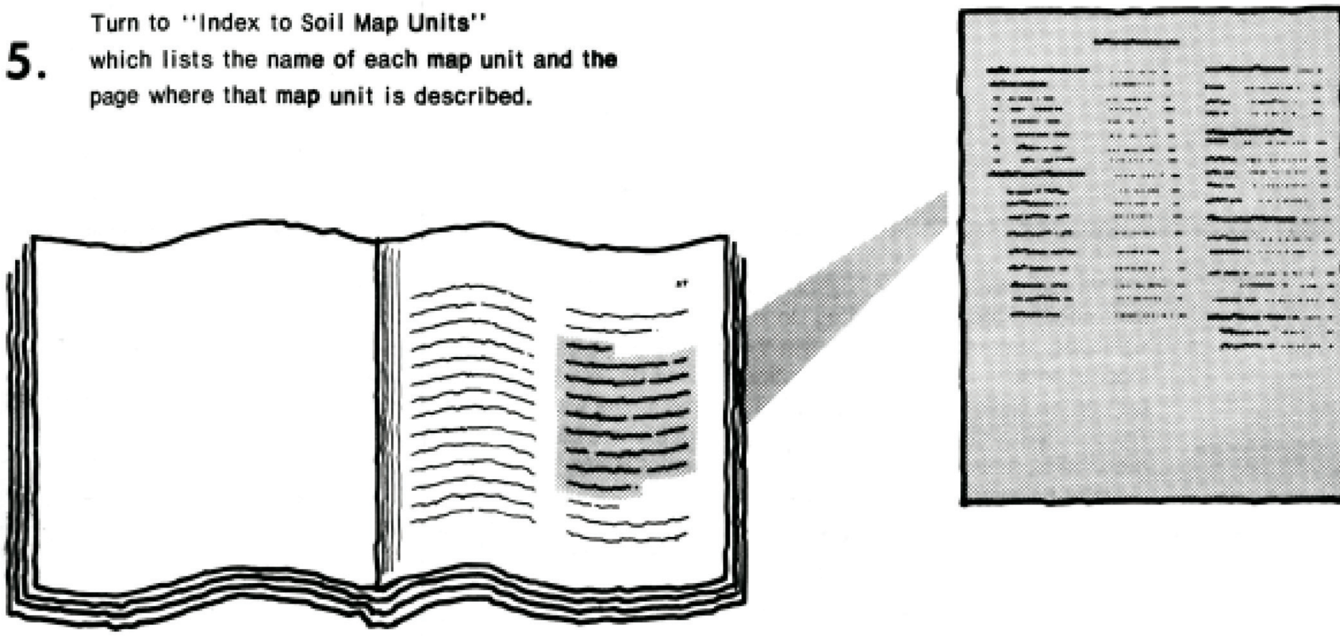
United States Department of Agriculture
Soil Conservation Service
in cooperation with
Texas Agricultural Experiment Station

soil survey of

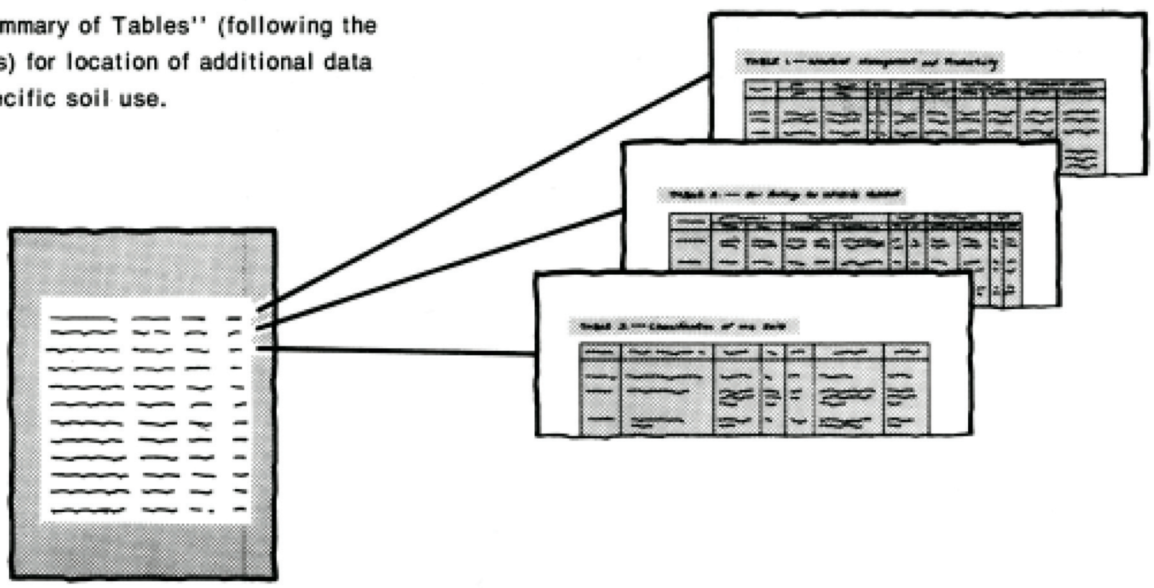
Dallas County, Texas

THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1965-72. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1975. 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 Dalworth Soil and Water Conservation District.

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

This soil survey supercedes the soil survey of Dallas County published in 1924 (*4*).

Cover: The business district of downtown Dallas.

Contents

Issued February 1980

Index to map units

Summary of tables

Foreword

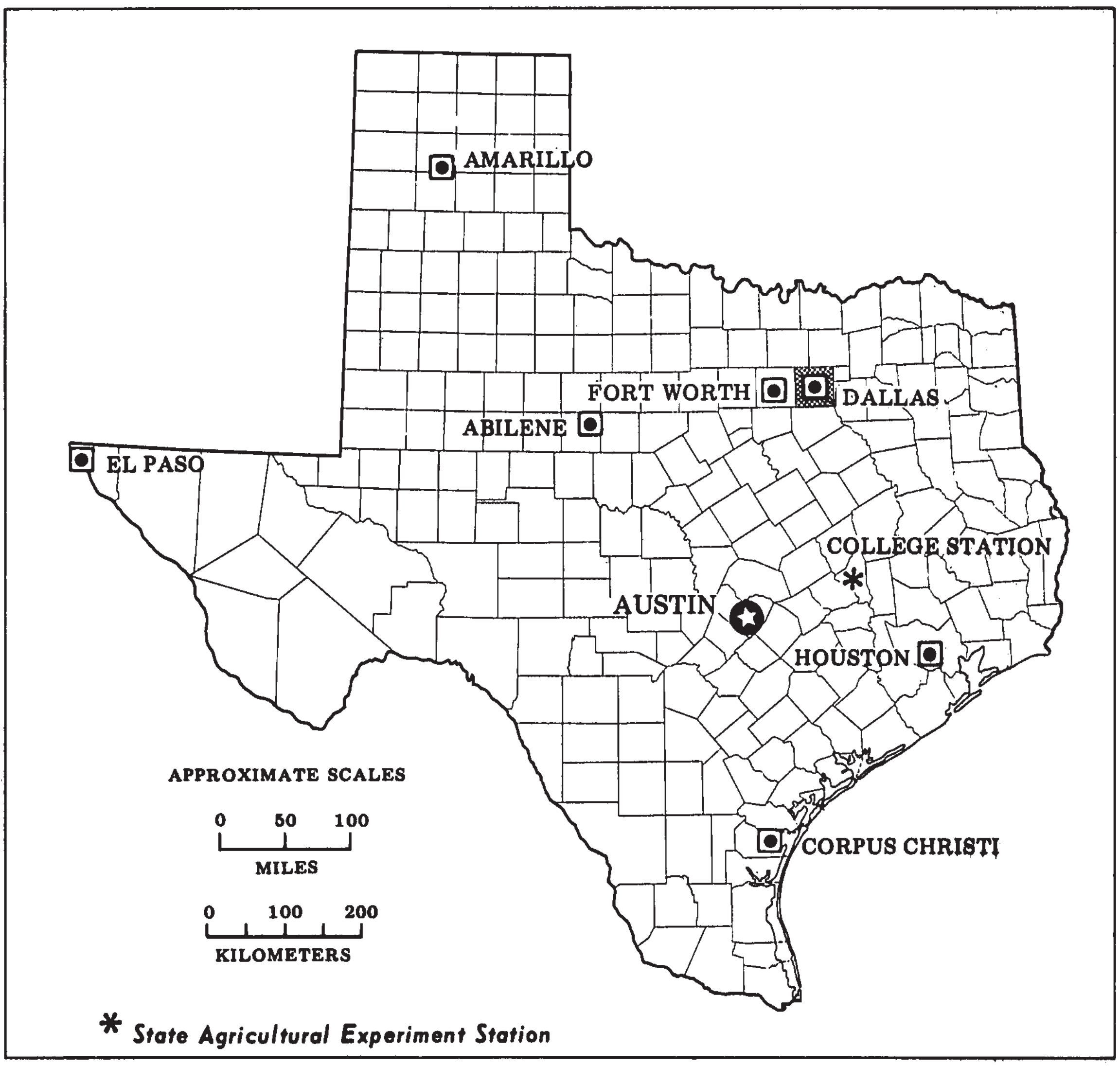
This soil survey contains information that can be used in land-planning programs in Dallas County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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

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

George C. Marks
State Conservationist
Soil Conservation Service



Location of Dallas County in Texas.

soil survey of

Dallas County, Texas

by Daniel R. Coffee, Ralph H. Hill, and Dennis D. Ressel,
Soil Conservation Service
Assisting with the fieldwork were Edward W. Pauls and Milton Allen,
Soil Conservation Service

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DALLAS COUNTY is in the northeastern part of Texas. It has a total area of 902 square miles, or 577,280 acres, of which 25,110 acres is water areas. Dallas, the county seat, is the eighth largest city in the United States. In 1975, its population was estimated at 894,000. In 1970, according to the census of that year, Dallas County had a population of 1,327,321.

About 25 percent of the county is cropland. Grain sorghum, cotton, wheat, and hay are the main crops. Most of the soils that are used as cropland are subject to water erosion. About 46 percent of the county is in urban uses (*3*).

In 1940, the land owners in Dallas and Tarrant Counties and parts of Ellis and Johnson Counties organized the Dalworth Soil and Water Conservation District. Through this conservation district the Department of Agriculture, Soil Conservation Service, provides technical assistance to farmers and ranchers in managing, using, and conserving the soils on their farms and ranches.

General nature of the county

This section provides general information about the history and development, climate, geology, agriculture, and natural resources of Dallas County.

History and development

Until 1842, the area that is now Dallas County was inhabited mainly by Comanche Indians. It was Spanish territory until 1821, when Mexico won its independence from Spain. In 1836, this area became part of the Republic of Texas, and in 1845 it was annexed by the United States.

Dallas County was established in 1846 from parts of Nacogdoches and Robertson Counties, and Dallas was made the county seat. After that, the county was rapidly settled, and the population has increased steadily since.

The city of Dallas is a leading center of insurance, banking, and transportation. It has more than 2,500 factories, including major electronics manufacturers.

Climate

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

Summers are hot in Dallas County. Winters are cool as a result of the occasional surges of cold air, which cause the otherwise mild temperatures to drop. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfall is infrequent. The total annual precipitation is usually adequate for cotton, feed grains, and small grains.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Dallas, Texas, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 48 degrees F, and the average daily minimum temperature is 38 degrees. The lowest temperature on record, which occurred at Dallas on February 1, 1971, is 7 degrees. In summer the average temperature is 84 degrees, and the average daily maximum temperature is 94 degrees. The highest recorded temperature, which occurred on July 25, 1954, is 111 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 36 inches. Of this, 20 inches, or 57 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 6.01 inches at Dallas on October 1, 1959. Thunderstorms occur on about 40 days each year, and most occur in spring.

Average seasonal snowfall is 2 inches. The greatest snow depth at any one time during the period of record was 7 inches. On an average of 1 day, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 79 percent. The sun shines 75 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in April.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration. Damage is variable and spotty.

Geology

Paula Black, geologist, Core Laboratories, Inc., Dallas, Texas, wrote this section.

Dallas County is in the northern part of the Texas Coastal Plain. It is part of a north-trending physiographic province, the Blackland Prairie, which is characterized by little relief and dark, thick, plastic clay soils.

About 100 million years ago, the survey area was at the edge of the old Gulf Coast embayment and was covered by a shallow Cretaceous sea. The sediment that was deposited in this sea consists of sand, silt, and clay. This sediment formed layers that incline eastward toward the embayment at an average rate of 45 feet per mile

Three sand aquifers, all of which underlie the surface of Dallas County, were the main source of water in this area for many years. Today, because of excessive pumping of water from these aquifers, the water table is low and wells are dry in many parts of the county. The many reservoirs that encircle the area now supply most of the water for the county. These reservoirs are built on the Trinity River, which flows southeast across the county.

The bedrock exposed at the surface in Dallas County is of late Cretaceous age. It includes the Eagle Ford Shale in the western part of the county, the Austin Chalk through the central part, and the Taylor Marl in the eastern part. The Austin Chalk is more resistant to weathering than the other kinds of rock, and it determines most of the topographic relief. The most prominent relief is the White Rock escarpment in the southwestern part of the county.

The Taylor Marl (calcareous clay) is similar to the Eagle Ford Shale except it has more calcium carbonate as a cementing agent. The marl is about 600 feet thick in the eastern part of the county and commonly is covered by deposits of thick terrace alluvium. The predominant soil that formed in the Taylor Marl is the black, waxy Houston Black clay. Because of their high shrink-swell potential, soils that derived from the Taylor Marl are highly susceptible to slumping and sliding.

In the past few million years, the Trinity River has extended its headwaters northwesterly. It has cut down into older rock and left old flood plains standing as high terraces. These terraces are above the level of the present flood plain. They consist of old alluvial sediment that ranges from gravel and sand to clay, and they cover more than 30 percent of the county. Many of these terraces have provided gravel for construction and some water for irrigation. Various kinds of soils have formed on these terraces. Sandy and loamy soils, including Silstid and Silawa soils, formed in sandy sediment on the terraces, and Axtell, Branyon, and Rader soils formed in clayey sediment.

The Eagle Ford Shale consists mainly of dark, blue gray marine shale (fissile clay) and has an average thickness of 475 feet. This shale weathers to an unstable, highly plastic clay that is very susceptible to slumping and sliding. The most common soils that derived from the Eagle Ford Shale are the olive Vertel clays and, to a lesser extent, the dark brown Heiden clays. These soils have the same high plasticity and shrink-swell potential as their parent material.

The Austin Chalk is about 600 feet thick and consists of alternating beds of chalk and marl (calcareous clay). In the middle part (about 200 feet thick) of the Austin Chalk, there are more marl beds than in the upper and lower parts. The marl weathers readily and generally is unstable on slopes that are more than 10 percent. Austin silty clay is the common soil of this formation.

In low, nearly level or gently sloping, slowly drained areas, the marl and chalk weather into dark, plastic clay soils, for example, Dalco and Houston Black soils. In steeper, higher lying areas, particularly along tributary streams and in gullied areas, the soils show a closer association to the bedrock. Because of the slope, geologic erosion has removed soil material nearly as fast as it has formed. Thus, the soils are shallow, gravelly, and highly calcareous and have a poorly developed profile. Eddy and Brackett soils are examples.

Agriculture

Agriculture in Dallas County consists of raising livestock, growing crops, and dairy farming.

In 1920, the acreage of cultivated land was estimated to be more than 500,000 acres. In 1970, according to the Conservation Needs Inventory of that year (*3*), the acreage of cropland was about 138,000 acres; about 265,000 acres was in urban uses, 96,000 acres was pastureland, and 28,000 acres was rangeland.

Grain sorghum and cotton are the main row crops. Wheat and oats grown for grain and sorghums grown for hay are the main sown crops. Johnsongrass is the main perennial hay crop. Alfalfa is grown to a minor extent on some of the soils on bottom lands.

Beef cattle are the main livestock. They are sold mainly at local auctions. Herds are mostly cow-calf operations that are maintained the year round. The beef cattle graze mainly improved bermudagrass and some native grasses. Dairy cattle are also produced in the survey area. Some purebred herds of both beef and dairy cattle produce breeding stock for local and distant sales.

Natural resources

The soil is the most important natural resource in Dallas County.

The water supply in the county is adequate for rural domestic use and for livestock. The underground geologic formations of Paluxy and Trinity sands are the main sources of water for these uses. The water for urban areas is mainy supplied by manmade lakes.

Gravel and sand are mined on the flood plains and old river terraces. Cement is made from the soft limestone of the Austin Chalk formation. Bricks are made from clay taken from material under the Vertel and Ferris soils.

How this survey was made

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

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

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

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

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

General soil map for broad land use planning

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

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

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

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used. The ratings do not take into consideration the location of the soils in relation to transportation systems and other facilities.

Each map unit is rated for *cultivated crops, pasture, urban uses, recreation areas* and *sanitary facilities*. Cultivated crops include cotton, grain sorghum, wheat, and others grown extensively in the survey area. Pasture refers to areas where native range plants are used for grazing by livestock. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness. Sanitary facilities include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Map unit descriptions

1. Houston Black-Heiden

Deep, nearly level to strongly sloping, clayey soils; on uplands

This map unit consists mainly of moderately alkaline, moderately well drained and well drained soils that have slopes of 0 to about 12 percent. This unit makes up about 29 percent of the county.

Houston Black soils make up about 51 percent of this unit, and Heiden soils make up 16 percent. Minor soils make up the rest.

Houston Black soils are moderately well drained. They are nearly level and gently sloping and are on broad uplands. Typically, the surface layer is very dark gray to black clay about 50 inches thick. The layer below that is dark grayish brown clay to a depth of 70 inches or more.

Heiden soils are well drained. They are gently sloping to strongly sloping and are on uplands. Typically, the surface layer is dark gray clay about 37 inches thick. To a depth of 56 inches, the soil is grayish brown clay. To a depth of 78 inches, it is clay mottled in shades of gray and yellow.

Minor soils in this map unit are the gently rolling and rolling Altoga and Lewisville soils on uplands, the nearly level to gently sloping Branyon and Burleson soils on uplands, and the nearly level Frio and Trinity soils on flood plains.

The soils in this map unit are used as cropland and pasture and for urban uses. They have high potential for grain sorghum, cotton, small grain, and improved bermudagrass.

The very high shrink-swell potential, low strength, corrosivity, and clayey texture of the soils are the main limitations to urban uses. The clayey texture and very slow permeability are the main limitations to recreation uses.

2. Eddy-Stephen-Austin

Very shallow, shallow, and moderately deep, gently sloping to moderately steep, loamy and clayey soils; on uplands

This map unit consists mainly of moderately alkaline, well drained soils. Slopes are mainly 1 to 8 percent but range from 1 to 20 percent. This unit makes up about 20 percent of the county.

Eddy soils make up about 23 percent of the unit, Stephen soils 17 percent, and Austin soils 15 percent (fig. 1). Minor soils and pits and dumps make up the rest.

Eddy soils are very shallow to shallow. They are gently sloping to moderately steep and are on ridges and the side slopes of ridges. Typically, the surface layer is grayish brown clay loam about 4 inches thick. To a depth of 11 inches, the soil consists of platy chalk limestone fragments and about 15 percent grayish brown clay, by volume. White, platy and massive chalky limestone is below a depth of 11 inches.

Stephen soils are shallow. They are gently sloping and are on ridges. Typically, the surface layer is very dark grayish brown silty clay about 5 inches thick. To a depth of 14 inches, the soil is very dark grayish brown silty clay. White, platy and massive chalky limestone is below a depth of 14 inches.

Austin soils are moderately deep. They are gently sloping to sloping and are in valleys. Typically, the surface layer is very dark grayish brown silty clay about 10 inches thick. To a depth of 32 inches, the soil is brown silty clay. White, platy chalky limestone is below a depth of 32 inches.

The minor soils in this unit are the gently sloping and sloping Altoga and Lewisville soils on the side slopes of ridges, the gently sloping to steep Brackett soils on the side slopes of ridges, the gently sloping Dalco soils in narrow valleys, the nearly level Frio soils on narrow flood plains, and the gently sloping to strongly sloping Silawa soils on uplands. Also included in this unit are a few areas of Pits and Dumps where limestone and shale have been quarried and some small areas of Urban land.

The soils in this unit are used as cropland, pastureland, and rangeland and for urban uses. Grain sorghum, wheat, and oats are the main crops. These soils have low potential for improved bermudagrass. Woody vegetation covers most of the rangeland. The steeper soils have a sparse grass cover. The restricted root zone, droughtiness, and slope are the main limitations to the use of these soils as cropland.

The depth to rock and the slope are the main limitations to urban uses. The underlying rock is soft and is a good footing for foundations. The clayey texture, depth to rock, moderately slow permeability, and slope of the soils and the gravel content of the shallow and very shallow soils are the main limitations to recreation uses.

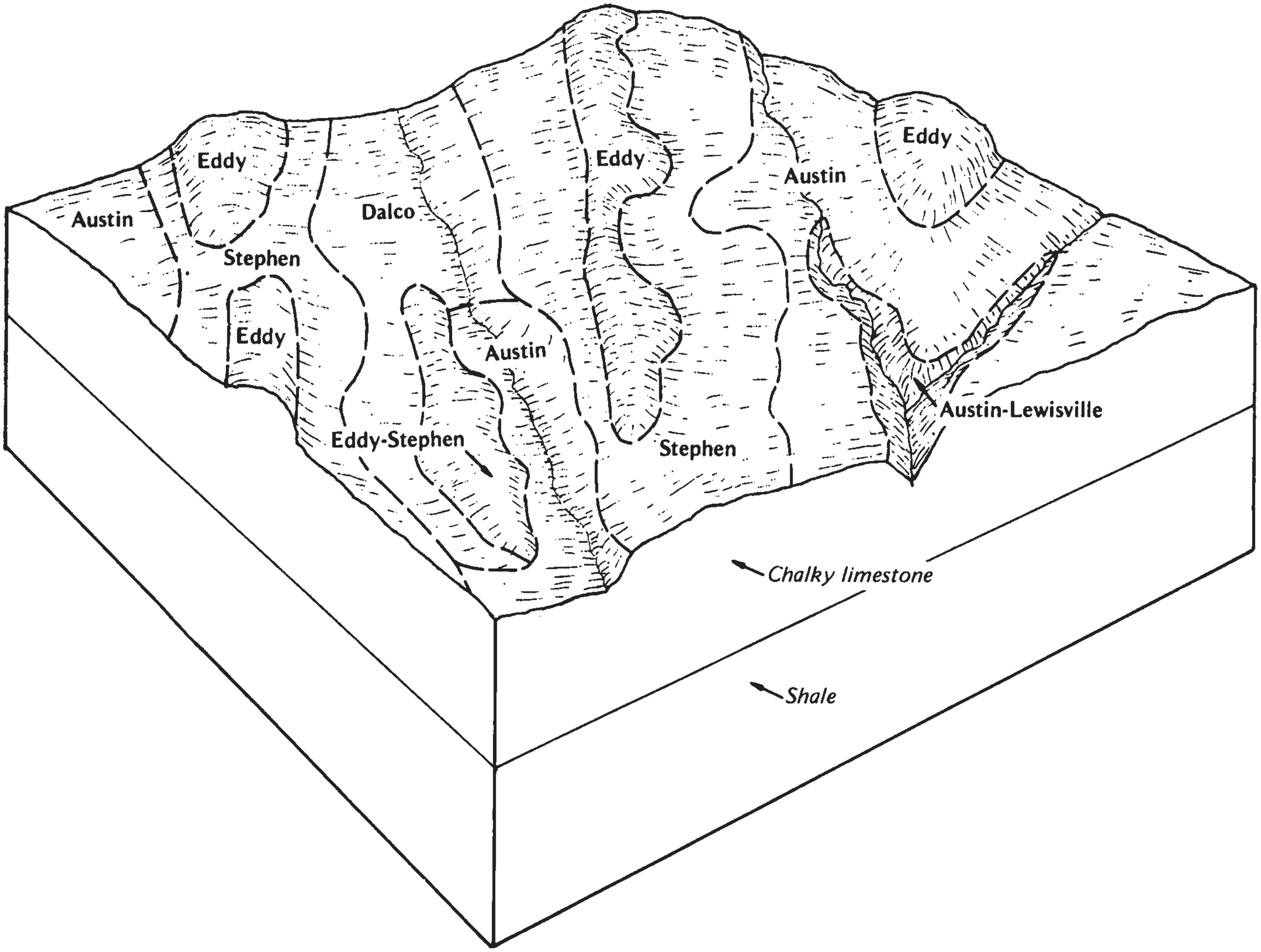

Figure 1.—Typical pattern of soils and parent material in the Eddy-Stephen-Austin map unit.

3. Trinity-Frio

Deep, nearly level, clayey soils; on flood plains

This map unit consists mainly of moderately alkaline, somewhat poorly drained and well drained soils that have slopes of 0 to 1 percent. This unit makes up about 19 percent of the county.

Trinity soils make up about 56 percent of the unit, and Frio soils make up 19 percent. Minor soils make up the rest.

Trinity soils are somewhat poorly drained. They are on broad bottom lands along the Trinity River and its larger tributaries. Typically, these soils are dark gray to very dark gray clay from the surface to a depth of about 45 inches, and they are very dark grayish brown clay to a depth of 68 inches.

Frio soils are well drained. They are on broad bottom lands along the larger streams. Typically, the surface layer is very dark grayish brown to dark grayish brown silty clay about 53 inches thick. To a depth of 74 inches, the soil is brown silty clay loam.

The minor soils in this map unit are Arents in areas where sand and gravel have been removed and Gowen, Ovan, and Seagoville soils on flood plains.

The soils in this map unit are used as cropland and pasture. The soils that are occasionally flooded have high potential for grain sorghum and cotton. Those that are frequently flooded are not suited to cultivation. These soils have high potential for improved bermudagrass. Many small areas are stripmined for sand and gravel.

The flood hazard, clayey texture, and very slow and moderately slow permeability of the soils and the very high shrink-swell potential of the Trinity soils are the main limitations to urban and recreation uses.

4. Austin-Houston Black

Moderately deep and deep, nearly level to sloping, clayey soils; on uplands

This map unit consists mainly of moderately alkaline, well drained and moderately well drained soils that have slopes of about 0 to 8 percent. This unit makes up about 14 percent of the county.

Austin soils make up about 28 percent of this unit, and Houston Black soils make up 26 percent. Minor soils and urban areas make up the rest.

Austin soils are well drained. They are gently sloping to sloping and are on ridges, knolls, and side slopes on uplands. Typically, the surface layer is very dark grayish brown silty clay about 10 inches thick. To a depth of 32 inches, the soil is brown silty clay. White, platy chalk is below a depth of 32 inches.

Houston Black soils are moderately well drained. They are nearly level to gently sloping and are in valleys. Typically, the surface layer is very dark gray to black clay about 52 inches thick. To a depth of 70 inches, the soil is dark grayish brown clay.

The minor soils in this unit are the Altoga and Heiden soils on ridges and side slopes, the gently sloping Dalco soils in narrow valleys, the nearly level Branyon soils on uplands, the gently sloping Mabank soils on uplands, and the gently sloping to sloping Lewisville soils on uplands. Also included are small areas of Gowen, Frio, and Trinity soils on flood plains and a few areas of Urban land.

The soils in this map unit are used as cropland and pasture and for urban uses. They have high potential for grain sorghum, cotton, wheat, oats, and improved bermudagrass. Droughtiness and the clayey texture are the main limitations to use as cropland.

The very high and high shrink-swell potential, low strength, and corrosivity of the soils and in some areas the depth to rock are the main limitations to urban uses. Some wooded areas along the streams are highly desirable for residential development. The clayey texture and moderately slow or very slow permeability are the main limitations to recreation uses.

5. Wilson-Rader-Axtell

Deep, nearly level to gently sloping, loamy soils; on uplands

This map unit consists mainly of deep, slightly acid to strongly acid, somewhat poorly drained and moderately well drained soils that have slopes of 0 to 5 percent. This unit makes up about 8 percent of the county.

Wilson soils make up about 26 percent of the map unit, Rader soils 15 percent, and Axtell soils 15 percent (fig. 2). Minor soils make up the rest.

Wilson soils are somewhat poorly drained. They are in low areas. Typically, the surface layer is dark gray clay loam about 5 inches thick. To a depth of 37 inches, the soil is dark gray clay. To a depth of 64 inches, it is mottled very dark gray, light olive brown, and olive brown clay.

Rader soils are moderately well drained. They are on low mounds and ridges. Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. To a depth of 16 inches, the soil is brown sandy clay loam. To a depth of 25 inches, it is clay mottled in shades of brown and red. To a depth of 64 inches, it is clay and sandy clay mottled in shades of yellow, red, gray, and brown.

Axtell soils are moderately well drained. They are gently sloping and are on uplands. Typically, the surface layer is fine sandy loam about 8 inches thick. It is dark grayish brown in the upper 4 inches and very pale brown below that. To a depth of 11 inches, the soil is mottled pinkish gray, brown, and yellowish red sandy clay loam. To a depth of 80 inches, it is dark reddish brown and grayish brown clay and sandy clay that has red, yellow, brown, and gray mottles.

The minor soils in this map unit are the gently undulating and hilly Arents in areas where soil has been moved in excavating for sand and gravel; Bastsil, Dutek, and Silstid soils in small areas on low terraces; nearly level or depressional Mabank soils on high terraces; Crockett, Lewisville, Sunev, and Normangee soils on adjacent uplands; and nearly level Gowen soils on flood plains.

The soils in this map unit are used mainly as pasture and for urban uses. They have fair potential for improved bermudagrass. Droughtiness and the clayey texture are the main limitations to use as cropland.

The wetness, high shrink-swell potential, and low strength of the soils are the main limitations to urban uses. The wetness, clayey texture, and very slow permeability are the main limitations to recreation uses. Some areas that have trees are highly desirable for residential development.

6. Ferris-Heiden

Deep, gently to strongly sloping, clayey soils; on uplands

This map unit consists mainly of moderately alkaline, well drained soils that have slopes of about 1 to 12 percent. This unit makes up about 6 percent of the county.

Ferris soils make up about 53 percent of the unit, and Heiden soils make up 18 percent (fig. 3). Minor soils make up the rest.

Ferris soils are on hillsides. They are sloping and strongly sloping. Typically, the surface layer is light yellowish brown clay about 3 inches thick. To a depth of 28 inches, the soil is olive clay. To a depth of 41 inches, it is light brownish gray, mottled clay. Mottled brown, olive, and gray shale is below a depth of 41 inches.

Heiden soils are on foot slopes and ridgetops. They are gently sloping to strongly sloping. Typically, the sur-

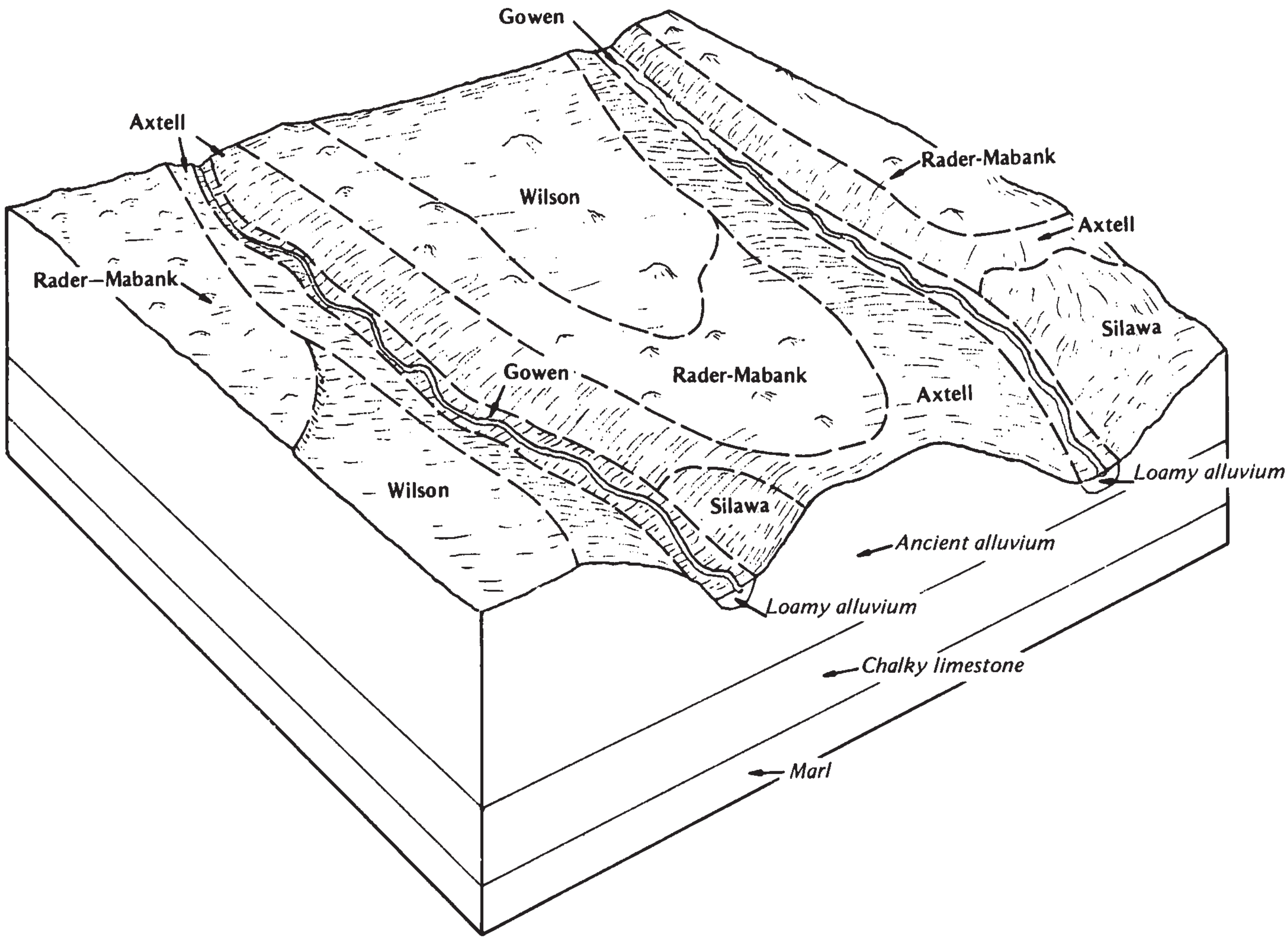

Figure 2.—Typical pattern of soils and parent material in the Wilson-Rader-Axtell map unit.

face layer is dark gray clay about 37 inches thick. To a depth of 56 inches, the soil is grayish brown clay. To a depth of 78 inches, it is clay mottled in shades of gray and yellow.

The minor soils in this unit are the gently sloping to strongly sloping Altoga, Lewisville, Sunev, and Vertel soils on uplands, the nearly level and gently sloping Houston Black soils on ridges and in low areas in valleys, and the nearly level Ovan and Trinity soils on flood plains.

The soils in this unit are used as pasture and rangeland and for urban uses. These soils have medium potential for King Ranch bluestem and common bermudagrass. They support mid and tall rangeland grasses. Droughtiness and the clayey texture are the main limitations to use as cropland.

The very high shrink-swell potential, low strength, unstable slopes, erosion hazard, clayey texture, and corrosivity of the soils are the main limitations to urban uses. The clayey texture, very slow permeability, slope, and erosion hazard are the main limitations to recreation uses.

7. Silawa-Silstid-Bastsil

Deep, nearly level to sloping, loamy and sandy soils; on stream terraces

This map unit consists mainly of deep, slightly acid to medium acid, well drained soils that have slopes of 0 to 8 percent. This unit makes up about 4 percent of the county.

Silawa soils make up about 40 percent of this unit,

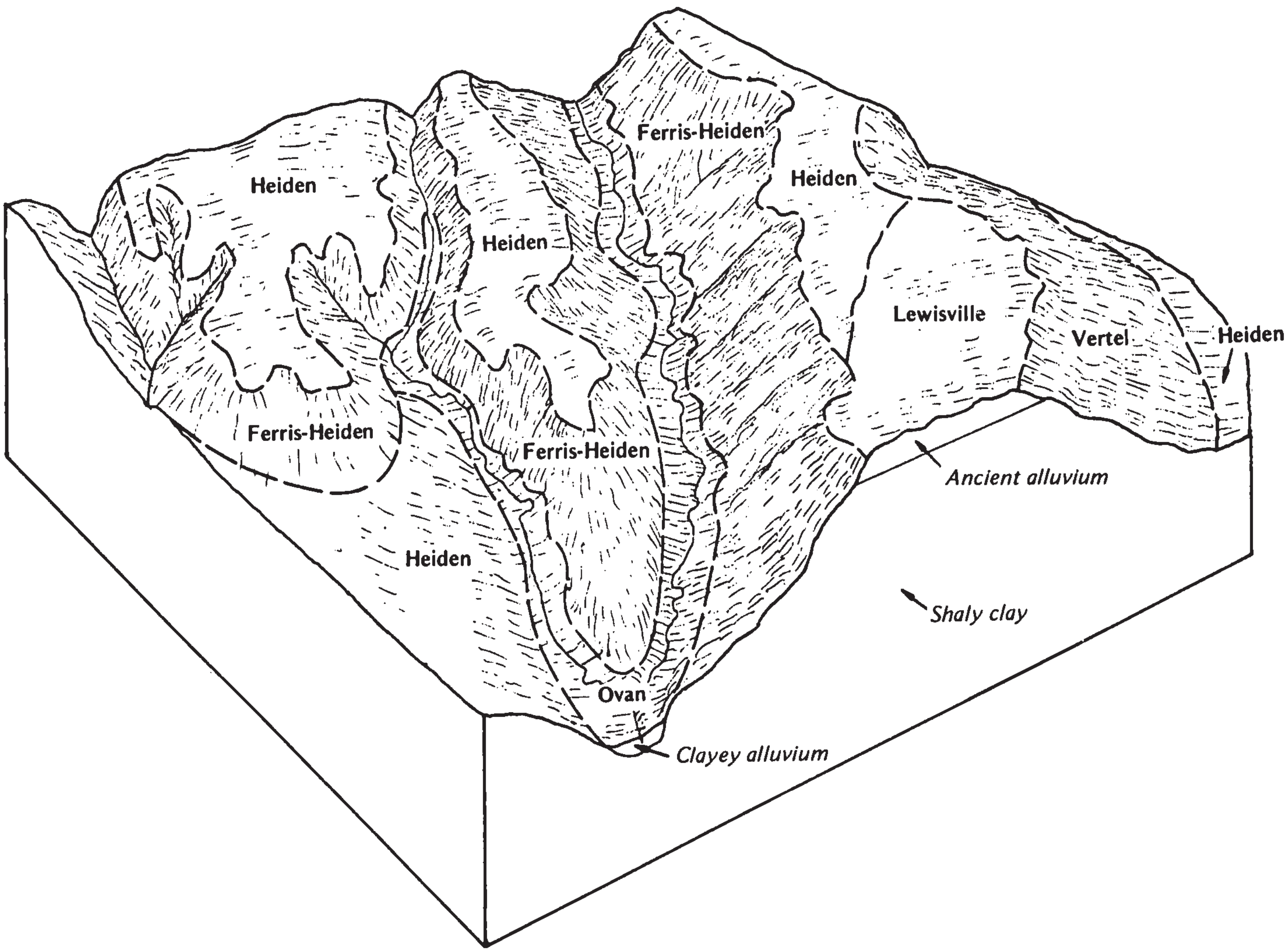

Figure 3.—Typical pattern of soils and parent material in the Ferris-Heiden map unit.

Silstid soils 28 percent, and Bastsil soils 11 percent (fig. 4). Minor soils make up about 21 percent.

Silawa soils are on ridges and side slopes on uplands. They are gently sloping to sloping. Typically, the surface layer is brown to grayish brown fine sandy loam about 6 inches thick. To a depth of 26 inches, the soil is sandy clay loam that is reddish brown in the upper 6 inches and yellowish red below that. To a depth of 43 inches, it is reddish yellow fine sandy loam. To a depth of 80 inches, it is reddish yellow loamy fine sand.

Silstid soils are on uplands. They are nearly level to gently sloping. Typically, the surface layer is loamy fine sand about 27 inches thick. It is brown in the upper 10 inches and light yellowish brown below that. To a depth of 65 inches, the soil is yellowish brown sandy clay loam that has brown and red mottles. To a depth of 80 inches, it is reddish yellow loamy fine sand that has brown and gray mottles.

Bastsil soils are on high terraces. They are nearly level to gently sloping. Typically, the surface layer is brown fine sandy loam about 8 inches thick. To a depth of 34 inches, the soil is sandy clay loam that is yellowish red in the upper 4 inches and red below that. To a depth of 68 inches, it is mottled red and gray sandy clay loam.

The minor soils in this map unit are Arents in small areas where soil has been removed in excavating for sand and gravel; Altoga, Lewisville, and Sunev soils in sloping areas near streams; the nearly level Axtell and

Rader soils on high terraces; Dutek soils on low ridges; and the sandy Eufaula soils on low ridges near flood plains.

The soils in this unit are used mainly as pasture and for urban uses. They have medium potential for improved bermudagrass. These soils have no major limitations to use as cropland or to urban uses. On some sites, seepage and the sandy texture can limit the use of the soils for sanitary facilities.

Broad land use considerations

Until now, the development of Dallas County has taken place without broad land use planning. Residential and industrial development decisions have been made with little regard to land suitability. As a result, houses have been built on flood plains, on steep unstable soils, and on the most productive agricultural soils. In general, the kind of soil, the slope, and the susceptibility of areas to flooding are the main factors to be considered in planning land use in Dallas County.

