidly.

Favorable. Features of soil favorable.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Floods. Soil temporarily floods by stream overflow, runoff, or high tides.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Large stones. Rock fragments 10 inches or more across.

Low strength. Not enough strength to adequately support the load.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Not needed. Practice not applicable.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percs slowly. Water moves through the soil too slowly.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Piping. Water may form tunnels or pipe-like cavities.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Rooting depth. Soil is thin over layer that restricts root growth.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Seepage. Water moves through soil too fast.

Shrink-swell. Soil expands significantly on wetting and shrinks on drying.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slope. Slope is too great.

Slow intake. Water infiltration restricted.

Small stones. Contains many rock fragments less than 10 inches across.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Inadequate thickness of suitable soil.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Too clayey. Soil slippery and sticky when wet and slow to dry.

Too sandy. Soil soft and loose; droughty and low in fertility.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Unstable fill. Banks or fills likely to cave or slough.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet. Soil wet during period of use.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. In referring to a capability unit, pasture and hayland group, or range site, read the introduction to the section for general information about its management.

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and hayland group		Range site	
			Symbol	Page	Symbol	Page	Name	Page
AfA	Axtell fine sandy loam, 0 to 1 percent slopes----	7	IIIs-1	34	8A	39	Claypan Savannah	44
AfC	Axtell fine sandy loam, 1 to 5 percent slopes----	8	IVe-3	34	8A	39	Claypan Savannah	44
AfC2	Axtell fine sandy loam, 2 to 5 percent slopes, eroded----------	8	IVe-3	34	8A	39	Claypan Savannah	44
AfE2	Axtell fine sandy loam, 5 to 12 percent slopes, eroded----------	8	VIe-3	35	8B	39	Claypan Savannah	44
AtD	Axtell-Tabor complex, 1 to 8 percent slopes------	8	IVe-3	34	8A	39	Claypan Savannah	44
BaA	Bastrop fine sandy loam, 0 to 1 percent slopes---	9	I-2	31	8C	39	Sandy Loam	46
BaB	Bastrop fine sandy loam, 1 to 3 percent slopes---	9	IIe-3	32	8C	39	Sandy Loam	46
BaC2	Bastrop fine sandy loam, 3 to 5 percent slopes, eroded----------	9	IIIe-3	33	8C	39	Sandy Loam	46
BeB	Behring clay loam, 1 to 3 percent slopes---------	10	IIe-1	32	7A	38	Blackland	43
BeC2	Behring clay loam, 3 to 5 percent slopes, eroded-	10	IIIe-1	33	7A	38	Blackland	43
BeD2	Behring clay loam, 5 to 8 percent slopes, eroded----------	10	IVe-1	34	7B	38	Blackland	43
Bo	Bosque loam----------	11	I-1	31	2A	36	Loamy Bottomland	45
BuB	Burleson clay, 1 to 3 percent slopes----------	12	IIe-1	32	7A	38	Blackland	43
CfB	Crockett fine sandy loam, 1 to 3 percent slopes--	12	IIIe-2	33	8A	39	Claypan Prairie	44
CgC	Crockett gravelly sandy loam, 1 to 5 percent slopes----------	12	IVe-2	34	8A	39	Claypan Prairie	44
ChE	Crockett gravelly loam, 5 to 10 percent slopes---	13	VIe-2	35	8B	39	Claypan Prairie	44
CsC2	Crockett soils, 2 to 5 percent slopes, eroded----	13	IVe-2	34	8A	39	Claypan Prairie	44
CsE2	Crockett soils, 5 to 10 percent slopes, eroded---	13	VIe-2	35	8B	39	Claypan Prairie	44
CsD3	Crockett soils, 3 to 8 percent slopes, severely eroded----------	13	VIe-2	35	8B	39	Claypan Prairie	44
DeC	Demona loamy fine sand, 1 to 5 percent slopes----	14	IIIe-5	34	9A	39	Sandy	46
Dm	Demona loamy fine sand, somewhat poorly drained variant----------	15	IIIe-5	34	9A	39	Sandy	46
DoB	Dougherty loamy fine sand, 0 to 3 percent slopes----------	15	IIIe-5	34	9A	39	Sandy	46
DoD	Dougherty loamy fine sand, 3 to 8 percent slopes----------	15	IVe-5	35	9A	39	Sandy	46
FeF2	Ferris clay, 5 to 20 percent slopes, eroded------	16	VIe-1	35	7B	38	Eroded Blackland	45
Gs	Gowen soils, frequently flooded----------	16	Vw-2	35	2A	36	Loamy Bottomland	45
HeB	Heiden clay, 1 to 3 percent slopes----------	17	IIe-1	32	7A	38	Blackland	43
HeC2	Heiden clay, 3 to 5 percent slopes, eroded-------	17	IIIe-1	33	7A	38	Blackland	43
HeD2	Heiden clay, 5 to 8 percent slopes, eroded-------	17	IVe-1	34	7B	38	Blackland	43
HoA	Houston Black clay, 0 to 1 percent slopes--------	18	IIw-1	33	7A	38	Blackland	43
HoB	Houston Black clay, 1 to 3 percent slopes--------	18	IIe-1	32	7A	38	Blackland	43
JeF	Jedd stony soils, 5 to 20 percent slopes---------	19	VIe-4	36	8D	39	Sandstone Hills	45