At present, about 46 percent of the land in Dallas County is in urban and related uses. About 25 percent is used as cropland, 20 percent as pastureland, and 9 percent as rangeland and other uses. The figures in table 4 show that about 19 percent of the land has very low potential for urban uses, 49 percent has low potential, 28 percent has medium potential, and only 4 percent has high potential. About 47 percent of the land in the county has high potential for cultivated farm crops, about 8 percent has medium potential, and 45 percent has low potential. Much of the land that has high potential for

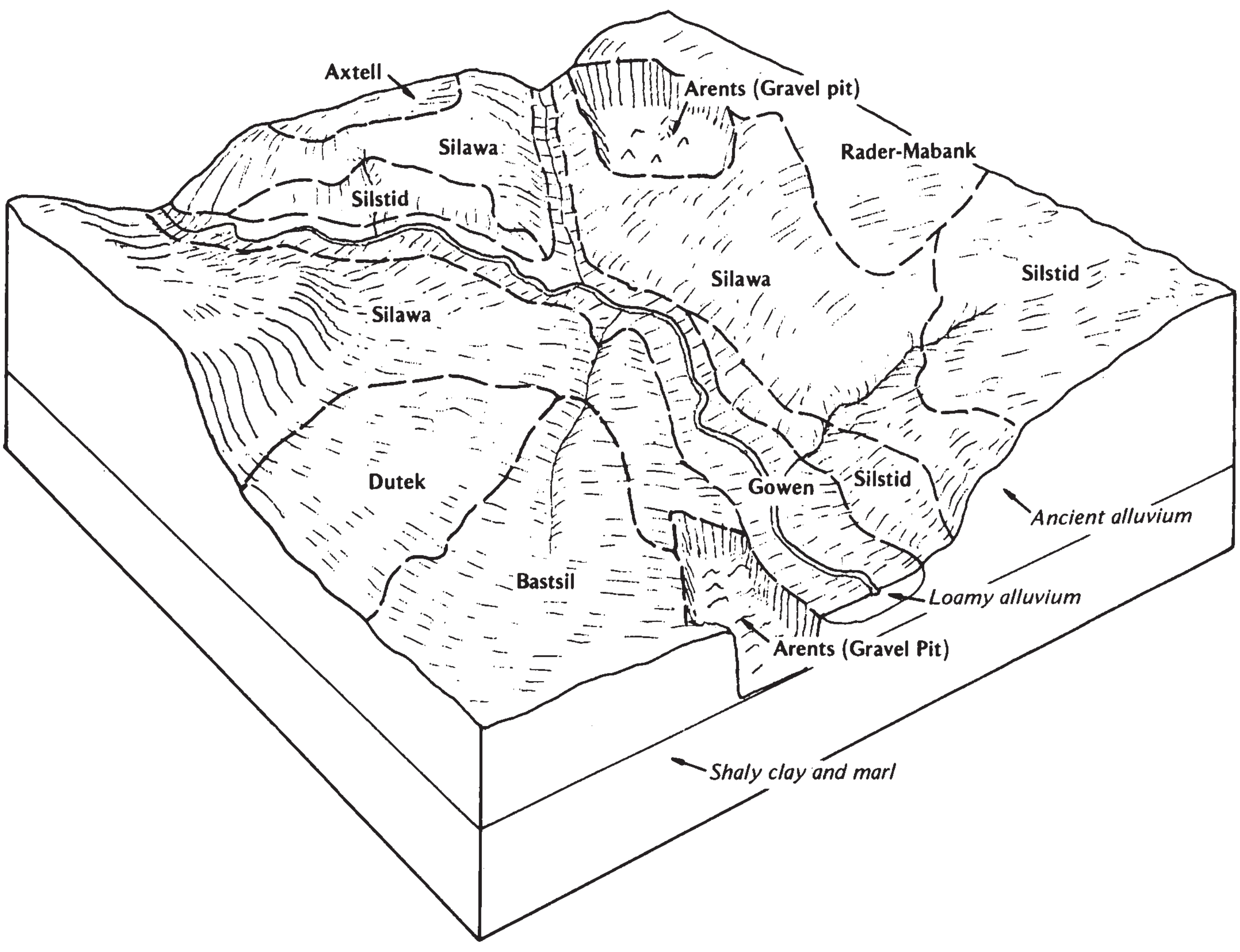

Figure 4.—Typical pattern of soils and parent material in the Silawa-Silstid-Bastsil map unit.

cultivated farm crops has been used for urban development. The rest of the good cropland is also in danger of being converted to residential developments because it is nearly level to gently sloping and has few limitations to this development.

In recent years, less cropland has been used for row crops and more has been converted to grazing land. In the soil survey of 1924 (*4*), about 90 percent of the county was cultivated. Today, only about 25 percent is used for crops. Near the housing developments, many acres that were once cultivated are now idle and awaiting development. Most of this land has high or medium potential for use as cropland.

The one map unit in Dallas County that has very low potential for urban uses is the Trinity-Frio map unit. Because of the hazard of flooding, urban development on this land would be expensive. The soils in the Houston Black-Heiden, Eddy-Stephen-Austin, Austin-Houston Black, Wilson-Rader-Axtell, and Ferris-Heiden map units can be developed for urban use at a lower cost than can those in the Trinity-Frio map unit. The main limitations of these soils to urban uses are the high or very high shrink-swell potential, low soil strength, and high corrosivity to uncoated steel.

In addition to these limitations, the Eddy, Austin, and Stephen soils are limited by shallowness to bedrock. These soils have limestone bedrock at a depth of 5 to 40 inches; however, the rock is rippable and makes a good foundation for most structures. Except for the Eddy soils, all of these soils have high or medium potential for use as cropland or pasture.

The soils in the Silawa-Silstid-Bastsil map unit are well suited to urban uses. Some areas of this unit and of the Wilson-Rader-Axtell unit are wooded and are highly valued for residential development. Most areas of the Eddy-Stephen-Austin map unit are covered with trees and shrubs; in some areas of this unit, the land is steep and broken, providing striking scenery. The soils in the Eddy-Stephen-Austin map unit also are highly valued for residential development; however, because they are shallow and have unstable slopes, these soils have only medium potential for this use.

Most of the soils in Dallas County have low potential for recreation uses. The only soils that have high potential for recreation uses are those in the Silawa-Silstid-Bastsil map unit. The other soils in the county are too clayey, have slow permeability, are subject to flooding, or are shallow to bedrock.

Most of the soils in the county have low potential for sanitary facilities. The main limitations, especially to septic tank absorption fields, are the slow absorption of effluent and the shallowness of the soils to bedrock.

Soil maps for detailed planning

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Austin silty clay, 1 to 3 percent slopes, is one of several phases in the Austin series.

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Eddy-Brackett complex, 8 to 20 percent slopes, is an example.

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

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

1—Altoga silty clay, 5 to 12 percent slopes, eroded. This is a deep, well drained, sloping to strongly sloping soil on escarpments of stream terraces. The areas are long and narrow to oval and range from 10 to more than 100 acres. In most areas, the original surface layer has been removed by sheet erosion. Rills and small gullies are common.

Typically, the surface layer is moderately alkaline, light yellowish brown silty clay about 4 inches thick. It is underlain, to a depth of 25 inches, by moderately alkaline, very pale brown silty clay that has fine yellowish brown mottles. To a depth of 65 inches, the soil is moderately alkaline silty clay that is mottled yellowish brown in the upper part and light brownish gray in the lower part. To a depth of 80 inches, it is moderately alkaline, brownish yellow silty clay loam.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The hazard of erosion is severe.

Included in mapping are small areas of Ferris, Heiden, Lewisville, and Sunev soils. The included soils make up less than 15 percent of the mapped areas.

This soil is used as pasture and for urban development. Because of the erosion hazard it is not suitable for cultivation.

This soil has medium potential for use as pasture. Runoff, erosion, and the high content of calcium carbonate are the main limitations.

This soil has low potential for urban development. The high shrink-swell potential, low soil strength, corrosivity, and the hazard of erosion are limitations to urban use.

This soil is in capability subclass VIe and in the Clay Loam range site.

2—Arents, loamy, gently undulating. This map unit is made up of areas that have been mined for gravel and sand. Piles of discarded overburden and remaining soil material have been smoothed, and most pits have been filled with soil material. The areas are lower than the surrounding landscape. Slopes range from 1 to 5 percent. The areas are rectangular and range from 20 to several hundred acres.

Because of mixing during mining operations, these soils do not have uniform layers. In places, there are fragments of soil layers. These soils are mainly sandy clay loam, clay loam, loam, or fine sandy loam in the upper 80 inches. Quartz pebbles are few to common throughout.

The organic matter content is low. Permeability is moderate. The water table is at a depth of 10 to 25 feet. Most areas are subject to flooding unless protected by levees.

Included in mapping are small areas of Bastsil, Dutek, Silawa, Silstid, and Trinity soils. Also included are areas of water in the deeper pits and areas where the surface is covered with thin layers of gravel or sand.

The soils in this map unit are used as pasture and for urban uses, including light industry, race tracks, golf driving ranges, sanitary landfills, and residential areas.

These soils have medium potential for use as pasture. Because of the low organic matter content, fertilizer is needed for good forage production.

These soils have low potential for urban development. The hazard of flooding in most areas is a limitation, but flooding can be controlled by levees or other flood-control structures. Corrosivity to uncoated steel also is a limitation.

This map unit was not assigned to a capability subclass or a range site.

3—Arents, loamy, hilly. This map unit consists of the discarded overburden of mining operations. The overburden has been left in mounds and ridges in the gravel pits. The areas are rectangular and range from 15 to several hundred acres. Slopes range from 10 to 30 percent. The pits contain areas of water that make up 5 to 25 percent of most mapped areas.

Typically, the soil material, to a depth of 80 inches, is moderately alkaline, light yellowish brown gravelly sandy clay loam. There are fragments of soil layers throughout.

Included in mapping are small areas of Bastsil, Dutek, Frio, Silstid, and Trinity soils. Also included are areas where thin layers of gravel or sand are on the surface. The included soils make up less than 15 percent of the mapped areas.

Permeability is moderate, and the available water capacity is medium. Runoff is rapid. The hazard of erosion is severe.

Most areas of this map unit are idle. A few areas are grazed. These soils have medium potential for use as pasture. The hilly slopes and the inaccessibility of the areas to livestock are limitations to use as pasture.

These soils have very low potential for urban development. The hazard of flooding in most areas is a major limitation, but flooding can be controlled by levees or other flood-control structures. The slopes of the ridges and mounds are a limitation; this limitation can be overcome by land leveling and smoothing. The corrosivity to uncoated steel also is a limitation.

This map unit was not assigned to a capability subclass or a range site.

4—Arents, clayey, gently undulating. This map unit consists of clayey soil material removed from nearby road cuts, borrow pits, or drainage ditches. This material has been piled into mounds several feet high. The areas are rectangular and range from 15 to 75 acres.

Typically, the soil material is dark brown, calcareous clay. It has many clods and bodies consisting of very dark brown and very dark grayish brown fragments of surface soil. In a few places, pebbles and broken concrete make up as much as 25 percent of the soil material.

Most areas of this map unit are idle and are covered with thick stands of johnsongrass. A few areas are used as building sites.

Permeability is slow to very slow, and the available water capacity is high. Runoff is medium.

These soils have very low potential for urban development. The high shrink-swell potential and low strength of the soil are limitations. Sloping areas erode easily, but this erosion can be controlled by sodding or other erosion-control practices. The high content of clay is a limitation to recreation uses, but this limitation can be overcome by adding a layer of loamy or sandy topsoil. Wet spots and ponding are limitations in some areas.

This map unit was not assigned to a capability subclass or a range site.

5—Austin silty clay, 1 to 3 percent slopes. This is a moderately deep, well drained, gently sloping soil on uplands. The areas are oval to long and narrow and range from 10 to several hundred acres.

Typically, the surface layer is moderately alkaline, very dark grayish brown silty clay about 10 inches thick. To a depth of 32 inches, the soil is moderately alkaline, brown silty clay. White, platy chalk is at a depth of 32 inches. It is massive at a depth of 34 inches.

Permeability is moderately slow, and the available water capacity is low. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Austin silty clay loam and Dalco, Lewisville, and Stephen soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as cropland and pasture. It has high potential for these uses. If this soil is used for crops, crop residue should be left on the surface to help control erosion, reduce runoff and soil temperature, conserve moisture, and maintain soil tilth and productivity (fig. 5). This soil is well suited to improved bermudagrass.

This soil has medium potential for urban development. The high shrink-swell potential, corrosivity, low strength, and moderate depth of the soil are limitations to urban uses.

This soil is in capability subclass IIIe and in the Clay Loam range site.

6—Austin silty clay, 3 to 5 percent slopes. This is a moderately deep, well drained, gently sloping soil. The areas are oblong to oval and range from 10 to about 50 acres.

Typically, the surface layer is moderately alkaline, very dark grayish brown silty clay about 8 inches thick. To a depth of 28 inches, the soil is moderately alkaline, brown silty clay. White, platy chalk, or soft limestone, is at a depth of 28 inches. The chalk is massive below a depth of about 35 inches.

Permeability is moderately slow, and the available water capacity is low. Runoff is medium, and the hazard of erosion is moderate.

Included in some mapped areas are small areas of Austin silty clay loam and Stephen and Eddy soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as pasture and cropland. It has medium potential for these uses. If this soil is used for

Figure 5.—Residue of grain sorghum on the surface of Austin silty clay, 1 to 3 percent slopes. The use of crop residue helps to reduce runoff and control erosion on this soil.

crops, crop residue should be left on the surface to help control runoff and erosion, reduce soil temperature, conserve moisture, and maintain soil tilth and productivity. This soil is well suited to improved bermudagrass.

This soil has medium potential for urban uses. The moderate depth, low strength, corrosivity, and high shrink-swell potential of the soil and the hazard of erosion are limitations to urban development.

This soil is in capability subclass IVe and in the Clay Loam range site.

7—Austin-Lewisville complex, 5 to 8 percent slopes, eroded. This complex is made up of moderately deep and deep, well drained soils. These soils are on the walls and flood plains of sloping, narrow valleys along creeks. The mapped areas mostly are long and narrow and range from about 20 to more than 100 acres. Erosion has removed the original surface layer on about 40 percent of the acreage of these soils. Gullies that are 1 to 2 feet deep and 5 to 20 feet wide are common.

The Austin soil makes up about 50 percent of this complex, the Lewisville soil makes up about 30 percent, and minor soils make up the rest. These soils are so intermingled that it was not practical to separate them at the scale used in mapping. Typically, the Austin soil is on the upper and lower parts of slopes, and the Lewisville soil is on the middle part of slopes and in areas near the streams.

Typically, the surface layer of the Austin soil is moderately alkaline, very dark grayish brown silty clay about 6 inches thick. Fine chalk fragments are common. To a depth of 20 inches, the soil is moderately alkaline, dark brown silty clay. The underlying material is platy chalk or soft limestone.

Permeability of the Austin soil is moderately slow, and the available water capacity is low. Runoff is rapid. The hazard of erosion is severe.

Typically, the surface layer of the Lewisville soil is moderately alkaline, dark grayish brown silty clay about 19 inches thick. It has a few fragments of soft limestone and snail shells throughout. To a depth of 66 inches, the soil is moderately alkaline, light grayish brown silty clay. The underlying material is platy chalky limestone.

Permeability of the Lewisville soil is moderate, and the available water capacity is high. Runoff is medium. The hazard of erosion is severe.

Included in mapping are small areas of Austin silty clay loam and Brackett, Eddy, Frio, and Stephen soils. The included soils make up less than 20 percent of any one mapped area.

These soils generally are wooded and are used as rangeland. They have medium potential for use as pasture and rangeland.

These soils have medium potential for urban uses. The severe hazard of erosion, the high shrink-swell potential, low soil strength, corrosivity, moderate depth to rock, and the hazard of overflow in areas near stream channels are limitations to urban development. These soils are suitable for parks, nature study areas, and wildlife habitat.

These soils are in capability subclass VIe and in the Clay Loam range site.

8—Austin-Urban land complex, 0 to 2 percent slopes. This complex is made up of nearly level and gently sloping, well drained soils and areas of Urban land on uplands (fig. 6). The areas are oval to oblong and are as much as several hundred acres in size.

The Austin soil makes up about 50 percent of this complex, and Urban land, which consists of areas covered by buildings and pavement, makes up 40 percent. The rest of the complex is made up of minor soils. These soils and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Austin soil is very dark grayish brown, moderately alkaline silty clay about 10 inches thick. To a depth of 32 inches, the soil is moderately alkaline, brown silty clay. The underlying material is white, platy chalk.

Permeability is moderately slow, and the available water capacity is low. Runoff is medium. The hazard of erosion is moderate.

Included in mapping are small areas of Dalco, Eddy, Lewisville, and Stephen soils. The included soils make up less than 10 percent of any one mapped area.

The soils in this complex have medium potential for urban uses. The high shrink-swell potential, corrosivity, low strength, and moderate depth of the soil are limitations.

This map unit was not assigned to a capability subclass or a range site.

9—Austin-Urban land complex, 2 to 5 percent slopes. This complex is made up of gently sloping, well drained soils and areas of Urban land on uplands. The areas are oval to oblong and range from 20 to a few hundred acres in size.

The Austin soil makes up about 60 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. The rest of this complex is made up of minor soils. These soils and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Austin soil is moderately alkaline, very dark grayish brown silty clay about 8 inches thick. To a depth of 20 inches, the soil is moderately alkaline, brown silty clay. The underlying material is white chalk that is platy in the upper part and massive below that.

Permeability is moderately slow, and the available water capacity is low. Runoff is medium. The hazard of erosion is moderate.

Included in mapping are small areas of Brackett, Eddy, Lewisville, and Stephen soils. The included soils make up as much as 10 percent of any one mapped area.

Figure 6.—In this area of the Austin-Urban land complex, 0 to 2 percent slopes, the Austin soil is used for producing hay and for residential development.

The soils in this complex have medium potential for urban uses. The shrink-swell potential, moderate depth, corrosivity, and low strength of the soil and the hazard of erosion are limitations.

This map unit was not assigned to a capability subclass or a range site.

10—Axtell fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level, moderately well drained soil on old high stream terraces. The areas are oval or oblong and range from 15 to 100 acres or more.

Typically, the surface layer is slightly acid, dark grayish brown fine sandy loam about 4 inches thick. To a depth of 8 inches, the soil is slightly acid, very pale brown fine sandy loam, and to a depth of 39 inches, it is very strongly acid clay that is mottled in shades of brown, gray, and red. To a depth of 52 inches, the soil is medium acid, grayish brown sandy clay that has prominent red mottles. To a depth of 80 inches, it is moderately alkaline, grayish brown sandy clay that has red mottles.

Permeability is very slow, and the available water capacity is high. Runoff is slow. The hazard of erosion is slight.

Included in mapping are small areas of Crockett, Mabank, Rader, and Wilson soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture. About 20 percent of the acreage is cropland. This soil has medium potential for use as pasture. It is well suited to improved bermudagrass. This soil has low potential for crops; the yield of crops commonly grown in the county is below average. If this soil is used for crops, crop residue should be left on the surface to help conserve moisture, reduce soil temperature, and maintain tilth and productivity.

This soil has medium potential for urban development. The high shrink-swell potential, corrosivity, and low strength of the soil are limitations to urban uses. These limitations can be overcome through good design and careful installation. Areas that have trees are desirable for residential development.

This soil is in capability subclass IIIs and in the Claypan Savannah range site.

11—Axtell fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping, moderately well drained soil on old high stream terraces. The areas are oval to long and narrow and range from 10 to about 100 acres.

Typically, the surface layer is slightly acid, dark grayish brown fine sandy loam about 4 inches thick. To a depth of 8 inches, the soil is slightly acid, very pale brown fine sandy loam, and to a depth of 39 inches, it is very strongly acid clay that is mottled in shades of brown, red, and gray. To a depth of 52 inches, the soil is medium acid, grayish brown clay that has red and brown mottles. To a depth of 80 inches, it is moderately alkaline, grayish brown sandy clay.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Crockett, Mabank, Silawa, and Rader soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture, for which it has medium potential. Forage production is high if the pasture is properly managed. This soil is well suited to improved bermudagrass. This soil has low potential for use as cropland. The hazard of erosion and, in most areas, the low fertility of the soil are limitations. Terraces and contour farming help to control erosion. Crop residue should be left on the surface to help conserve moisture and to maintain tilth and productivity.

This soil has medium potential for urban development. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. Areas of this soil that have trees are highly desirable for residential development.

This soil is in capability subclass IIIe and in the Claypan Savannah range site.

12—Axtell fine sandy loam, 2 to 5 percent slopes, eroded. This is a deep, moderately well drained soil on old high stream terraces. The areas are oblong to long and narrow and range from 10 to about 50 acres. Gullies are common in all areas, and subsoil material is exposed in about 30 percent of the areas. Between the gullies, sheet erosion has removed as much as 40 percent of the surface layer.

Typically, the surface layer is medium acid, dark grayish brown fine sandy loam about 4 inches thick. To a depth of 19 inches, the soil is strongly acid, dark brown clay loam. To a depth of 35 inches, it is mottled, light yellowish brown and yellowish red, strongly acid clay. The next layer, to a depth of 80 inches, is medium acid clay that has yellow and gray mottles.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is severe. In most areas, the organic matter content is low because erosion has removed material from the surface layer.

Included in mapping are small areas of Crockett, Rader, and Silawa soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture, for which it has medium potential. It is well suited to improved bermudagrass. This soil has low potential for use as cropland. The low fertility, very slow permeability, and poor tilth of the soil and the hazard of erosion are limitations to crop production. Establishing close-growing crops helps to control erosion. Leaving crop residue on the surface of the soil helps to control erosion, conserve moisture, reduce soil temperature, and maintain tilth and productivity.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation.

This soil is in capability subclass IVe and in the Claypan Savannah range site.

13—Axtell-Urban land complex, 1 to 5 percent slopes. This complex is made up of deep, gently sloping, moderately well drained soils and areas of Urban land on uplands. The areas are oblong or oval and range from about 20 to 70 acres.

The Axtell soil makes up about 50 percent of this complex, and Urban land, which consists of areas covered with buildings, streets, and pavement, makes up about 25 percent. The rest of the complex is made up of minor soils. These soils and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Axtell soil is slightly acid, dark grayish brown fine sandy loam about 4 inches thick. To a depth of 8 inches, the soil is very slightly acid, pale brown fine sandy loam, and to a depth of 39 inches, it is very strongly acid clay that has brown, red, and gray mottles. To a depth of 52 inches, the soil is medium acid, grayish brown clay that has red and brown mottles. To a depth of 80 inches, it is moderately alkaline, grayish brown sandy clay.

Permeability of the Axtell soil is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Crockett, Mabank, Rader, Silawa, and Wilson soils. The included soils make up less than 25 percent of any one mapped area.

The soils in this complex have medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but these limitations can be overcome through good design and careful installation.

This map unit was not assigned to a capability subclass or a range site.

14—Bastsil fine sandy loam, 0 to 3 percent slopes. This is a deep, well drained, nearly level to gently sloping soil. The areas are oval to irregular in shape and range from 15 to 60 acres in size.

Typically, the surface layer is medium acid, brown fine sandy loam 8 inches thick. To a depth of 12 inches, the soil is medium acid, yellowish red sandy clay loam, and to a depth of 34 inches, it is medium acid, red sandy clay loam. To a depth of 68 inches, it is mottled red, yellowish red, and light gray sandy clay loam.

Runoff is medium. The hazard of erosion is moderate. Permeability is moderate, and the available water capacity is high.

Included in mapping are small areas of Mabank, Silawa, and Smithville soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland and pasture. It has high potential for these uses. Crop and forage yields are high if good management practices are used. Leaving crop residue on the soil helps to conserve moisture, to reduce runoff and soil temperature, and to maintain soil tilth and productivity. This soil is well suited to improved bermudagrass.

This soil has high potential for urban development. Corrosivity to uncoated steel is a limitation. The low strength of the soil is a limitation for local roads and streets. These limitations can be overcome through good design and careful installation.

This soil is in capability subclass IIe and in the Sandy Loam range site.

15—Bastsil-Urban land complex, 0 to 2 percent slopes. This complex is made up of nearly level to gently sloping, well drained soils and areas of Urban land. The areas are oval to irregular in shape and are dominantly 20 to 50 acres in size.

The Bastsil soil makes up about 40 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 35 percent. Minor soils make up the rest. In most yards of the newer residential developments, the soil has been altered by the addition of a thin layer of topsoil and by land leveling. These soils and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Bastsil soil is medium acid, brown fine sandy loam about 8 inches thick. To a depth of 12 inches, the soil is medium acid, yellowish red sandy clay loam, and to a depth of 34 inches, it is medium acid, red sandy clay loam. To a depth of 68 inches, the soil is mottled dark red, yellowish red, and light gray sandy clay loam.

Permeability of the Bastsil soil is moderate, and the available water capacity is high. Runoff is medium. The hazard of erosion is moderate.

Included in mapping are small areas of Mabank, Silawa, and Smithville soils. The included soils make up less than 25 percent of any one mapped area.

The soils in this complex have high potential for urban uses. Corrosivity to uncoated steel is a limitation. The low strength of the soil is a limitation for local roads and streets. These limitations can be overcome through good design and careful installation.

This map unit was not assigned to a capability subclass or a range site.

16—Brackett loam, 3 to 5 percent slopes. This is a shallow, gently sloping, well drained soil on uplands. The areas are oblong or crescent-shaped and range from 5 to 40 acres.

Typically, the surface layer is moderately alkaline, light grayish brown loam about 9 inches thick. To a depth of 16 inches, the soil is moderately alkaline, light gray loam. The layer below that, to a depth of 23 inches, consists of fractured soft limestone that is about 25 percent, by volume, moderately alkaline, pale brown loam. The underlying material is white, weakly fractured soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Eddy and Stephen soils. In some small areas, this Brackett soil has slopes of 5 to 8 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland, for which it has low potential. Low fertility, droughtiness, and the shallow root zone are the main limitations to this use.

This soil has medium potential for urban development. The shallowness to rock and slope are the main limitations; however, the rock is rippable. The soil has medium potential for recreation uses. Shallowness to rock and the moderately slow permeability are limitations.

This soil is in capability subclass IVe and in the Adobe range site.

17—Branyon clay, 0 to 1 percent slopes. This is a deep, nearly level, moderately well drained soil on old high stream terraces. The areas are oblong or oval and range from 30 to several hundred acres.

Typically, the surface layer is moderately alkaline, very dark gray clay about 6 inches thick. To a depth of 52 inches, the soil is moderately alkaline, dark gray clay, and to a depth of 72 inches, it is moderately alkaline, gray clay. To a depth of 80 inches, the soil is moderately alkaline, grayish brown clay that has common fine, yellowish brown mottles.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Burleson, Houston Black, and Lewisville soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland, for which it has high potential. The yield of crops is good if the soil is properly managed. The slow drainage and the clayey texture of this soil are limitations to use as cropland. Leaving crop residue on the surface helps to maintain tilth and productivity. This soil has high potential for use as pasture.

This soil has low potential for urban development. The very high shrink-swell potential, low strength, and corrosivity of the soil and the slow runoff are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. This soil is suitable for recreation uses. The clayey texture, slow runoff, and very slow permeability are limitations, but they can be partly overcome by adding a layer of loamy topsoil and by providing drainage outlets.

This soil is in capability subclass IIw and in the Blackland range site.

18—Burleson clay, 0 to 1 percent slopes. This is a deep, nearly level, moderately well drained soil on old stream terraces. The areas are oval or oblong and range from 15 to about 150 acres.

Typically, the surface layer is neutral, very dark gray clay about 4 inches thick. To a depth of 46 inches, the soil is slightly acid, very dark gray clay, and to a depth of 64 inches, it is neutral, grayish brown clay. To a depth of 80 inches, the soil is moderately alkaline, grayish brown clay.

Permeability is very slow, and the available water capacity is high. Tilth generally is poor, and the surface tends to crust (fig. 7). Runoff is slow. The hazard of erosion is slight.

Included in mapping are small areas of Branyon, Houston Black, and Wilson soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland and pastureland. It has high potential for these uses. If this soil is managed properly, yields are good. The slow runoff and poor tilth are limitations.

This soil has low potential for urban development. The high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. This soil is not suitable for recreation uses because of the clayey texture and very slow permeability, which are difficult to overcome.

This soil is in capability subclass IIw and in the Blackland range site.

19—Burleson clay, 1 to 3 percent slopes. This is a deep, gently sloping, moderately well drained soil on old stream terraces. The areas are oval or oblong and range from 10 to several hundred acres.

Typically, the surface layer is neutral, very dark gray clay about 4 inches thick. To a depth of 37 inches, the soil is slightly acid, very dark gray clay, and to a depth of 55 inches it is neutral, grayish brown clay. To a depth of 80 inches, the soil is moderately alkaline, grayish brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is medium. The hazard of erosion is moderate. Tilth generally is poor, and the surface tends to crust.

Included in mapping are small areas of Heiden, Houston Black, and Wilson soils and a few places where the Burleson soil is eroded. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and pasture. It has high potential for these uses. The permeability, texture, and tilth of the soil and the hazard of erosion are limitations. Leaving crop residue on the surface helps to control erosion and to improve tilth and productivity. This soil is well suited to improved bermudagrass.

This soil has low potential for urban development. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. This soil is not suitable for recreation uses because of the clayey texture, the very slow permeability, and the hazard of erosion.

The soil is in capability subclass IIe and in the Blackland range site.

20—Crockett fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level, moderately well drained soil on uplands. The areas are irregular in shape and range from 10 to as much as a few hundred acres in size.

Typically, the surface layer is neutral, grayish brown fine sandy loam about 7 inches thick. To a depth of 11 inches, the soil is neutral, dark brown clay, and to a depth of 37 inches, it is yellowish brown clay that has dark brown mottles in the upper part. To a depth of 53 inches, the soil is moderately alkaline, strong brown clay that has gray and red mottles. To a depth of 80 inches, it is moderately alkaline clay that is mottled in shades of brown, yellow, and gray.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Axtell, Mabank, and Rader soils. The included soils make up less than 15 percent of the mapped areas.

This soil is used mainly as cropland. In some areas, it is used as pasture. This soil has medium potential for crops and high potential for use as pasture. If this soil is used as cropland, crop residue should be left on or near the surface to help control soil temperature and maintain tilth and productivity. This soil is well suited to improved bermudagrass.

This soil has medium potential for urban uses. The high shrink-swell potential, corrosivity, and low strength of the soil are limitations, but they can be overcome through good design and careful installation. This soil is

Figure 7.—After a rain, a crust forms on the surface of Burleson clay, 0 to 1 percent slopes.

limited for recreation uses such as camp areas and playgrounds by the very slow permeability and the slow runoff. These limitations can be partially overcome by providing a drainage system.

This soil is in the capability subclass IIIs and in the Claypan Prairie range site.

21—Crockett fine sandy loam, 1 to 3 percent slopes. This is a deep, gently sloping, moderately well drained soil on uplands. The areas are irregular in shape and range from 5 to about 100 acres in size.

Typically, the surface layer is neutral, grayish brown fine sandy loam about 7 inches thick. To a depth of 11 inches, the soil is neutral, dark brown clay, and to a depth of 37 inches, it is neutral, yellowish brown clay that has dark brown mottles. To a depth of 53 inches, the soil is moderately alkaline, strong brown clay that has gray and red mottles. To a depth of 80 inches, it is moderately alkaline clay that is mottled in shades of brown, yellow, and gray.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Axtell and Rader soils. The included soils make up less than 10 percent of the mapped areas.

This soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. This soil has medium potential for use as cropland. The main limitations to crops are the hazard of erosion and the low fertility of this soil. Leaving crop residue on or near the surface helps to control soil temperature, reduce erosion, and maintain fertility and productivity. If this soil is used for row crops, terraces and contour farming are needed to control runoff.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. The very slow permeability is a limitation for recreation uses.

This soil is in capability subclass IIIe and in the Claypan Prairie range site.

22—Crockett fine sandy loam, 2 to 5 percent slopes, eroded. This is a deep, gently sloping, moderately well drained soil on uplands. The areas are irregular in shape and range from 10 to 70 acres in size. All areas of this soil are gullied, but most gullies have been revegetated and are partly stabilized. The gullies are 20 to 80 feet apart, 1 to 2 feet deep, and 10 to 25 feet wide. The clayey lower layers of this soil are exposed in about 25 percent of the areas, especially along the sides of gullies. The surface layer has been removed in 30 to 50 percent of the areas. Some of the original surface layer has been removed throughout nearly all the areas.

Typically, the surface layer is slightly acid, light brownish gray fine sandy loam 2 inches thick. To a depth of 8 inches, the soil is strongly acid, pale brown clay loam. To a depth of 16 inches, it is strongly acid, dark grayish brown clay. To a depth of 51 inches, it is moderately alkaline, dark grayish brown clay, and to a depth of 70 inches, it is moderately alkaline, grayish brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is severe.

Included in mapping are small areas of Axtell and Silawa soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture, for which it has medium potential. The yield of pasture grasses is good if the pasture is properly managed. The main limitations to this use are low fertility, very slow permeability, and runoff. They can be partly overcome by fertilizing and by maintaining a good grass cover throughout the year. This soil has low potential for use as cropland. If this soil is used as cropland, cover crops and the use of crop residue can help to control erosion and maintain productivity.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the erosion hazard are limitations, but they can be overcome through good design and careful installation. This soil is not suitable for recreation uses such as camp areas or playgrounds because of the very slow permeability of the soil. This limitation is difficult to overcome.

This soil is in capability subclass IVe and in the Claypan Prairie range site.

23—Dalco clay, 1 to 3 percent slopes. This is a moderately deep, gently sloping, moderately well drained soil on uplands. The areas are irregular in shape and range from 20 to as much as several hundred acres in size.

Typically, the surface layer is black, moderately alkaline clay about 26 inches thick. To a depth of 35 inches, the soil is moderately alkaline, dark gray clay. The underlying material, to a depth of 80 inches, is white, soft chalky limestone; the limestone is platy to a depth of 41 inches and massive below that.

Permeability is very slow, and the available water capacity is low. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Austin, Houston Black, and Trinity soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland, for which it has high potential. The yield of crops is good if the soil is properly managed. Leaving crop residue on the surface helps to conserve moisture, reduce runoff, and maintain the tilth and productivity of the soil. If this soil is used for row crops, terraces and contour farming are needed to reduce runoff. The soil has high potential for use as pasture. It is well suited to improved bermudagrass.

This soil has low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. The underlying limestone is a limitation to excavations but can be cut using excavating equipment. This soil is suitable for recreation uses, but the clayey texture and very slow permeability of the soil are limitations. Adding a layer of loamy or sandy topsoil helps to overcome the limitation of clayey texture.

This soil is in capability subclass IIe and in the Blackland range site.

24—Dalco-Urban land complex, 0 to 3 percent slopes. This complex is made up of moderately deep, moderately well drained, nearly level and gently sloping soils and areas of Urban land. The areas are oval and oblong and range from 20 acres to several hundred acres.

The Dalco soil makes up about 50 percent of this complex and Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. Minor soils make up the rest. Typically, 20 to 45 percent of the residential areas are covered with buildings. The soil in these areas has been altered in constructing the buildings and streets and in excavating for service lines. The Dalco soil and areas of Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Dalco soil is moderately alkaline, black clay about 26 inches thick. To a depth of 39 inches, the soil is moderately alkaline, dark gray clay. The underlying material is white chalky limestone that is platy to a depth of 45 inches and massive below that.

Permeability is very slow, and the available water capacity is low. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Austin, Houston Black, and Stephen soils. The included soils make up less than 20 percent of any one mapped area.

The soils in this complex have low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. The underlying limestone is a limitation to shallow excavations but can be cut using excavating equipment. The clayey texture of the soil is a limitation to recreation uses.

This map unit was not assigned to a capability subclass or a range site.

25—Dutek loamy fine sand, 1 to 5 percent slopes. This is a deep, gently sloping, well drained soil on old stream terraces on uplands. The areas are mainly long and narrow and range from 5 to more than 100 acres.

Typically, the surface layer is slightly acid, brown loamy fine sand about 8 inches thick. To a depth of 34 inches, the soil is slightly acid loamy fine sand that is light yellowish brown in the upper part and very pale brown in the lower part. To a depth of 54 inches, it is medium acid, yellowish red sandy clay loam. To a depth of 64 inches, the soil is very strongly acid, yellowish red fine sandy loam, and to depth of 75 inches, it is very strongly acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is medium. Runoff is slow. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included in mapping are small areas of Silstid soils. The included soils make up less than 15 percent of any one mapped area.

In most areas, this soil is used as pasture, for which it has medium potential. It is well suited to improved bermudagrass. This soil has low potential for use as cropland. If this soil is used for crops, crop residue should be left on the surface to help conserve moisture, reduce soil temperature, prevent wind erosion, and maintain soil tilth and productivity.

This soil has high potential for urban uses. The corrosivity of the soil is a limitation. This soil is suited to most recreation uses; however, the sandy surface texture restricts some uses.

This soil is in capability subclass IIIe and in the Sandy range site.

26—Eddy clay loam, 1 to 3 percent slopes. This is a very shallow to shallow, gently sloping, well drained soil overlying the Austin Chalk geologic formation. The areas are irregular in shape and range from 10 to about 100 acres in size.

Typically, the surface layer is grayish brown, moderately alkaline clay loam about 5 inches thick. The layer below that, to a depth of 11 inches, consists of platy soft chalky limestone and about 15 percent grayish brown clay loam. The underlying material is white soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is severe.

Included in mapping are small areas of Austin, Brackett, and Stephen soils. The included soils make up less than 15 percent of the mapped areas.

The soil is used mainly as pasture and rangeland. It has low potential for these uses. This soil is fairly well suited to King Ranch bluestem. The climax vegetation on rangeland consists of tall and mid grasses and some juniper and Texas oak.

This soil has medium potential for urban uses. Corrosivity and the shallowness to rock are limitations; however, the rock is rippable and provides a good footing for foundations. The soil is suited to recreation uses; however, the moderately slow permeability, small stones on the surface, and shallowness to rock are limitations.

This soil is in capability subclass IVs and in the Chalky Ridge range site.

27—Eddy clay loam, 3 to 8 percent slopes. This is a very shallow to shallow, well drained, gently sloping to sloping soil overlying the Austin Chalk geologic formation. The areas are mainly long and narrow and range from 20 to more than 100 acres.

Typically, the surface layer is moderately alkaline, grayish brown clay loam 4 inches thick. The layer below that, to a depth of 11 inches, consists of platy soft chalky limestone and about 15 percent, by volume, grayish brown clay loam. The underlying material is white soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Brackett and Stephen soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture and rangeland. It has low potential for these uses. Forage production is low. This soil is suited to King Ranch bluestem. The climax vegetation on rangeland consists of tall and mid grasses and some juniper and Texas oak.

This soil has medium potential for urban uses. Corrosivity and the shallowness to rock are limitations; however, the rock is soft and rippable and provides a good footing for foundations. This soil is suited to recreation uses. The moderately slow permeability, shallowness to rock, and small stones on the surface are limitations.

This soil is in capability subclass VIe and in the Chalky Ridge range site.

28—Eddy-Brackett complex, 8 to 20 percent slopes. This complex is made up of strongly sloping to moderately steep, well drained, very shallow and shallow soils overlying the Austin Chalk geologic formation. The areas are long and narrow and range from 20 to several hundred acres.

The Eddy soil makes up about 50 percent of this complex, the Brackett soil makes up 30 percent, and minor soils make up the rest. These soils are so intermingled that it was not practical to separate them in mapping at the scale used. Typically, the Eddy soil is on the upper part of slopes, and the Brackett soil is on the lower part.

Typically, the surface layer of the Eddy soil is moderately alkaline, dark grayish brown clay loam 3 inches thick. To a depth of 6 inches, the soil is moderately alkaline, dark grayish brown, very gravelly clay loam. The underlying material is platy chalky limestone (fig. 8).

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Typically, the surface layer of the Brackett soil is grayish brown, moderately alkaline loam 6 inches thick. To a depth of 16 inches, the soil is brown, moderately alkaline, gravelly clay loam, and to a depth of 20 inches, it is

Figure 8.—Exposed profile and substratum of Eddy clay loam in an area of Eddy-Brackett complex, 8 to 20 percent slopes. The thick vegetation and ground cover of forest litter are typical of most areas of these soils.

brown, moderately alkaline, very gravelly loam. The underlying material is soft, platy chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Austin, Frio, Lewisville, and Stephen soils and some rock outcrops. The included soils make up less than 25 percent of any one mapped area.

The soils in this complex are used mainly as rangeland, for which they have low potential. Most areas have a dense cover of trees and shrubs. The climax plant community consists of tall and mid grasses and woody plants, including Texas oak, ash, juniper, buckeye, and woody shrubs. Rangeland management on these soils requires proper stocking and controlled grazing. Because of the steepness of slopes, the erosion hazard, and the shallowness to bedrock, these soils are not suited to use as cropland.

These soils have medium potential for urban uses. The shallowness of the soils, unstable slopes, corrosivity, and the hazard of erosion are limitations. These soils are suitable for some recreation uses, including native study areas and paths and trials. They are suitable for use as wildlife habitat.

This complex is in capability subclass VIe. The Eddy soil is in the Chalky Ridge range site, and the Brackett soil is in the Steep Adobe range site.

29—Eddy-Brackett-Urban land complex, 8 to 15 percent slopes. This complex is made up of strongly sloping and moderately steep, well drained, very shallow and shallow soils and areas of Urban land. The areas generally are long and narrow and range from 15 to several hundred acres.

The Eddy soil makes up about 35 percent of this complex, and the Brackett soil about 20 percent. Urban land, which consists of areas covered with buildings and pavement, makes up 25 percent of the complex, and minor soils make up the rest. The soil in yards has been altered by cutting and filling, by mixing limestone fragments into the soil, and by adding loamy topsoil. These soils and the Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Eddy soil is moderately alkaline, dark grayish brown loam 3 inches thick. The layer below that, to a depth of 15 inches, consists of platy soft limestone and about 20 percent, by volume, dark grayish brown loam. The underlying material is platy, fractured, soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Typically, the surface layer of the Brackett soil is moderately alkaline, grayish brown loam 6 inches thick. To a depth of 16 inches, the soil is moderately alkaline, brown gravelly loam, and to a depth of 20 inches, it is moderately alkaline, brown, very gravelly loam. The underlying material is soft platy chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Austin and Stephen soils and areas of limestone outcrops and ledges. These inclusions make up less than 20 percent of any one mapped area.

The soils in this complex have medium potential for urban uses. The shallowness to rock, the unstable slopes, the corrosivity of the soil, and the hazard of erosion are limitations.

This map unit was not assigned to a capability subclass or a range site.

30—Eddy-Stephen complex, 1 to 5 percent slopes. This complex is made up of gently sloping, well drained, very shallow and shallow soils overlying the Austin Chalk geologic formation. The areas generally are oblong and range from 10 to as much as a few hundred acres.

The Eddy soil makes up about 60 percent of this complex, the Stephen soil makes up 30 percent, and minor soils make up the rest. These soils are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Eddy soil is moderately alkaline, dark grayish brown, gravelly clay loam. To a depth of 15 inches, the soil is moderately alkaline, dark grayish brown, very gravelly clay loam. The underlying material is chalky limestone that is platy in the upper 2 inches and massive below that.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is severe.

Typically, the surface layer of the Stephen soil is moderately alkaline, dark grayish brown silty clay about 8 inches thick. To a depth of 14 inches, the soil is moderately alkaline, brown silty clay. The underlying material is white, platy, soft chalky limestone. Fragments of limestone are common throughout the soil.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Austin and Brackett soils. The included soils make up less than 10 percent of any one mapped area.

These soils are used mainly as pasture, for which they have low potential. The shallowness to rock is the main limitation. Because of the erosion hazard and the shallowness to rock, these soils are not suited to cultivation.

These soils have medium potential for urban uses. The hazard of erosion and the shallowness to rock are the main limitations; however, the rock is soft and rippable, and erosion can be controlled through careful installation.

These soils are suitable for recreation uses; however, the clayey texture of the Stephen soils, the shallowness to rock, and the gravelly surface layer of the Eddy soil are limitations.

These soils are in capability subclass VIe and in the Chalky Ridge range site.

31—Eddy-Urban land complex, 1 to 4 percent slopes. This complex is made up of gently sloping, shallow and very shallow, well drained soils and areas of Urban land. The areas generally are oval or oblong and range from 20 to as much as a few hundred acres.

The Eddy soil makes up about 55 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 25 percent. Minor soils make up the rest. The soil in yards generally has been altered by cutting and filling, shallow excavations, and other development operations. In some yards, a layer of loamy topsoil 2 to 4 inches thick has been added to the soil. The Eddy soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Eddy soil is grayish brown, moderately alkaline clay loam 5 inches thick. The layer below that, to a depth of 11 inches, consists of platy soft chalky limestone and about 15 percent grayish brown clay loam. The underlying material is white, soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is severe.

Included in mapping are small areas of Brackett and Stephen soils. The included soils make up less than 20 percent of any one mapped area.

The Eddy soil has medium potential for urban uses. The shallowness to rock and corrosivity are the main limitations; however, the rock is soft and rippable and provides a good footing for foundations. Because the erosion hazard is severe, care is needed during construction to prevent soil loss.

This map unit was not assigned to a capability subclass or a range site.

32—Eddy-Urban land complex, 4 to 8 percent slopes. This complex is made up of gently sloping to sloping, shallow and very shallow, well drained soils and areas of Urban land. The areas generally are oval or oblong and range from 15 to as much as a few hundred acres.

The Eddy soil makes up about 50 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. Minor soils make up the rest. The soil in yards has been altered by cutting, filling, and leveling during construction, and limestone fragments have been mixed into the soil. In most yards, a layer of loamy topsoil 2 to 4 inches thick has been added. The Eddy soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Eddy soil is moderately alkaline, grayish brown clay loam 4 inches thick. The layer below that, to a depth of 11 inches, consists of platy, soft limestone and about 15 percent, by volume, grayish brown clay loam. The underlying material is white, soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Austin, Brackett, and Stephen soils. The included soils make up less than 20 percent of any one mapped area.

The Eddy soil has medium potential for urban uses. The shallowness to rock and corrosivity are limitations; however, the rock is rippable and provides a good footing for foundations. Erosion is a hazard but can be controlled through careful installation.

This map unit was not assigned to a capability subclass or a range site.

33—Eufaula loamy fine sand, 0 to 2 percent slopes. This is a deep, nearly level to gently sloping, somewhat excessively drained soil on old low terraces a few feet above the flood plain of the Trinity River. The areas are oblong and range from 30 to about 100 acres.

Typically, the surface layer is neutral, brown loamy fine sand about 13 inches thick. To a depth of 44 inches, the soil is mildly alkaline, strong brown loamy fine sand that has reddish brown mottles. To a depth of 80 inches, it is mottled reddish yellow and strong brown, moderately alkaline loamy fine sand.

Permeability is rapid, and the available water capacity is low. Runoff is very slow, and water erosion is a slight hazard. Wind erosion is a moderate hazard.

Included in mapping are small areas of Seagoville soils and areas of a soil that is similar to this Eufaula soil except that it has a surface layer of fine sandy loam. The included soils make up less than 20 percent of the mapped areas.

This soil is used mainly as pasture, for which it has low potential. The low available water capacity and low fertility of the soil are limitations. This soil is well suited to improved bermudagrass.

This soil has low potential for crops. It can be cultivated, but the yield of crops is low unless the soil is properly fertilized. Crop residue should be left on the surface of the soil to help conserve moisture, prevent wind erosion, and maintain productivity.

This soil has high potential for urban uses. It has few limitations to urban development. The walls of cuts and excavations tend to cave in or slough. In many areas, this soil is used for mining gravel and sand.

This soil is in capability subclass IVs and in the Deep Sand range site.

34—Ferris-Heiden complex, 5 to 12 percent slopes. This complex is made up of deep, well drained, gently rolling and rolling soils on hillsides. The areas generally are oblong and range from 15 to several hundred acres.

The Ferris soil makes up about 60 percent of this complex, the Heiden soil makes up about 20 percent, and minor soils make up the rest. The Ferris soil is on the steeper slopes, and the Heiden soil is in valleys, on the lower part of slopes, and on ridgetops. These soils are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Ferris soil is moderately alkaline, light yellowish brown clay 3 inches thick. To a depth of 28 inches, the soil is moderately alkaline, olive clay. To a depth of 41 inches, it is moderately alkaline, light brownish gray clay. To a depth of 72 inches, the soil is mottled light brownish gray, light olive brown, and gray shaly clay.

Permeability is very slow, and the available water capacity is high. Runoff is rapid, and the hazard of erosion is severe.

Typically, the surface layer of the Heiden soil is moderately alkaline, dark grayish brown clay 19 inches thick. To a depth of 45 inches, the soil is moderately alkaline, grayish brown clay. The layer below that, to a depth of 78 inches, is mottled brownish gray, olive yellow, and brownish yellow, moderately alkaline shaly clay.

Permeability is very slow, and the available water capacity is high. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Normangee, Houston Black, Trinity, and Vertel soils. The included soils make up less than 20 percent of any one mapped area.

The soils in this complex are used mainly as rangeland and pasture. They have medium potential for these uses. The yield of forage on rangeland is good. The climax plant community consists of tall and mid grasses. Proper stocking and controlled grazing are needed in managing rangeland and pasture on these soils. The rapid runoff and the severe hazard of erosion are limitations to establishing introduced grasses. These soils have low potential for use as cropland.

These soils have low potential for urban uses. Limitations to urban uses are the very high shrink-swell potential, low strength, and corrosivity of the soils, the unstable slopes, and the hazard of erosion; they are difficult and costly to overcome. In addition, the walls of excavations tend to cave in or slough. These soils are limited for recreation uses by the clayey texture of the soil, the very slow permeability, and the steepness of slopes.

These soils are in capability subclass VIe. The Ferris soil is in the Eroded Blackland range site, and the Heiden soil is in the Blackland range site.

35—Ferris-Urban land complex, 5 to 12 percent slopes. This complex is made up of deep, well drained, sloping and strongly sloping soils and areas of Urban land. The areas are irregular in shape and range from 15 to several hundred acres in size.

Typically, the Ferris soil makes up about 60 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 25 percent; minor soils make up the rest. On about 50 percent of the acreage the soil has been altered by cutting, filling, and shaping. In many places, the cutting and shaping have exposed the underlying shaly clay. A thin layer of loamy and sandy topsoil has been added to many yards. The Ferris soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Ferris soil is moderately alkaline, light yellowish brown clay 3 inches thick. To a depth of 28 inches, the soil is moderately alkaline, olive clay. To a depth of 41 inches, it is moderately alkaline, light brownish gray clay. The layer below that, to a depth of 72 inches, consists of mottled, light brownish gray, light olive brown, and gray shaly clay.

Permeability of the Ferris soil is very slow, and the available water capacity is high. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Heiden and Vertel soils. The included soils make up no more than 15 percent of any one mapped area.

The Ferris soil has low potential for urban uses. Limitations to urban uses are the very high shrink-swell potential, low strength, and corrosivity of the soil, the unstable slopes, and the severe hazard of erosion. In addition, the walls of excavations tend to cave in or slough. These limitations are difficult to overcome.

This map unit was not assigned to a capability subclass or a range site.

36—Frio silty clay, occasionally flooded. This is a deep, well drained, nearly level soil on flood plains. The areas generally are long and narrow and range from about 20 to several hundred acres. This soil is occasionally flooded. The floodwaters are shallow, and the floods are of brief duration. Some areas are protected by levees.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay 7 inches thick (fig. 9). To a depth of 32 inches, the soil is moderately alkaline, very dark grayish brown silty clay. To a depth of 53 inches, it is moderately alkaline, very dark grayish brown silty clay. To a depth of 74 inches, the soil is moderately alkaline, brown silty clay loam.

Permeability is moderately slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Gowen and Trinity soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland and pasture. It has high potential for use as cropland and high potential for use as pasture. This soil is well suited to the crops commonly grown in the county. The yield of crops is good if the soil is properly managed. This soil is well suited to improved bermudagrass.

This soil has low potential for urban uses because of the hazard of flooding and the low strength and corrosivity of the soil. It has low potential for recreation uses

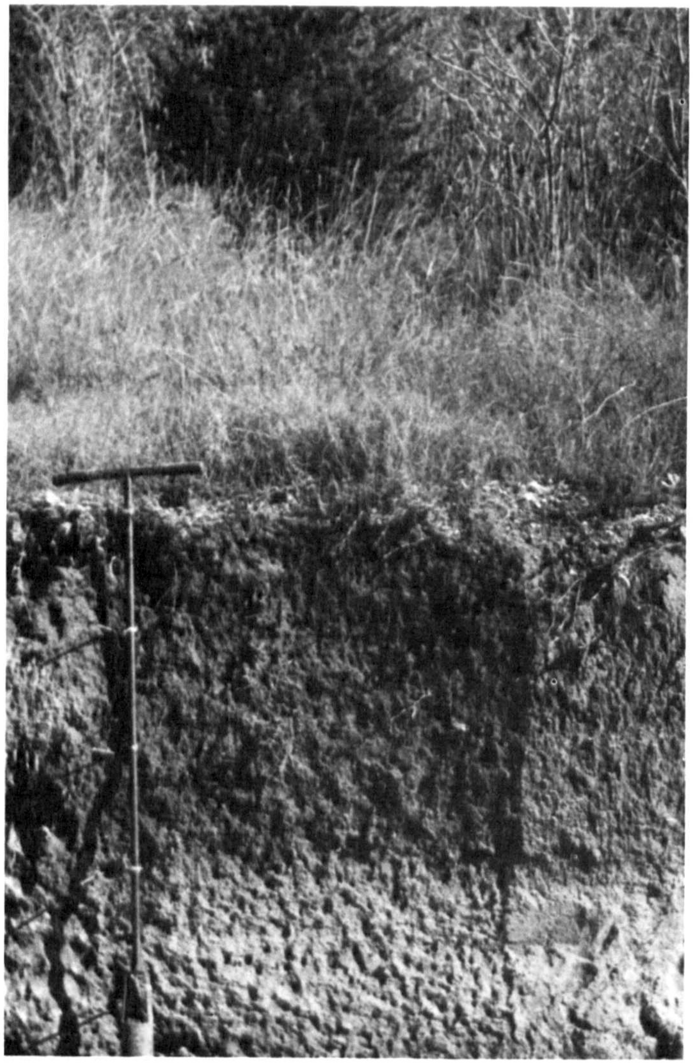

Figure 9.—A profile of Frio silty clay, occasionally flooded. The dark surface soil is about 3 feet thick.

because of the hazard of flooding and the clayey surface texture.

This soil is in capability subclass IIw and in the Loamy Bottomland range site.

37—Frio silty clay, frequently flooded. This is a deep, well drained, nearly level soil on flood plains. The areas generally are long and narrow and range from 50 to several hundred acres. This soil generally is flooded one or more times each year. The floodwaters are shallow, and the floods are of brief duration.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay 7 inches thick. To a depth of 46 inches, the soil is moderately alkaline, very dark grayish brown silty clay. To a depth of 74 inches, it is moderately alkaline, brown silty clay loam.

Permeability is moderately slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Gowen and Trinity soils. The included soils make up less than 15 percent of the mapped areas.

This soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. This soil is not suited to use as cropland because of the frequent flooding.

This soil has very low potential for urban uses because of the frequent flooding and the low strength and corrosivity of the soil. It is limited for recreation uses by the hazard of flooding and the clayey surface texture.

This soil is in capability subclass Vw and in the Loamy Bottomland range site.

38—Frio-Urban land complex. This complex is made up of deep, nearly level, well drained soils and areas of Urban land on the flood plains of small streams. The areas are long and narrow and range from 30 to more than 1,000 acres.

The Frio soil makes up about 70 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 15 percent. The rest is minor soils. In some areas, fill material consisting of clay, broken concrete, and pavement has been stacked or spread 2 to 4 feet deep on the surface. The Frio soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Frio soil is moderately alkaline, dark grayish brown silty clay 7 inches thick. To a depth of 53 inches, the soil is moderately alkaline, very dark grayish brown silty clay. To a depth of 74 inches, it is moderately alkaline, brown silty clay loam.

Permeability is moderately slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Gowen and Trinity soils. The included soils make up less than 15 percent of any one mapped area.

The Frio soil has low potential for urban uses because of the hazard of flooding. In most areas of this complex, however, levees have been constructed to prevent damage by floods. Other limitations to urban uses are the low strength and corrosivity of the soil. The Frio soil has low potential for recreation uses because of the hazard of flooding and the clayey surface texture. Some areas of this complex are used as greenbelts or open space and for city parks.

This map unit was not assigned to a capability subclass or a range site.

39—Gowen loam, occasionally flooded. This is a deep, well drained, nearly level soil on flood plains. The areas are long and narrow to oblong and range from 20 to 100 acres. This soil is subject to occasional flooding;

floodwaters are shallow, and the floods are of brief duration.

Typically, the surface layer is a moderately alkaline, dark grayish brown loam 21 inches thick. To a depth of 32 inches, the soil is moderately alkaline, dark grayish brown clay loam, and there are thin strata of brown sandy loam. To a depth of 53 inches, the soil is moderately alkaline, grayish brown sandy clay loam, and there are thin strata of fine sand. To a depth of 80 inches, the soil is mottled, dark gray and dark yellowish brown, moderately alkaline sandy clay.

Permeability is moderate, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Frio and Trinity soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. This soil has high potential for crops. If this soil is used for crops, leaving crop residue on the surface will help to conserve moisture and maintain tilth and productivity.

This soil has low potential for urban uses because of the hazard of flooding and the corrosivity of the soil to uncoated steel. The flooding is a limitation that is difficult to overcome. Limitations to recreation uses are the clayey surface texture and the hazard of flooding.

This soil is in capability subclass IIw and in the Loamy Bottomland range site.

40—Gowen loam, frequently flooded. This a a deep, well drained, nearly level soil on flood plains. The areas are long and narrow and range from 15 to 40 acres. This soil generally is flooded one or more times each year. The floodwaters are shallow, and the floods are of brief duration.

Typically, the surface layer is neutral, brown clay loam 4 inches thick. To a depth of 35 inches, the soil is moderately alkaline, dark grayish brown loam and there are a few thin strata of brown clay loam. To a depth of 53 inches, the soil is moderately alkaline, grayish brown sandy clay loam, and there are common thin strata of fine sand. To a depth of 80 inches, the soil is moderately alkaline, dark gray and dark yellowish brown sandy clay.

Permeability is moderate, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Frio and Trinity soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used as pasture, for which it has high potential. The yield of forage is high. This soil is well suited to improved bermudagrass. This soil has low potential for crops, mainly because of the hazard of flooding.

This soil has very low potential for urban and recreation uses. The hazard of flooding and the corrosivity of the soil are the main limitations.

This soil is in capability subclass Vw and in the Loamy Bottomland range site.

41—Helden clay, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are oblong and range from 15 to about 200 acres.

Typically, the surface layer is moderately alkaline, dark gray clay 6 inches thick. To a depth of 37 inches, the soil is moderately alkaline, very dark grayish brown clay. To a depth of 56 inches, it is moderately alkaline, grayish brown clay that has gray and yellowish brown mottles. The underlying material, to a depth of 78 inches, is shaly clay mottled in shades of gray and yellow.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Normangee, Houston Black, and Wilson soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland and pasture. It has high potential for these uses. The yield of forage and crops is high if the soil is properly managed. Crop residue should be left on the surface to help control runoff and erosion and to maintain tilth and productivity. If this soil is used for row crops, terraces and contour farming are needed. This soil is well suited to improved bermudagrass. This soil is well suited to use as rangeland. The climax plant community consists of tall and mid grasses.

This soil has low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. This soil has low potential for recreation uses. The clayey surface texture is the main limitation.

This soil is in capability subclass IIe and in the Blackland range site.

42—Helden clay, 2 to 5 percent slopes, eroded. This is a deep, well drained, gently sloping soil on uplands. The areas are mainly oblong to long and narrow and range from 15 to about 100 acres. In most areas, erosion has removed about 50 percent of the surface layer. Shallow gullies are common and are 20 to 60 feet apart. There are deep gullies in some mapped areas.

Typically, the surface layer is moderately alkaline, dark gray clay 6 inches thick. To a depth of 37 inches, the soil is moderately alkaline, dark grayish brown clay. To a depth of 56 inches, it is moderately alkaline, grayish brown clay. The underlying material, to a depth of 78 inches, is shaly clay that has gray and yellow mottles.

Permeability is very slow, and the available water capacity is high. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Ferris soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as pasture, for which it has medium potential. It is well suited to improved bermudagrass. The yield of forage is good if the soil is properly managed. This soil has low potential for use as cropland because of the severe hazard of erosion. The use of close-growing crops and keeping crop residue on the soil help to control runoff and erosion and to maintain tilth and productivity. This soil is well suited to use as rangeland. The climax plant community consists of tall and mid grasses.

This soil has low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil and the severe hazard of erosion are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. The clayey surface texture is a limitation to the use of this soil for camp and picnic areas. The slope is a limitation to playground uses.

This soil is in capability subclass IIIe and in the Blackland range site.

43—Houston Black clay, 0 to 1 percent slopes. This is a deep, moderately well drained, nearly level soil on smooth uplands. The areas are irregular in shape and range from 10 to a few hundred acres in size.

Typically, the surface layer is moderately alkaline, very dark gray clay 6 inches thick. To a depth of 38 inches, the soil is moderately alkaline, black clay. To a depth of 52 inches, it is moderately alkaline, very dark gray clay. To a depth of 70 inches, the soil is moderately alkaline, dark grayish brown clay that has many light olive brown mottles.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Branyon and Burleson soils and small areas of gently sloping Houston Black soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland, for which it has high potential. The yield of crops commonly grown in the county is good if the soil is properly managed. Leaving crop residue on the surface helps to maintain tilth and productivity. This soil has high potential for use as pasture. It is well suited to improved bermudagrass.

This soil has low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. The clayey surface texture is a limitation to recreation uses.

This soil is in capability subclass IIw and in the Blackland range site.

44—Houston Black clay, 1 to 3 percent slopes. This is a deep, moderately well drained, gently sloping soil on smooth uplands. The areas are oblong or irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is moderately alkaline, very dark gray clay 6 inches thick. To a depth of 38 inches, the soil is moderately alkaline, black clay, and to a depth of 52 inches, it is moderately alkaline, very dark gray clay. To a depth of 70 inches, the soil is moderately alkaline, dark grayish brown clay that has many light olive brown mottles.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Burleson, Dalco, and Heiden soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland, for which it has high potential. The yield of crops commonly grown in the county is good if the soil is properly managed. Leaving crop residue on or near the surface helps to control runoff and to maintain tilth and productivity. Terraces and contour farming help to control runoff and erosion. This soil has high potential for use as pasture. It is well suited to improved bermudagrass.

This soil has low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil and the hazard of erosion are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. The clayey surface texture is a limitation to recreation uses.

This soil is in capability subclass IIe and in the Blackland range site.

45—Houston Black-Urban land complex, 0 to 4 percent slopes. This complex is made up of deep, moderately well drained, nearly level and gently sloping soils and areas of Urban land. The areas are mainly oval and oblong and range from 20 to several hundred acres.

The Houston Black soil makes up about 40 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 35 percent. Minor soils make up the rest. In many places, excavation for service lines has altered the soil. In some yards, a layer of loamy or sandy topsoil 2 or 3 inches thick has been spread over the surface. The Houston Black soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Houston Black soil is moderately alkaline, very dark gray clay 6 inches thick. To a depth of 38 inches, the soil is moderately alkaline, black clay, and to a depth of 52 inches, it is moderately alkaline, very dark gray clay. To a depth of 70 inches, the soil is moderately alkaline, dark grayish brown clay that has light olive brown mottles.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Burleson, Dalco, Heiden, and Wilson soils. Some of the included soils, for example, Burleson and Heiden soils, are extensive in some areas, but they were not separated in mapping because they are similar to the Houston Black soil in their response to urban uses. The included soils make up, on the average, 25 percent of each mapped area.

The soil has low potential for urban uses. The very high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. These limitations can be overcome through good design and careful installation. The clayey surface texture and very slow permeability are the main limitations to recreation uses.

This map unit was not assigned to a capability subclass or a range site.

46—Lewisville silty clay, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on old stream terraces. The areas are oval or irregular in shape and range from 10 to 25 acres in size.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay 17 inches thick. To a depth of 27 inches, the soil is moderately alkaline, grayish brown silty clay. To a depth of 42 inches, it is moderately alkaline, light yellowish brown silty clay. Below that, to a depth of 52 inches, the soil is moderately alkaline, light brownish gray silty clay that has brownish mottles. To a depth of 75 inches, it is moderately alkaline, light yellowish brown silty clay that has fine, gray and brown mottles.

Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Heiden and Houston Black soils. The included soils make up as much as 15 percent of some mapped areas.

This soil is used mainly as cropland, for which it has high potential. The yield of crops commonly grown in the county is good if the soil is properly managed. Leaving crop residue on or near the surface helps to control erosion and to maintain tilth and productivity. This soil has high potential for use as pasture. It is well suited to improved bermudagrass. This soil also is well suited to pecan trees.

This soil has medium potential for urban uses. The high shrink-swell potential, corrosivity, and low strength of the soil are limitations, but they can be overcome through good design and careful installation. The clayey surface texture is the main limitation to recreation uses.

This soil is in capability subclass IIe and in the Clay Loam range site.

47—Lewisville silty clay, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on old stream terraces. The areas mainly are long and narrow and range from 10 to 40 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay. To a depth of 23 inches, the soil is moderately alkaline, grayish brown silty clay, and to a depth of 41 inches, it is moderately alkaline, light yellowish brown silty clay. Below that, to a depth of 54 inches, the soil is moderately alkaline, light brownish gray silty clay that has common fine brownish mottles. To a depth of 75 inches, it is moderately alkaline, light yellowish brown silty clay that has gray and brown mottles.

Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Heiden and Houston Black soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. The yield of forage is high if the soil is properly managed. This soil has high potential for use as cropland. If this soil is used for crops, terraces and contour farming are needed to control erosion and conserve moisture. Leaving crop residue on the surface helps to control erosion and to maintain tilth and productivity. This soil is well suited to pecan trees, which grow naturally in most pastures.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. This soil is suited to recreation uses. The clayey surface texture is the main limitation.

This soil is in capability subclass IIIe and in the Clay Loam range site.

48—Lewisville silty clay, 5 to 8 percent slopes. This is a deep, well drained, sloping soil on old stream terraces. The areas generally are oval and range from 10 to 30 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay about 13 inches thick. To a depth of 28 inches, the soil is moderately alkaline, light olive brown silty clay, and to a depth of 47 inches, it is moderately alkaline, light yellowish brown silty clay. To a depth of 80 inches, the soil is moderately alkaline, light yellowish brown silty clay that has common, fine, light gray mottles.

Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of erosion is severe.

Included in mapping are small areas of Altoga soils and a few areas where gullies have formed because of erosion. These included areas make up less than 15 percent of any one mapped area.

This soil is used as pasture, for which it has high potential. The yield of forage is high if the soil is properly managed. This soil is well suited to improved bermudagrass. It also is well suited to pecan trees, which grow naturally in most pastures. This soil has low potential for use as cropland, mainly because erosion is a severe hazard.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. This soil is suited to recreation uses. The clayey surface texture and the slope are limitations.

This soil is in capability subclass IVe and in the Clay Loam range site.

49—Lewisville-Urban land complex, 0 to 4 percent slopes. This complex is made up of deep, well drained, nearly level and gently sloping soils and areas of Urban land. The areas generally are oblong and range from 10 to more than 200 acres.

The Lewisville soil makes up about 55 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. Minor soils make up the rest. In many places, the soil has been altered by excavation, cutting and filling, and land leveling. In some yards, a layer of loamy and sandy topsoil 2 to 4 inches thick has been spread over the surface. This Lewisville soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Lewisville soil is moderately alkaline, dark grayish brown silty clay 17 inches thick. To a depth of 27 inches, the soil is moderately alkaline, grayish brown silty clay, and to a depth of 42 inches, it is moderately alkaline, light yellowish brown silty clay. To a depth of 55 inches, the soil is moderately alkaline, light brownish gray silty clay that has brownish mottles, and to a depth of 75 inches, it is moderately alkaline, light yellowish brown silty clay that has fine, gray and brown mottles.

Included in mapping are small areas of Heiden and Houston Black soils. The included soils make up less than 15 percent of any one mapped area.

Permeability is moderate, and the available water capacity is high. Runoff is slow to medium, and the hazard of erosion is moderate.

The Lewisville soil has medium potential for urban uses. The high shrink-swell potential, corrosivity, and low strength of the soil are limitations, but they can be overcome through good design and careful installation. The Lewisville soil is suited to recreation uses. The clayey surface texture is the main limitation.

This map unit was not assigned to a capability subclass or a range site.

50—Lewisville-Urban land complex, 4 to 8 percent slopes. This complex is made up of deep, well drained, gently sloping and sloping soils and areas of Urban land. The areas are irregular in shape and range from 15 to 100 acres in size.

The Lewisville soil makes up about 60 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. Minor soils make up the rest. The soil in areas of Urban land has been altered by street grading and shaping, by land leveling for lots and streets, and by excavating for water and sewer lines. The Lewisville soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Lewisville soil is moderately alkaline, dark grayish brown silty clay 13 inches thick. To a depth of 28 inches, the soil is moderately alkaline, light olive brown silty clay. To a depth of 47 inches, it is moderately alkaline, light yellowish brown silty clay. Below that, to a depth of 80 inches, the soil is moderately alkaline, light yellowish brown silty clay that has common fine, light gray mottles.

Permeability is moderate, and the available water capacity is high. Runoff is medium, and the hazard of erosion is severe.

Included in mapping are small areas of Altoga and Sunev soils and areas of Lewisville soils that are slightly more sloping than the Lewisville soil in this complex. The included soils make up as much as 10 percent of any one mapped area.

The Lewisville soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. The Lewisville soil is suitable for recreation uses; the clayey surface texture and the slopes are limitations.

This map unit was not assigned to a capability subclass or a range site.

51—Mabank fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level, somewhat poorly drained soil in slight depressions on uplands. The areas are oval to oblong and range from 10 to 150 acres. In winter, a perched water table generally is at a depth of 0.6 to 1 foot.

Typically, the surface layer is neutral, grayish brown fine sandy loam 5 inches thick. To a depth of 12 inches, the soil is slightly acid, gray clay loam. To a depth of 16 inches, it is strongly acid, dark gray clay. And to a depth of 65 inches, the soil is strongly acid to medium acid gray clay.

Permeability is very slow, and the available water capacity is high. Runoff is very slow, and the hazard of erosion is slight.

Included in mapping are small areas of Crockett and Wilson soils. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as pasture, for which it has medium potential. It is well suited to improved bermudagrass. This soil has medium potential for crops. The yield of forage and the crops commonly grown in the county is good if the soil is properly managed. If this soil is used as cropland, leaving crop residue on the surface helps to modify the soil temperature and to maintain soil tilth and productivity. In some areas, drainage ditches are needed to improve runoff.

The soil has medium potential for urban uses. The high shrink-swell potential, low strength, corrosivity, and wetness of the soil are limitations, but they can be overcome through good design and careful installation. Wetness is the main limitation for recreation uses.

This soil is in capability subclass IIIw and in the Claypan Prairie range site.

52—Mabank fine sandy loam, 1 to 3 percent slopes. This is a deep, somewhat poorly drained, gently sloping soil on uplands. The areas are irregular in shape and range from 10 to about 40 acres in size. In winter, this soil has a perched water table at a depth of 0.6 to 1.0 foot.

Typically, the surface layer is neutral, grayish brown fine sandy loam 5 inches thick. To a depth of 12 inches, the soil is slightly acid, gray clay. To a depth of 16 inches, it is strongly acid, dark gray clay. And to a depth of 65 inches, the soil is strongly acid to medium acid gray clay.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Crockett and Heiden soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used as cropland and pasture. It has medium potential for these uses. If this soil is used for crops, crop residue should be left on the surface to help control erosion, modify the soil temperature, and maintain tilth and productivity. Terraces and contour farming are needed for row crops. This soil is well suited to improved bermudagrass.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, wetness, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. Wetness and the hazard of erosion are the main limitations to recreation uses.

This soil is in capability subclass IIIe and in the Claypan Prairie range site.

53—Normangee clay loam, 1 to 3 percent slopes. This is a deep, moderately well drained, gently sloping soil on uplands. The areas are oblong or irregular in shape and range from 10 to 50 acres.

Typically, the surface layer is neutral, dark grayish brown clay loam 9 inches thick. To a depth of 14 inches, the soil is neutral, dark brown clay. To a depth of 25 inches, it is slightly acid, grayish brown clay that has light olive brown mottles. Between depths of 25 and 41 inches, the soil is slightly acid, olive clay that has common yellowish brown mottles. To a depth of 66 inches, it is moderately alkaline clay that is mottled in shades of brown, olive, and gray. Fine platy shale is at a depth of 66 inches.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Crockett and Wilson soils and areas of a soil that is similar to this Normangee soil except that it has a high content of gravel throughout. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland, for which it has medium potential. Leaving crop residue on the surface helps to control erosion, modify the soil temperature, and maintain the tilth and productivity of the soil. This soil has high potential for use as pasture. It is well suited to improved bermudagrass.

This soil has medium potential for urban uses. The high shrink-swell potential, low strength, and corrosivity of the soil and the hazard of erosion are limitations, but they can be overcome through good design and careful installation. The clayey texture and very slow permeability of this soil are limitations to recreation uses.

This soil is in capability subclass IIIe and in the Claypan Prairie range site.

54—Ovan clay, occasionally flooded. This is a deep, moderately well drained, nearly level soil on flood plains. The areas are oblong or long and narrow and range from 25 to several hundred acres. They are flooded occasionally. The floodwater is shallow and of slow velocity.

Typically, the surface layer is moderately alkaline, very dark grayish brown clay 15 inches thick. To a depth of 35 inches, the soil is moderately alkaline, dark grayish brown clay. To a depth of 80 inches, it is moderately alkaline, light olive brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Trinity clay. This soil makes up less than 10 percent of any one mapped area.

This soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. This soil has high potential for crops. If this soil is used for crops, leaving the crop residue on the surface will help to maintain tilth and productivity. Drainage ditches and outlets are needed in some areas. On rangeland, the climax plant community consists of tall and mid grasses. Hardwood trees have invaded many areas.

This soil has very low potential for urban uses. The hazard of flooding and the high shrink-swell potential, corrosivity, and clayey texture of the soil are limitations to urban development. In addition, the walls of cuts and excavations tend to cave in or slough.

This soil is in capability subclass IIw and in the Clayey Bottomland range site.

55—Ovan clay, frequently flooded. This is a deep, moderately well drained, nearly level soil on flood plains. The areas are oblong to long and narrow and range from 30 to several hundred acres. They are flooded two or more times each year. The floodwater is shallow, and the floods are of brief duration.

Typically, the surface layer is moderately alkaline, very dark grayish brown clay 15 inches thick. To a depth of

35 inches, the soil is moderately alkaline, dark grayish brown clay. To a depth of 80 inches, it is moderately alkaline, light olive brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Trinity soils. These included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as pasture and rangeland. It has high potential for these uses. This soil is well suited to improved bermudagrass. On rangeland, the climax vegetation consists of tall and mid grasses. Hardwood trees have invaded most areas of rangeland. This soil has low potential for crops. The frequent flooding is a limitation to cultivation.

This soil has very low potential for urban uses. The frequent flooding and the high shrink-swell potential, clayey texture, and corrosivity of the soil are limitations to recreation uses and to urban development. In addition, the walls of cuts and excavations tend to cave in or slough.

This soil is in capability subclass Vw and in the Clayey Bottomland range site.

56—Pits and Dumps. This map unit consists of areas from which limestone or shale have been removed. The pits are several feet deep, and the mounds of rubble or shale are several to many feet high. Water stands in the low parts of some pits. Little or no vegetation grows in most of these areas. The areas generally are 8 to 75 feet below the original surface.

Most areas provide small amounts of forage and are in pasture. A few areas have been smoothed for use as building sites.

This map unit was not assigned to a capability subclass or a range site.

57—Rader-Mabank complex, 0 to 2 percent slopes. This complex is made up of deep, moderately well drained and somewhat poorly drained, nearly level and gently sloping soils on uplands. The areas are irregular in shape and range from 30 to several hundred acres in size. In winter, the Mabank soil has a perched water table at a depth of 0.6 to 1.0 foot.

The Rader soil makes up about 65 percent of this complex, the Mabank soil makes up 20 percent, and minor soils make up the rest. The Rader soil is on mounds and in high areas, and the Mabank soil is in low areas. These soils are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Rader soil is slightly acid, dark grayish brown fine sandy loam 8 inches thick. To a depth of 16 inches, the soil is medium acid, yellowish brown sandy clay. To a depth of 30 inches, it is strongly acid, mottled red, brown, and gray clay loam and clay. To a depth of 38 inches, the soil is mottled, moderately alkaline, brown and gray clay. To a depth of 64 inches, it is moderately alkaline, brown clay that has yellowish brown, brown, and gray mottles.

Runoff is slow, and the hazard of erosion is slight. Permeability is very slow, and the available water capacity is high.

Typically, the surface layer of the Mabank soil is neutral, grayish brown fine sandy loam 5 inches thick. To a depth of 12 inches, the soil is slightly acid, gray clay loam. To a depth of 31 inches, it is strongly acid, gray and dark gray clay, and to a depth of 65 inches, it is medium acid, gray clay.

Runoff is very slow, and the hazard of erosion is slight. Permeability is very slow. The available water capacity is high.

Included in mapping are small areas of Axtell, Crockett, and Wilson soils, and areas of a soil that is similar to this Mabank soil except that it has lighter colored lower layers. The included soils make up less than 15 percent of any one mapped area.

The soils in this complex are used mainly as pasture. In some areas, they are used as rangeland. These soils have medium potential for use as pasture, rangeland, and cropland. They are suited to improved bermudagrass. If these soils are used for crops, the surface needs to be smoothed and drainage improved. Crop residue should be left on or near the surface to help modify the soil temperature and to maintain tilth and productivity.

These soils have medium potential for urban uses. The high shrink-swell potential, low strength, corrosivity, and wetness of these soils are limitations to urban development, but they can be overcome through good design and careful installation. The wetness and very slow permeability of these soils are limitations to recreation uses.

This complex is in capability subclass IIIe. The Rader soil is in the Sandy Loam range site, and the Mabank soil is in the Claypan Prairie range site.

58—Rader-Urban land complex, 0 to 2 percent slopes. This complex is made up of deep, moderately well drained, nearly level to gently sloping soils and areas of Urban land. The areas of this complex are irregular in shape and as much as several hundred acres in size.

Typically, the Rader soil makes up about 50 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 20 percent. Minor soils make up the rest. Many areas of this complex have been used for low-density residential development; in many yards and gardens, the surface has been smoothed. Mounds of the Rader soil have been used as fill in many low areas. In some areas, the soil has been disturbed by shallow excavations for service lines. This Rader soil and areas of Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Rader soil is slightly acid, dark grayish brown fine sandy loam 8 inches thick.

To a depth of 16 inches, the soil is medium acid, yellowish brown sandy clay loam. To a depth of 30 inches, it is strongly acid, mottled red, brown, and gray clay loam and clay. Below that, to a depth of 38 inches, the soil is moderately alkaline, mottled brown and gray clay. To a depth of 64 inches, it is moderately alkaline, brown clay that has yellowish brown, brown, and gray mottles.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Axtell, Crockett, Mabank, and Wilson soils. The included soils make up as much as 30 percent of some mapped areas.

The Rader soil has medium potential for urban uses. The high shrink-swell potential, low strength, corrosivity, and wetness of the soil are limitations to urban development, but they can be overcome through good design and careful installation.

This map unit was not assigned to a capability subclass or a range site.

59—Seagoville clay, occasionally flooded. This is a deep, moderately well drained, nearly level soil on flood plains of the major streams. The areas are oval and oblong and range from 50 to several hundred acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay 14 inches thick. To a depth of 30 inches, the soil is moderately alkaline, grayish brown clay, and to a depth of 38 inches it is moderately alkaline, dark grayish brown sandy clay loam. Below that, to a depth of 75 inches, the soil is moderately alkaline, brownish yellow sandy clay loam that has red mottles.

Permeability is very slow, and the available water capacity is medium. Runoff is slow, and the hazard of erosion is slight.

Included in mapping and making up as much as 15 percent of the mapped areas are small areas of Trinity clay.

The Seagoville soil is used mainly as cropland, for which it has high potential. Leaving crop residue on the surface helps to maintain the tilth and productivity of the soil. This soil has high potential for use as pasture. It is well suited to improved bermudagrass.

This soil has very low potential for urban uses; the main limitations are the hazard of flooding and the high shrink-swell potential and corrosivity of the soil. In addition, the walls of cuts and excavations tend to cave in or slough. Most of these limitations can be overcome through good design and careful installation. The clayey surface texture is the main limitation to recreation uses.

This soil is in capability subclass IIw and in the Clayey Bottomland range site.

60—Silawa fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are oblong or irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is neutral, brown fine sandy loam 10 inches thick. To a depth of 19 inches, the soil is slightly acid, yellowish red sandy clay loam. To a depth of 34 inches, it is medium acid, reddish yellow sandy clay loam. To a depth of 44 inches, the soil is strongly acid, reddish yellow fine sandy loam, and to a depth of 80 inches, it is medium acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is medium. Runoff is slow. Water and wind erosion are moderate hazards.

Included in mapping are small areas of Bastsil and Dutek soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as pasture, for which it has high potential. It is suited to improved bermudagrass. This soil has medium potential for use as cropland. Leaving crop residue on the surface helps to control erosion, modify the soil temperature, and maintain the organic matter content and productivity of the soil. The yield of crops and forage is good if this soil is properly managed.

This soil has high potential for urban uses. The low strength of the soil is a limitation to local roads and streets but can be easily overcome through good design and careful installation. The corrosivity of the soil also is a limitation but can be overcome by taking measures to protect installations. This soil is well suited to recreation uses.

This soil is in capability subclass IIe and in the Sandy Loam range site.

61—Silawa fine sandy loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping to sloping soil on uplands. The areas are oblong to irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is neutral, brown fine sandy loam 2 inches thick. To a depth of 6 inches, the soil is slightly acid, grayish brown fine sandy loam, and to a depth of 12 inches, it is medium acid, reddish brown sandy clay loam. To a depth of 26 inches, the soil is strongly acid, yellowish red sandy clay loam, and to a depth of 43 inches, it is strongly acid, reddish yellow fine sandy loam. Below that, to a depth of 80 inches, the soil is strongly acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is medium. Runoff is medium. Water erosion is a severe hazard, and wind erosion is a moderate hazard.

Included in mapping and making up less than 5 percent of this map unit are small areas of Bastsil soils.

This soil is used mainly as pasture, for which it has medium potential. It is suited to improved bermudagrass. In some areas, this soil is used as cropland, for which it has low potential. Establishing close-growing crops and leaving crop residue on the surface or working it into the surface layer help to control erosion, modify the soil temperature, and maintain the organic matter content and productivity of the soil. In some areas, terraces and grassed waterways are needed to control runoff and erosion.

This soil has high potential for urban uses. The main limitations are the slope and the hazard of erosion. The low strength of the soil is a limitation to local roads and streets, and corrosivity is a limitation unless installations are protected. The slope and the hazard of erosion are the main limitations to recreation uses.

This soil is in capability subclass IVe and in the Sandy Loam range site.