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Pasture and hayland group		Range site	
			Symbol	Page	Symbol	Page	Name	Page
KrA	Krum silty clay, 0 to 1 percent slopes	19	IIs-1	32	7C	38	Clay Loam	43
Ls	Lincoln soils	20	IVs-1	35	3A	38	Sandy Bottomland	46
Lw	Lincoln soils, frequently flooded	20	Vw-3	35	3A	38	Sandy Bottomland	46
MaA	Mabank loam, 0 to 1 percent slopes	21	IIIw-1	34	8A	39	Claypan Prairie	44
MaB	Mabank loam, 1 to 3 percent slopes	21	IIIe-2	33	8A	39	Claypan Prairie	44
Nd	Norwood loam	21	I-1	31	2A	36	Loamy Bottomland	45
No	Norwood silty clay loam	21	I-1	31	2A	36	Loamy Bottomland	45
PaE	Patilo complex, 1 to 12 percent slopes	22	IVe-5	35	9B	39	Deep Sand	44
RoB	Rosanky fine sandy loam, 1 to 3 percent slopes	23	IIe-2	32	8C	39	Sandy Loam	46
RoD	Rosanky fine sandy loam, 3 to 8 percent slopes	23	IVe-4	34	8C	39	Sandy Loam	46
Sa	Sayers fine sandy loam	23	IVs-1	35	3A	38	Sandy Bottomland	46
Sb	Sayers fine sandy loam, frequently flooded	24	Vw-3	35	3A	38	Sandy Bottomland	46
SeD2	Shep clay loam, 3 to 8 percent slopes, eroded	24	VIe-5	36	7D	39	Sandy Loam	46
Sg	Ships silty clay	25	IIs-2	32	1A	36	Clayey Bottomland	44
SkC	Silstid loamy fine sand, 1 to 5 percent slopes	25	IIIe-5	35	9A	39	Sandy	46
Sm	Smithville fine sandy loam	26	I-2	31	2A	36	Loamy Bottomland	45
TfA	Tabor fine sandy loam, 0 to 1 percent slopes	27	IIIs-1	34	8A	39	Sandy Loam	46
TfB	Tabor fine sandy loam, 1 to 3 percent slopes	27	IIIe-4	34	8A	39	Sandy Loam	46
Tr	Trinity clay	27	IIw-2	33	1A	36	Clayey Bottomland	44
Tw	Trinity clay, frequently flooded	27	Vw-1	35	1A	36	Clayey Bottomland	44
Uh	Uhland soils, frequently flooded	28	Vw-2	35	2A	36	Loamy Bottomland	45
VeD	Vernia complex, 1 to 8 percent slopes	29	IVs-2	35	9B	39	Gravelly	45
WgB	Wilson gravelly clay loam, 1 to 3 percent slopes	30	IIIe-2	33	7H	39	Claypan Prairie	44
WgC	Wilson gravelly clay loam, 3 to 5 percent slopes	30	IVe-2	34	7H	39	Claypan Prairie	44
WsA	Wilson clay loam, 0 to 1 percent slopes	30	IIIw-1	34	7H	39	Claypan Prairie	44
WsB	Wilson clay loam, 1 to 3 percent slopes	30	IIIe-2	33	7H	39	Claypan Prairie	44

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