62—Silawa fine sandy loam, 2 to 8 percent slopes, eroded. This is a deep, gently sloping to sloping, well drained soil on uplands. The areas are oblong to irregular in shape and are 10 to 40 acres in size. Most areas are dissected by shallow gullies and an occasional deep gully. The surface layer has been washed away from about 30 percent of the areas, and the subsoil is exposed.

Typically, the surface layer is neutral, grayish brown fine sandy loam 5 inches thick. To a depth of 12 inches, the soil is medium acid, reddish brown sandy clay loam. To a depth of 41 inches, it is strongly acid, yellowish red sandy clay loam. Below that, to a depth of 80 inches, the soil is strongly acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is medium. Runoff is medium. Water erosion is a severe hazard, and wind erosion is a moderate hazard.

Included in mapping are small areas of Bastsil and Dutek soils. The included soils make up less than 5 percent of any one mapped area.

The Silawa soil is used mainly as pasture, for which it has medium potential. It is well suited to improved bermudagrass. This soil has low potential for use as cropland, mainly because erosion is a severe hazard. If this soil is used for crops, establishing close-growing crops and leaving crop residue on the surface or working it into the surface layer help to control erosion and maintain productivity.

This soil has high potential for urban uses. The slope, corrosivity, and the severe hazard of erosion are the main limitations. The slope is a limitation for playgrounds.

This soil is in capability subclass IVe and in the Sandy Loam range site.

63—Silawa-Urban land complex, 2 to 6 percent slopes. This complex is made up of deep, well drained, gently sloping and sloping soils and areas of Urban land. Typically, the areas are long and narrow and range from 25 to more than 100 acres.

The Silawa soil makes up about 50 percent of this complex. Urban land, which consists of areas covered with buildings and pavement, makes up 25 percent. Minor soils make up the rest. In most areas, the soil has not been extensively disturbed by cutting and filling or excavating. This soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Silawa soil is slightly acid, grayish brown fine sandy loam 6 inches thick. To a depth of 13 inches, the soil is medium acid, reddish brown sandy clay loam. To a depth of 44 inches, it is strongly acid, yellowish red sandy clay loam. And to a depth of 80 inches, the soil is strongly acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is medium. Runoff is medium. Water and wind erosion are moderate hazards.

Included in mapping are small areas of Bastsil and Dutek soils. Also included is a soil that is similar to the Silawa soil except that it has yellowish lower layers. The included soils make up less than 25 percent of any one mapped area.

The Silawa soil has high potential for urban uses. The erosion hazard and the corrosivity and low strength of the soil are limitations, but they can be easily overcome through good design and careful installation. There are few limitations to recreation uses. The slope is a limitation for playgrounds.

This map unit was not assigned to a capability subclass or a range site.

64—Silstid loamy fine sand, 0 to 3 percent slopes. This is a deep, well drained, nearly level to gently sloping soil on uplands. The areas are irregular in shape and range from 20 to about 2,500 acres in size.

Typically, the surface layer is neutral, brown loamy fine sand 10 inches thick. To a depth of 27 inches, the soil is neutral, light yellowish brown loamy fine sand. To a depth of 44 inches, it is slightly acid to medium acid, yellowish brown sandy clay loam. Below that, to a depth of 80 inches, the soil is strongly acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is low. Runoff is slow, and water erosion is a slight hazard. Wind erosion is a severe hazard if the surface is bare.

Included in mapping are small areas of Bastsil, Dutek, Eufaula, Mabank, and Silawa soils. The included soils make up less than 15 percent of any one mapped area.

The Silstid soil is used mainly as pasture, for which it has medium potential. It is suited to improved bermudagrass. This soil has low potential for use as cropland. If this soil is used for crops, crop residue should be left on the surface or worked into the surface layer to help conserve moisture, modify the soil temperature, and maintain productivity.

This soil has high potential for urban uses. The corrosivity of the soil is a hazard to underground installations. The sandy texture of this soil is a limitation to recreation uses.

This soil is in capability subclass IIIs and in the Sandy range site.

65—Silstid-Urban land complex, 0 to 6 percent slopes. This complex is made up of nearly level, gently sloping, and sloping soils and areas of Urban land. The areas are oval or oblong and range from 30 to a few hundred acres.

The Silstid soil makes up about 60 percent of this complex. Urban land, which consists of areas covered with buildings and pavement, makes up about 25 percent. Minor soils make up the rest. The soil has been slightly altered during development. The Silstid soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Silstid soil is neutral, brown loamy fine sand 10 inches thick. To a depth of 27 inches, the soil is neutral, light yellowish brown loamy fine sand, and to a depth of 65 inches, it is slightly acid to medium acid, yellowish brown sandy clay loam. Below that, to a depth of 80 inches, the soil is strongly acid, reddish yellow loamy fine sand.

Permeability is moderate, and the available water capacity is low. Runoff is slow to medium, and water erosion is a slight to moderate hazard. Wind erosion is a severe hazard if the surface is bare.

Included in mapping are small areas of Dutek, Bastsil, Mabank, and Silawa soils. The included soils make up less than 15 percent of any one mapped area.

The Silstid soil has high potential for urban uses. The corrosivity of the soil is a hazard to underground installations. The sandy texture is a limitation to recreation uses.

This map unit was not assigned to a capability subclass or a range site.

66—Smithville loam. This is a deep, well drained, nearly level to gently sloping soil on high bottoms and low terraces. Slopes range from 0 to 2 percent. The areas are mainly oblong and range from 30 to 70 acres.

Typically, the surface layer is dark grayish brown, neutral loam 5 inches thick. To a depth of 18 inches, the soil is moderately alkaline, dark grayish brown loam. To a depth of 40 inches, it is moderately alkaline, dark brown sandy clay loam. To a depth of 61 inches, the soil is moderately alkaline, light brownish gray loam, and to a depth of 76 inches, it is moderately alkaline, yellowish brown loam.

Permeability is moderate, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Lewisville and Wilson soils. Also included are a few areas of the more sloping Smithville soils. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland, for which it has high potential. Leaving crop residue on the surface or working it into the surface layer helps to maintain the tilth and productivity of the soil. This soil has high potential for use as pasture. It is suited to improved bermudagrass.

This soil has high potential for urban uses. The main limitations are the moderate shrink-swell potential and the corrosivity of the soil, but they can be overcome through good design and careful installation. This soil has few limitations to recreation uses.

This soil is in capability class I and in the Loamy Bottomland range site.

67—Stephen silty clay, 1 to 3 percent slopes. This is a shallow, well drained, gently sloping soil overlying the Austin Chalk geologic formation. The areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is moderately alkaline, very dark grayish brown silty clay 5 inches thick. To a depth of 14 inches, the soil is moderately alkaline, very dark grayish brown silty clay. The underlying material is white, platy and massive, soft chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Austin and Eddy soils. These soils make up less than 15 percent of any one mapped area.

This soil is used mainly as cropland, for which it has medium potential. The main limitations to this use are the hazard of erosion and the shallowness of the soil. Terraces and grassed waterways help to control runoff. Crop residue should be left on the surface or worked into the surface layer to help reduce erosion and to maintain the tilth and productivity of the soil. This soil has low potential for use as pasture, mainly because of the shallowness to rock. It is suited to improved bermudagrass.

This soil has medium potential for urban uses. Shallowness to rock is the main limitation; however, the rock is rippable and provides a good footing for foundations. The corrosivity of the soil is a limitation to underground installations. The clayey texture is a limitation to recreation uses.

This soil is in capability subclass IIIe and in the Chalky Ridge range site.

68—Stephen silty clay, 3 to 5 percent slopes. This is a shallow, well drained, gently sloping soil overlying the Austin Chalk geologic formation. The areas generally are oblong and range from 15 to 40 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay 10 inches thick. To a depth of 13 inches, the soil is moderately alkaline, dark brown silty clay that has a few limestone fragments. The underlying material is white, soft chalky limestone that is platy to a depth of 17 inches and massive below that.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is severe.

Included in maping are small areas of Eddy and Brackett soils. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland, for which it has medium potential. The main crop is small grains. The shallowness of the soil and the hazard of erosion are the main limitations to crops. Establishing close-growing crops and leaving crop residue on the surface or working it into the surface layer help to control erosion, conserve moisture, and maintain soil tilth and productivity. This soil has low potential for use as pasture. It is suited to improved bermudagrass.

This soil has medium potential for urban uses. The shallowness to rock is the main limitation; however, the rock is rippable and provides a good footing for foundations. The corrosivity of the soil is a limitation to underground installations. The clayey texture is a limitation to recreation uses.

This soil is in capability subclass IVe and in the Chalky Ridge range site.

69—Stephen-Urban land complex, 1 to 4 percent slopes. This complex is made up of shallow, well drained, gently sloping soils and areas of Urban land overlying the Austin Chalk geologic formation. The areas are oval or oblong and range from 15 to several hundred acres.

The Stephen soil makes up about 60 percent of this complex. Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. Minor soils make up the rest. In the more recent residential developments, the upper layers of the soil have been disturbed extensively by building and street construction. In the older developments, the soil has been disturbed only by street shaping and by excavating for service lines. In some areas, a layer of loamy topsoil 2 to 4 inches thick has been spread over the surface. The Stephen soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Stephen soil is moderately alkaline, very dark brown silty clay 14 inches thick. The underlying material is white, platy and massive chalky limestone.

Permeability is moderately slow, and the available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Austin, Brackett, and Eddy soils. Also included are small areas of sloping Stephen soils. The included soils make up less than 10 percent of any one mapped area.

The Stephen soil has medium potential for urban uses. The shallowness to rock is the main limitation; however, the rock is rippable and provides a good footing for foundations. The corrosivity of the soil is a limitation to underground installations. The clayey texture is a limitation to recreation uses.

This map unit was not assigned to a capability subclass or a range site.

70—Sunev clay loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are mainly long and narrow and range from 10 to 30 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam. To a depth of 25 inches, the soil is moderately alkaline, brown clay loam, and to a depth of 39 inches, it is moderately alkaline, yellowish brown clay loam. To a depth of 65 inches, the soil is moderately alkaline, very pale brown clay loam.

Permeability is moderate, and the available water capacity is medium. Runoff is slow, and the hazard of erosion is moderate.

Included in mapping are small areas of Altoga and Lewisville soils. The included soils make up less than 10 percent of any one mapped area.

The Sunev soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. This soil has medium potential for use as cropland. The high content of calcium carbonate and the moderate hazard of erosion are limitations to crops. If this soil is used for crops, crop residue should be left on the surface or worked into the surface layer to help conserve moisture, control erosion, and maintain tilth and productivity.

This soil has high potential for urban uses. The low strength and corrosivity of the soil are limitations, but they can be overcome through good design and careful installation. The high content of clay in the surface layer is a limitation to recreation uses.

This soil is in capability subclass IIe and in the Clay Loam range site.

71—Sunev clay loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are mainly long and narrow and range from 10 to 30 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam 12 inches thick. To a depth of 19 inches, the soil is moderately alkaline, brown clay loam. To a depth of 30 inches, it is moderately alkaline, yellowish brown clay loam. And to a depth of 65 inches, the soil is moderately alkaline, very pale brown clay loam.

Permeability is moderate, and the available water capacity is medium. Runoff is medium, and the hazard of erosion is severe.

Included in mapping are small areas of Altoga soils and small areas of eroded Sunev clay loam. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as pasture, for which it has medium potential. It is suited to improved bermudagrass. This soil has medium potential for use as cropland. The medium runoff and the severe hazard of erosion are limitations for crops. Establishing close-growing crops and leaving crop residue on the surface or working it into the surface layer help to control runoff and erosion and to maintain tilth and productivity.

This soil has high potential for urban uses. The corrosivity and low strength of the soil are limitations, but they can be overcome through good design and careful installation.

The soil is in capability subclass IVe and in the Clay Loam range site.

72—Trinity clay, occasionally flooded. This is a deep, somewhat poorly drained, nearly level soil on flood plains. The areas are long and range from 25 to as much as several thousand acres in size. This soil is subject to flooding during major storms unless levees are constructed to protect the areas.

Typically, the surface layer is moderately alkaline, very dark grayish brown clay 5 inches thick. To a depth of 31 inches, the soil is moderately alkaline, very dark gray clay. To a depth of 48 inches, it is moderately alkaline, black clay. Below that, to a depth of 68 inches, the soil is moderately alkaline, black clay that has brownish mottles.

Permeability is very slow, and the available water capacity is high. Runoff is very slow, and the hazard of erosion is slight.

Included in mapping are small areas of Ovan and Seagoville soils and small sloughlike areas of Trinity soils that are frequently flooded. The included soils make up less than 20 percent of any one mapped area.

The Trinity soil is used mainly as cropland, for which it has high potential. If the soil is properly managed, the yield of the crops commonly grown in the county is good. Leaving crop residue on or near the surface helps to maintain the tilth and productivity of the soil. In places, drainage outlets are needed. This soil has high potential for use as pasture. It is well suited to improved bermudagrass.

This soil has very low potential for urban uses. The hazard of flooding and the wetness, corrosivity, and very high shrink-swell potential of the soil are limitations. In addition, the walls of cuts and excavations tend to cave in or slough. The hazard of flooding and clayey texture and wetness of the soil are the main limitations to recreation uses.

This soil is in capability subclass IIw and in Clayey Bottomland range site.

73—Trinity clay, frequently flooded. This is a deep, nearly level, somewhat poorly drained soil on flood plains. The areas are long and narrow and range from 30 to as much as several thousand acres. This soil is flooded two or three times in most years. The floodwater is shallow to moderately deep.

Typically, the surface layer is moderately alkaline, dark gray clay 7 inches thick. To a depth of 20 inches, the soil is moderately alkaline, dark grayish brown clay. To a depth of 45 inches, it is moderately alkaline, very dark gray clay. Below that, to a depth of 68 inches, the soil is moderately alkaline, dark grayish brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Ovan and Seagoville soils and island-like areas of Trinity soils that are occasionally flooded. The included soils make up less than 20 percent of any one mapped area.

The Trinity soil is used mainly as pasture, for which it has high potential. It is well suited to improved bermudagrass. This soil is not used for crops because of the frequent flooding.

This soil has very low potential for urban uses and low potential for recreation uses. The frequent flooding and the wetness, corrosivity, very high shrink-swell potential, and clayey texture of the soil are limitations to these uses. In addition, the walls of cuts and excavations tend to cave in or slough.

This soil is in capability subclass Vw and in the Clayey Bottomland range site.

74—Trinity-Urban land complex. This complex is made up of deep, nearly level, somewhat poorly drained soils and areas of Urban land on flood plains. The areas generally are long and narrow and range from 40 to as much as several hundred acres.

The Trinity soil makes up about 60 percent of this complex, and Urban land, which consists of areas covered with pavement and buildings, makes up 20 percent. Minor soils make up the rest. In some areas, fill material consisting of soil, rock, broken pavement, and trash has been stacked 2 to 4 feet deep on the surface. In some areas, clayey material, accumulated during the straightening of some stream channels, has been spread 1 to 3 feet deep on the flood plains. The Trinity soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Trinity soil is moderately alkaline, very dark gray clay 30 inches thick. To a depth of 48 inches, the soil is moderately alkaline, black clay. Below that, to a depth of 80 inches, it is moderately alkaline, dark grayish brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is very slow, and the hazard of erosion is slight.

Included in mapping are small areas of Frio, Gowen, and Ovan soils. The included soils make up less than 20 percent of any one mapped area.

The soils in this complex have very low potential for urban uses, mainly because of the hazard of flooding. In most areas of Urban land, levees have been constructed to prevent damage by flooding. Other limitations to urban development are the very high shrink-swell potential, corrosivity, low strength, and wetness of the soil. The walls of cuts and excavations tend to cave in or slough. Wetness and the hazard of flooding are the main limitations to recreation uses.

This map unit was not assigned to a capability subclass or a range site.

75—Urban land. This map unit consists of extensively built up areas where 75 percent or more of the surface is covered with buildings and pavement. The soils in these areas have been altered or covered during urban development; therefore, it was not feasible to identify and separate them in mapping. The areas range from 40 to as much as several hundred acres in size. Residential areas make up about 10 percent of this complex.

Included in mapping are small areas where buildings and other structures cover 40 to 60 percent of the surface.

This map unit was not assigned to a capability subclass or a range site.

76—Ustorthents, undulating. This map unit is made up of areas where loamy and sandy soil material has been removed. In these areas, the surface is 2 to 6 feet lower than in the surrounding areas. The slopes are nearly level to undulating. The areas are irregular in shape and range from 15 to 50 acres in size.

The soil material in this unit is dominantly loamy. There are a few mounds of sand and a few low areas of clayey material. The soil material varies widely in color. In a few areas, there are small, deep pits that are partly filled with water.

The areas of this unit mainly are idle and are covered with weeds and grasses. A few areas are used as building sites.

This map unit was not assigned to a capability subclass or a range site.

77—Vertel clay, 5 to 12 percent slopes. This is a moderately deep, sloping and strongly sloping, well drained soil on uplands. The areas are long and narrow and range from 20 to as much as several hundred acres.

Typically, the surface layer is moderately alkaline, olive clay 14 inches thick. To a depth of 24 inches, the soil is moderately alkaline, olive gray clay. The layer below that, to a depth of 60 inches, consists of medium acid, dark gray weathered shale and clay that have olive and dark yellowish brown mottles.

Permeability is very slow, and the available water capacity is medium. Runoff is rapid, and the hazard of erosion is severe.

Included in mapping are small areas of Brackett, Eddy, Ferris, and Heiden soils. The included soils make up less than 15 percent of any one mapped area.

The Vertel soil is used mainly as rangeland, for which it has medium potential. The climax plant community consists of tall and short grasses. In a few areas, this soil is used as pasture. It is suited to improved bermudagrass. This soil is not suitable for crops because of the severe hazard of erosion.

This soil has low potential for urban uses. The unstable slopes, the hazard of erosion, and the very high shrink-swell potential, corrosivity, and low strength of the soil are limitations. In addition, the walls of excavations tend to cave in or slough. The slope and the clayey texture of the soil are the main limitations to recreation uses.

This soil is in capability subclass VIe and in the Eroded Blackland range site.

78—Wilson clay loam, 0 to 1 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on uplands. The areas are irregular in shape and range from 10 to as much as several hundred acres in size.

Typically, the surface layer is mildly alkaline, dark grayish brown clay loam 5 inches thick. To a depth of 13 inches, the soil is mildly alkaline, dark gray clay. To a depth of 42 inches, it is neutral, dark gray clay. To a depth of 56 inches, the soil is mottled, very dark gray and olive brown, neutral clay, and to a depth of 64 inches, it is moderately alkaline, light olive clay.

Permeability is very slow, and the available water capacity is high. Runoff is very slow, and the hazard of erosion is slight.

Included in mapping are small areas of Burleson, Crockett, Houston Black, and Mabank soils. The included soils make up less than 10 percent of any mapped area.

The Wilson soil is used mainly as cropland, for which it has medium potential. Leaving crop residue on or near the surface of the soil helps to maintain tilth and productivity. In some areas, this soil is used as pasture, for which it has medium potential. It is well suited to improved bermudagrass.

This soil has low potential for urban uses. The high shrink-swell potential, corrosivity, and low strength of the soil are limitations, but they can be overcome through good design and careful installation. Wetness also is a limitation to urban uses, and it is more difficult to overcome. Wetness and the very slow permeability of the soil are the main limitations to recreation uses.

This soil is in capability subclass IIIw and in the Claypan Prairie range site.

79—Wilson clay loam, 1 to 3 percent slopes. This is a deep, gently undulating, somewhat poorly drained soil on uplands. The areas are oblong and range from 10 to 100 acres.

Typically, the surface layer is mildly alkaline, dark grayish brown clay loam 4 inches thick. To a depth of 11 inches, the soil is mildly alkaline, dark gray clay. To a depth of 42 inches, it is neutral, dark gray clay. Below that, to a depth of 56 inches, the soil is mottled, dark gray and olive brown, neutral clay, and to a depth of 64 inches, it is moderately alkaline, light olive brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Burleson, Crockett, Houston Black, and Mabank soils. The included soils make up less than 10 percent of any mapped area.

The Wilson soil is used mainly as pasture, for which it has medium potential. It is suited to improved bermudagrass. In a few areas, this soil is used as cropland, for which it has low potential. The hazard of erosion and the very slow permeability and low fertility of the soil are the main limitations to crops. Leaving crop residue on the surface or working it into the surface layer helps to maintain the tilth and productivity of this soil. Terraces and grassed waterways can help to control runoff.

This soil has low potential for urban uses. The hazard of erosion and the high shrink-swell potential, corrosivity, and low strength of the soil are limitations to urban development, but they can be overcome through good design and careful installation. Wetness also is a limitation to urban uses, and it is more difficult to overcome. The very slow permeability and wetness of this soil are the main limitations to recreation uses.

This soil is in capability subclass IIIe and in the Claypan Prairie range site.

80—Wilson-Urban land complex, 0 to 2 percent slopes. This complex is made up of nearly level to gently sloping, deep, somewhat poorly drained soils and areas of Urban land. The areas are oblong and range from 15 to as much as a few hundred acres.

The Wilson soil makes up about 60 percent of this complex, and Urban land, which consists of areas covered with buildings and pavement, makes up 30 percent. Minor soils make up the rest. In the more recent residential developments, the upper layers of the soil have been disturbed extensively by building and street construction. In the older developments, the soil has been disturbed only by street shaping and by excavating for service lines. In some yards, a layer of loamy topsoil 2 to 4 inches thick has been spread over the surface. The Wilson soil and Urban land are so intermingled that it was not practical to separate them in mapping at the scale used.

Typically, the surface layer of the Wilson soil is mildly alkaline, dark grayish brown clay loam 5 inches thick. To a depth of 42 inches, the soil is neutral, dark gray clay. To a depth of 56 inches, it is mottled, very dark gray and olive brown, neutral clay. Below that, to a depth of 64 inches, the soil is moderately alkaline, light olive brown clay.

Permeability is very slow, and the available water capacity is high. Runoff is slow, and the hazard of erosion is slight.

Included in mapping are small areas of Burleson, Crockett, Houston Black, and Mabank soils. The included soils make up less than 10 percent of any one mapped area.

The Wilson soil has medium potential for urban uses. The high shrink-swell potential, corrosivity, and low strength of the soil are the main limitations to urban uses, but they can be overcome through good design and careful installation. Wetness also is a limitation to urban uses, and it is more difficult to overcome. The wetness and very slow permeability of the soil are the main limitations to recreation uses.

This map unit was not assigned to a capability subclass or a range site.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

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

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

More than 234,000 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory (*3*). Of this total 96,273 acres was used as permanent pasture; 55,327 acres for row crops, mainly cotton and grain sorghum; 36,208 acres for close-growing crops, mainly wheat and oats; 40,000 acres as hayland and for rotation hay and pasture; and 16,242 acres for conservation use. The rest was idle cropland.

The soils in Dallas County have good potential for increased production of food crops. About 81,000 acres of potentially good cropland is currently used as pasture and rangeland. In addition to the reserve productive capacity of this land, food production could be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

The acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1967, about 264,000 acres in the survey area was urban and built-up land, and this acreage has been increasing at the rate of about 5,000 acres per year. For more information on land use and planning, refer to the section "Broad land use considerations."

Soil erosion is the major concern on about two-thirds of the cropland and pasture in Dallas County. If the slope is more than 1 percent, erosion is a hazard. Austin, Houston Black, Lewisville, and Crockett soils, for example, commonly have slopes of 2 to 6 percent.

The loss of surface layer material through erosion damages the natural environment in two ways. First, productivity is reduced as the surface layer is lost and subsoil material is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, for example, Axtell, Crockett, Mabank, and Rader soils, and on soils that have a layer in or below the subsoil that restricts the root zone, for example, the chalky limestone in Austin and Stephen soils. Erosion also reduces productivity on soils that tend to be droughty, for example, Dutek and Silstid soils.

Second, soil erosion on farmland results in sedimentation of streams. Controlling erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal and recreation uses and for fish and wildlife.

On many sloping soils in cropland, tilling or preparing a seedbed is difficult because the original friable surface soil has been eroded, and clayey material is at the surface. Such clayey spots are common in areas of eroded Axtell and Crockett soils.

Erosion-control practices provide a protective surface cover, reduce runoff, and increase water infiltration. A cropping system that maintains a vegetative cover on the soil can reduce soil loss to an amount that will not reduce the productive capacity of the soil. On livestock farms, which require pasture and hay, legume and grass forage crops in the cropping system can reduce erosion on sloping soils, provide nitrogen, and improve tilth for the crop that follows.

Terraces and diversions reduce the length of slopes and reduce runoff and erosion. They are not practical on deep, well drained soils that have regular slopes. Most gently sloping soils in Dallas County are suitable for terraces.

Contouring is a commonly used erosion control practice in the survey area. Soils that have smooth, uniform slopes, as do most soils in the county, are the best suited to contouring.

Soil blowing is a hazard on the sandy Dutek and Silstid soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a vegetative cover, surface mulch, or a rough surface through proper tillage can minimize soil blowing on these soils.

Information on designing erosion control practices for each kind of soil in Dallas County is available at the local office of the Soil Conservation Service.

Soil drainage is the major management need on about 30 percent of the acreage used for crops and pasture in the survey area. Some soils are so wet that the production of crops common to the area generally is not possible. These are the somewhat poorly drained and moderately well drained Mabank, Trinity, Wilson, Axtell, Branyon, Burleson, Houston Black, Ovan, and Rader soils.

Soil fertility is naturally low in most loamy and sandy soils on uplands in the survey area. The soils on flood plains, including Frio, Gowen, Ovan, and Trinity soils, are moderately alkaline and are naturally higher in plant nutrients than most soils on uplands. Most of the loamy and sandy soils are slightly acid to very strongly acid. All of the clayey soils, except Burleson soils, are moderately alkaline.

Soil tilth is an important factor in the germination of seeds and in water infiltration. Soils that have good tilth are granular and porous.

Most of the soils used for crops in the survey area have a surface layer of clay that is dark in color and high in content of organic matter. Most of the clayey soils are self-tilling, and when they are dry they have good surface tilth. When wet, clayey soils are difficult to till. Regular additions of crop residue, manure, or other organic material can help to improve soil tilth and reduce crust formation on these soils.

The dark-colored Branyon, Houston Black, and Heiden soils are clayey, and tilth is a concern because these soils often stay wet until late in spring. If they are plowed when wet, they tend to be very cloddy when dry, and a good seedbed is difficult to prepare. Plowing these wet soils in the fall generally results in good tilth in spring.

Field crops that are suited to the soils and climate of Dallas County include cotton and grain sorghum, which are row crops, and corn, sunflowers, and some vegetables. Wheat and oats are the commonly grown close-growing crops.

Specialty crops grown commercially in the survey area are vegetables and nursery plants. Turnips, peppers, cabbage, okra, tomatoes, and other vegetables are grown on the loamy and sandy soils. Nursery plants are grown mainly on the sandy and loamy soils on old river terraces. Plums, pears, and peaches are grown in home gardens throughout most of the county.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. In the survey area, these are the Bastsil, Dutek, Silawa, Silstid, and Smithville soils and soils that have slopes of less than 6 percent. Many of the deep soils, especially the soils on flood plains, are well suited to pecan trees. Frio soils are especially well suited, because native pecans grow on these soils in the pastures along flood plains. There are a few orchards of improved pecan varieties on some bottom lands.

The latest information on growing specialty crops is available at the local offices of the Cooperative Extension Service and the Soil Conservation Service.

Pasture grasses that are suited to the soils and climate in Dallas County are mainly bermudagrasses. Coastal bermudagrass is the most common variety. Other pasture grasses that are grown in the county are kleingrass, lovegrass, King Ranch bluestem, and Harding grass.

Yields per acre

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

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

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

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

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

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

Land capability classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

Rangeland

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for some soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 7 follows.

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

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

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

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The main soils that are used as rangeland are Ferris, Heiden, and Vertel soils. These are deep and moderately deep, gently rolling and rolling clays. They support mid and tall grasses, and productivity is medium to high. Erosion is a severe hazard if the range is heavily grazed.

About 5 percent of Dallas County is rangeland. Most of the acreage is in the southwestern part of the county. Cow-calf operations are dominant; on some ranches that have purebred herds, the operations are cow-calf-yearling. The size of the ranches ranges from 500 to about 3,000 acres.

On most ranches, the forage produced on rangeland is supplemented with grazing crops such as oats and sudan. In winter, hay and concentrates are also fed to range animals. On some ranches, creep feeding of concentrates to calves is practiced to increase market weight.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with mesquite trees, weeds, and annual grasses. The amount of usable forage produced may be less than half of that originally produced. Range productivity can be increased by using management practices that are effective for specific kinds of soil and range sites.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construc-

tion. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building site development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

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

Sanitary facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering properties and classifications.

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

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

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

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

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

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

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

Water management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

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

Community planning

This section briefly describes the factors to be considered in selecting a site for urban development, methods to control runoff and erosion on construction sites, precautions to be taken to insure that public health is not endangered in using the soils, and the most effective methods of gardening and landscaping the soils.

Site selection

In selecting a site for urban development, careful onsite investigation of the soil is necessary. Costly failures of buildings and other structures can occur unless planners and builders select the proper soil for an intended use. If a soil is poorly suited to the intended use, site preparation can be very expensive and difficult. In some cases, structures can be designed to overcome the limitations of the soil, but only if the limitations are known prior to design.

One of the main factors to be considered in selecting a site is the susceptibility of the soil to flooding. The alluvial Frio, Gowen, Ovan, and Trinity soils are subject to occasional or frequent flooding and should not be selected as sites for permanent structures. These soils are best suited to use as green belts, sound barriers, wildlife habitat, or recreation uses such as hike and bike trails or picnic areas.

Other factors that affect site selection are soil permeability, slope, texture, available water capacity, drainage, reaction (pH), shrink-swell potential, strength, corrosivity to uncoated steel and concrete, erosion and runoff characteristics, hydrologic classification, suitability of the soil to use as septic tank absorption fields, suitability for foundations and local streets and roads, and potential for recreation uses. Many of these soil properties, features, and suitabilities are given in the sections "Engineering" and "Recreation." The most important of these factors are described in the following sections. Additional information is given in tables 12, 13, and 14.

Foundations

The soils in Dallas County require careful examination before they are used as sites for foundations. Throughout most of the county, the soils are clayey and have a high content of the clay mineral montmorillonite. Soils of this kind swell when they are wet and shrink and crack when they dry. This action creates such movement and pressure that walls and foundations will crack unless they have been adequately designed and carefully installed. The extent to which a soil will change in volume as moisture content changes is the shrink-swell potential of the soil (see table 18).

The soils that are most susceptible to shrinking and swelling are Branyon, Burleson, Ferris, Heiden, Houston Black, Ovan, Trinity, and Vertel soils. Other soils in the county that have lower layers that are high in montmorillonite are Axtell, Crockett, Dalco, Mabank, Normangee, and Wilson soils.

The soils that are likely to swell and shrink enough to damage foundations are those that have a high liquid limit and high plasticity index. These soils are classified as CH in the Unified soil classification system. The Unified classification for each soil in the county is given in tables 17 and 20.

Other soils that can cause damage to foundations are those that are subject to flooding and ponding, are poorly drained, have low strength, have high corrosivity, or are unstable on the steeper slopes.

Underground utility lines

Water mains, gas pipelines, communication lines, anchors, and sewer pipes that are buried in the soil can corrode and break unless they are protected against certain electrobiochemical reactions that result from inherent soil properties.

All metals corrode to some degree when buried in the soil, and some metals corrode more rapidly in some soils than in others. The corrosion potential of a soil depends on the physical, chemical, electrical, and biological characteristics of the soil. For example, concentrations of oxygen, concentrations of anaerobic bacteria, the content of moisture, and external factors, such as manmade electrical currents, influence corrosion potential. Design and installation of utility lines also have an influence. In some cases, corrosion is intensified by connecting two dissimilar metals, by burying metal structures at varying depths, and by extending pipelines through different kinds of soils.

Although electrical resistivity is only one factor in corrosion, a measurement of that property is a fairly accurate reflection of the corrosion potential of a soil. Electrical resistivity measures the resistivity of a soil to the flow of an electrical current when the soil is wet to field capacity. It is measured in ohms per cubic centimeter. A low value indicates low resistivity, or high conductivity, and thus a high corrosion potential.

An earth resistivity meter was used to measure the resistivity of the soils in Dallas County. A four-electrode configuration was used, in which four probes are driven into the ground along a straight line and equidistant from each other. An alternating current was passed into the ground through the outer two probes, and the potential appearing across the inner two probes was measured. The instrument thereby measured the resistance of the soil mass under test.

Because the depth of the measured soil mass is directly proportional to the probe spacing, a record of electrical conductivity of the subsurface layer was obtained to the desired depth as the probe spacings were increased. These values were then converted into units of resistivity. As different kinds of soil exhibit different values of apparent electrical resistivity, the surface layer and lower layers of selected kinds of soil in the county were readily classified.

The values of resistivity obtained with the earth resistivity meter have been rounded off to the nearest 100 ohms per cubic centimeter. The ranges in resistivity have been translated into categories of corrosion potential as follows— *high*, less than 2,000 ohms per cubic centimeter; *moderate*, 2,000 to 5,000 ohms per cubic centimeter; and *low*, more than 5,000 ohms per cubic centimeter.

In table 12, the electrical resistivity and the corresponding corrosion potential are given for each kind of soil tested. They are given for each soil layer, to a depth of 10 feet.

In soils that have a high shrink-swell potential, stress caused by volume changes can break cast-iron pipe. In these soils, it may be necessary to cushion pipes with sand to prevent damage. Table 18 gives the estimated shrink-swell potential of each soil in Dallas County.

Controlling runoff and erosion

During urban construction, the natural vegetation generally is removed from the soil, and large areas are left bare. On construction sites, the amount and rate of runoff generally increase, and the natural pattern of runoff changes. After a heavy rain, runoff generally is much greater than it was when the land was used for farming. The runoff concentrates in streets and gutters instead of flowing into natural waterways. This causes flooding, erosion, and deposition of sediment in lower lying areas. See table 11 for limitations and features of the soils that affect water management.

Planning and design for controlling erosion and runoff should take place before construction begins. With a good development plan, the problems brought on by erosion, runoff, and sedimentation generally can be avoided or lessened. Two general kinds of erosion- and sedimentation-control measures can be used —mechanical and vegetative.

Some of the mechanical measures that can be used to control erosion and runoff are:

Land grading—Only those areas to be used immediately for construction should be graded, not the entire site. Large areas should not be left bare of vegetation.

Bench terraces—Bench terraces should be constructed across the slope to fit the natural terrain. They are useful to break up long slopes and to slow runoff.

Subsurface drains—If the natural drainage channels need to be filled in during construction, subsurface drains can be installed to help remove excess ground water.

Diversions—Diversions consist of a channel and a ridge constructed across the slope to intercept and divert runoff. They require a stable outlet to dispose of water.

Berms—Berms are diversions that consist of compacted earth ridges constructed on a slight grade. They do not have a channel and can be temporary or permanent.

Storm sewers—Storm sewers are useful for disposing of runoff from streets and adjacent lots. However, to prevent sediment from being deposited downstream or from clogging the storm sewers, small sediment basins should be constructed adjacent to the sewer inlet. Once construction is complete and the bare areas are revegetated, the sediment basins can be removed.

Outlets—Outlets, generally grassed waterways, can be established to help dispose of water from diversions, parking lots, streets, and other areas.

Waterway stabilization structures—On soils that are so steep that vegetation cannot be established to protect the waterway from erosion, grade stabilization structures, special culverts, and pipe can be used, generally in combination with special vegetation.

Lined channels—On soils that are too steep or too unstable for vegetation alone to control erosion, plastic or fiberglass mats can be used as a temporary lining in ditches and channels.

Sediment basins—Sediment basins are temporary earth dams constructed across waterways to detain runoff and trap sediment to prevent sedimentation downstream.

Some of the vegetative measures that can be used to control erosion and runoff are:

Mulch—Hay, the straw from small grains, and certain processed material can be used as mulch to protect sloping soils and other critical areas if the grading is completed at an unfavorable time for seeding. These areas can be seeded later without removing the mulch. The mulch needs to be anchored with asphalt, straight blade disks, or netting or by some other method. Hydromulching, in which seed, fertilizer, and mulch are applied as a slurry, is a fast, all-in-one operation that requires little labor.

Temporary cover—Rapidly growing winter plants, such as annual ryegrass, can be used to cover bare areas until permanent vegetation can be seeded or established.

Permanent cover—If a lawn is not to be established, bermudagrass, bahiagrass, weeping lovegrass, adapted legumes, trees, shrubs, and certain vines make a good permanent ground cover. Most grasses and legumes require weeding, fertilizing, mowing, and other maintenance.

Fibrous material—Jute netting, cotton netting, paper netting, burlap bags, and fiberglass matting have a special use in controlling erosion and runoff. Most of these fibrous materials are used only temporarily to hold mulch in place or to prevent soil blowing or washing while the seedlings are being established.

In many areas, the developers do not include steps to control runoff and erosion in their overall development plan. In these areas, the responsibility for erosion control is left to the individual homeowners. Some erosion-control measures that are practical for protecting small residential tracts are:

Grading—The surface of the soil should be graded so that it is level or gently sloping. Where the surface layer is loamy, the topsoil can be removed and stockpiled until it can be replaced on the graded surface.

Contouring—Driveways, walks, fences, retaining walls, and raised flower beds should be constructed on the contour or, if that is not feasible, straight across the slope.

Diversions—Small diversions can be built to intercept runoff before it flows across erodible soils. They should be protected with a permanent cover of vegetation.

Waterways—Waterways can be constructed to help prevent gullying and to help drain ponded areas. They need to be shaped, smoothed, and established with sod. In places, they can be constructed as small ditches along property lines. The waterways generally empty into bar ditches or paved and curbed streets.

Drainage—Seep spots, waterlogged soils, and small ponded areas generally can be drained with ditches or tile drains. Some low areas can be filled with topsoil.

In addition to these methods of erosion control, homeowners can make use of the vegetative measures previously mentioned. Any erosion-control method that is used should be designed as part of an overall landscape plan.

Potential for urban development

The soils in Dallas County are rated in table 13 for their potential for urban development. Ratings are given for dwellings that do not have a basement and are connected to a public sewer system, streets, shallow excavations for utility lines, and uncoated steel pipe. In addition to these elements of urban development, shopping centers and small businesses also were considered in rating the overall potential of the soils.

The soils that have the highest potential for urban development are those on which streets and structural foundations can be placed and not deteriorate because of adverse soil factors. In general, these soils are easy to excavate and cultivate, require little leveling or soil moving, are well drained, and are not subject to flooding. The soils that have the lowest potential are those that are subject to flooding or are too sloping and unstable.

The factors considered in rating the potential of the soils for each element of urban development are: the hazard of flooding, depth to the water table, wetness, shrink-swell potential, soil strength, soil texture, corrosivity to uncoated steel, and slope. Soils that are subject to flooding have very low potential for urban development because of the difficulty and expense involved in controlling floodwater. In most cases, the watershed area is much larger than the area controlled by any one land developer.

Soils that have a high shrink-swell potential or low strength have medium potential for development. These limitations can be partly overcome by increasing the strength of the structures. In Dallas County, these soils commonly have additional limitations, such as wetness, clayey texture, or high corrosivity to uncoated steel, that further lower their potential for urban development.

Clayey soils are difficult to excavate and therefore are more expensive to develop and maintain.

High corrosivity of a soil to uncoated steel pipe can be partly overcome by coating the pipe with a protective material, by attaching anodes to the metal, by using more resistant metal or material such as plactic or concrete, or by using rubber or plastic connectors.

In table 13, the potential for urban development is *high* for soils that have few limitations that cause problems during construction or after development; the limitations can be easily overcome. The potential is *medium* for soils that have several limitations that cause problems during construction or after development; some of the limitations can be easily overcome, but one or more of the limitations will be difficult or expensive to overcome. The potential is *low* for soils that have several limitations that cause problems both during construction and after development or that have one severe limitation; the limitations are difficult and very expensive to overcome. The potential is *very low* for soils that are subject to flooding; most of these soils also have other limitations that are difficult to overcome.

Public health

This section briefly describes ways in which the use of soils can affect public health. Using the soils for sewage disposal and sanitary landfills, locating potential sites of disease-carrying insects, and insuring that the soils are suitable for housing are the main topics.

Sewage disposal. Sewer lines, septic tank systems, and sewage lagoons should be located and constructed so that the public water supply is not polluted by seepage. Sewer lines must be located in stable soils; otherwise, if the gradeline is interrupted, the sewer system will break down and endanger the public health. Table 18 provides information on the shrink-swell potential and corrosion potential of the soils in Dallas County that should be helpful in locating pipelines and in protecting pipelines against corrosion and breakage. Water wells, streams, and lakes can be contaminated by runoff from clogged filter fields. On soils that have rapid permeability, septic tank effluent can pollute ground water. In table 9, the soils in Dallas County are rated as sites for septic tank absorption fields and sewage lagoons.

Sanitary landfills. In selecting a site for a sanitary landfill, it is necessary to consider the topography of the area and the characteristics of the soil, including drainage, texture, permeability, reaction, and nature of the underlying material. In table 9, the degree and kind of limitations for sanitary landfills are given for the soils in Dallas County. However, onsite inspection is necessary to determine the suitability of specific sites.

Disease-carrying insects. Mosquitoes and other disease-carrying insects breed in stagnant water. The soil maps and soil descriptions can help to identify areas subject to flooding and areas that are ponded from time to time because of nearly level topography or poor internal drainage. After they are located, these areas can be sprayed to eliminate insects, and a drainage system can be installed to remove the standing water that attracts the insects.

Housing. Houses should not be built on soils that are subject to flooding or ponding. Floodwater is a disease carrier, causing sewage systems to overflow and spread effluent. If houses are built on soils that have a high shrink-swell potential, foundations and walls can crack. Rainwater seeps in through these cracks, and insects collect in the moist spots. The soil maps and soil descriptions can help housing planners to foresee and prevent these and other health hazards.

Gardening and landscaping

Suburban homeowners interested in landscaping their property need to know what kinds of soils they have and the kinds of flowers, ground cover, vines, shrubs, and trees to which these soils are best suited. On some homesites, plants are needed to control erosion.

Soils that are well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter in various stages of decomposition, adequate available water capacity, good drainage, and a granular structure that allows free movement of water, air, and roots. The acidity or alkalinity of the soils also must be suitable for the plants to be grown. For example, roses and most annual flowers, most vegetables, and most grasses generally grow best in soils that are neutral or only slightly acid. Azaleas, camellias, and similar plants require acid soils. Some plants that are grown on soils, such as Altoga soils, that have a high content of lime develop chlorosis, a yellowing of the leaves. However, there are many flowers, shrubs, and trees to which the limy soils in Dallas County are well suited; suitable flowers include canna, hollyhocks, and zinnias, and suitable shrubs and trees include abelia, nandina, crabapple, and fruitless mulberry.

Table 14 lists the soils in Dallas County and some of the flowers, ground cover, vines, shrubs, and trees that are suitable for each. Some of the plants listed are native to Dallas County. The County Extension Horticulturist can provide a list of additional suitable plants.

It generally is less expensive and more effective to condition the natural soil than to replace it with manmade soil. The soil needs to be tested to determine the amount and kind of fertilizer needed for the plants to be grown. The most important amendment to the soil is organic matter, which can be supplied by peat moss, compost, rotted sawdust, or manure. Leaves, grass clippings, sawdust, and organic material from the kitchen can be composted and added to the soil. At least 2 inches of organic matter should be added to the soil. For clayey soils, at least 2 inches of fertile loam or sand, perlite, calcined clay, or vermiculite should also be added. In addition, 5 pounds of superphosphate (0-20-0) or 16-20-0 fertilizer and 10 pounds of gypsum should be broadcast per 100 square feet. All of these materials should then be spaded or rototilled in the upper 8 inches of the natural soil. To make the soil acid, 1 to 2 pounds of sulfur can be incorporated into the soil. If the soil is too acid, it can be neutralized by adding bonemeal, lime, wood ashes or surface layer material from a calcareous soil, for example, Lewisville or Frio soils.

In some areas of the county, the soils are so clayey or so poorly drained that it is necessary to construct a raised bed for growing flowers and some shrubs. Brick, tile, metal, cedar, or redwood can be used as a retainer along the edge of the bed. The bed should be filled with good soil material that is well balanced in physical and chemical amendments.

Whether they are grown in natural or manmade soil, all plants require careful maintenance, especially during the period of establishment. Management needs include fertilizing, watering, weed control, and insect control.

Gardening and landscaping should be part of the basic plan in any urban development project. The potential of the natural soil for growing plants should be determined before selecting a site. Also, large, healthy trees are a valuable asset to property and therefore should be protected during construction. Many trees that have a potential in landscaping are killed or damaged beyond restoration because of carelessness in excavation, filling, and construction. For guidelines for protecting existing trees, consult the local office of the Soil Conservation Service or the Agricultural Extension Service.

Recreation

The soils of the survey area are rated in table 15 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 15, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 15 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 8.

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

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

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

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

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 16, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

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

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

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

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

Soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

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

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

Engineering properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

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

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

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

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

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

Physical and chemical properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

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

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

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

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

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

Soil and water features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

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

Engineering test data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation.

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

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 21, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

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

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

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

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

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Altoga series

The Altoga series consists of deep, well drained, clayey soils. Altoga soils formed in old alluvium on ridges and side slopes. The slopes range from 5 to 12 percent.

Typical pedon of Altoga silty clay, 5 to 12 percent slopes, eroded; from the intersection of Interstate Highway 20 and Lawson Road, this pedon is located 3.8 miles south on Lawson Road and 200 feet east in a pasture:

Ap—0 to 4 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; strong very fine to medium subangular blocky structure; very hard, friable; many fine roots; many worm casts; common fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—4 to 25 inches; very pale brown (10YR 7/3) silty clay, pale brown (10YR 6/3) moist; common fine distinct yellowish brown mottles; strong very fine and fine subangular blocky structure; very hard, friable; common fine roots and fine pores; common fine concretions and lumps of calcium carbonate; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B22—25 to 40 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) silty clay; moderate very fine and fine subangular and angular blocky structure; very hard, firm; few fine roots; few fine concretions and soft lumps of calcium carbonate; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

B3ca—40 to 65 inches; light brownish gray (2.5Y 6/2) silty clay; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular and angular blocky structure; very hard, firm; few fine roots; few masses and concretions of calcium carbonate; few fine black concretions; calcareous; moderately alkaline; clear wavy boundary.

IIC—65 to 80 inches; brownish yellow (10YR 6/6) silty clay loam; common medium distinct light gray (10YR 7/1) mottles; moderate fine platy structure; hard, friable; few fine black concretions; moderately alkaline.

The solum is 35 to 65 inches thick. The soil is moderately alkaline throughout. The calcic horizon is at a depth of 25 to 45 inches.

The A horizon is 3 to 12 inches thick. It is grayish brown, pale brown, brown, or light yellowish brown.

The B horizon is silty clay, silty clay loam, or clay loam and is 38 to 50 percent clay. It is very pale brown, yellowish brown, light yellowish brown, pale yellow, or light brownish gray. In some pedons, the B horizon has mottles in shades of gray, brown, or yellow.

If there is a C horizon, it is at a depth of 35 to 66 inches and is similar to the B horizon in texture and color.

Austin series

The Austin series consists of moderately deep, well drained, clayey soils. Austin soils formed in material that derived from soft chalky limestone of the Austin Chalk formation. The slopes range from 0 to 8 percent.

Typical pedon of Austin silty clay, 1 to 3 percent slopes; from the intersection of Interstate Highway 35E and Danieldale Road, this pedon is located east on Danieldale Road and 500 feet south in a field:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong fine and very fine subangular blocky structure; compacted and angular blocky structure in lower part; very hard, firm but crumbly; calcareous; moderately alkaline; clear smooth boundary.

A1—5 to 10 inches; very dark grayish brown (10YR 3/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; very hard, firm but crumbly; calcareous; moderately alkaline; gradual smooth boundary.

B21—10 to 20 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; strong fine and very fine subangular blocky structure; very hard, firm but crumbly; common worm casts; common fine limestone pebbles 2 to 50 mm in diameter at a depth of 15 to 18 inches; moderately alkaline; calcareous; gradual wavy boundary.

B22ca—20 to 32 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong very fine subangular blocky structure; hard, friable; common soft lumps and concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

Cr—32 to 40 inches; white platy chalky limestone that is massive below a depth of 34 inches.

The solum is 20 to 40 inches thick. The soil is more than 35 percent clay. The calcium carbonate equivalent is 40 to 65 percent in the control section.

The Ap and A1 horizons are very dark grayish brown, dark grayish brown, brown, or dark brown. The Ap and A1 horizons combined are 7 to 17 inches thick.

The B2 horizon is light brownish gray, brown, or yellowish brown silty clay or clay.

The C horizon consists of beds of platy chalk. It includes thick layers of massive chalky limestone that is slightly weathered and platy in the upper few inches.

Axtell series

The Axtell series consists of deep, moderately well drained, loamy soils. Axtell soils formed in old alluvium on old high stream terraces on uplands. The slopes range from 0 to 8 percent.

Typical pedon of Axtell fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 175 and Mathis Road in Seagoville, this pedon is located 400 feet south on Mathis Road and 200 feet west in an open pasture:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many roots; few siliceous pebbles; slightly acid; gradual smooth boundary.

A2—4 to 8 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; common fine pores; slightly acid; clear wavy boundary.

B21t—8 to 11 inches; mottled pinkish gray (7.5YR 6/2), brown (7.5YR 5/2), and yellowish red (5YR 5/6) sandy clay loam; moderate medium subangular and angular blocky structure; hard, friable; few fine roots; common fine pores; few fine siliceous pebbles; very strongly acid; clear wavy boundary.

B22t—11 to 23 inches; dark reddish brown (5YR 3/4) clay; common fine and medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; strong medium and coarse blocky structure; extremely hard, very firm; few fine roots; few fine pebbles; very strongly acid; diffuse wavy boundary.

B23t—23 to 39 inches; grayish brown (10YR 5/2) clay, many medium prominent dark red (2.5YR 3/6) and strong brown (7.5YR 5/6) mottles; moderate medium blocky structure; few slickensides that do not intersect; extremely hard, very firm; few fine roots between peds; very strongly acid; diffuse wavy boundary.

B3—39 to 52 inches; grayish brown (10YR 5/2) sandy clay; common medium prominent dark red (2.5YR 3/6) and strong brown (7.5YR 5/6) mottles; moderate coarse blocky structure; few slickensides; extremely hard, very firm; few roots between peds; few siliceous pebbles; medium acid; diffuse wavy boundary.

C—52 to 80 inches; grayish brown (10YR 5/2) sandy clay; common fine and medium distinct strong brown (7.5YR 5/6), yellowish red (5YR 5/6), and dark brown (7.5YR 4/4) mottles; strong coarse prismatic structure; extremely hard, very firm; few fine roots between peds; few fine siliceous pebbles; common fine black bodies; few fine concretions of calcium carbonate; moderately alkaline.

When the soil is dry, there are cracks 1/2 inch or more wide at a depth of 20 inches. In some pedons, there are fine siliceous pebbles throughout the soil.

When the soil is dry, the Ap or A1 horizon is dark grayish brown, light brownish gray, brown, pale brown, very pale brown, or grayish brown. The A horizon generally is less than 10 inches thick but can be as much as 15 inches thick over subsoil troughs. When the soil is dry, the A2 horizon is very pale brown, light yellowish brown, or pale brown. The boundary between the A and B horizons is clear to abrupt and wavy.

In most places, the B21t horizon is mottled in shades of yellow, red, gray, or brown. It ranges from clay to clay loam and is 38 to 55 percent clay. The soil is very strongly acid to medium acid.

The B22t horizon has prominent to distinct mottles in shades of red, gray, and brown. The soil is 40 to 60 percent clay, and it is strongly acid to neutral.

The B3 and C horizons are 35 to 55 percent clay. They are sandy clay or clay loam. The soil in these horizons is neutral to moderately alkaline. In some pedons, there are soft lumps of calcium carbonate.

Bastsil series

The Bastsil series is made up of deep, well drained, nearly level to gently sloping loamy soils. Bastsil soils formed in old alluvium on old high stream terraces. The slopes range from 0 to 3 percent.

Typical pedon of Bastsil fine sandy loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 635 and U.S. Highway 175, this pedon is located about 1 mile north on Interstate Highway 635 to Seagoville Road, 1,300 feet east on Seagoville Road, 600 feet south on Carolyn Jean Drive, and 300 feet southwest in a pasture within the Balch Springs city limits:

Ap—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse blocky structure; hard, friable; medium acid; clear smooth boundary.

B21t—8 to 12 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate coarse blocky; hard, friable; clay films coating about 50 percent of the faces of peds; few fine siliceous pebbles; medium acid; gradual wavy boundary.

B22t—12 to 34 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; few fine siliceous pebbles; medium acid; gradual wavy boundary.

B23t—34 to 68 inches; mottled dark red (2.5YR 3/6), yellowish red (5YR 5/6), and light gray (10YR 7/1) sandy clay loam; very hard, friable; weak coarse prismatic structure parting to weak medium subangular blocky; few fine siliceous pebbles; common fine dark brown concretions in the lower 12 inches; medium acid.

The soil is noncalcareous to a depth below 60 inches.

When the soil is dry, the A horizon is brown, pale brown, or reddish brown. It is strongly acid to slightly acid.

The Bt horizon is sandy clay loam that is 18 to 35 percent clay. It is red, reddish brown, reddish yellow, yellowish red, or strong brown, and the soil is medium acid to mildly alkaline. The B23t horizon is clay loam or sandy clay loam.

The Bastsil soils in this survey are taxadjuncts to the Bastsil series because they do not have secondary eluviation (skeletans and clean sand grains) in the lower part of the Bt horizon; however, they are similar in use and management to the soils of the Bastsil series.

Brackett series

The Brackett series is made up of shallow, well drained, loamy soils. Brackett soils formed in material that derived from soft chalky limestone. The slopes range from 3 to 25 percent.

Typical pedon of Brackett loam, 3 to 5 percent slopes; from the intersection of Camp Wisdom Road and Cockrell Hill Road, this pedon is located 3,700 feet east on Cockrell Hill Road and 2,400 feet north in a pasture within the Dallas city limits:

A1—0 to 9 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate and strong very fine granular and subangular blocky structure; hard, friable; abundant roots and worm casts; few shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B2—9 to 16 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; moderate very fine subangular blocky structure; hard, friable; abundant roots and worm casts; few fine soft weathered fragments of chalky limestone; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cr1—16 to 23 inches; weakly fractured soft chalky limestone, about 25 percent very pale brown (10YR 7/3) loam in horizontal and vertical fractures; the size and number of fractures decrease with depth; few roots and worm casts; calcareous; moderately alkaline; gradual wavy boundary.

Cr2—23 to 29 inches; white (10YR 8/1) and yellow (10YR 7/6) slightly fractured soft limestone; the limestone is less than 3 on Mohs' scale of hardness.

The solum is 10 to 20 inches thick. Coarse fragments in the solum range from a few small, soft limestone fragments to rounded limestone fragments less than three inches long that make up as much as 35 percent of the soil. The soil is more than 40 percent calcium carbonate.

When the soil is dry, the A horizon is grayish brown, brown, pale brown, light brownish gray, light yellowish brown, or light gray.

When dry, the B2 horizon is grayish brown, light brownish gray, light gray, brown, pale brown, very pale brown, or light yellowish brown. It is gravelly clay loam, clay loam, or loam and is 18 to 30 percent clay.

The Cr horizon generally is 25 to 70 percent soft limestone fragments but can be as much as 80 percent waterworn limestone pebbles. The fine earth fraction ranges from loam to clay loam.

Branyon series

The Branyon series is made up of deep, moderately well drained, nearly level clayey soils. Branyon soils formed in clayey alluvial sediment on old stream terraces. The slopes are 0 to 1 percent.

Typical pedon of Branyon clay, 0 to 1 percent slopes; from the intersection of Farm Road 1,382 and Texas 303 in Grand Prairie, this pedon is located 425 feet southwest in a field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) moist; strong fine and medium blocky structure; very hard, very firm; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.
A11—6 to 52 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine and medium blocky structure; common extensive intersecting slickensides; extremely hard, extremely firm; common fine concretions of calcium carbonate; few dark soft concretions; calcareous; moderately alkaline; diffuse wavy boundary.
A12—52 to 72 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate to strong fine and medium blocky structure; common intersecting slickensides; extremely hard, extremely firm; common fine concretions of calcium carbonate; few black concretions; calcareous; moderately alkaline; diffuse wavy boundary.
AC—72 to 80 inches; grayish brown (10YR 5.2) clay, dark grayish brown (10YR 4/2) moist; common fine faint yellowish brown (10YR 5/4) mottles; moderate medium and coarse blocky structure; common intersecting slickensides; extremely hard, extremely firm; common fine concretions of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Intersecting slickensides are common below a depth of about 16 inches and extend to a depth of 80 inches or more. Siliceous pebbles and limestone pebbles make up 0 to 10 percent of some pedons. In 85 percent or more of each pedon, subhorizons having matrix colors or mottles of chroma of more than 1.5 are at a depth of 50 to about 80 inches.

The Ap or A11 horizon is very dark gray, dark gray, or gray. The A12 horizon is dark gray or gray. The AC horizon is gray, light gray, grayish brown, or light brownish gray and has few to many distinct brownish, yellowish, or olive mottles.

Burleson series

The Burleson series is made up of deep, moderately well drained, clayey soils. Burleson soils formed in clayey alluvial sediment on old stream terraces. The slopes range from 0 to 3 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Matthew Road and Sandra Drive in Grand Prairie, this pedon is located 150 feet east on Sandra Drive and 100 feet north in a field:

Ap—0 to 4 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak fine blocky structure; extremely hard, very firm; neutral; clear smooth boundary.
A1—4 to 46 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine to medium blocky structure; common intersecting slickensides below a depth of about 18 inches; extremely hard, extremely firm; slightly acid; diffuse wavy boundary.
AC—46 to 64 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) and very dark gray (10YR 3/1) mottles, moderate fine and medium blocky structure; extremely hard, extremely firm; neutral; diffuse wavy boundary.
C—64 to 80 inches; grayish brown (10YR 5/2) clay; common fine distinct yellowish brown (10YR 5/6) mottles; many fine concretions and some soft lumps of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 70 inches thick. In areas of virgin rangeland and in areas of former cropland that have been idle for as much as 10 years, a gilgai microrelief is well defined. In most pedons, intersecting slickensides are common at a depth of about 2 feet. The soil texture is clay throughout the profile. When the soil is dry, the surface has a hard, light grayish crust 1/4 to 1/2 inch thick.

In most areas the A horizon is noncalcareous. The A horizon, excluding the AC horizon, is 25 inches thick on microknolls and ranges to more than 50 inches thick in microdepressions. When the soil is dry, the A11 and A12 horizons are very dark gray, dark gray, or gray. The surface layer is slightly acid to moderately alkaline.

The AC horizon is grayish brown, dark grayish brown, gray, light brownish gray, light olive gray, or pale olive. It has common brown, yellow, or olive mottles.

The C horizon is grayish brown, olive gray, gray, or dark gray and has brownish or olive mottles. In some pedons, the AC and C horizons have calcium carbonate concretions.

Crockett series

The Crockett series is made up of deep, moderately well drained, nearly level to gently sloping loamy soils. Crockett soils formed on old stream terraces on uplands. The slopes range from 0 to 5 percent.

Typical pedon of Crockett fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 183 and Story Road in Irving, this pedon is located 1,000 feet west on an access road and 330 feet north in an area of idle land:

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, friable; common fine roots; few fine siliceous pebbles; neutral; abrupt wavy boundary.

B21t—7 to 11 inches; dark brown (7.5YR 4/2) clay; many fine distinct reddish brown (5YR 4/4) and strong brown (7.5YR 5/6) mottles; strong medium and coarse blocky structure; extremely hard, very firm; common fine roots; few fine siliceous pebbles; neutral; gradual wavy boundary.

B22t—11 to 22 inches; mottled yellowish brown (10YR 5/6) and dark brown (10YR 4/3) clay; moderate medium and coarse blocky structure; common slickensides; extremely hard, very firm; few fine roots between peds; few fine siliceous pebbles; neutral; diffuse wavy boundary.

B23t—22 to 37 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse blocky structure; few slickensides; extremely hard, very firm; few roots between peds; few soft masses of calcium carbonate; few vertical cracks; some faces of peds have very dark grayish brown coatings; few fine siliceous pebbles; moderately alkaline; gradual wavy boundary.

B3t—37 to 53 inches; strong brown (7.5YR 5/6) clay; common medium distinct light brownish gray (10YR 6/2) and yellowish red (5YR 5/6) mottles; weak medium blocky structure; few prominent slickensides; very hard, very firm; few fine roots between peds; few concretions and soft masses of calcium carbonate; few fine black concretions; few siliceous pebbles; moderately alkaline; diffuse wavy boundary.

C—53 to 80 inches; mottled strong brown (7.5YR 5/6), olive yellow (2.5Y 6/6), yellowish brown (10YR 5/6), and light brownish gray (10YR 6/2) sandy clay; moderate coarse blocky structure; hard, firm; common white and pinkish streaks, pockets, and concretions of calcium carbonate; common faint bedding planes; few siliceous pebbles; moderately alkaline.

The solum is 45 to 70 inches thick. When the soil is dry, it has cracks that extend to a depth of more than 30 inches. The cracks are 1/2 to 3/4 inch wide at a depth of 20 inches. The depth to secondary carbonates ranges from 30 to 50 inches. The clay content does not decrease more than about 10 percent within a depth of 60 inches.

When the soil is dry, the A horizon is grayish brown, brown, or pale brown. In some areas, it is dark grayish brown and is less than 10 inches thick. The A horizon ranges from 4 to 15 inches in thickness. The boundary of the A horizon is abrupt to clear and wavy.

The Bt horizon is clay or sandy clay. The upper part of the Bt horizon is mottled in shades of brown, gray, and red. The abundance and distinctness of mottles vary within a short distance. The lower part of the Bt horizon is mottled in shades of brown, yellow, gray, and olive. The upper part of the Bt horizon ranges from slightly acid to medium acid, and the lower part ranges from slightly acid to moderately alkaline. In some pedons, there are gypsum crystals in the Bt horizon.

Dalco series

The Dalco series is made up of moderately deep, moderately well drained, clayey soils in shallow valleys. Dalco soils formed in material that derived from soft chalky limestone of the Austin Chalk formation. The slopes range from 0 to 3 percent.

Typical pedon of Dalco clay, 1 to 3 percent slopes; from the intersection of Galaxy Road and Arapaho Road in Garland, this pedon is located 800 feet west on Arapaho Road and 200 feet north in a field:

Ap—0 to 9 inches; black (N 2/0) clay; weak very fine angular and subangular blocky structure; very firm, very sticky and very plastic; few fine chalk fragments; calcareous; moderately alkaline; gradual smooth boundary.

A12—9 to 26 inches; black (10YR 2/1) clay; moderate very fine blocky structure; very firm, very sticky and very plastic; few slickensides in lower part; calcareous; moderately alkaline; gradual wavy boundary.

AC—26 to 35 inches; dark gray (10YR 4/1) clay; strong coarse angular blocky structure; many intersecting slickensides and parallelepipeds; very firm, very sticky and very plastic; common very fine chalk fragments, many in the lower 6 inches; calcareous; moderately alkaline; abrupt wavy boundary.

Cr—35 to 80 inches; white soft chalky limestone; fine platy in the upper 6 inches, massive and fractured below that.

The solum is 24 to about 40 inches thick. When the soil is dry, cracks 1 inch to 2 inches wide extend to a depth of 30 to 40 inches or to the underlying chalky limestone. Intersecting slickensides are few to common below a depth of 16 inches and many below a depth of about 24 inches in microbasins.

The A horizon is black or very dark gray. The AC horizon is dark gray, very dark grayish brown, or dark grayish brown. The A and AC horizons are moderately alkaline to mildly alkaline and calcareous or noncalcareous.

The underlying limestone generally is platy and soft in the upper part and massive below. It has a hardness of less than 3 on Mohs' scale.

Dutek series

The Dutek series is made up of deep, well drained, sandy soils. Dutek soils formed in sandy and loamy material on old stream terraces on uplands. The slopes range from 0 to 6 percent.

Typical pedon of Dutek loamy fine sand, 1 to 5 percent slopes; from the intersection of Belt Line Road and Shady Grove Road in Irving, this pedon is located 500 feet south of Belt Line Road and 300 feet east in a wooded pasture (the area has since been excavated for sand):

A1—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak very fine granular structure; soft to loose, very friable; slightly acid; gradual smooth boundary.

A21—8 to 26 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/6) moist; single grained; loose, very friable; slightly acid; gradual smooth boundary

A22—26 to 34 inches; very pale brown (10YR 7/4) loamy fine sand, brownish yellow (10YR 6/6) moist; single grained; loose, very friable; slightly acid; clear smooth boundary.

B2t—34 to 54 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 5/8) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; thin clay films on the faces of peds; medium acid; gradual smooth boundary.

B3—54 to 64 inches; yellowish red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; weak coarse prismatic structure; slightly hard, friable; few patchy clay films; common fine bodies of red sandy clay loam; very strongly acid; gradual wavy boundary.

C—64 to 75 inches; reddish yellow (7.5YR 6/6) loamy fine sand, strong brown (7.5YR 5/6) moist; single grained; slightly hard, very friable; very strongly acid.

The solum is more than 60 inches thick.

The A horizon is 20 to 40 inches thick. When the soil is dry, the A1 horizon is brown, pale brown, or light yellowish brown, and the A2 horizon is yellowish brown, light yellowish brown, or very pale brown. The A1 and A2 horizons range from mildly alkaline to slightly acid. The A2 horizon ranges from fine sand to loamy fine sand.

The B2t horizon is red or yellowish red. It ranges from sandy clay loam to heavy fine sandy loam, and the clay content is 18 to 35 percent. The soil is medium acid to slightly acid. The B3 horizon is yellowish red or strong brown. In places, there is no B3 horizon.

The C horizon ranges from loamy fine sand to fine sandy loam. It is reddish yellow or yellowish brown and ranges from strongly acid to neutral. In places, it has faint mottles in shades of yellow, red, or brown.

Eddy series

The Eddy series consists of very shallow and shallow, well drained, loamy soils. Eddy soils formed in material that derived from soft limestone of the Austin Chalk formation. The slopes range from 1 to 20 percent.

Typical pedon of Eddy clay loam, 3 to 8 percent slopes; from the intersection of Blackburn Road and Naaman Road, this pedon is located about 4.5 miles north of Garland and 70 feet southeast in a pasture (1,000 feet south of the Collin-Dallas county line):

A1—0 to 4 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; strong very fine subangular blocky and granular structure; hard, friable; many fine roots; many worm casts; about 5 percent chalk fragments, mainly less than 3 inches across; moderately alkaline; abrupt wavy boundary.

A and Cr—4 to 11 inches; platy chalky limestone; about 15 percent grayish brown clay loam between the plates and in cracks; gradual wavy boundary.

Cr—11 to 40 inches; white, platy and massive chalky limestone.

The solum is 3 to 15 inches thick. Limestone fragments make up more than 35 percent, by volume, of the solum.

The upper part of the A horizon is 5 to 20 percent limestone fragments, and the lower part is more than 50 percent. Most fragments are less than 3 inches across. When the soil is dry, the A horizon is grayish brown, light brownish gray, dark grayish brown, brown, or pale brown. Where the A horizon has value of less than 3.5 when the soil is moist, it is less than 4 inches thick.

In some places, the chalky limestone in the Cr horizon is massive. In others, it is platy, loose, and soft in the upper 2 or 3 feet. The limestone has a hardness of less than 3 on Mohs' scale.

Eufaula series

The Eufaula series consists of deep, somewhat excessively drained, sandy soils. Eufaula soils formed in sandy alluvium on low old stream terraces. The slopes are 0 to 2 percent.

Typical pedon of Eufaula loamy fine sand, 0 to 2 percent slopes; from the Trinity River bridge about 5 miles south of Kleberg, this pedon is located 5,400 feet southwest on Belt Line Road and 200 feet east in a pasture:

A11—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, neutral; gradual smooth boundary.

A12—6 to 13 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak coarse prismatic structure; hard, friable; neutral; gradual smooth boundary.

B21t—13 to 44 inches; strong brown (7.5YR 5/6) loamy fine sand, strong brown (7.5YR 4/6) moist; common fine splotches and streaks of reddish brown (5YR 5/4) fine sandy loam; weak fine subangular blocky structure; loose, very friable; sand grains are coated; few fine siliceous pebbles; mildly alkaline; diffuse wavy boundary.

B22t—44 to 80 inches; reddish yellow (7.5YR 6/6) loamy fine sand; splotches and streaks of strong brown (7.5YR 5/6) fine sandy loam; single grained; slightly hard, friable; few fine siliceous pebbles; moderately alkaline.

The solum is more than 70 inches thick. The organic matter content is less than 1 percent. Throughout the control section, the soil is coarser than loamy very fine sand.

When the soil is dry, the A horizon is brown or yellowish brown. It ranges from neutral to mildly alkaline.

The Bt horizon is strong brown, reddish brown, or reddish yellow.

The Eufaula soils in this survey area are taxadjuncts to the Eufaula series because the Bt horizon of fine sandy loam is in streaks and splotches and not in lamellae; however, these soils are similar to the soils of the Eufaula series in use and management.

Ferris series

The Ferris series consists of deep, well drained, sloping and strongly sloping clayey soils. Ferris soils formed in clayey marine sediment on uplands. The slopes range from 5 to 12 percent.

Typical pedon of Ferris clay, in an area of Ferris-Heiden complex, 5 to 12 percent slopes; from the intersection of Belt Line Road and Pioneer Road, this pedon is located about 1.5 miles south of Mesquite, 3,000 feet northeast along Pioneer Road, and 50 feet west in a pasture:

A1—0 to 3 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak fine and very fine subangular blocky structure; extremely hard, very firm; many fine roots; common worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

A12—3 to 16 inches; olive (5Y 5/4) clay, olive (5Y 4/4) moist; strong very fine and fine blocky structure; extremely hard, very firm; common fine roots; common worm casts; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—16 to 28 inches; olive (5Y 5/4) clay, olive (5Y 4/4) moist; common fine distinct light olive brown (2.5Y 5/4) mottles; moderate very fine to medium blocky structure; a few intersecting slickensides; extremely hard, very firm; common fine roots; 5 percent, by volume, soft masses of calcium carbonate; few worm casts; calcareous; moderately alkaline; gradual wavy boundary.

AC2—28 to 41 inches; light brownish gray (2.5Y 6/2) clay; many medium distinct light olive brown (2.5Y 5/4) mottles; weak fine to coarse angular blocky structure; extremely hard, very firm; few roots; common fine seams and pockets of calcium carbonate; few worm casts; vertical cracks are 1/8 inch wide at a depth of 40 inches; calcareous; moderately alkaline; clear smooth boundary.

C—41 to 72 inches; mottled light olive brown (2.5Y 5/4), light brownish gray (2.5Y 6/2), and gray (10YR 5/1) shaly clay; light yellowish brown (2.5Y 6/4), rubbed; moderate fine to coarse platy structure; extremely hard, very firm; few fine roots between some peds; few clay balls; few pockets of calcium carbonate; calcareous; moderately alkaline.

The solum is 30 to 60 inches thick. The soil generally has open cracks more than 20 inches deep in summer. The soil is calcareous throughout.

When the soil is dry, the A horizon is grayish brown, brown, light yellowish brown, light olive brown, olive brown, olive gray, or olive. Where the color value is less than 3.5 when the soil is dry, the horizon is less than 12 inches thick or makes up less than half of the pedon.

The AC horizon is olive, olive gray, light olive brown, or light brownish gray. In some pedons, it has mottles in shades of brown, gray, yellow, or olive.

The C horizon is weathered shaly clay or shale. The gray colors are derived from the shale. In most pedons, the C horizon has concretions or soft masses of calcium carbonate. In some pedons, there are gypsum crystals in the AC and C horizons.

Frio series

The Frio series is made up of deep, well drained, clayey soils. Frio soils formed in recent alluvium on flood plains. The slopes are 0 to 2 percent.

Typical pedon of Frio silty clay, frequently flooded; from the intersection of Dallas-Forth Worth Turnpike and Belt Line Road in Grand Prairie, this pedon is located 1,750 feet north on Belt Line Road, 3,500 feet east on county road, and 2,700 feet east in a pasture:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, friable; common fine and medium roots; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

A12—7 to 32 inches; very dark grayish brown (10YR 3/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong very fine and fine subangular blocky structure; very hard, friable; common fine roots; cracks are common throughout when the soil is dry; common fine fragments of limestone; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

A13—32 to 53 inches; very dark grayish brown (10YR 3/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, friable; common fine roots; few fine fragments of limestone; common worm casts; calcareous; moderately alkaline; gradual wavy boundary.

Cca—53 to 74 inches; brown (10YR 5/3) silty clay loam; moderate fine blocky structure; hard, friable; few fine roots; common fine threads and seams of calcium carbonate; few shell fragments; few worm casts; calcareous; moderately alkaline.

The depth to sand, gravel, or limestone is more than 6 feet. The A12, A13, and Cca horizons are silty clay loam, silty clay, or clay loam and are more than 35 percent clay. When the soil is dry, the A horizon is dark grayish brown, very dark grayish brown, very dark brown, or dark brown; below a depth of about 30 inches, the soil is any of the above colors, or it is very dark gray, brown, or yellowish brown. In places, the soil is 5 to 10 percent limestone or siliceous pebbles.

Gowen series

The Gowen series is made up of deep, well drained, loamy soils on flood plains of the smaller streams. The slopes are 0 to 1 percent.

Typical pedon of Gowen loam, occasionally flooded; from the intersection of Loop 12 and Shady Grove Road in Irving, this pedon is located 1,800 feet east on Shady Grove Road and 500 feet south in a pasture:

A11—0 to 21 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky and granular structure; hard, friable; many fine roots; many fine pores; moderately alkaline; diffuse smooth boundary.

A12—21 to 32 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; common thin strata of brown (10YR 5/3) sandy loam; weak medium blocky and granular structure; hard, friable; few fine roots; common fine pebbles and fine pores; moderately alkaline; gradual smooth boundary.

C1—32 to 52 inches; grayish brown (2.5Y 5/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; common strata of light olive brown (2.5Y 5/4) fine sand 1/2 inch thick; a few strata are more than 1/2 inch thick; weak coarse blocky and moderate fine platy structure; very hard, friable; moderately alkaline; gradual wavy boundary.

C2—52 to 80 inches; mottled dark gray (10YR 4/1) and dark yellowish brown (10YR 4/4) sandy clay; weak coarse blocky structure; very hard, very firm; common fine siliceous pebbles; moderately alkaline.

The soil is stratified throughout. The organic matter content varies irregularly from the surface to a depth of 50 inches. The solum ranges from moderately alkaline to neutral. In the control section, the clay content is 22 to 35 percent.

The A horizon is 24 to 40 inches thick. When the soil is dry, the A horizon is very dark gray, dark gray, dark grayish brown, very dark grayish brown, or dark brown. The A12 horizon and the C1 horizon are fine sandy loam, loam, clay loam, or sandy clay loam; they are 20 to 35 percent clay.

Heiden series

The Heiden series is made up of deep, well drained, clayey soils. Heiden soils formed in clayey marine sediment on uplands. The slopes range from 1 to 12 percent.

Typical pedon of Heiden clay, 2 to 5 percent slopes, eroded; from the intersection of Gus Thomason Road and Town East Boulevard in Mesquite, this pedon is located 100 feet east on Town East Boulevard and 50 feet south in abandoned cropland:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine blocky structure; very hard, very firm; common roots; few fine concretions of calcium carbonate; few fine pebbles; calcareous; moderately alkaline; clear wavy boundary.

A1—6 to 37 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse blocky structure; extremely hard, very firm; few fine roots; common slickensides in the lower part forming most of the ped surfaces; calcareous; moderately alkaline; gradual wavy boundary.

AC—37 to 56 inches; grayish brown (10YR 5/2) clay; common fine distinct dark gray (10YR 4/1) and yellowish brown (10YR 5/6) mottles; weak fine blocky structure; extremely hard, very firm; many fine soft lumps of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—56 to 78 inches; mottled light brownish gray (2.5Y 6/2), olive yellow (2.5Y 6/6), and brownish yellow (10YR 6/8) shaly clay; moderate fine platy structure; very hard, very firm; calcareous; moderately alkaline.

The A and AC horizons combined are 40 to more than 65 inches thick. Cracks form to a depth of more than 20 inches more than once each year. Slickensides are common between depths of 20 and 40 inches. The soil is moderately alkaline clay throughout. In a few places, the soil is not calcareous.

When the soil is dry, the A horizon is dark grayish brown, very dark grayish brown, dark brown, dark gray, or very dark gray. Where the chroma is less than 1.5, the surface layer is less than 12 inches thick in more than half the pedon. In some pedons, gypsum crystals are common in the AC and C horizons.

The C horizon ranges from strongly weathered shaly clay to slightly weathered shale that is noncalcareous in some areas.

Houston Black series

The Houston Black series is made up of deep, moderately well drained, clayey soils. Houston Black soils formed in clayey marine sediment on uplands. The slopes range from 0 to 4 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; from the intersection of Interstate Highway 635 and Town East Boulevard in Mesquite, this pedon is located 2,600 feet east on Town East Boulevard and 2,600 feet north in a field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) moist; moderate medium and fine subangular and angular blocky structure; extremely hard, very firm; many fine roots; many worm casts; calcareous; moderately alkaline; gradual wavy boundary.

A11—6 to 38 inches; black (10YR 2/1) clay, black (10YR 2/1) moist; moderate medium and fine blocky structure; common intersecting slickensides below a depth of 16 inches; extremely hard, extremely firm; common fine roots and worm casts; moderately alkaline; calcareous; diffuse wavy boundary.

A12—38 to 52 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) moist; moderate medium and coarse blocky structure; common intersecting slickensides; extremely firm, extremely hard; few fine roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

AC—52 to 70 inches; dark grayish brown (2.5Y 4/2) clay, dark grayish brown (2.5Y 4/2) moist; many medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium and coarse blocky structure; common intersecting slickensides; extremely hard, extremely firm; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Cracks 1 centimeter to 10 centimeters wide form to a depth of more than 20 inches more than once each year. Intersecting slickensides are common at a depth of 16 to 40 inches. In some areas, there are a few hard siliceous pebbles throughout the soil. Where the soil is underlain by chalk, there are a few thin chalky fragments on the surface and in the soil.

Houston Black soils in native pasture have a gilgai relief of microknolls and microdepressions 10 to 15 feet across. In the more sloping areas, the microrelief is a series of ridges and valleys that run down the slopes. In these areas, the surface ranges from thick on the microknolls and ridges to very thick in the microdepressions and valleys, and there is deep tonguing of the individual A horizons. In cultivated areas, the gilgai relief has been smoothed out.

When the soil is dry, the A horizon of soils in microdepressions is dark gray, very dark gray, or black. On microknolls, the individual A horizons below the Ap horizon are dark grayish brown, brown, olive brown, olive, or olive gray. The soil is mildly alkaline to moderately alkaline. The AC horizon is at a depth of 6 to 18 inches on the microknolls and at a depth of more than 20 inches in the microdepressions.

The AC horizon is brownish colored and has chroma of more than 1.5. In some pedons, the AC horizon has mottles of gray, brown, and yellow. The soil is moderately alkaline.

Lewisville series

The Lewisville series is made up of deep, well drained, clayey soils. Lewisville soils formed in old alluvium on stream terraces. The slopes range from 0 to 8 percent.

Typical pedon of Lewisville silty clay, 3 to 5 percent slopes; from the intersection of Denton Tap Road and Belt Line Road in Coppell, this pedon is located 3,400 feet north on Denton Tap Road and 900 feet east in a pasture:

A11—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong fine granular and very fine subangular blocky structure; hard, friable; common fine roots; calcareous; moderately alkaline; gradual smooth boundary.

A12—9 to 15 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate very fine to medium subangular blocky structure; hard, friable; few fine roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—15 to 23 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; hard, friable; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—23 to 41 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; strong fine and very fine blocky structure; very hard, friable; few dark worm casts; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3—41 to 54 inches; light brownish gray (2.5Y 6/2) silty clay; common fine faint grayish brown (10YR 5/2) and light olive brown (2.5Y 5/4) mottles; moderate fine blocky structure; very hard, friable; few fine concretions of calcium carbonate and few fine pebbles; few fine black concretions; calcareous; moderately alkaline; gradual smooth boundary.

C—54 to 75 inches; light yellowish brown (2.5Y 6/4) silty clay; few fine distinct gray (N 5/10) and strong brown (7.5YR 5/6) mottles; moderate fine blocky structure; very hard, firm; few fine concretions of calcium carbonate; few black concretions; few fine pebbles; calcareous; moderately alkaline.

The solum is 30 to 60 inches thick. The soil typically is silty clay throughout; in some pedons it is silty clay loam. The mollic epipedon is 10 to 20 inches thick. The soil is calcareous throughout, and there generally are threads and films of calcium carbonate in all horizons below the mollic epipedon.

When the soil is dry, the A horizon is very dark grayish brown, dark grayish brown, or dark brown.

The B horizon is brown, light brown, grayish brown, dark yellowish brown, yellowish brown, or light yellowish brown.

In most pedons, concretions and soft lumps of calcium carbonate are in the B and C horizons; they generally make up less than 5 percent, by volume, of the soil within a depth of 40 inches.

Mabank series

The Mabank series is made up of deep, somewhat poorly drained, nearly level loamy soils on uplands. Mabank soils formed in marine clay and shale. The slopes range from 0 to 3 percent.

Typical pedon of Mabank fine sandy loam, 0 to 1 percent slopes; from the intersection of Farmers Road and U.S. Highway 175 in Seagoville, this pedon is located 400 feet northeast on Farmers Road and 100 feet east in idle cropland:

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; structureless; hard, friable; common fine roots; few fine siliceous pebbles; neutral; abrupt wavy boundary.

B21tg—5 to 12 inches; gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; very hard, firm; common fine roots; few fine siliceous pebbles; slightly acid; clear wavy boundary.

B22tg—12 to 16 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate coarse subangular blocky structure; very hard, very firm; few fine roots; few fine siliceous pebbles; strongly acid; gradual smooth boundary.

B23tg—16 to 31 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; few fine faint brownish mottles; moderate medium and coarse blocky structure; few slickensides; extremely hard, very firm; few fine siliceous pebbles;. strongly acid; gradual smooth boundary.

B24tg—31 to 57 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium and coarse blocky structure; few slickensides; extremely hard, very firm; few fine siliceous pebbles; medium acid; diffuse smooth boundary.

B3g—57 to 65 inches; gray (10YR 6/1) clay; few fine faint brownish yellow mottles; extremely hard, very firm; medium acid.

The solum is more than 60 inches thick. Secondary carbonates are at a depth of more than 30 inches. In dry periods each year, the soil has common cracks at least 0.4 inch wide at a depth of 20 inches or more.

The A horizon is grayish brown, dark grayish brown, dark gray, very dark gray, gray, or light brownish gray.

The B21tg and B22tg horizons are gray, dark gray, or very dark gray clay. They are strongly acid to neutral. The lower B23tg and B24tg horizons are grayish brown, light brownish gray, light gray, or gray and have mottles in shades of brown, yellow, and red. They are medium acid to moderately alkaline. In most pedons, the soil has slickensides that do not intersect and few to common fine quartz pebbles.

The Mabank soils in the survey area are taxadjuncts to the Mabank series because the lower part of the Bt horizon is slightly more acid; however, these soils are similar to the soils of the Mabank series in use and management.

Normangee series

The Normangee series is made up of deep, moderately well drained, gently undulating loamy soils. Normangee soils formed in clayey marine sediments. The slopes range from 0 to 3 percent.

Typical pedon of Normangee clay loam, 1 to 3 percent slopes; from the intersection of Belt Line Road and Valley View Lane north of Irving, this pedon is located 6,800 feet south on Valley View Lane and 4,200 feet east in a pasture:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; common fine roots and worm casts; few small siliceous pebbles; neutral; clear wavy boundary.

B21t—9 to 14 inches; dark brown (10YR 4/3) clay; dark brown (10YR 3/3) moist; common fine distinct reddish brown (2.5YR 4/4) mottles; moderate medium blocky structure; very hard, firm; few roots and worm casts; few patchy clay films on faces of peds; few fine siliceous pebbles; neutral; clear wavy boundary.

B22t—14 to 25 inches; grayish brown (2.5Y 5/2) clay, grayish brown (2.5Y 5/2) moist; many medium prominent reddish brown (5YR 5/4) and few medium faint light olive brown (2.5Y 5/6) mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, very firm; few fine roots; common pressure faces; common thick clay films; few fine siliceous pebbles; slightly acid; gradual wavy boundary.

B23t—25 to 41 inches; olive (5Y 5/3) clay, olive gray (5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/4) and few medium faint olive (5Y 5/4) mottles; weak coarse prismatic structure; extremely hard, extremely firm; few roots between peds; common pressure faces; few siliceous pebbles; few fine black concretions; slightly acid; gradual smooth boundary.

IIC1ca—41 to 66 inches; yellowish brown (10YR 5/8) clay, yellowish brown (10YR 5/8) moist; few medium faint light olive brown (2.5Y 5/4) and olive gray (5Y 4/2) mottles; weak coarse blocky and fine platy structure; very hard, very firm; about 10 percent siliceous pebbles; 20 percent hard concretions of calcium carbonate; few shale fragments; calcareous; moderately alkaline; gradual smooth boundary.

IIC2ca—66 to 71 inches; mottled pale yellow (2.5Y 7/4), brownish yellow (10YR 6/6), and light olive gray (5Y 6/2) shale; fine platy structure; soft calcium carbonate in cracks and between plates; moderately alkaline.

The solum is about 40 to 60 inches thick. In the control section, the soil is more than 40 percent clay. Secondary carbonates are at a depth of more than 28 inches.

When the soil is dry, the A horizon is dark grayish brown or very dark grayish brown. It is hard or very hard when the soil is dry and slightly acid to neutral.

The B21t horizon is clay or sandy clay. When the soil is dry, it is dark grayish brown, dark brown, brown, or grayish brown. In some pedons, this horizon has yellowish red mottles. The B21t horizon is slightly acid to moderately alkaline.

The B22t horizon is slightly acid or neutral. It is grayish brown, light olive brown, dark yellowish brown, dark brown, or reddish brown. In some pedons, this horizon has brownish yellow, yellowish brown, olive brown, yellowish red, or strong brown mottles.

The IIC horizon, if present, is at a depth of about 40 to 66 inches and consists of mottled shale, partly weathered shale, or clay. It has few to common concretions of calcium carbonate.

Ovan series

The Ovan series is made up of deep, moderately well drained, clayey soils. Ovan soils formed in recent alluvium on flood plains. The slopes are less than 1 percent.

Typical pedon of Ovan clay, frequently flooded; from the intersection of Camp Wisdom Road and Farm Road 1328 in Grand Prairie, this pedon is located 2,500 feet west on Camp Wisdom Road and 100 feet south in a meadow:

Ap—0 to 7 inches; very dark grayish brown (2.5Y 3/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine blocky structure; very firm, very sticky and very plastic, many fine roots; moderately alkaline; clear smooth boundary.

A11—7 to 15 inches; very dark grayish brown (2.5Y 3/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate very fine and fine blocky structure; very firm, very sticky and very plastic; many fine roots; many worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12—15 to 35 inches; dark grayish brown (2.5Y 4/2) clay; common medium faint olive brown (2.5Y 4/4) mottles; weak fine blocky structure; few intersecting slickensides; very firm, very sticky and very plastic; few fine roots; few fine concretions of calcium carbonate; fine gypsum crystals; calcareous; moderately alkaline; diffuse wavy boundary.

B2—35 to 80 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; weak fine blocky structure; very firm, very sticky and very plastic; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick. In some pedons, there are concretions of calcium carbonate throughout the soil. In some pedons, there are gypsum crystals below a depth of 15 inches.

The A horizon is very dark grayish brown, dark brown, or dark olive gray.

The B horizon is dark grayish brown, olive brown, or yellowish brown or is mottled with these colors.

Rader series

The Rader series is made up of deep, moderately well drained, nearly level and gently sloping loamy soils. Rader soils formed in loamy and clayey marine sediment on uplands. The slopes are 0 to 2 percent.

Typical pedon of Rader fine sandy loam in an area of Rader-Urban land complex, 0 to 2 percent slopes; from the intersection of Peach Tree Road and Seagoville Road in Balch Springs, this pedon is located 2,100 feet north on Peach Tree Road and 1,200 feet west in idle cropland:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam; few fine faint brownish mottles; moderate medium subangular blocky structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.

B&A—8 to 16 inches; yellowish brown (10YR 5/4) sandy clay loam; common fine distinct grayish brown (10YR 5/2) mottles; 10 to 15 percent common pockets and streaks, 1/4 to 1/2 inch wide, of very pale brown (10YR 7/4) fine sandy loam; weak fine to medium subangular blocky structure; common fine roots; hard, friable; medium acid; gradual wavy boundary.

B21t—16 to 25 inches; mottled red (2.5YR 4/6), brown (7.5YR 5/4), and light brownish gray (10YR 6/2) clay loam; moderate medium blocky structure; extremely hard, very firm; few fine roots; strongly acid; gradual wavy boundary.

B22t—25 to 30 inches; mottled yellowish brown (10YR 5/6), pale brown (10YR 6/3), light yellowish brown (10YR 6/4), and yellowish red (5YR 4/6) clay; moderate medium and coarse blocky structure; extremely hard, very firm; few roots; common fine black concretions; strongly acid; gradual wavy boundary.

B23t—30 to 38 inches; mottled yellowish brown (10YR 5/4), gray (10YR 5/1), and brown (7.5YR 5/4) clay; moderate medium and coarse blocky structure; extremely hard, very firm; few roots; few black concretions; moderately alkaline; diffuse wavy boundary.

B3—38 to 64 inches; brown (10YR 5/3) sandy clay; common medium distinct yellowish brown and gray mottles; weak blocky structure; extremely hard, extremely firm; few roots; few hard concretions of calcium carbonate; moderately alkaline.

The solum is more than 60 inches thick. The control section is 28 to 35 percent clay.

The A horizon is dark grayish brown, grayish brown, pale brown, or brown. It is 3 to 8 inches thick. In pedons that have a thicker A horizon, there is an A2 horizon.

The A part of the B&A horizon is very pale brown, yellowish brown, light brownish gray, or light gray loam or fine sandy loam. The B part is yellowish brown, strong brown, pale brown, or brownish yellow loam or sandy clay loam. The B&A horizon is 4 to 9 inches thick and is slightly acid to strongly acid.

The B2t horizon is clay, clay loam, or sandy clay. It is mottled red, yellowish red, strong brown, or brown. In most pedons, the B2t horizon is mottled in shades of red, brown, gray, and yellow. The upper part of the B2t horizon is very strongly acid to slightly acid, and the lower part is slightly acid to moderately alkaline.

The Rader soils in this survey area are taxadjuncts to the Rader series because they are on a slightly lower, moundy topography and have a thinner A horizon; however these soils are similar to the soils of the Rader series in use and management.

Seagoville series

The Seagoville series is made up of deep, moderately well drained, clayey soils. Seagoville soils formed in recent alluvium on flood plains along the major streams. The slopes are less than 1 percent.

Typical pedon of Seagoville clay, occasionally flooded; this pedon is located in a field, about 8.5 miles south of Seagoville and 600 feet south from the intersection of Davis Road and Bilindsay Road:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and fine blocky structure; very hard, very firm; few roots; common pores; common worm casts; calcareous; moderately alkaline; abrupt smooth boundary.

A11—6 to 14 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine blocky structure; extremely hard, very firm; few roots; many shiny pressure faces; calcareous; moderately alkaline; gradual wavy boundary.

A12—14 to 30 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium and coarse blocky structure; common coarse intersecting slickensides; extremely hard, very firm; few roots; calcareous; moderately alkaline; gradual wavy boundary.

IIAb—30 to 38 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; moderately alkaline; gradual wavy boundary.

IIBtb—38 to 75 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common medium prominent red (2.5YR 4/6) mottles; moderate coarse subangular blocky structure; hard, friable; few clay films; few fine black concretions; moderately alkaline.

The A horizon is dark grayish brown or grayish brown. It is mildly alkaline or moderately alkaline.

The IIAb horizon is dark brown, dark grayish brown, or grayish brown. In some pedons, it has brownish mottles. It is fine sandy loam, loam, or sandy clay loam and is 18 to 25 percent clay. The IIAb horizon is mildly alkaline or moderately alkaline and calcareous.

The IIBtb horizon is brownish yellow, brown, yellowish brown, pale brown, or strong brown. It is sandy clay loam or fine sandy loam.

In some pedons, a IIC horizon of fine sand or loamy fine sand is within a depth of 40 inches.

Silawa series

The Silawa series is made up of deep, well drained, loamy soils. Silawa soils formed in sandy sediment on uplands. The slopes range from 1 to 8 percent.

Typical pedon of Silawa fine sandy loam, 2 to 8 percent slopes, eroded; from the intersection of Kleberg Road and Belt Line Road, this pedon is located 1 mile east on Kleberg Road and 200 feet north in a wooded pasture:

Ap—0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

A2—2 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

B21t—6 to 12 inches; reddish brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/4) moist; the faces of peds are dark grayish brown (10YR 4/2); moderate coarse subangular blocky structure; hard, friable; medium acid; gradual wavy boundary.

B22t—12 to 26 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; the faces of peds are dark yellowish brown (10YR 4/6); moderate coarse subangular blocky structure; hard, friable; strongly acid; diffuse wavy boundary.

B3—26 to 43 inches; reddish yellow (7.5YR 7/6) fine sandy loam, reddish yellow (7.5YR 6/6) moist; yellowish red lamellae make up about 30 percent of the horizon; massive; slightly hard, very friable; strongly acid; diffuse wavy boundary.

C—43 to 80 inches; reddish yellow (5YR 7/6) loamy fine sand, yellowish red (5YR 5/6) moist; massive; loose, very friable; strongly acid.

The A horizon is 6 to about 18 inches thick. The Ap or A1 horizon is brown, grayish brown, or pale brown. The A2 horizon is pale brown, light yellowish brown, light brown, grayish brown, or very pale brown. The A horizon is neutral to medium acid.

The Bt horizon is yellowish red, reddish yellow, reddish brown, or red. It is 18 to about 35 percent clay. The soil is medium acid to strongly acid.

The C horizon is similar in color to the Bt horizon. It is fine sandy loam, gravelly fine sandy loam, sandy clay loam, loamy fine sand, or fine sand. The soil is neutral to strongly acid.

About 30 percent of the Silawa soils in Dallas County are taxadjuncts to the Silawa series because they have a strong brown or yellowish brown Bt horizon; however, these soils are similar to the soils of the Silawa series in use and management.

Silstid series

The Silstid series is made up of deep, well drained, gently sloping and gently rolling sandy soils. Silstid soils formed in sandy sediment on uplands. The slopes range from 0 to 8 percent.

Typical pedon of Silstid loamy fine sand, 0 to 3 percent slopes; from the intersection of Log Cabin Road and Belt Line Road about 1.75 miles south of the Kleberg Post Office, this pedon is located 5,700 feet southwest on Log Cabin Road and 100 feet east in a pasture that is being mined for gravel and sand:

A1—0 to 10 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; many fine roots; soft; slightly acid; gradual wavy boundary.

A2—10 to 27 inches; light yellowish brown (10YR 6/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grained; common fine roots; slightly acid; gradual wavy boundary.

B21t—27 to 44 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; common fine and coarse pores; slightly acid; diffuse wavy boundary.

B22t—44 to 65 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine and medium red (2.5YR 4/6) mottles; weak coarse subangular blocky structure; few fine roots; common fine pores; medium acid; diffuse wavy boundary.

C—65 to 80 inches; reddish yellow (7.5YR 7/8) loamy fine sand; many coarse distinct strong brown (7.5YR 5/8) mottles, common medium prominent light gray (10YR 7/2) mottles, and few fine distinct dark grayish brown (10YR 4/2) mottles; massive; slightly hard, very friable; strongly acid.

The A horizon is about 20 to 32 inches thick. The A2 horizon is loamy fine sand or fine sand. When the soil is dry, the A1 is brown, pale brown, or very pale brown. It is slightly acid to neutral.

The Bt horizon is about 22 to 30 percent clay. When the soil is dry, the Bt horizon is yellowish brown, brownish yellow, yellow, or strong brown. The B2t horizon has strong brown to reddish mottles throughout. It is slightly acid to medium acid.

The C horizon, if present, is loamy fine sand, fine sandy loam, or sandy clay loam.

Smithville series

The Smithville series is made up of deep, well drained, loamy soils that formed in old alluvium on stream terraces. The slopes range from 0 to 2 percent.

Typical pedon of Smithville loam; from the intersection of Interstate Highway 45 and Fulgrum Road about 1.5 miles east of the Wilmer-Hutchins School, this pedon is located 1 mile east on Fulgrum Road and 1,800 feet south in a field:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak granular structure; very hard, friable; neutral; clear smooth boundary.

A1—5 to 18 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, friable; moderately alkaline; gradual smooth boundary.

B2t—18 to 40 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate fine subangular and angular blocky; prismatic peds have few patchy clay films; very hard, friable; moderately alkaline; clear smooth boundary.

B3ca—40 to 61 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; many fine threads and few fine concretions of calcium carbonate; hard, friable; calcareous; moderately alkaline; diffuse wavy boundary.

C2—61 to 76 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable; calcareous; moderately alkaline; many fine pores.

The mollic epipedon is 22 to 40 inches thick.

The A horizon is dark grayish brown or dark brown. It is slightly acid to moderately alkaline.

The B2t horizon is brown or dark brown. It is slightly acid to moderately alkaline.

The B3ca horizon is light brownish gray, light yellowish brown, yellowish brown, or light olive brown. It is loam or fine sandy loam and is slightly acid to moderately alkaline. Concretions of calcium carbonate and black concretions (probably of iron and manganese) are few to common. In most pedons, the C horizon has films and threads of calcium carbonate. Its colors are similar to those of the B3ca horizon.

The Smithville soils are taxadjuncts to the Smithville series because free carbonates are at a greater depth than that specified in the range for the series; however, these soils are similar to the soils of the Smithville series in use and management.

Stephen series

The Stephen series is made up of shallow, well drained, clayey soils on uplands. Stephen soils formed in material that derived from soft limestones of the Austin Chalk formation. The slopes range from 1 to 5 percent.

Typical pedon of Stephen silty clay, 1 to 3 percent slopes; from the intersection of Wilson Road and U.S. Highway 67 in Duncanville, this pedon is located 2,100 feet northeast on U.S. Highway 67 and 225 feet west in a pasture:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) silty clay, very dark grayish brown (10YR 2/2) moist; moderate fine blocky structure; very hard, firm but crumbly; common fine roots; about 5 percent, by volume, fine chalk fragments; calcareous; moderately alkaline; clear smooth boundary.

A1—5 to 14 inches; very dark grayish brown (10YR 3/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong very fine and fine subangular blocky structure; very firm, friable; common fragments and pebbles of chalk; calcareous; moderately alkaline; abrupt wavy boundary.

Cr—14 to 20 inches; white, platy and massive chalky limestone; the limestone has a hardness of less than 3 on Mohs' scale.

The solum ranges from 10 to 20 inches in thickness. The content of calcium carbonate ranges from 5 to about 35 percent. Fragments of chalk or chalky limestone range from none to many. In most areas where the soil is near soils of the Eddy series, fragments of chalk are on the surface.

When the soil is dry, the A horizon is dark brown, very dark grayish brown, or dark grayish brown. The A1 horizon is, if present, mainly a silty clay that is 40 to 50 percent clay. The underlying chalky limestone is soft to strongly cemented.

Sunev series

The Sunev series is made up of deep, well drained, loamy soils. Sunev soils formed in highly calcareous loamy sediment on uplands and colluvial footslopes. The slopes range from 1 to 8 percent.

Typical pedon of Sunev clay loam, 3 to 8 percent slopes; from the intersection of Langdon Road and Interstate Highway 45 in Hutchins, this pedon is located 1.25 miles southwest on Langdon Road and 1,000 feet south in a field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky and granular structure; very hard, friable; common fine roots; few snail shell fragments; few black concretions; common worm casts; calcareous; moderately alkaline; abrupt clear boundary.

A1—6 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable; few roots; few snail shell fragments; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—12 to 19 inches; brown (10YR 5/3) clay loam; dark brown (10YR 4/3) moist; moderate very fine subangular blocky structure; hard, friable; few roots; few snail shell fragments; many worm casts; calcareous; moderately alkaline; gradual wavy boundary.

B22ca—19 to 30 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak very fine subangular blocky structure; hard, friable; few shell fragments and few fine chalk fragments; calcareous; moderately alkaline; gradual wavy boundary.

B3ca—30 to 65 inches; very pale brown (10YR 7/4) clay loam, pale brown (10YR 6/3) moist; weak very fine subangular blocky and granular structure; hard, friable; few chalk and shell fragments; common hard concretions of calcium carbonate 2 to 8 mm in diameter; calcareous; moderately alkaline.

The clay content is 25 to 35 percent. The calcium carbonate equivalent ranges from 40 to 65 percent in the control section. In some pedons, gravel beds are below a depth of 40 inches.

In some pedons, the A horizon in noncalcareous. It is 10 to 20 inches thick. When the soil is dry, the A horizon is dark grayish brown, dark brown, or very dark grayish brown.

When the soil is dry, the B horizon is brown, pale brown, very pale brown, yellowish brown, or light yellowish brown. It is clay loam, loam, or silty clay loam. Films, threads, and concretions of calcium carbonate range from a few to as much as 10 percent of the mass.

The C horizon, if present, is light yellowish brown or pale brown. The calcium carbonate equivalent is 35 to 70 percent.

Trinity series

The Trinity series is made up of deep, somewhat poorly drained soils. Trinity soils formed in recent alluvium on flood plains. The slopes are less than 1 percent.

Typical pedon of Trinity clay, frequently flooded; from the Inwood Road crossing, this pedon is located 100 feet downstream and 200 feet north of the river channel, inside the levees in Dallas:

A11—0 to 7 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; very hard, very firm; few fine siliceous pebbles; calcareous; moderately alkaline; clear smooth boundary.

A12—7 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; few slickensides in lower part; extremely hard, very firm; calcareous; moderately alkaline; diffuse smooth boundary.

A13—20 to 45 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; common intersecting slickensides throughout; extremely hard, very firm; calcareous; moderately alkaline; diffuse smooth boundary.

A14—45 to 68 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse blocky structure; extremely hard, very firm; calcareous; moderately alkaline.

The soil is moderately alkaline and calcareous throughout. It has cracks that extend to a depth of more than 30 inches; the cracks are as much as 2 cm wide at a depth of 20 inches. Intersecting slickensides are between depths of 10 to 40 inches.

When the soil is dry, the A horizon is dark gray, very dark gray, or black. The Ap horizon, if present, is very dark grayish brown. In some pedons, the subsurface layer is faintly mottled in shades of olive and olive yellow. In some pedons, the soil has chroma of 2 or more below a depth of about 24 inches; these areas are mainly on flood plains of streams, such as Mesquite Creek, that drain into the East Fork and Elm Fork of the Trinity River. In some pedons, there are calcium carbonate concretions and black concretions (probably of iron and manganese) throughout the pedon.

Vertel series

The Vertel series is made up of sloping to strongly sloping soils that formed in clayey marine sediment on uplands. The slopes range from 5 to 12 percent.

Typical pedon of Vertel clay, 5 to 12 percent slopes; from the intersection of Farm Road 1382 and Camp Wisdom Road, this pedon is located 1.8 miles south on Farm Road 1382 and 100 feet west in rangeland:

A1—0 to 14 inches; olive (5Y 5/3) clay, olive (5Y 4/3) moist; strong fine and medium subangular blocky structure; extremely hard, very firm, very sticky and plastic; few fine and medium roots; common worm casts; few fine pebbles; common pressure faces in lower part; moderately alkaline; gradual wavy boundary.

AC—14 to 24 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots, mainly on the faces of peds; common vertical cracks 1 inch wide; common intersecting slickensides and wedge-shaped parallepipeds; moderately alkaline; gradual wavy boundary.

Cr—24 to 60 inches; dark gray (5Y 4/1) weathered shale and clay, very dark gray (5Y 3/1) moist; common medium distinct olive (5Y 5/3) and dark yellowish brown (10YR 4/4) mottles; strong fine platy rock structure; very hard, very firm; few vertical cracks in upper part; many fine gypsum crystals; medium acid.

The solum is 24 to 40 inches thick. The A and AC horizons are 60 to 76 percent clay. When the soil is dry, cracks 0.5 inch to 1.5 inches wide extend into the upper part of the Cr horizon. Where the soil has not been tilled, there is a gilgai microrelief that has microdepressions 1 to 3 feet wide and 2 to 8 inches deep and microknolls 10 to 16 feet wide that are oriented up and down the slopes.

The A horizon is dark grayish brown, grayish brown, or olive. It is neutral to moderately alkaline. The soil is noncalcareous throughout more than half of any one pedon.

The AC horizon is dark grayish brown, grayish brown, olive gray, olive, light olive brown, or light brownish gray. In some pedons, it has few to common mottles of yellowish brown, olive brown, brown, or yellowish red. The AC horizon is neutral to moderately alkaline. It has few to common gypsum crystals. In some pedons, there are a few fine strongly cemented concretions of calcium carbonate in this horizon.

The Cr horizon is stratified, weathered shale or shale and clay. It is gray, dark gray, yellowish brown, or yellow. In some pedons, the strata are olive brown or yellowish red. The Cr horizon is medium acid to moderately alkaline. It has few to common gypsum crystals.

Wilson series

The Wilson series is made up of deep, somewhat poorly drained, nearly level and gently sloping loamy soils. Wilson soils formed in clayey marine sediment on uplands. The slopes range from 0 to 3 percent.

Typical pedon of Wilson clay loam, 0 to 1 percent slopes; from the intersection of Belt Line Road and Apollo Road in Grand Prairie, this pedon is located 1,050 feet south on Belt Line Road and 100 feet east in idle cropland:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine to medium subangular blocky structure; very hard, firm; mildly alkaline; abrupt wavy boundary.

B21tg—5 to 13 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, very firm; mildly alkaline; gradual wavy boundary.

B22tg—13 to 42 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong medium and coarse blocky structure; few small pressure faces; extremely hard, very firm; neutral; diffuse wavy boundary.

B3g—42 to 56 inches; mottled very dark gray (10YR 3/1) and olive brown (2.5Y 4/4) clay; moderate medium blocky structure; extremely hard, very firm; few fine quartz pebbles; neutral; gradual smooth boundary.

C—56 to 64 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; massive; extremely hard, very firm; many fine concretions of calcium carbonate; calcareous; moderately alkaline.

The soil is saturated in some periods during most years. During wet periods, the soil has a perched water table above the Bt horizon. During dry periods, cracks extend to a depth of 30 inches; they are more than 1 cm wide at a depth of 20 inches. Throughout the B horizon, 60 percent or more of the matrix has chroma of less than 2.

When the soil is dry, the A horizon is very dark gray, dark gray, or dark grayish brown. It is 5 to 10 inches thick. The boundary between the A and B horizons ranges from abrupt to clear and wavy, forming "highs" and "troughs". In some deeper troughs where the A horizon is more than about 8 inches thick, there is a thin A2 horizon about 1 inch thick.

When the soil is dry, the B2tg horizon is very dark gray, dark gray, or black. In some pedons, it has mottles in shades of brown, olive, or yellow. The A horizon and the upper part of the Btg horizon are slightly acid to mildly alkaline.

Formation of the soils

This section briefly describes the five factors of soil formation—parent material, climate, plants and animals, relief, and time.

Parent material

Parent material determines the chemical and mineralogical composition of the soils. The kinds of parent materials and the geologic formations in Dallas County are described as they relate to the soils in the section "Geology"

Climate

The climate in Dallas County is humid subtropical. It is uniform throughout the county. Summers are hot. Rainfall has been sufficient to leach calcium carbonate from the upper horizons of some soils; however, it has not leached carbonates entirely from the soil profile. Clay particles have moved down in the soils, forming horizons that are very slowly permeable. The Crockett and Wilson soils are examples of soils in which this process has occurred.

Plants and animals

Plants and animals help to develop the chemical and physical characteristics of soils. The kinds and amount of plants on a soil are determined partly by climate and parent material. Decaying leaves, stems, and roots add organic matter to the soils, imparting a dark color to the surface layer. Roots form channels that aid in the movement of water and air. Animals such as bacteria, fungi, and other microorganisms, insects, and earthworms help to improve the fertility and physical condition of the soils.

Human activity has also affected the soils. Cultivation reduces the plant cover, thereby decreasing the pore space for air and water movement, reducing the animal population, and lowering fertility.

Relief

Relief affects soil development through its influence on drainage and runoff. If other factors are equal, profile development depends on the amount of water that enters the soil. Steep soils absorb less moisture and generally have less developed profiles than gently sloping soils. Runoff on steep soils is so rapid that geologic erosion almost keeps pace with soil development. Soils in low areas receive water from adjacent slopes, and some are wet for a longer period than are soils in higher positions on the landscape.

Soils can form in similar parent material but have dissimilar profiles due to their different positions on the landscape. The distinctness of horizons and the thickness of the solum are closely related to relief. Gently sloping soils generally have a thick solum and distinct horizons. Steeper soils have a thinner solum and less distinct horizons.

Time

The degree of soil development that takes place through the interaction of parent material, climate, plants and animals, and relief depends on the length of time these factors have been active. Mature profiles that have well defined horizons develop only after a long period of time. Crockett soils are well developed and have distinct horizons. Ovan soils are younger than Crockett soils and therefore are less developed.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the ac-

tivities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Marl. A loose or crumbling earthy deposit (as of sand, silt, or clay) that has a substantial amount of calcium carbonate.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Dallas, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	55.6	35.4	45.5	82	11	58	1.78	.72	2.63	4	1.3
February---	60.1	39.0	49.6	84	17	98	2.05	.91	2.98	4	.5
March------	67.7	46.0	56.8	91	23	278	2.56	.75	4.02	4	.2
April------	76.7	56.0	66.4	92	35	492	4.81	2.09	7.01	6	.0
May--------	83.9	64.1	74.0	97	45	744	4.16	2.10	5.84	6	.0
June-------	91.4	71.9	81.7	101	58	951	3.01	1.00	4.61	4	.0
July-------	95.8	76.2	86.0	106	65	1,116	1.94	.37	3.17	3	.0
August-----	95.7	75.3	85.5	106	64	1,101	2.14	.53	3.41	3	.0
September--	88.2	68.1	78.2	101	50	846	3.77	1.58	5.58	5	.0
October----	78.5	57.2	67.9	94	38	555	3.88	.88	6.23	4	.0
November---	66.0	45.4	55.8	85	25	204	2.69	1.15	3.93	4	.0
December---	58.3	38.3	48.3	82	16	87	2.27	.74	3.48	4	.2
Year-----	76.5	56.1	66.3	107	11	6,530	35.06	26.55	43.03	51	2.2

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Dallas, Texas]

Probability	Temperature: 24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 14	March 18	March 30
2 years in 10 later than--	March 4	March 11	March 24
5 years in 10 later than--	February 13	February 26	March 14
First freezing temperature in fall:			
1 year in 10 earlier than--	November 24	November 15	October 31
2 years in 10 earlier than--	December 4	November 23	November 8
5 years in 10 earlier than--	December 22	December 8	November 22

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Dallas, Texas]

Probability	Daily minimum temperature: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	278	259	222
8 years in 10	288	268	232
5 years in 10	307	285	253
2 years in 10	328	301	273
1 year in 10	349	310	283

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map Unit	Extent of area	Cultivated crops	Pasture	Urban uses	Recreation areas	Sanitary facilities
	Pct					
1. Houston Black-Heiden	29	High	High	Low: too clayey, shrink-swell, low strength, corrosivity.	Low: too clayey, percs slowly.	Low: too clayey, percs slowly.
2. Eddy-Stephen-Austin	20	Low: rooting depth, slope.	Low: rooting depth, droughty, slope.	Medium: depth to rock, slope, corrosivity.	Medium: depth to rock, slope, percs slowly, too clayey.	Low: depth to rock, percs slowly.
3. Trinity-Frio	19	Low: floods.	High	Very low: floods, shrink-swell, too clayey, percs slowly.	Low: floods, percs slowly, too clayey, shrink-swell	Low: floods, percs slowly, too clayey.
4. Austin-Houston Black	14	High	High	Low: depth to rock, shrink-swell, low strength, corrosivity.	Low: too clayey, percs slowly.	Low: too clayey, percs slowly.
5. Wilson-Rader-Axtell	8	Medium: too clayey, droughty.	Medium: wetness, low fertility.	Medium: shrink-swell, low strength, wetness.	Low: percs slowly, too clayey, wetness.	Low: too clayey. percs slowly, wetness.
6. Ferris-Heiden	6	Low: too clayey, droughty.	Medium: droughty.	Low: slope, too clayey, shrink-swell, low strength, corrosivity.	Low: too clayey, percs slowly, erodes easily.	Low: too clayey percs slowly.
7. Silawa-Silstid-Bastsil	4	High	Medium: low fertility.	High	High	Medium: too sandy, seepage.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Altoga silty clay, 5 to 12 percent slopes, eroded	7,610	1.3
2	Arents, loamy, gently undulating	2,390	0.4
3	Arents, loamy, hilly	8,840	1.5
4	Arents, clayey, gently undulating	620	0.1
5	Austin silty clay, 1 to 3 percent slopes	16,720	2.9
6	Austin silty clay, 3 to 5 percent slopes	4,400	0.8
7	Austin-Lewisville complex, 5 to 8 percent slopes, eroded	4,050	0.7
8	Austin-Urban land complex, 0 to 2 percent slopes	17,400	3.0
9	Austin-Urban land complex, 2 to 5 percent slopes	12,040	2.1
10	Axtell fine sandy loam, 0 to 1 percent slopes	540	0.1
11	Axtell fine sandy loam, 1 to 3 percent slopes	3,310	0.6
12	Axtell fine sandy loam, 2 to 5 percent slopes, eroded	1,330	0.2
13	Axtell-Urban land complex, 1 to 5 percent slopes	3,610	0.6
14	Bastsil fine sandy loam, 0 to 3 percent slopes	1,240	0.2
15	Bastsil-Urban land complex, 0 to 2 percent slopes	4,100	0.7
16	Brackett loam, 3 to 5 percent slopes	740	0.1
17	Branyon clay, 0 to 1 percent slopes	13,190	2.3
18	Burleson clay, 0 to 1 percent slopes	6,720	1.2
19	Burleson clay, 1 to 3 percent slopes	5,800	1.0
20	Crockett fine sandy loam, 0 to 1 percent slopes	1,030	0.2
21	Crockett fine sandy loam, 1 to 3 percent slopes	1,480	0.3
22	Crockett fine sandy loam, 2 to 5 percent slopes, eroded	680	0.1
23	Dalco clay, 1 to 3 percent slopes	3,450	0.6
24	Dalco-Urban land complex, 0 to 3 percent slopes	11,880	2.1
25	Dutek loamy fine sand, 1 to 5 percent slopes	2,400	0.4
26	Eddy clay loam, 1 to 3 percent slopes	6,320	1.1
27	Eddy clay loam, 3 to 8 percent slopes	6,460	1.1
28	Eddy-Brackett complex, 8 to 20 percent slopes	7,730	1.3
29	Eddy-Brackett-Urban land complex, 8 to 15 percent slopes	1,770	0.3
30	Eddy-Stephen complex, 1 to 5 percent slopes	3,290	0.6
31	Eddy-Urban land complex, 1 to 4 percent slopes	3,950	0.7
32	Eddy-Urban land complex, 4 to 8 percent slopes	9,500	1.6
33	Eufaula loamy fine sand, 0 to 2 percent slopes	240	([1])
34	Ferris-Heiden complex, 5 to 12 percent slopes	27,700	4.8
35	Ferris-Urban land complex, 5 to 12 percent slopes	5,220	0.9
36	Frio silty clay, occasionally flooded	6,050	1.1
37	Frio silty clay, frequently flooded	9,530	1.7
38	Frio-Urban land complex	7,140	1.2
39	Gowen loam, occasionally flooded	1,170	0.2
40	Gowen loam, frequently flooded	740	0.1
41	Heiden clay, 1 to 3 percent slopes	7,990	1.4
42	Heiden clay, 2 to 5 percent slopes, eroded	20,200	3.5
43	Houston Black clay, 0 to 1 percent slopes	15,330	2.7
44	Houston Black clay, 1 to 3 percent slopes	44,770	7.8
45	Houston Black-Urban land complex, 0 to 4 percent slopes	45,530	7.9
46	Lewisville silty clay, 1 to 3 percent slopes	4,220	0.7
47	Lewisville silty clay, 3 to 5 percent slopes	5,210	0.9
48	Lewisville silty clay, 5 to 8 percent slopes	1,440	0.2
49	Lewisville-Urban land complex, 0 to 4 percent slopes	8,580	1.5
50	Lewisville-Urban land complex, 4 to 8 percent slopes	3,590	0.6
51	Mabank fine sandy loam, 0 to 1 percent slopes	1,790	0.3
52	Mabank fine sandy loam, 1 to 3 percent slopes	660	0.1
53	Normangee clay loam, 1 to 3 percent slopes	1,970	0.3
54	Ovan clay, occasionally flooded	2,950	0.5
55	Ovan clay, frequently flooded	4,920	0.9
56	Pits and Dumps	980	0.2
57	Rader-Mabank complex, 0 to 2 percent slopes	3,220	0.6
58	Rader-Urban land complex, 0 to 2 percent slopes	10,070	1.8
59	Seagoville clay, occasionally flooded	2,500	0.4

See footnote at end of table.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
60	Silawa fine sandy loam, 1 to 3 percent slopes	3,180	0.6
61	Silawa fine sandy loam, 3 to 8 percent slopes	1,950	0.3
62	Silawa fine sandy loam, 2 to 8 percent slopes, eroded	3,400	0.6
63	Silawa-Urban land complex, 2 to 6 percent slopes	1,930	0.3
64	Silstid loamy fine sand, 0 to 3 percent slopes	5,400	0.9
65	Silstid-Urban land complex, 0 to 6 percent slopes	1,800	0.3
66	Smithville loam	330	0.1
67	Stephen silty clay, 1 to 3 percent slopes	6,210	1.1
68	Stephen silty clay, 3 to 5 percent slopes	1,200	0.2
69	Stephen-Urban land complex, 1 to 4 percent slopes	15,500	2.7
70	Sunev clay loam, 1 to 3 percent slopes	340	0.1
71	Sunev clay loam, 3 to 8 percent slopes	1,830	0.3
72	Trinity clay, occasionally flooded	24,370	4.2
73	Trinity clay, frequently flooded	29,200	5.1
74	Trinity-Urban land complex	8,900	1.6
75	Urban land	8,210	1.4
76	Ustorthents, undulating	240	(1)
77	Vertel clay, 5 to 12 percent slopes	4,320	0.7
78	Wilson clay loam, 0 to 1 percent slopes	3,780	0.7
79	Wilson clay loam, 1 to 3 percent slopes	3,490	0.6
80	Wilson-Urban land complex, 0 to 2 percent slopes	8,290	1.4
	Water	25,110	4.3
	Total	577,280	100.0

[1]Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermuda-grass
	Lb	Bu	Bu	Bu	AUM[1]
Altoga:					
1	---	---	---	---	3.5
Arents:					
2	---	---	---	---	6.5
3	---	---	---	---	4.0
4	---	---	---	---	5.0
Austin:					
5	350	75	30	70	7.0
6	300	65	---	50	6.0
7[2]	---	---	---	---	6.1
8[2]	---	---	---	---	---
9[2]	---	---	---	---	---
Axtell:					
10	250	45	---	---	6.5
11	250	40	---	---	6.5
12	150	30	---	---	5.0
13[2]	---	---	---	---	---
Bastsil:					
14, 15[2]	350	80	55	80	7.0
Brackett:					
16	---	---	10	20	2.0
Branyon:					
17	450	85	30	70	8.0
Burleson:					
18	400	85	30	70	8.0
19	450	80	30	70	8.0
Crockett:					
20	350	50	25	45	7.0
21	350	50	25	45	7.0
22	200	40	---	---	5.5
Dalco:					
23, 24[2]	400	80	---	---	---
Dutek:					
25	---	40	---	---	5.5

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermuda-grass
	Lb	Bu	Bu	Bu	AUM[1]
Eddy:					
26	---	---	15	30	2.5
27	---	---	---	---	---
28[2]	---	---	---	---	---
29[2]	---	---	---	---	---
30[2]	---	---	---	---	---
31[2]	---	---	---	---	---
32[2]	---	---	---	---	---
Eufaula:					
33	---	25	---	---	4.5
Ferris:					
34[2]	---	---	---	---	4.5
35[2]	---	---	---	---	---
Frio:					
36	450	80	---	65	7.5
37	---	---	---	---	7.0
38[2]	---	---	---	---	---
Gowen:					
39	500	70	30	---	---
40	---	---	---	---	---
Heiden:					
41	400	75	35	70	7.5
42	300	45	30	60	5.5
Houston Black:					
43	500	90	35	70	8.0
44	450	85	35	70	8.0
45[2]	---	---	---	---	---
Lewisville:					
46	500	80	35	70	8.0
47	375	70	30	60	7.5
48	---	60	---	50	6.0
49[2]	---	---	---	---	---
50[2]	---	---	---	---	---
Mabank:					
51	330	55	---	50	6

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermudagrass
	Lb	Bu	Bu	Bu	AUM[1]
Mabank:					
52	300	45	---	50	6
Normangee:					
53	300	50	30	50	7.5
Ovan:					
54	400	90	35	80	8.0
55	---	---	---	---	8.0
Pits and Dumps:					
56.					
Rader:					
57[2]	---	60	30	65	8.0
58[2]	---	---	---	---	---
Seagoville:					
59	---	80	40	60	8.0
Silawa:					
60	350	55	---	---	6.5
61, 62	---	---	---	---	5.5
63[2]	---	---	---	---	---
Silstid:					
64	---	40	---	---	5.5
65[2]	---	---	---	---	---
Smithville:					
66	500	90	40	70	9.0
Stephen:					
67	250	55	25	45	4.0
68	150	45	20	40	3.5
69[2]	---	---	---	---	---
Sunev:					
70	275	60	30	60	7.0
71	---	30	---	40	5.5
Trinity:					
72	450	90	35	80	8.0
73	---	---	---	---	8.0
74[2]	---	---	---	---	---
Urban land:					
75.					
Ustorthents:					
76.					
Vertel:					
77	---	---	---	---	3.0

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Grain sorghum	Wheat	Oats	Improved bermuda-grass
	Lb	Bu	Bu	Bu	AUM[1]
Wilson:					
78	350	55	30	65	6.0
79	300	45	30	60	6.0
80[2]	---	---	---	---	---

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.
[2]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for the composition and behavior characteristics of the map unit.

TABLE 7.--RANGE PRODUCTIVITY AND COMPOSITION

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Altoga:					
1	Clay Loam	Favorable	6,500	Little bluestem	35
		Normal	5,000	Big bluestem	20
		Unfavorable	3,800	Indiangrass	15
				Switchgrass	5
				Florida paspalum	5
				Virginia wildrye	5
				Sideoats grama	5
Austin:					
5, 6	Clay Loam	Favorable	6,500	Little bluestem	40
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	15
				Sideoats grama	5
				Switchgrass	5
				Silver bluestem	5
				Texas needlegrass	5
7:					
Austin part	Clay Loam	Favorable	6,500	Little bluestem	40
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	15
				Sideoats grama	5
				Switchgrass	5
				Silver bluestem	5
				Texas needlegrass	5
Lewisville part	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,500	Indiangrass	15
		Unfavorable	3,500	Big bluestem	15
				Switchgrass	10
				Texas needlegrass	5
				Virginia wildrye	5
				Torrey silver bluestem	5
				Meadow dropseed	5
				Buffalograss	5
				Sideoats grama	5
Axtell:					
10	Claypan Savannah	Favorable	5,000	Little bluestem	25
		Normal	3,500	Sideoats grama	15
		Unfavorable	2,500	Indiangrass	10
				Beaked panicum	5
				Purpletop	5
				Florida paspalum	5
				Tall dropseed	5
11, 12	Claypan Savannah	Favorable	5,000	Little bluestem	25
		Normal	3,500	Sideoats grama	15
		Unfavorable	2,500	Indiangrass	10
				Beaked panicum	5
				Purpletop	5
				Florida paspalum	5
				Tall dropseed	5
Bastsil:					
14	Sandy Loam	Favorable	5,000	Little bluestem	50
		Normal	4,000	Indiangrass	10
		Unfavorable	2,000	Switchgrass	5
				Purpletop	5
				Sideoats grama	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				Lindheimer hackberry	5

TABLE 7.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Brackett:					
16	Adobe	Favorable	4,000	Little bluestem	40
		Normal	3,200	Sideoats grama	8
		Unfavorable	1,800	Tall grama	7
				Indiangrass	5
				Silver bluestem	5
Branyon:					
17	Blackland	Favorable	7,000	Little bluestem	50
		Normal	5,500	Indiangrass	13
		Unfavorable	3,500	Big bluestem	12
Burleson:					
18, 19	Blackland	Favorable	7,000	Little bluestem	40
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Sideoats grama	5
				Texas needlegrass	5
				Silver bluestem	5
				Tall dropseed	5
Crockett:					
20, 21, 22	Claypan Prairie	Favorable	6,000	Little bluestem	10
		Normal	5,000	Indiangrass	10
		Unfavorable	3,000	Virginia wildrye	10
				Florida paspalum	10
				Sideoats grama	10
				Texas needlegrass	10
				Silver bluestem	10
				Paspalum	10
				Big bluestem	5
Dalco:					
23	Blackland	Favorable	6,000	Little bluestem	50
		Normal	5,000	Indiangrass	25
		Unfavorable	3,500	Switchgrass	5
				Sideoats grama	5
				Vine-mesquite	5
Dutek:					
25	Sandy	Favorable	4,500	Little bluestem	35
		Normal	4,000	Indiangrass	10
		Unfavorable	2,000	Post oak	10
				Blackjack oak	10
				Switchgrass	5
				Purpletop	5
				Silver bluestem	5
				Greenbrier	5
Eddy:					
26, 27	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5
Eddy:					
28:					
Eddy part	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5

TABLE 7.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Eddy:					
28:					
Brackett part	Steep Adobe	Favorable	3,000	Little bluestem	30
		Normal	2,200	Sideoats grama	10
		Unfavorable	1,500	Tall grama	10
				Indiangrass	10
				Tall dropseed	5
				Silver bluestem	5
				Slim tridens	5
				Hairy grama	5
30:					
Eddy part	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5
Stephen part	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5
Eufaula:					
33	Deep Sand	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand bluestem	10
				Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
Ferris:					
34:					
Ferris part	Eroded Blackland	Favorable	7,000	Little bluestem	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Switchgrass	5
				Florida paspalum	5
				Eastern gamagrass	5
				Virginia wildrye	5
				Sideoats grama	5
				Texas needlegrass	5
				Meadow dropseed	5
Heiden part	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
Frio:					
36, 37	Loamy Bottomland	Favorable	5,500	Big bluestem	10
		Normal	4,000	Little bluestem	10
		Unfavorable	3,000	Vine-mesquite	10
				Switchgrass	5
				Indiangrass	5
				Eastern gamagrass	5
				Texas needlegrass	5
				Plains lovegrass	5
				Canada wildrye	5
				Cane bluestem	5
				Southwestern bristlegrass	5

TABLE 7.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Gowen:					
39, 40	Loamy Bottomland	Favorable	8,000	Indiangrass	20
		Normal	5,500	Big bluestem	15
		Unfavorable	4,000	Little bluestem	15
				Switchgrass	10
				Tall dropseed	5
				Sideoats grama	5
				Vine-mesquite	5
				Texas needlegrass	5
Heiden:					
41, 42	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
Houston Black:					
43, 44	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Indiangrass	25
		Unfavorable	3,500	Switchgrass	5
				Sideoats grama	5
				Vine-mesquite	5
Lewisville:					
46, 47, 48	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,500	Indiangrass	15
		Unfavorable	3,500	Big bluestem	15
				Switchgrass	10
				Texas needlegrass	5
				Virginia wildrye	5
				Torrey silver bluestem	5
				Meadow dropseed	5
				Buffalograss	5
				Sideoats grama	5
Mabank:					
51, 52	Claypan Prairie	Favorable	6,000	Little bluestem	30
		Normal	5,000	Big bluestem	15
		Unfavorable	3,000	Indiangrass	15
				Switchgrass	10
				Virginia wildrye	5
				Texas needlegrass	5
				Torrey silver bluestem	5
				Meadow dropseed	5
Normangee:					
53	Claypan Prairie	Favorable	5,500	Little bluestem	45
		Normal	4,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Switchgrass	10
				Florida paspalum	5
				Sideoats grama	5
Ovan:					
54, 55	Clayey Bottomland	Favorable	7,500	Little bluestem	40
		Normal	6,000	Canada wildrye	15
		Unfavorable	4,000	Big bluestem	10
				Purpletop	10
				Texas needlegrass	5
				American elm	5
				Pecan	5
Rader:					
57:					
Rader part	Sandy Loam	Favorable	6,000	Little bluestem	40
		Normal	4,500	Post oak	10
		Unfavorable	3,500	Indiangrass	5
				Switchgrass	5
				Paspalum	5
				Purpletop	5
				Beaked panicum	5
				Sedge	5

TABLE 7.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Rader:					
57:					
Mabank part	Claypan Prairie	Favorable	6,000	Little bluestem	40
		Normal	4,500	Post oak	10
		Unfavorable	3,500	Indiangrass	5
				Switchgrass	5
				Eastern gamagrass	5
				Paspalum	5
				Purpletop	5
				Beaked panicum	5
				Sedge	5
				Longleaf uniola	5
Seagoville:					
59	Clayey Bottomland	Favorable	7,500	Little bluestem	40
		Normal	6,000	Canada wildrye	15
		Unfavorable	4,000	Big bluestem	10
				Purpletop	10
				Texas needlegrass	5
				American elm	5
				Pecan	5
Silawa:					
60, 61, 62	Sandy Loam	Favorable	5,500	Little bluestem	50
		Normal	4,500	Indiangrass	10
		Unfavorable	2,500	Switchgrass	5
				Purpletop	5
				Sideoats grama	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				Hackberry	5
Silstid:					
64	Sandy	Favorable	4,500	Little bluestem	50
		Normal	4,000	Indiangrass	10
		Unfavorable	2,000	Crinkleawn	5
				Purpletop	5
				Switchgrass	5
				Fringeleaf paspalum	5
				Post oak	5
				Blackjack oak	5
Smithville:					
66	Loamy Bottomland	Favorable	7,500	Virginia wildrye	15
		Normal	6,000	Beaked panicum	8
		Unfavorable	4,000	Rustyseed paspalum	7
				Switchgrass	5
				Indiangrass	5
				Little bluestem	5
				White tridens	5
				Eastern gamagrass	5
Stephen:					
67, 68	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5

TABLE 7.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Sunev:					
70, 71	Clay Loam	Favorable	7,000	Little bluestem	50
		Normal	5,500	Indiangrass	15
		Unfavorable	3,500	Big bluestem	10
Trinity:					
72, 73	Clayey Bottomland	Favorable	6,500	Virginia wildrye	15
		Normal	4,000	Sedge	15
		Unfavorable	3,000	Eastern gamagrass	10
				Switchgrass	10
				Indiangrass	10
				Giant cane	5
				Beaked panicum	5
				Panicum	5
Vertel:					
77	Eroded Blackland	Favorable	5,000	Little bluestem	40
		Normal	4,000	Big bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	10
				Virginia wildrye	5
				Vine-mesquite	5
				Texas needlegrass	5
Wilson:					
78, 79	Claypan Prairie	Favorable	6,000	Little bluestem	45
		Normal	4,500	Indiangrass	10
		Unfavorable	3,000	Big bluestem	10
				Virginia wildrye	5
				Vine-mesquite	5
				Florida paspalum	5
				Sideoats grama	5
				Texas needlegrass	5
				Silver bluestem	5

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Altoga:					
1	Moderate: too clayey.	Severe: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Arents:					
2	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
3	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
4	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Austin:					
5, 6	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
7[1]:					
Austin part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Lewisville part	Moderate: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
8[1]:					
Austin part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Urban land part.					
9[1]:					
Austin part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Urban land part.					
Axtell:					
10, 11, 12	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
13[1]:					
Axtell part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Urban land part.					
Bastsil:					
14, 15[1]	Slight	Slight	Slight	Slight	Moderate: low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Brackett:					
16	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Branyon:					
17	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Burleson:					
18, 19	Severe: too clayey, cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Crockett:					
20, 21, 22	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Dalco:					
23, 24	Severe: too clayey, depth to rock, cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell, corrosive.	Severe: shrink-swell.
Dutek:					
25	Moderate: cutbanks cave.	Slight	Slight	Slight	Slight.
Eddy:					
26	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
27	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.
28[1]:					
Eddy part	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope.
Brackett part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: depth to rock.
29[1]:					
Eddy part	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: depth to rock, slope.
Brackett part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: depth to rock.
Urban land part.					
30[1]:					
Eddy part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Stephen part	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Eddy:					
31:					
Eddy part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Urban land part.					
32:					
Eddy part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.
Urban land part.					
Eufaula:					
33	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Ferris:					
34:					
Ferris part	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Heiden part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
35:					
Ferris part	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Urban land part.					
Frio:					
36, 37	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
38[1]:					
Frio part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Urban land part.					
Gowen:					
39	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Moderate: shrink-swell, floods.
40	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Heiden:					
41, 42	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Houston Black:					
43, 44	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
45:					
Houston Black part	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Urban land part.					
Lewisville:					
46, 47, 48	Moderate: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
49[1], 50[1]:					
Lewisville part	Moderate: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Urban land part.					
Mabank:					
51, 52	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.
Normangee:					
53	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell, low strength.
Ovan:					
54	Severe: too clayey, cutbanks cave.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
55	Severe: too clayey, cutbanks cave.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Pits and Dumps: 56.					
Rader:					
57[1]:					
Rader part	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.
Mabank part	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Rader:					
58:					
Rader part-----	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.
Urban land part.					
Seagoville:					
59---------------	Severe: floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Silawa:					
60---------------	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: low strength.
61, 62-----------	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.
63:					
Silawa part----	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.
Urban land part.					
Silstid:					
64---------------	Moderate: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
65:					
Silstid part---	Moderate: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Slight.
Urban land part.					
Smithville:					
66---------------	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Stephen:					
67, 68-----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
69:					
Stephen part---	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Urban land part.					
Sunev:					
70---------------	Slight-----------	Slight-----------	Slight-----------	Slight------------	Moderate: low strength.
71---------------	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Moderate: low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Trinity:					
72	Severe: wetness, floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: shrink-swell.
73	Severe: wetness, floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell.
74:					
Trinity part	Severe: wetness, floods, too clayey, cutbanks cave.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: shrink-swell.
Urban land part.					
Urban land: 75.					
Ustorthents: 76.					
Vertel:					
77	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Wilson:					
78, 79	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
80:[1]					
Wilson part	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Urban land part.					

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair" and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Altoga:					
1	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey.
Arents:					
2	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
3	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
4	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Austin:					
5, 6	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
7[1]:					
Austin part	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
Lewisville part	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.
8[1], 9[1]:					
Austin part	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
Urban land part.					
Axtell:					
10	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
11, 12	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
13[1]:					
Axtell part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Urban land part.					
Bastsil:					
14, 15[1]	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Brackett:					
16	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Branyon:					
17	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Burleson:					
18	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
19	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Crockett:					
20	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
21, 22	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Dalco:					
23, 24	Severe: percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
Dutek:					
25	Slight	Moderate: seepage, slope.	Severe: too sandy, seepage.	Slight	Fair: too sandy.
Eddy:					
26, 27	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
28[1], 29[1]:					
Eddy part	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Brackett part	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer.
Urban land part.					
30:[1]					
Eddy part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Stephen part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
31[1], 32[1]:					
Eddy part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Urban land part.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Eufaula:					
33	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Ferris:					
34[1]:					
Ferris part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Heiden part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
35[1]:					
Ferris part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Urban land part.					
Frio:					
36, 37	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.
38[1]:					
Frio part	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.
Urban land part.					
Gowen:					
39	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
40	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Heiden:					
41, 42	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Houston Black:					
43	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
44	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
45[1]:					
Houston Black part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Urban land part.					
Lewisville:					
46, 47, 48	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.
49[1], 50[1]:					
Lewisville part	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Fair: too clayey.
Urban land part.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mabank:					
51	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
52	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
Normangee:					
53	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Ovan:					
54	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
55	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey.
Pits and Dumps: 56.					
Rader:					
57[1]:					
Rader part	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Fair: too clayey.
Mabank part	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
58[1]:					
Rader part	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Fair: too clayey.
Urban land part.					
Seagoville:					
59	Severe: floods, percs slowly.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods.	Poor: too clayey.
Silawa:					
60, 61, 62	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
63:[1]					
Silawa part	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Urban land part.					
Silstid:					
64	Slight	Moderate: seepage.	Slight	Slight	Poor: too sandy.
65[1]:					
Silstid part	Slight	Moderate: seepage, slope.	Slight	Slight	Poor: too sandy.
Urban land part.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Smithville:					
66	Slight	Moderate: seepage.	Slight	Slight	Good.
Stephen:					
67, 68	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
69[1]:					
Stephen part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
Urban land part.					
Sunev:					
70, 71	Slight	Severe: seepage.	Slight	Slight	Fair: excess lime.
Trinity:					
72	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
73	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
74[1]:					
Trinity part	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
Urban land part.					
Urban land:					
75.					
Ustorthents:					
76.					
Vertel:					
77	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Wilson:					
78	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
79	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
80[1]:					
Wilson part	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
Urban land part.					

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Altoga:				
1	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Arents:				
2	Fair: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
3	Fair: shrink-swell, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
4	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Austin:				
5, 6	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
7[1]:				
Austin part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lewisville part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
8[1], 9[1]:				
Austin part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Axtell:				
10, 11, 12	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
13[1]:				
Axtell part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Urban land part.				
Bastsil:				
14, 15[1]	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Brackett:				
16	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Branyon:				
17	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Burleson:				
18, 19	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Crockett:				
20, 21, 22	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Dalco:				
23, 24[1]	Poor: too clayey, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Dutek:				
25	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Eddy:				
26, 27	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
28[1]:				
Eddy part	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Brackett part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
29[1]:				
Eddy part	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Brackett part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Urban land part.				
30[1]:				
Eddy part	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Stephen part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
31[1], 32[1]:				
Eddy part	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Urban land part.				

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Eufaula:				
33	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Ferris:				
34[1]:				
Ferris part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Heiden part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
35[1]:				
Ferris part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Frio:				
36, 37	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
38[1]:				
Frio part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land part.				
Gowen:				
39, 40	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Heiden:				
41, 42	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Houston Black:				
43, 44	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
45:[1]				
Houston Black part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Lewisville:				
46, 47, 48	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
49[1], 50[1]:				
Lewisville part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mabank:				
51, 52	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Normangee:				
53	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Ovan:				
54, 55	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Pits and Dumps: 56.				
Rader:				
57[1]:				
Rader part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Mabank part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
58[1]:				
Rader part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Urban land part.				
Seagoville:				
59	Poor: shrink-swell.	Fair: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Silawa:				
60, 61, 62	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
63[1]:				
Silawa part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land part.				
Silstid:				
64	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
65[1]:				
Silstid part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Urban land part.				
Smithville:				
66	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Stephen:				
67, 68	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Stephen:				
69[1]:				
Stephen part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Sunev:				
70, 71	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Trinity:				
72, 73	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
74[1]:				
Trinity part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				
Urban land: 75.				
Ustorthents: 76.				
Vertel:				
77	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Wilson:				
78, 79	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
80[1]:				
Wilson part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Urban land part.				

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Altoga:					
1	Moderate: seepage.	Moderate: unstable fill.	Not needed	Favorable	Favorable.
Arents:					
2	Severe: seepage.	Moderate: low strength.	Floods	Complex slope	Favorable.
3	Severe: seepage.	Moderate: low strength.	Slope	Slope	Slope.
4	Slight	Moderate: unstable fill, compressible.	Percs slowly	Percs slowly	Percs slowly.
Austin:					
5, 6	Severe: depth to rock.	Moderate: compressible.	Not needed	Favorable	Favorable.
7:[1]					
Austin part	Severe: depth to rock.	Moderate: compressible.	Not needed	Favorable	Favorable.
Lewisville part	Moderate: seepage.	Moderate: unstable fill.	Favorable	Favorable	Favorable.
8, 9[1]:					
Austin part	Severe: depth to rock.	Moderate: compressible.	Not needed	Favorable	Favorable.
Urban land part.					
Axtell:					
10, 11, 12	Slight	Moderate: unstable fill.	Complex slope, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
13:[1]					
Axtell part	Slight	Moderate: unstable fill.	Complex slope, percs slowly.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Urban land part.					
Bastsil:					
14, 15[1]	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Favorable.
Brackett:					
16	Severe: seepage.	Severe: thin layer.	Depth to rock	Depth to rock, rooting depth.	Droughty, rooting depth.
Branyon:					
17	Slight	Moderate: compressible, piping.	Percs slowly, cutbanks cave.	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Burleson:					
18, 19	Slight	Moderate: unstable fill, hard to pack.	Percs slowly	Percs slowly	Percs slowly.
Crockett:					
20, 21, 22	Slight	Moderate: unstable fill, compressible.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Dalco:					
23, 24:[1]	Severe: depth to rock.	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly.
Dutek:					
25	Moderate: seepage.	Moderate: piping.	Not needed	Too sandy, erodes easily.	Erodes easily.
Eddy:					
26, 27	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
28:[1]					
Eddy part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
Brackett part	Severe: seepage.	Severe: thin layer.	Depth to rock	Depth to rock, rooting depth.	Droughty, rooting depth.
29:[1]					
Eddy part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
Brackett part	Severe: seepage.	Severe: thin layer.	Depth to rock	Depth to rock, rooting depth.	Droughty, rooting depth.
Urban land part.					
30:[1]					
Eddy part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
Stephen part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
31, 32[1]:					
Eddy part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
Urban land part.					
Eufaula:					
33	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
Ferris:					
34:[1]					
Ferris part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ferris:					
Heiden part	Slight	Moderate: unstable fill, shrink-swell.	Not needed	Slope	Percs slowly, slope.
35:[1]					
Ferris part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Urban land part.					
Frio:					
36, 37	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable.
38:[1]					
Frio part	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable.
Urban land part.					
Gowen:					
39	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable.
40	Moderate: seepage.	Moderate: compressible.	Not needed	Wetness	Favorable.
Heiden:					
41, 42	Slight	Moderate: unstable fill, shrink-swell.	Not needed	Percs slowly	Percs slowly.
Houston Black:					
43, 44	Slight	Moderate: compressible, unstable fill.	Percs slowly	Percs slowly	Percs slowly.
45:[1]					
Houston Black part	Slight	Moderate: compressible, unstable fill.	Percs slowly	Percs slowly	Percs slowly.
Urban land part.					
Lewisville:					
46, 47, 48	Moderate: seepage.	Moderate: unstable fill.	Favorable	Favorable	Favorable.
49, 50[1]:					
Lewisville part	Moderate: seepage.	Moderate: unstable fill.	Favorable	Favorable	Favorable.
Urban land part.					
Mabank:					
51, 52	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Normangee:					
53	Slight	Moderate: unstable fill.	Not needed	Slow intake, erodes easily, percs slowly.	Percs slowly, erodes easily.
Ovan:					
54, 55	Slight	Moderate: low strength.	Not needed	Percs slowly	Percs slowly.
Pits and Dumps:					
56:					
Rader:					
57:[1]					
Rader part	Slight	Moderate: unstable fill.	Complex slope	Wetness, percs slowly.	Wetness, percs slowly.
Mabank part	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly.
58:[1]					
Rader part	Slight	Moderate: unstable fill.	Complex slope	Wetness, percs slowly.	Wetness, percs slowly.
Urban land part.					
Seagoville:					
59	Severe: seepage.	Fair: unstable fill.	Not needed	Not needed	Percs slowly.
Silawa:					
60, 61, 62	Severe: seepage.	Moderate: piping, erodes easily.	Not needed	Erodes easily	Erodes easily.
63:[1]					
Silawa part	Severe: seepage.	Moderate: piping, erodes easily.	Not needed	Erodes easily	Erodes easily.
Urban land part.					
Silstid:					
64	Moderate: seepage.	Moderate: piping.	Not needed	Too sandy	Erodes easily.
65:[1]					
Silstid part	Moderate: seepage.	Moderate: piping.	Not needed	Too sandy	Erodes easily.
Urban land part.					
Smithville:					
66	Severe: seepage.	Moderate: compressible.	Favorable	Favorable	Favorable.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Stephen:					
67, 68	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
69:[1]					
Stephen part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, rooting depth.	Droughty, rooting depth.
Urban land part.					
Sunev:					
70, 71	Severe: seepage.	Moderate: compressible, piping.	Not needed	Favorable	Favorable.
Trinity:					
72	Slight	Moderate: compressible, unstable fill.	Percs slowly, floods.	Floods, wetness, percs slowly.	Wetness, percs slowly.
73	Slight	Moderate: compressible, unstable fill.	Percs slowly, floods.	Floods, wetness, percs slowly.	Floods, wetness, percs slowly.
74:[1]					
Trinity part	Slight	Moderate: compressible, unstable fill.	Percs slowly, floods.	Floods, wetness, percs slowly.	Wetness, percs slowly.
Urban land part.					
Urban land: 75.					
Ustorthents: 76.					
Vertel:					
77	Slight	Moderate: compressible, unstable fill.	Not needed	Percs slowly	Percs slowly.
Wilson:					
78, 79	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly.
80:[1]					
Wilson part	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly.
Urban land part.					

[1]This map unit is made up of two or more dominant kinds of soil. See description of the map unit for composition and behavior characteristics.

TABLE 12.--ELECTRICAL RESISTIVITY AND CORROSION POTENTIAL OF SELECTED SOILS

Soil name	Depth	Electrical resistivity	Corrosion potential for uncoated steel
	Ft	Ohms/cm3	
Altoga silty clay (2 profiles)	0-3	1,100-1,300	High
	3-6	800-1,400	High
	6-10	800-1,800	High
Axtell fine sandy loam (6 profiles)	0-1	5,800-7,500	Low[1]
	1-3	1,500-1,900	High
	3-6	800-1,900	High
	6-10	600-800	High
Bastsil fine sandy loam (1 profile)	0-1	87,000	Low
	1-3	7,600	Low[1]
	3-6	9,000	Low[1]
	6-10	19,000	Low[1]
Branyon clay (3 profiles)	0-3	500-900	High
	3-6	600-700	High
	6-10	800-900	High
	10-15	900-1,700	High
Burleson clay (1 profile)	0-3	900	High
	3-6	800	High
	6-10	700	High
Crockett fine sandy loam (1 profile)	0-1	4,800	Moderate
	1-3	900	High
	3-6	600	High
	6-10	3,200	Moderate[1]
Ferris clay (4 profiles)	0-2	800-1,100	High
	2-6	400-1,300	High
	6-10	500-1,000	High
Frio silty clay (1 profile)	0-2	1,500	High
	2-6	800	High
	6-10	600	High
Gowen loam (1 profile)	0-2	3,000	Moderate
	2-3	2,900	Moderate
	3-6	1,300	High[1]
	6-10	900	High[1]
Lewisville silty clay (2 profiles)	0-3	900-1,200	High
	3-6	1,100-1,500	High
	6-10	1,200-1,400	High
Mabank fine sandy loam (2 profiles)	0-1	2,100-3,800	Moderate
	1-3	1,200-1,700	High
	3-6	800-2,100	High
	6-10	1,100-2,100	High

See footnote at end of table.

TABLE 12.--ELECTRICAL RESISTIVITY AND CORROSION POTENTIAL OF SELECTED SOILS

Soil name	Depth	Electrical resistivity	Corrosion potential for uncoated steel
	Ft	Ohms/cm3	
Silawa fine sandy loam (4 profiles)	0-1	5,200-23,000	Low
	1-3	4,300-5,600	Low[1]
	3-6	5,700-12,000	Low
	6-10	6,000-19,000	Low
Silstid loamy fine sand (4 profiles)	0-2	35,000-80,000	Low
	2-4	7,400-30,000	Low[1]
	4-6	8,000-24,000	Low
	6-10	5,200-19,000	Low
Sunev clay loam (1 profile)	0-3	5,000	Low[1]
	3-6	2,400	Moderate
	6-10	1,500	High[1]
Wilson clay loam (2 profiles)	0-1	1,300-2,700	High to moderate[1]
	1-3	700-1,100	High
	3-6	500-700	High
	6-10	300-500	High

[1]This layer has a slightly different corrosion potential than that shown in table 18. The difference in these values can be attributed to differences in the moisture content of the soil when the measurements were made.

TABLE 13.--POTENTIAL OF THE SOILS FOR URBAN DEVELOPMENT

Map symbol and soil name	Elements of urban development				Potential for urban development	Main limitations
	Dwellings[1]	Streets	Shallow excavations	Uncoated steel		
Altoga: 1	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Arents: 2, 3	Low	Low	Low	Medium	Low	Floods, corrosivity.
Arents: 4	Low	Low	Low	Low	Low	Ponding, shrink-swell, corrosivity.
Austin: 5, 6, 7, 8, 9	Low	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Axtell: 10, 11, 12, 13	Medium	Medium	Medium	Medium	Medium	Shrink-swell, corrosivity, low strength.
Bastsil: 14, 15	High	High	High	Medium	High	Corrosivity.
Brackett: 16	Medium	Medium	Medium	Low	Medium	Depth to rock, slope, corrosivity.
Branyon: 17	Low	Low	Low	Low	Low	Shrink-swell, corrosivity, low strength, cutbanks cave.
Burleson: 18, 19	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, cutbanks cave.
Crockett: 20, 21, 22	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Dalco: 23, 24	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, cutbanks cave.
Dutek: 25	High	High	High	Medium	High	Corrosivity.
Eddy: 26, 27, 28, 29, 30, 31, 32	Medium	Medium	Medium	Low	Medium	Depth to rock, slope, corrosivity.

See footnote at end of table.

TABLE 13.--POTENTIAL OF THE SOILS FOR URBAN DEVELOPMENT--Continued

Map symbol and soil name	Elements of urban development				Potential for urban development	Main limitations
	Dwellings[1]	Streets	Shallow excavations	Uncoated steel		
Eufaula:						
33	High	High	Medium	High	High	Cutbanks cave.
Ferris:						
34, 35	Low	Low	Low	Low	Low	Shrink-swell, slope, corrosivity, cutbanks cave.
Frio:						
36, 37, 38	Very low	Very low	Low	Low	Very low	Floods, low strength, corrosivity.
Gowen:						
39, 40	Very low	Very low	Low	Medium	Very low	Floods, corrosivity.
Heiden:						
41, 42	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, cutbanks cave.
Houston Black:						
43, 44, 45	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, cutbanks cave.
Lewisville:						
46, 47, 48, 49, 50	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Mabank:						
51, 52	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Normangee:						
53	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Ovan:						
54, 55	Very low	Very low	Very low	Low	Very low	Floods, shrink-swell, corrosivity, cutbanks cave.
Rader:						
57, 58	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.
Seagoville:						
59	Very low	Very low	Very low	Low	Very low	Floods, shrink-swell, cutbanks cave.
Silawa:						
60, 61, 62, 63	High	High	High	Medium	High	Corrosivity.

See footnote at end of table.

TABLE 13.--POTENTIAL OF THE SOILS FOR URBAN DEVELOPMENT--Continued

Map symbol and soil name	Elements of urban development				Potential for urban development	Main limitations
	Dwellings[1]	Streets	Shallow excavations	Uncoated steel		
Silstid:						
64, 65	High	High	High	Medium	High	Corrosivity.
Smithville:						
66	High	High	High	Medium	High	Corrosivity, shrink-swell.
Stephen:						
67, 68, 69	Medium	Medium	Low	Low	Medium	Depth to rock, corrosivity.
Sunev:						
70, 71	High	High	High	Medium	High	Corrosivity.
Trinity:						
72, 73, 74	Very low	Very low	Very low	Low	Very low	Floods, shrink-swell, corrosivity, cutbanks cave.
Ustorthents:						
76	Low	Low	Low	Medium	Low	Ponds, corrosivity.
Vertel:						
77	Low	Low	Low	Low	Low	Shrink-swell, low strength, corrosivity, slope, cutbanks cave.
Wilson:						
78, 79, 80	Medium	Medium	Medium	Low	Medium	Shrink-swell, low strength, corrosivity.

[1] Ratings are for dwellings that do not have a basement and that use a public sewer system.

TABLE 14.--SELECTED SUITABLE PLANTS

[Only those map units suitable for flowers and ground cover, vines, shrubs, or trees are listed]

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Altoga: 1	Canna, periwinkle, zinnia, amaryllis, daylily, hollyhock, lantana, chenille, ornamental pepper, salvia, euonymus, blue fescue, English ivy, liriope, honeysuckle, green or gray santolina, vinca, moneywort, dwarf nandina.	Boston ivy, trumpet creeper, English ivy, honeysuckle, Virginia creeper, banksian rose.	Abelia, quince, cotoneaster, Texas sage, yucca, Japanese ligustrum, nandina.	Hackberry, mulberry, Japanese black pine, cedar elm, crabapple, Mexican plum, redcedar.
Arents: 2, 3	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Carolina jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Acuba, barberry, elaeagnus, gardenia, azalea, camellia, mahonia, holly, pittosporum, crepe myrtle, rose, pomegranate.	Deodar cedar, sweetgum, magnolia, pine, Chinese pistache, oak, cedar elm, callery, pear, pecan, mountain laurel.
Arents: 4	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Austin: 5, 6, 7, 8, 9	Canna, lantana, periwinkle, zinnia, narcissus, verbena, daylily, pansy, copper plant, euonymus, Carolina jessamine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina, asiatic jasmine.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Hackberry, Japanese black pine, ginkgo, Chinese pistache, oaks, cedar elm, redbud, crabapple.
Axtell: 10, 11, 12, 13	Canna, daylily, amaryllis, shasta daisy, lantana, alyssum, plumbago, hydrangea, chenille, ornamental pepper, liriope, vinca, moneywort, aspidistra, pigmy bamboo.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, gardenia, ligustrum, oleander, Texas sage, hydrangea, pomegranate.	Mulberry, oaks, bald cypress, sycamore, maple, Chinese tallow, cedar elm, Chinese pistache, cottonwood, yellow-poplar.

TABLE 14.--SELECTED SUITABLE PLANTS--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Bastsil: 14, 15	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Caroline jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Acuba, barberry, elaeagnus, gardenia, azalea, camellia, mahonia, holly, pittosporum, crepe myrtle, rose, pomegranate.	Deodar cedar, sweetgum, magnolia, pine, Chinese pistache, oaks, cedar elm, callery pear, pecan, mountain laurel.
Brackett: 16	Zinnia, daylily, shasta daisy, grape hyacinth, small flower narcissus, alyssum, euonymus, blue fescue, green or gray santolina, vinca, sedum.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, Japanese ligustrum, nandina, yucca, Texas sage.	Cedar elm, redbud, redcedar, Mexican plum, Texas oak.
Branyon: 17	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Burleson: 18, 19	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, ginkgo, Chinese pistache, hackberry.
Crockett: 20, 21, 22	Canna, daylily, amaryllis, shasta daisy, lantana, alyssum, plumbago, hydrangea, chenille, ornamental pepper, liriope, vinca, moneywort, aspidistra, pigmy bamboo.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, gardenia, ligustrum, oleander, Texas sage, hydrangea, pomegranate.	Mulberry, oaks, bald cypress, sycamore, maple, Chinese tallow, cedar elm, Chinese pistache, cottonwood, yellow-poplar.
Dalco: 23, 24	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.

TABLE 14.--SELECTED SUITABLE PLANTS--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Dutek: 25	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, marigold, periwinkle, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Carolina jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Acuba, barberry, elaeagnus, gardenia, azalea, camellia, mahonia, holly, crepe myrtle, rose, pomegranate.	Deodar cedar, sweetgum, magnolia, pine, Chinese pistache, oaks, cedar elm, callery pear, pecan, mountain laurel.
Eddy: 26, 27, 28, 29 30, 31, 32	Zinnia, daylily, shasta daisy, grape, hyacinth, small flower narcissus, alyssum, euonymus, blue fescue, green or gray santolina, vinca, sedum.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, Japanese ligustrum, nandina, yucca, Texas sage.	Cedar elm, redbud, redcedar, Mexican plum, Texas oak.
Eufaula: 33	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, marigold, periwinkle, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Carolina jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Abelia, acuba, barberry, elaeagnus, quince, cleyera, cotoneaster, ligustrum, mahonia, nandina, pyracantha, Indiana hawthorn, fatsia, holly, boxwood, crepe myrtle.	Pecan, weeping willow, bald cypress.
Ferris: 34, 35	Canna, periwinkle, zinnia, amaryllis, daylily, hollyhock, lantana, chenille, ornamental pepper, salvia, euonymus, blue fescue, English ivy, liriope, honeysuckle, green or gray santolina, vinca, moneywort, dwarf nandina.	Boston ivy, trumpet creeper, English ivy, honeysuckle, Virginia creeper, banksian rose.	Abelia, quince, cotoneaster, Texas sage, yucca, Japanese ligustrum, nandina.	Hackberry, mulberry, Japanese black pine, cedar elm, crabapple, Mexican plum, redcedar.
Frio: 36, 37, 38	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.

TABLE 14.--SELECTED SUITABLE PLANTS--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Gowen: 39, 40	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, marigold, periwinkle, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Carolina jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Indiana hawthorn, roses, althea, Texas laurel, pomegranate, Texas sage, loquat, boxwood, abelia, acuba, barberry, azalea, camellia, mahonia.	Sycamore, cottonless cottonwood, bur oak, sweetgum, water oak, balk cypress, mountain laurel, live oak, magnolia, pecan, tulip poplar.
Heiden: 41, 42	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Houston Black: 43, 44, 45	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Lewisville: 46, 47, 48, 49, 50	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Mabank: 51, 52	Canna, zinnia, amaryllis, daylily, lantana, shasta daisy, hydrangea, salvia, plumbago, carpet bugle, euonymus, liriope, honeysuckle, pigmy bamboo, vinca, moneywort, aspidistra.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, ligustrum, forsythia, deutzia, hydrangea, pomegranite, oleander, American holly.	Hackberry, sweetgum, yellow-poplar, mulberry, Chinese pistache, sycamore, bur oak, water oak, Chinese tallow, cedar elm, redbud, weeping willow, bald cypress, redcedar.
Normangee: 53	Canna, daylily, amaryllis, shasta daisy, lantana, alyssum, plumbago, hydrangea, chenille, ornamental pepper, liriope, vinca, moneywort, aspidistra, pigmy bamboo.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, gardenia, ligustrum, oleander, Texas sage, hydrangea, pomegranate.	Mulberry, oaks, bald cypress, sycamore, maple, Chinese tallow, cedar elm, Chinese pistache, cottonwood, yellow-poplar.

TABLE 14.--SELECTED SUITABLE PLANTS--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Ovan:				
54, 55	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Rader:				
57, 58	Canna, daylily, amaryllis, shasta daisy, lantana, alyssum, plumbago, hydrangea, chenille, ornamental pepper, liriope, vinca, moneywort, aspidistra, pigmy bamboo.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, gardenia, ligustrum, oleander, Texas sage, hydrangea, pomegranate.	Mulberry, oaks, bald cypress, sycamore, maple, Chinese tallow, cedar elm, Chinese pistache, cottonwood, yellow-poplar.
Seagoville:				
59	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Silawa:				
60, 61, 62, 63	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Carolina jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Acuba, barberry, elaeagnus, gardenia, azalea, camellia, mahonia, holly, pittosporum, crepe myrtle, rose, pomegranate.	Deodar cedar, sweetgum, magnolia, pine, Chinese pistache, oaks, cedar elm, callery pear, pecan, mountain laurel.
Silstid:				
64, 65	Canna, chrysanthemum, pansy, lantana, petunia, calendula, ornamental pepper, marigold, periwinkle, dwarf abelia, aspidistra, juniper, holly, English ivy, jessamine, dwarf yaupon, blue fescue.	Boston ivy, clematis, climbing fig, Carolina jessamine, English ivy, Confederate jasmine, wistaria, Virginia creeper, banksian rose, grape.	Acuba, barberry, elaeagnus, gardenia, azalea, camellia, mahonia, holly, crepe myrtle, rose, pomegranate.	Deodar cedar, sweetgum, magnolia, pine, Chinese pistache, oaks, cedar elm, callery pear, pecan, mountain laurel.
Smithville:				
66	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.

TABLE 14.--SELECTED SUITABLE PLANTS--Continued

Soil name and map symbol	Flowers and ground cover	Vines	Shrubs	Trees
Stephen: 30, 67, 68, 69	Canna, lantana, periwinkle, zinnia, narcissus, verbena, daylily, pansy, copper plant, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Hackberry, Japanese black pine, ginkgo, Chinese pistache, oaks, cedar elm, redbud, crabapple.
Sunev: 70, 71	Canna, daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Trinity: 72, 73, 74	Canna daylily, copper plant, narcissus, lantana, zinnia, periwinkle, pansy, euonymus, Carolina jessamine, asiatic jasmine, English ivy, liriope, dwarf juniper, dwarf yaupon, dwarf nandina.	Boston ivy, trumpet creeper, Carolina jessamine, climbing fig, honeysuckle, mustang grape, banksian rose, rose.	Pittosporum, loquat, oleander, Texas sage, Texas laurel, abelia, acuba, mahonia, fatsia, pomegranate.	Pecan, sweetgum, Japanese black pine, oaks, cedar elm, redbud, crabapple, hackberry, ginkgo, Chinese pistache.
Vertel: 77	Canna, periwinkle, zinnia, amaryllis, hollyhock, lantana, chenille, ornamental pepper, salvia, euonymus, blue fescue, English ivy, liriope, honeysuckle, green or gray santolina, vinca, moneywort, dwarf nandina, daylily.	Boston ivy, trumpet creeper, English ivy, honeysuckle, Virginia creeper, banksian rose.	Abelia, quince, cotoneaster, Texas sage, yucca, Japanese ligustrum, nandina.	Hackberry, mulberry, Japanese black pine, cedar elm, crabapple, Mexican plum, redcedar.
Wilson: 78, 79, 80	Canna, zinnia, amaryllis, daylily, lantana, shasta daisy, hydrangea, salvia, plumbago, carpet bugle, euonymus, liriope, honeysuckle, pigmy, bamboo, vinca, moneywort, aspidistra.	Boston ivy, trumpet creeper, honeysuckle, Virginia creeper.	Quince, ligustrum, forsythia, deutzia, hydrangea, pomegranate, oleander, American holly.	Hackberry, sweetgum, yellow-poplar, mulberry, Chinese pistache, sycamore, bur oak, water oak, Chinese tallow, cedar elm, redbud, weeping willow, bald cypress, redcedar.

TABLE 15.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Altoga:				
1	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Arents:				
2	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: too clayey.
3	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.
4	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Austin:				
5, 6	Severe: too clayey.	Severe: too clayey	Severe: too clayey.	Severe: too clayey.
7:				
Austin part	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Lewisville part	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
8:				
Austin part	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Urban land part.				
9:				
Austin part	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Urban land part.				
Axtell:				
10, 11, 12	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
13:				
Axtell part	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Urban land part.				
Bastsil:				
14, 15	Slight	Slight	Slight	Slight.
Brackett:				
16	Moderate: percs slowly.	Slight	Severe: depth to rock.	Slight.
Branyon:				
17	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Burleson:				
18, 19	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.

TABLE 15.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Crockett:				
20, 21, 22	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Dalco:				
23, 24	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Dutek:				
25	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Eddy:				
26, 27	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: depth to rock.	Moderate: small stones, too clayey.
28:				
Eddy part	Moderate: slope, percs slowly.	Moderate: slope, small stones.	Severe: depth to rock, slope.	Moderate: small stones, too clayey.
Brackett part	Moderate: percs slowly, slope.	Moderate: slope.	Severe: depth to rock.	Slight.
29:				
Eddy part	Moderate: slope, percs slowly.	Moderate: slope, small stones.	Severe: depth to rock, slope.	Moderate: small stones, too clayey.
Brackett part	Moderate: percs slowly, slope.	Moderate: slope.	Severe: depth to rock.	Slight.
Urban land part.				
30:				
Eddy part	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: depth to rock.	Moderate: small stones, too clayey.
Stephen part	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.
31:				
Eddy part	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: depth to rock.	Moderate: small stones, too clayey.
Urban land part.				
32:				
Eddy part	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: depth to rock, slope.	Moderate: small stones, too clayey.
Urban land part.				
Eufaula:				
33	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Ferris:				
34:				
Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, slope.	Severe: too clayey.

TABLE 15.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ferris:				
Heiden part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
35:				
Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, slope.	Severe: too clayey.
Urban land part.				
Frio:				
36	Severe: floods.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
37	Severe: floods.	Severe: too clayey.	Severe: floods.	Severe: too clayey.
38:				
Frio part	Severe: floods.	Severe: too clayey.	Severe: floods.	Severe: too clayey.
Urban land part.				
Gowen:				
39	Severe: floods.	Moderate: floods.	Moderate: too clayey, floods.	Moderate: too clayey.
40	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: too clayey, floods.
Heiden:				
41, 42	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Houston Black:				
43, 44	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
45:				
Houston Black part	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Urban land part.				
Lewisville:				
46, 47	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
48	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
49:				
Lewisville part	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Urban land part.				
50:				
Lewisville part	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Urban land part.				

TABLE 15.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mabank:				
51, 52	Severe: wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Normangee:				
53	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
Ovan:				
54, 55	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
Pits and Dumps: 56.				
Rader:				
57: Rader part	Severe: percs slowly, wetness.	Slight	Severe: percs slowly, wetness.	Slight.
Mabank part	Severe: wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
58: Rader part	Severe: percs slowly, wetness.	Slight	Severe: percs slowly, wetness.	Slight.
Urban land part.				
Seagoville:				
59	Severe: too clayey, floods, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Silawa:				
60, 61, 62	Slight	Slight	Moderate: slope.	Slight.
63: Silawa part	Slight	Slight	Moderate: slope.	Slight.
Urban land part.				
Silstid:				
64	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
65: Silstid part	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Urban land part.				
Smithville:				
66	Slight	Slight	Slight	Slight.
Stephen:				
67, 68	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.

TABLE 15.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Stephen:				
69:				
Stephen part	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.
Urban land part.				
Sunev:				
70, 71	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
Trinity:				
72	Severe: wetness, floods, percs slowly.	Severe: too clayey.	Severe: wetness, too clayey.	Severe: too clayey.
73	Severe: wetness, floods, percs slowly.	Severe: floods, too clayey.	Severe: wetness, floods, percs slowly.	Severe: floods, too clayey.
74:				
Trinity part	Severe: wetness, floods, percs slowly.	Severe: too clayey.	Severe: wetness, too clayey.	Severe: too clayey.
Urban land part.				
Urban land:				
75.				
Ustorthents:				
76.				
Vertel:				
77	Severe: too clayey.	Severe: too clayey.	Severe: too clayey, slope.	Severe: too clayey.
Wilson:				
78, 79	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
80:				
Wilson part	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Urban land part.				

TABLE 16.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Altoga:												
1	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Arents:												
2	Poor	Fair	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
3	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
4	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Austin:												
5, 6	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
7:												
Austin part	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Lewisville part	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
8:												
Austin part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Urban land part.												
9:												
Austin part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Urban land part.												
Axtell:												
10, 11, 12	Fair	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
13:												
Axtell part	Fair	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
Urban land part.												
Bastsil:												
14, 15	Good	Fair	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Brackett:												
16	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Branyon:												
17	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Burleson:												
18, 19	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Crockett:												
20, 21, 22	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.

TABLE 16.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Dalco:												
23, 24	Fair	Fair	Fair	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Dutek:												
25	Poor	Fair	Good	Fair	---	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Eddy:												
26, 27	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
28:												
Eddy part	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Brackett part.												
29:												
Eddy part	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Brackett part.												
Urban land part.												
30:												
Eddy part	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Stephen part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
31:												
Eddy part	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Urban land part.												
32:												
Eddy part	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Urban land part.												
Eufaula:												
33	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Ferris:												
34:												
Ferris part	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Heiden part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
35:												
Ferris part	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Urban land part.												
Frio:												
36	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
37	Very poor.	Poor	Fair	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Fair.

TABLE 16.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Frio:												
38:												
Frio part	Very poor.	Poor	Fair	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Fair.
Urban land part.												
Gowen:												
39	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
40	Very poor.	Poor	Fair	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Fair.
Heiden:												
41	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
42	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Houston Black:												
43, 44	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
45:												
Houston Black part	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Urban land part.												
Lewisville:												
46, 47, 48	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
49, 50:												
Lewisville part	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Urban land part.												
Mabank:												
51, 52	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	---	Fair	Fair.
Normangee:												
53	Fair	Good	Fair	---	---	Good	Poor	Poor	Fair	---	Poor	Fair.
Ovan:												
54	Fair	Fair	Poor	Good	---	Fair	Poor	Good	Fair	---	Fair	Poor.
55	Poor	Poor	Fair	Good	---	Fair	Poor	Good	Poor	---	Fair	Poor.
Pits and Dumps:												
56.												
Rader:												
57:												
Rader part	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Mabank part	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	---	Fair	Fair.
58:												
Rader part	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Urban land part.												

TABLE 16.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Seagoville: 59	Good	Good	Fair	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
Silawa: 60	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
61, 62	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
63: Silawa part	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Urban land part.												
Silstid: 64	Poor	Poor	Fair	Poor	Poor	Good	Poor	Very poor.	Poor	Poor	Very poor.	Fair.
65: Silstid part	Poor	Poor	Fair	Poor	Poor	Good	Poor	Very poor.	Poor	Poor	Very poor.	Fair.
Urban land part.												
Smithville: 66	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Stephen: 67, 68	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
69: Stephen part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Urban land part.												
Sunev: 70	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
71	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Trinity: 72	Fair	Good	Fair	Good	---	---	Poor	Fair	Fair	Good	Poor	---
73	Poor	Fair	Fair	Good	---	---	Poor	Fair	Fair	Fair	Poor	---
74: Trinity part	Fair	Good	Fair	Good	---	---	Poor	Fair	Fair	Good	Poor	---
Urban land part.												
Urban land: 75.												
Ustorthents: 76.												
Vertel: 77	Poor	Fair	Poor	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Poor.
Wilson: 78, 79	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.

TABLE 16.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Wilson:												
80:												
Wilson part-----	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Urban land part.												

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Altoga:											
1	0-25	Silty clay	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	80-99	35-51	20-31
	25-80	Silty clay, silty clay loam, clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	65-99	30-48	15-30
Arents:											
2, 3, 4	0-80	Variable	---	---	---	---	---	---	---	---	---
Austin:											
5, 6	0-10	Silty clay	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-95	45-65	25-40
	10-32	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-5	93-100	90-100	80-100	75-95	45-65	22-38
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
7:											
Austin part	0-10	Silty clay	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-95	45-65	25-40
	10-32	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-5	93-100	90-100	80-100	75-95	45-65	22-38
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Lewisville part	0-15	Silty clay	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
	15-41	Silty clay, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	41-75	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
8:											
Austin part	0-10	Silty clay	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-95	45-65	25-40
	10-32	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-5	93-100	90-100	80-100	75-95	45-65	22-38
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land part.											
9:											
Austin part	0-10	Silty clay	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-95	45-65	25-40
	10-32	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-5	93-100	90-100	80-100	75-95	45-65	22-38
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land part.											
Axtell:											
10, 11, 12	0-8	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-95	28-60	<31	NP-7
	8-80	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	42-60	25-40
13:											
Axtell part	0-8	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-95	28-60	<31	NP-7
	8-80	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-75	42-60	25-40
Urban land part.											

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Bastsil:											
14, 15	0-8	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	75-95	36-70	<25	NP-7
	8-68	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	80-100	75-100	40-70	26-40	11-24
Brackett:											
16	0-16	Loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	16-29	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Branyon:											
17	0-80	Clay	CH	A-7-6	0	95-100	75-100	75-100	75-100	60-80	35-55
Burleson:											
18, 19	0-64	Clay	CH, MH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-95	51-80	27-55
	64-80	Clay, silty clay	CH, MH	A-7-6, A-7-5	0-1	95-100	80-100	75-95	70-95	51-80	30-55
Crockett:											
20, 21, 22	0-7	Fine sandy loam	SM, ML, CL, SC, SM-SC	A-4, A-6	0-2	95-100	95-100	90-100	36-95	15-35	3-15
	7-53	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6, A-7-6	0	85-100	80-100	75-100	65-91	36-60	22-40
	53-80	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-45	11-30
Dalco:											
23, 24	0-35	Clay	CH	A-7	0	90-100	90-100	85-100	85-98	55-75	32-50
	35-80	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Dutek:											
25	0-34	Loamy fine sand	SM, SP-SM	A-2	0	95-100	95-100	90-100	10-25	<22	NP-3
	34-54	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-2, A-4, A-6	0	98-100	95-100	90-100	30-55	24-40	6-20
	54-64	Fine sandy loam, sandy clay loam, loam.	SC, SM-SC, CL-ML, CL	A-2, A-4, A-6	0	95-100	95-100	90-100	22-55	20-40	4-20
	64-75	Loamy fine sand, fine sandy loam.	SM, SM-SC, SP-SM	A-2	0	95-100	95-100	90-100	10-35	<25	NP-7
Eddy:											
26, 27	0-4	Clay loam	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	4-11	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	11-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Eddy:											
28, 29:											
Eddy part	0-4	Clay loam	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	4-11	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	11-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Brackett part	0-16	Loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	16-29	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land part.											
30:											
Eddy part	0-4	Clay loam	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	4-11	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	11-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Stephen part	0-14	Silty clay	CL, CH	A-7-6	0-5	95-100	90-100	85-100	80-90	45-66	22-42
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
31:											
Eddy part	0-4	Clay loam	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	4-11	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	11-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land part.											
32:											
Eddy part	0-4	Clay loam	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	4-11	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	11-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land part.											
Eufaula:											
33	0-80	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
Ferris:											
34:											
Ferris part	0-72	Clay	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
Heiden part	0-37	Clay	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	37-78	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55
35:											
Ferris part	0-72	Clay	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ferris:											
Urban land part.											
Frio:											
36, 37	0-53	Silty clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	60-95	35-52	20-34
	53-74	Silty clay, clay loam, gravelly clay loam.	CL, CH	A-6, A-7	0-2	65-100	65-100	60-100	55-95	35-52	20-34
38:											
Frio part	0-53	Silty clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	60-95	35-52	20-34
	53-74	Silty clay, clay loam, gravelly clay loam.	CL, CH	A-6, A-7	0-2	65-100	65-100	60-100	55-95	35-52	20-34
Urban land part.											
Gowen:											
39, 40	0-32	Loam	CL	A-6, A-7-6	0	100	95-100	85-100	60-85	28-43	11-25
	32-80	Clay loam, loam	CL	A-4, A-6, A-7-6	0	100	95-100	85-100	55-85	25-43	10-25
Heiden:											
41, 42	0-37	Clay	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	37-78	Clay, silty clay	CH	A-7-6	0	90-100	90-100	75-100	70-99	52-80	35-55
Houston Black:											
43, 44	0-6	Clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
	6-70	Clay, silty clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
45:											
Houston Black part	0-6	Clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
	6-78	Clay, silty clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
Urban land part.											
Lewisville:											
46, 47, 48	0-15	Silty clay	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
	15-41	Silty clay, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	41-75	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
49:											
Lewisville part	0-15	Silty clay	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
	15-41	Silty clay, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	41-75	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
Urban land part.											
50:											
Lewisville part	0-15	Silty clay	CL, CH	A-7	0	100	99-100	82-99	80-95	41-59	20-36
	15-41	Silty clay, clay loam.	CL, CH	A-7	0	99-100	98-100	73-99	72-95	48-60	25-36
	41-75	Silty clay, clay loam.	CL, CH, SC	A-6, A-7	0	83-100	65-99	56-98	41-95	30-55	12-34
Urban land part.											
Mabank:											
51, 52	0-5	Fine sandy loam	CL, ML, SM, SC	A-4	0	95-100	95-100	80-98	40-70	<30	NP-10
	5-65	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	95-100	60-85	35-65	20-40

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Normangee:											
53----------------	0-9	Clay loam--------	CL	A-6, A-7	0	98-100	96-100	90-100	55-85	30-48	11-25
	9-66	Clay-------------	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
	66-71	Shale------------	CL, CH	A-7	0	95-100	90-100	90-100	70-90	41-60	20-35
Ovan:											
54, 55------------	0-80	Clay-------------	CL, CH	A-7-6	0	100	100	90-100	85-100	48-70	25-45
Pits and Dumps: 56.											
Rader:											
57: Rader part------	0-8	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	30-70	18-28	3-10
	8-16	Sandy clay loam, loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	16-64	Sandy clay, clay	CL, CH	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-40
Mabank part-----	0-5	Fine sandy loam	CL, ML, SM, SC	A-4	0	95-100	95-100	80-98	40-70	<30	NP-10
	5-65	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	95-100	60-85	35-65	20-40
58: Rader part------	0-8	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	30-70	18-28	3-10
	8-16	Sandy clay loam, loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	16-64	Sandy clay, clay	CL, CH	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-40
Urban land part.											
Seagoville:											
59----------------	0-30	Clay-------------	CH, CL	A-7-6	0	100	100	90-100	85-100	48-70	25-45
	30-38	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	100	100	70-90	40-60	20-35	8-20
	38-75	Sandy clay loam, fine sand.	SM, SM-SC, SC	A-4, A-2-4	0	100	100	50-75	15-45	<30	NP-10
Silawa:											
60, 61, 62--------	0-6	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	80-100	80-100	70-100	40-60	<26	NP-7
	6-26	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	80-100	80-100	80-100	35-60	25-40	8-18
	26-43	Fine sandy loam, gravelly fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0-2	45-100	45-100	38-100	18-60	21-34	4-14
	43-80	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	45-100	45-100	38-100	12-40	<26	NP-7

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Silawa:											
63:											
Silawa part	0-6	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	80-100	80-100	70-100	40-60	<26	NP-7
	6-26	Sandy clay loam, fine sandy loam.	CL, SC	A-4, A-6	0	80-100	80-100	80-100	35-60	25-40	8-18
	26-43	Fine sandy loam, gravelly fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0-2	45-100	45-100	38-100	18-60	21-34	4-14
	43-80	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SM-SC	A-2-4, A-4	0-2	45-100	45-100	38-100	12-40	<26	NP-7
Urban land part.											
Silstid:											
64	0-27	Loamy fine sand	SM, SP-SM	A-2-4	0	95-100	95-100	90-100	10-25	<25	NP-3
	27-65	Sandy clay loam	SC, SM-SC, CL	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	80-100	30-55	20-40	4-22
	65-85	Sandy clay loam, fine sandy loam, loamy fine sand.	SC, SM SP-SM, CL	A-4, A-6, A-2-4, A-2-6	0	95-100	85-100	70-100	12-55	20-40	4-22
65:											
Silstid part	0-27	Loamy fine sand	SM, SP-SM	A-2-4	0	95-100	95-100	90-100	10-25	<25	NP-3
	27-65	Sandy clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	80-100	30-55	20-40	4-22
	65-85	Sandy clay loam, fine sandy loam, loamy fine sand.	SC, SM, SP-SM, CL	A-4, A-6, A-2-4, A-2-6	0	95-100	85-100	70-100	12-55	20-40	4-22
Urban land part.											
Smithville:											
66	0-5	Loam	SC, CL, CL-ML, SM-SC	A-2-4, A-4	0	95-100	95-100	75-100	25-60	<30	NP-10
	5-18	Loam, fine sandy loam, sandy clay loam.	SC, CL	A-6	0	100	95-100	95-100	36-70	26-40	12-20
	18-40	Sandy clay loam, loam.	CL	A-6	0	100	95-100	80-100	51-80	26-40	15-25
	40-76	Fine sandy loam, loam.	SM-SC, CL, ML, CL-ML	A-4, A-6	0	90-100	75-100	60-100	40-70	20-35	7-19
Stephen:											
67, 68	0-14	Silty clay	CL, CH	A-7-6	0-5	95-100	90-100	85-100	80-90	45-66	22-42
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
69:											
Stephen part	0-14	Silty clay	CL, CH	A-7-6	0-5	95-100	90-100	85-100	80-90	45-66	22-42
	14-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Urban land part.											

TABLE 17.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
Sunev:											
70, 71------------	0-12	Clay loam-------	CL, SC	A-4, A-6	0	90-100	80-100	80-100	45-60	25-40	8-18
	12-30	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	80-100	80-100	51-65	28-40	8-18
	30-65	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	75-100	75-100	51-61	25-40	8-18
Trinity:											
72, 73------------	0-68	Clay------------	CH	A-7	0	100	98-100	85-100	80-99	55-90	30-60
74:											
Trinity part----	0-68	Clay------------	CH	A-7	0	100	98-100	85-100	80-99	55-90	30-60
Urban land part.											
Urban land: 75.											
Ustorthents: 76.											
Vertel:											
77----------------	0-14	Clay------------	CH	A-7-6	0	95-100	95-100	90-100	90-100	60-85	40-60
	14-24	Clay------------	CH	A-7-6	0	95-100	95-100	90-100	85-100	60-85	40-60
	24-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Wilson:											
78, 79------------	0-5	Clay loam-------	CL	A-4, A-6	0	95-100	85-100	80-100	60-96	25-36	10-20
	5-42	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	40-55	21-35
	42-64	Silty clay, clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-90	40-57	24-35
80:											
Wilson part-----	0-5	Clay loam-------	CL	A-4, A-6	0	95-100	85-100	80-100	60-96	25-36	10-20
	5-42	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	40-55	21-35
	42-64	Silty clay, clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-90	40-57	24-35
Urban land part.											

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Altoga:									
1	0-25	0.6-2.0	0.15-0.18	7.9-8.4	High	High	Low	0.32	5
	25-80	0.6-2.0	0.15-0.18	7.9-8.4	Moderate	High	Low	0.32	
Arents:									
2, 3	0-80	---	---	---	---	---	---	---	---
4	0-80	---	---	7.9-8.4	High	High	Low	0.32	5
Austin:									
5, 6	0-10	0.2-0.6	0.15-0.20	7.9-8.4	High	High	Low	0.32	2
	10-32	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	Low	0.32	
	32-40	---	---	---	---	---	---	---	
7:									
Austin part	0-10	0.2-0.6	0.15-0.20	7.9-8.4	High	High	Low	0.32	2
	10-32	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	Low	0.32	
	32-40	---	---	---	---	---	---	---	
Lewisville part	0-15	0.6-2.0	0.16-0.20	7.9-8.4	High	High	Low	0.32	5
	15-41	0.6-2.0	0.14-0.18	7.9-8.4	High	High	Low	0.37	
	41-75	0.6-2.0	0.14-0.18	7.9-8.4	High	High	Low	---	
8:									
Austin part	0-10	0.2-0.6	0.15-0.20	7.9-8.4	High	High	Low	0.32	2
	10-32	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	Low	0.32	
	32-40	---	---	---	---	---	---	---	
Urban land part.									
9:									
Austin part	0-10	0.2-0.6	0.15-0.20	7.9-8.4	High	High	Low	0.32	2
	10-32	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	High	Low	0.32	
	32-40	---	---	---	---	---	---	---	
Urban land part.									
Axtell:									
10, 11, 12	0-8	0.6-2.0	0.11-0.15	5.1-6.5	Low	Moderate	Moderate	0.43	5
	8-80	<0.06	0.13-0.18	4.5-7.3	High	High	Moderate	0.37	
13:									
Axtell part	0-8	0.6-2.0	0.11-0.15	5.1-6.5	Low	Moderate	Moderate	0.43	5
	8-80	<0.06	0.13-0.18	4.5-7.3	High	High	Moderate	0.37	
Urban land part.									
Bastsil:									
14, 15	0-8	2.0-6.0	0.11-0.17	5.1-6.5	Low	Low	Low	0.24	5
	8-68	0.6-2.0	0.15-0.19	5.6-7.8	Moderate	Moderate	Low	0.32	
Brackett:									
16	0-16	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2
	16-29	---	---	---	---	---	---	---	
Branyon:									
17	0-80	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	5
Burleson:									
18, 19	0-64	<0.06	0.12-0.18	5.6-8.4	High	High	Low	---	4
	64-80	<0.06	0.12-0.18	7.4-8.4	High	High	Low	---	

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Crockett:									
20, 21, 22	0-7	0.6-2.0	0.11-0.20	5.6-7.3	Low	Moderate	Low	0.43	5
	7-53	<0.06	0.14-0.18	5.6-7.8	High	High	Low	0.32	
	53-80	0.06-0.2	0.15-0.20	7.4-8.4	Moderate	High	Low	0.32	
Dalco:									
23, 24	0-35	<0.06	0.12-0.18	7.4-8.4	Very high	High	Low	0.32	3
Dutek:									
25	0-34	6.0-20	0.05-0.10	5.6-7.3	Very low	Low	Moderate	0.20	5
	34-54	0.6-2.0	0.12-0.17	5.1-6.0	Low	Moderate	Moderate	0.24	
	54-64	0.6-6.0	0.10-0.16	4.5-6.0	Low	Moderate	High	0.24	
	64-75	2.0-20	0.05-0.10	4.5-6.0	Very low	Low	High	0.20	
Eddy:									
26, 27	0-4	0.2-0.6	0.10-0.13	7.9-8.4	Low	High	Low	0.24	1
	4-11	0.2-0.6	0.03-0.07	7.9-8.4	Low	High	Low	0.24	
	11-40	---	---	---	---	---	---	---	
28:									
Eddy part	0-4	0.2-0.6	0.10-0.13	7.9-8.4	Low	High	Low	0.24	1
	4-11	0.2-0.6	0.03-0.07	7.9-8.4	Low	High	Low	0.24	
	11-40	---	---	---	---	---	---	---	
Brackett part	0-16	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2
	16-29	---	---	---	---	---	---	---	
29:									
Eddy part	0-4	0.2-0.6	0.10-0.13	7.9-8.4	Low	High	Low	0.24	1
	4-11	0.2-0.6	0.03-0.07	7.9-8.4	Low	High	Low	0.24	
	11-40	---	---	---	---	---	---	---	
Brackett part	0-16	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2
	16-29	---	---	---	---	---	---	---	
Urban land part.									
30:									
Eddy part	0-4	0.2-0.6	0.10-0.13	7.9-8.4	Low	High	Low	0.24	1
	4-11	0.2-0.6	0.03-0.07	7.9-8.4	Low	High	Low	0.24	
	11-40	---	---	---	---	---	---	---	
Stephen part	0-14	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	High	Low	0.32	1
	14-20	---	---	---	---	---	---	---	
31, 32:									
Eddy part	0-4	0.2-0.6	0.10-0.13	7.9-8.4	Low	High	Low	0.24	1
	4-11	0.2-0.6	0.03-0.07	7.9-8.4	Low	High	Low	0.24	
	11-40	---	---	---	---	---	---	---	
Urban land part.									
Eufaula:									
33	0-80	6.0-20.0	0.05-0.11	5.1-7.3	Low	Low	Moderate	0.17	5
Ferris:									
34:									
Ferris part	0-72	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	4
Heiden part	0-37	<0.06	0.15-0.20	7.9-8.4	Very high	High	Low	0.32	5
	37-78	<0.06	0.12-0.20	7.9-8.4	Very high	High	Low	0.32	
35:									
Ferris part	0-72	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	4

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Ferris:									
Urban land part.									
Frio:									
36, 37-----------	0-53	0.2-0.6	0.15-0.22	7.9-8.4	Moderate	High----------	Low------------	---	---
	53-74	0.2-0.6	0.11-0.22	7.9-8.4	Moderate	High----------	Low------------	---	
38:									
Frio part-------	0-53	0.2-0.6	0.15-0.22	7.9-8.4	Moderate	High----------	Low------------	---	---
	53-74	0.2-0.6	0.11-0.22	7.9-8.4	Moderate	High----------	Low------------	---	
Urban land part.									
Gowen:									
39, 40-----------	0-32	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate------	Low------------	---	---
	32-80	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate------	Low------------	---	
Heiden:									
41, 42-----------	0-37	<0.06	0.15-0.20	7.9-8.4	Very high	High----------	Low------------	0.32	5
	37-78	<0.06	0.12-0.20	7.9-8.4	Very high	High----------	Low------------	0.32	
Houston Black:									
43, 44-----------	0-6	<0.06	0.15-0.20	7.4-8.4	Very high	High----------	Low------------	0.32	4
	6-70	<0.06	0.15-0.20	7.4-8.4	Very high	High----------	Low------------	0.32	
45:									
Houston Black part-----------	0-6	<0.06	0.15-0.20	7.4-8.4	Very high	High----------	Low------------	0.32	4
	6-70	<0.06	0.15-0.20	7.4-8.4	Very high	High----------	Low------------	0.32	
Urban land part.									
Lewisville:									
46, 47, 48--------	0-15	0.6-2.0	0.16-0.20	7.9-8.4	High------	High----------	Low------------	0.32	5
	15-41	0.6-2.0	0.14-0.18	7.9-8.4	High------	High----------	Low------------	0.37	
	41-75	0.6-2.0	0.14-0.18	7.9-8.4	High------	High----------	Low------------	---	
49, 50:									
Lewisville part-	0-15	0.6-2.0	0.16-0.20	7.9-8.4	High------	High----------	Low------------	0.32	5
	15-41	0.6-2.0	0.14-0.18	7.9-8.4	High------	High----------	Low------------	0.37	
	41-75	0.6-2.0	0.14-0.18	7.9-8.4	High------	High----------	Low------------	---	
Urban land part.									
Mabank:									
51, 52-----------	0-5	0.6-2.0	0.11-0.15	5.6-7.3	Low-------	Moderate------	Moderate-------	0.43	5
	5-65	<0.06	0.12-0.18	5.6-8.4	High------	High----------	Moderate-------	0.32	
Normangee:									
53---------------	0-9	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	High----------	Low------------	0.43	3
	9-66	<0.06	0.12-0.18	5.6-8.4	High------	High----------	Low------------	0.37	
	66-71	<0.06	0.12-0.18	6.1-8.4	High------	High----------	Low------------	---	
Ovan:									
54, 55-----------	0-80	<0.06	0.15-0.20	7.9-8.4	High------	High----------	Low------------	0.32	5
Pits and Dumps:									
56.									
Rader:									
57:									
Rader part------	0-8	2.0-6.0	0.10-0.15	4.5-6.5	Low-------	Moderate------	Moderate-------	0.32	5
	8-16	0.2-0.6	0.12-0.18	4.5-5.5	Moderate	High----------	Moderate-------	0.32	
	16-64	<0.06	0.12-0.18	4.5-6.5	High------	High----------	Moderate-------	0.32	

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Rader:									
Mabank part	0-5	0.6-2.0	0.11-0.15	5.6-7.3	Low	Moderate	Moderate	0.43	5
	5-65	<0.06	0.12-0.18	5.6-8.4	High	High	Moderate	0.32	
58:									
Rader part	0-8	2.0-6.0	0.10-0.15	4.5-6.5	Low	Moderate	Moderate	0.32	5
	8-16	0.2-0.6	0.12-0.18	4.5-5.5	Moderate	High	Moderate	0.32	
	16-64	<0.06	0.12-0.18	4.5-6.5	High	High	Moderate	0.32	
Urban land part.									
Seagoville:									
59	0-30	<0.06	0.15-0.20	7.4-8.4	High	High	Low	0.37	5
	30-38	0.6-2.0	0.11-0.19	7.4-8.4	Low	High	Low	0.43	
	38-75	2.0-6.0	0.07-0.14	7.4-8.4	Low	Low	Low	0.28	
Silawa:									
60, 61, 62	0-6	2.0-6.0	0.10-0.15	5.6-6.5	Low	Low	Moderate	0.24	5
	6-26	0.6-2.0	0.12-0.17	5.1-6.0	Low	Moderate	Moderate	0.32	
	26-43	2.0-6.0	0.08-0.15	5.1-6.5	Low	Low	Moderate	0.32	
	43-80	6.0-20	0.05-0.11	5.1-6.5	Very low	Low	Moderate	0.20	
63:									
Silawa part	0-6	2.0-6.0	0.10-0.15	5.6-6.5	Low	Low	Moderate	0.24	5
	6-26	0.6-2.0	0.12-0.17	5.1-6.0	Low	Moderate	Moderate	0.32	
	26-43	2.0-6.0	0.08-0.15	5.1-6.5	Low	Low	Moderate	0.32	
	43-80	6.0-20	0.05-0.11	5.1-6.5	Very low	Low	Moderate	0.20	
Urban land part.									
Silstid:									
64	0-27	6.0-20	0.05-0.10	5.6-6.5	Low	Low	Moderate	0.17	5
	27-65	0.6-2.0	0.12-0.17	5.6-6.5	Low	Moderate	Moderate	0.24	
	65-85	0.6-2.0	0.10-0.16	5.6-6.5	Low	Moderate	Moderate	0.24	
65:									
Silstid part	0-27	6.0-20	0.05-0.10	5.6-6.5	Low	Low	Moderate	0.17	5
	27-65	0.6-2.0	0.12-0.17	5.6-6.5	Low	Moderate	Moderate	0.24	
	65-85	0.6-2.0	0.10-0.16	5.6-6.5	Low	Moderate	Moderate	0.24	
Urban land part.									
Smithville:									
66	0-5	0.6-2.0	0.13-0.18	6.6-7.8	Low	Low	Low	0.24	5
	5-18	0.6-2.0	0.13-0.18	6.6-7.8	Low	Low	Low	0.28	
	18-40	0.6-2.0	0.15-0.19	6.6-8.4	Moderate	Moderate	Low	0.32	
	40-76	0.6-2.0	0.13-0.18	7.9-8.4	Low	Low	Low	0.32	
Stephen:									
67, 68	0-14	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	High	Low	0.32	1
	14-20	---	---	---	---------	---------------	---------------	---	
69:									
Stephen part	0-14	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	High	Low	0.32	1
	14-20	---	---	---	---------	---------------	---------------	---	
Urban land part.									
Sunev:									
70, 71	0-12	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28	5
	12-30	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28	
	30-65	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28	
Trinity:									
72, 73	0-68	<0.06	0.15-0.20	7.4-8.4	Very high	High	Low	0.32	5
74:									
Trinity part	0-68	<0.06	0.15-0.20	7.4-8.4	Very high	High	Low	0.32	5
Urban land part.									

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Reaction	Shrink- swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
Urban land:									
75.									
Ustorthents:									
76.									
Vertel:									
77----------------	0-14	<0.06	0.09-0.18	6.6-8.4	Very high	High----------	Low-------------	0.37	3
	14-24	<0.06	0.10-0.18	6.6-8.4	Very high	High----------	Low-------------	0.37	
	24-60	---	---	---	----------	--------------	---------------	---	
Wilson:									
78, 79------------	0-5	0.2-0.6	0.15-0.20	5.6-7.8	Low--------	High----------	Low-------------	0.43	5
	5-42	<0.06	0.14-0.20	5.6-7.8	High------	High----------	Low-------------	0.37	
	42-64	<0.06	0.12-0.15	6.6-8.4	High------	High----------	Low-------------	0.37	
80:									
Wilson part-----	0-5	0.2-0.6	0.15-0.20	5.6-7.8	Low--------	High----------	Low-------------	0.43	5
	5-42	<0.06	0.14-0.20	5.6-7.8	High------	High----------	Low-------------	0.37	
	42-64	<0.06	0.12-0.15	6.6-8.4	High------	High----------	Low-------------	0.37	
Urban land part.									

TABLE 19.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Altoga:									
1	C	None	---	---	>6.0	---	---	>60	---
Arents:									
2, 3, 4	---	---	---	---	>6.0	---	---	>60	---
Austin:									
5, 6	C	None	---	---	>6.0	---	---	20-40	Rippable
7:									
Austin part	C	None	---	---	>6.0	---	---	20-40	Rippable
Lewisville part	B	None	---	---	>6.0	---	---	>60	---
8, 9:									
Austin part	C	None	---	---	>6.0	---	---	20-40	Rippable
Urban land part.									
Axtell:									
10, 11, 12	D	None	---	---	>6.0	---	---	>60	---
13:									
Axtell part	D	None	---	---	>6.0	---	---	>60	---
Urban land part.									
Bastsil:									
14, 15	B	None	---	---	>6.0	---	---	>60	---
Brackett:									
16	C	None	---	---	>6.0	---	---	10-20	Rippable
Branyon:									
17	D	None	---	---	>6.0	---	---	>60	---
Burleson:									
18, 19	D	None	---	---	>6.0	---	---	>60	---
Crockett:									
20, 21, 22	D	None	---	---	>6.0	---	---	>60	---
Dalco:									
23, 24	D	None	---	---	>6.0	---	---	24-40	Rippable
Dutek:									
25	A	None	---	---	>6.0	---	---	>60	---
Eddy:									
26, 27	C	None	---	---	>6.0	---	---	3-15	Rippable
28:									
Eddy part	C	None	---	---	>6.0	---	---	3-15	Rippable
Brackett part	C	None	---	---	>6.0	---	---	10-20	Rippable

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Eddy:									
29:									
Eddy part------	C	None--------	---	---	>6.0	---	---	3-15	Rippable
Brackett part--	C	None--------	---	---	>6.0	---	---	10-20	Rippable
Urban land part.									
30:									
Eddy part------	C	None--------	---	---	>6.0	---	---	3-15	Rippable
Stephen part---	C	None--------	---	---	>6.0	---	---	7-20	Rippable
31, 32:									
Eddy part------	C	None--------	---	---	>6.0	---	---	3-15	Rippable
Urban land part.									
Eufaula:									
33---------------	A	None--------	---	---	>6.0	---	---	>60	---
Ferris:									
34:									
Ferris part----	D	None--------	---	---	>6.0	---	---	>60	---
Heiden part----	D	None--------	---	---	>6.0	---	---	>60	---
35:									
Ferris part----	D	None--------	---	---	>6.0	---	---	>60	---
Urban land part.									
Frio:									
36---------------	B	Occasional--	Brief-----	May-Oct	>6.0	---	---	>60	---
37---------------	B	Frequent----	Brief-----	May-Oct	>6.0	---	---	>60	---
38:									
Frio part------	B	Common------	Brief-----	May-Oct	>6.0	---	---	>60	---
Urban land part.									
Gowen:									
39---------------	B	Occasional--	Brief-----	May-Sep	>6.0	---	---	>60	---
40---------------	B	Frequent----	Brief-----	May-Sep	>6.0	---	---	>60	---
Heiden:									
41, 42-----------	D	None--------	---	---	>6.0	---	---	>60	---
Houston Black:									
43, 44-----------	D	None--------	---	---	>6.0	---	---	>60	---
45:									
Houston Black part----------	D	None--------	---	---	>6.0	---	---	>60	---
Urban land part.									

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Lewisville:									
46, 47, 48	B	None	---	---	>6.0	---	---	>60	---
49, 50:									
Lewisville part	B	None	---	---	>6.0	---	---	>60	---
Urban land part.									
Mabank:									
51, 52	D	None	---	---	0.6-1.0	Perched	Dec-Mar	>60	---
Normangee:									
53	D	None	---	---	>6.0	---	---	>60	---
Ovan:									
54	D	Occasional	Brief	Mar-Jun	>6.0	---	---	>60	---
55	D	Frequent	Brief	Mar-Jun	>6.0	---	---	>60	---
Pits and Dumps: 56.									
Rader:									
57:									
Rader part	D	None	---	---	>6.0	---	---	>60	---
Mabank part	D	None	---	---	0.6-1.0	Perched	Dec-Mar	>60	---
58:									
Rader part	D	None	---	---	>6.0	---	---	>60	---
Urban land part.									
Seagoville:									
59	D	Occasional	Very brief	Oct-Jun	>6.0	---	---	>60	---
Silawa:									
60, 61, 62	B	None	---	---	>6.0	---	---	>60	---
63:									
Silawa part	B	None	---	---	>6.0	---	---	>60	---
Urban land part.									
Silstid:									
64	A	None	---	---	>6.0	---	---	>60	---
65:									
Silstid part	A	None	---	---	>6.0	---	---	>60	---
Urban land part.									
Smithville:									
66	B	None	---	---	>6.0	---	---	>60	---
Stephen:									
67, 68	C	None	---	---	>6.0	---	---	7-20	Rippable
69:									
Stephen part	C	None	---	---	>6.0	---	---	7-20	Rippable
Urban land part.									

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Sunev:									
70, 71	B	None	---	---	>6.0	---	---	>60	---
Trinity:									
72, 73	D	Occasional	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---
74:									
Trinity part	D	Frequent	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---
Urban land part.									
Urban land:									
75.									
Ustorthents:									
76.									
Vertel:									
77	D	None	---	---	>6.0	---	---	24-40	Rippable
Wilson:									
78, 79	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---
80:									
Wilson part	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---
Urban land part.									

TABLE 20.--ENGINEERING TEST DATA

[Dashes indicate that data were not available]

Soil name, report number, horizon, and depth in inches	Classification: AASHTO	Classification: Unified	Grain size distribution[1]: Percentage passing sieve--: 7/8 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	Percentage smaller than--: .02 mm	.005 mm	.002 mm	Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage: Limit	Linear	Ratio
													Pct		G/cc	Pct	Pct	Pct
Altoga silty clay:[3] (S72TX-057-001)																		
B21--------4 to 25	A-7-6(30)	CL	100	100	100	100	99	98	95	--	64	48	46	30	--	12.0	15.4	1.9
IIC-------65 to 80	A-6 (12)	CL	100	100	100	100	100	100	67	--	44	35	36	22	--	14.0	11.2	1.9
Austin silty clay:[4] (S72TX-057-002)																		
Ap---------0 to 5	A-7-6(35)	CH	100	100	100	100	100	99	92	--	50	39	59	34	--	13.0	19.0	1.9
B21-------10 to 20	A-7-6(29)	CH	100	96	94	93	92	90	85	--	58	44	56	32	--	12.0	19.3	2.0
B22ca----20 to 32	A-7-6(23)	CL	100	100	99	98	94	91	85	--	61	45	48	26	--	17.0	14.1	1.8
Crockett fine sandy loam:[5] (S72TX-057-004)																		
Ap---------0 to 7	A-4 (00)	SM-SC	100	100	100	98	96	90	40	--	6	5	20	4	--	16.0	2.3	1.8
B22t------11 to 22	A-7-6(26)	CH	100	100	100	99	98	96	72	--	44	41	54	38	--	10.0	19.4	2.0
C---------53 to 80	A-6 (06)	CL	100	100	96	91	86	76	53	--	27	17	31	19	--	12.0	9.8	1.9
Ferris clay:[6] (S72TX-057-006)																		
A12--------3 to 16	A-7-6(37)	CH	100	100	100	100	100	100	97	--	62	50	54	35	--	14.0	17.2	1.8
C---------41 to 72	A-7-6(46)	CH	100	100	100	100	100	100	98	--	67	55	61	42	--	16.0	18.7	1.8
Frio silty clay:[7] (S72TX-057-007)																		
A12--------8 to 19	A-7-6(32)	CH	100	100	100	100	100	100	93	--	52	41	51	32	--	12.0	17.5	1.9
Cca-------49 to 74	A-6 (14)	CL	100	100	100	100	100	99	75	--	38	31	36	22	--	12.0	11.8	1.9

See footnotes at end of table.

TABLE 20.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Percentage passing sieve--							Percentage smaller than--								
	AASHTO	Unified	7/8 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				Limit	Linear	Ratio
													Pct		G/cc	Pct	Pct	Pct
Silstid loamy fine sand:[8] (S72TX-057-009)																		
A1--------0 to 10	A-2-4(00)	SM	100	100	100	100	100	100	15	--	3	2	21	3	--	18.0	1.1	1.7
B21t-----27 to 44	A-6 (04)	SC	100	100	100	100	100	100	48	--	23	21	31	15	--	0.0	73.0	8.1
C--------65 to 85	A-2-4(00)	SP-SM	100	100	100	100	100	100	12	--	8	7	22	4	--	0.0	12.0	7.1
Stephen silty clay:[9] (S72TX-057-008)																		
Ap--------0 to 5	A-7-6(39)	CH	100	100	100	99	98	98	89	--	31	23	64	39	--	12.0	20.9	1.9
A1--------5 to 14	A-7-6(41)	CH	100	100	100	99	98	97	88	--	36	25	66	42	--	9.0	22.3	2.0
Trinity clay:[10] (S75TX-057-011)																		
A11-------5 to 31	A-7-6(67)	CH	100	100	100	100	99	98	97	--	82	65	86	59	--	11.0	26.3	2.0

[1]For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2]Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods, except that soil was added to water.

[3]Altoga silty clay:
0.8 mile west of Kaufman county line on I-20, 3.8 miles south on Lawson Road and 200 feet east, in pasture.

[4]Austin silty clay:
0.5 mile east of I-35 on Danieldale Road and 500 feet south, in a field.

[5]Crockett fine sandy loam:
1,000 feet west on access road from junction of Story Road and U.S. Highway 183 in Irving and 330 feet north, in idle land.

[6]Ferris clay:
3,000 feet northeast of Beltline Road and 50 feet west of Pioneer Road, in pasture.

[7]Frio silty clay:
975 feet east of Beltline Road and 350 feet north of West Fork of Trinity River.

[8]Silstid loamy fine sand:
1.75 miles south of Kleberg, 5,700 feet southwest on Log Cabin Road from junction with Beltline Road, and 100 feet east.

[9]Stephen silty clay:
2,100 feet northeast of Wilson Road on Texas Highway 67 in Duncanville and 225 feet west, in pasture.

[10]Trinity clay:
1.2 miles south of Seagoville and 100 feet east of Malloy Bridge.

TABLE 21.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Altoga	Fine-silty, carbonatic, thermic Typic Ustochrepts
Arents	Arents
Austin	Fine-silty, carbonatic, thermic Entic Haplustolls
Axtell	Fine, montmorillonitic, thermic Udertic Paleustalfs
*Bastsil	Fine-loamy, siliceous, thermic Udic Paleustalfs
Brackett	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Branyon	Fine, montmorillonitic, thermic Udic Pellusterts
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Dalco	Fine, montmorillonitic, thermic Udic Pellusterts
Dutek	Loamy, siliceous, thermic Arenic Haplustalfs
Eddy	Loamy-skeletal, carbonatic, thermic, shallow Typic Ustorthents
*Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Frio	Fine, mixed, thermic Cumulic Haplustolls
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Lewisville	Fine-silty, mixed, thermic Typic Calciustolls
*Mabank	Fine, montmorillonitic, thermic Vertic Albaqualfs
Normangee	Fine, montmorillonitic, thermic Vertic Haplustalfs
Ovan	Fine, montmorillonitic, thermic Udic Chromusterts
Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Seagoville	Clayey over loamy, montmorillonitic, thermic Udic Chromusterts
*Silawa	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Silstid	Loamy, siliceous, thermic Arenic Paleustalfs
*Smithville	Fine-loamy, mixed, thermic Pachic Argiustolls
Stephen	Clayey, mixed, thermic, shallow Entic Haplustolls
Sunev	Fine-loamy, carbonatic, thermic Typic Calciustolls
Trinity	Very-fine, montmorillonitic, thermic Typic Pelluderts
Ustorthents	Ustorthents
Vertel	Very-fine, montmorillonitic, thermic Udorthentic Chromusterts
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs

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