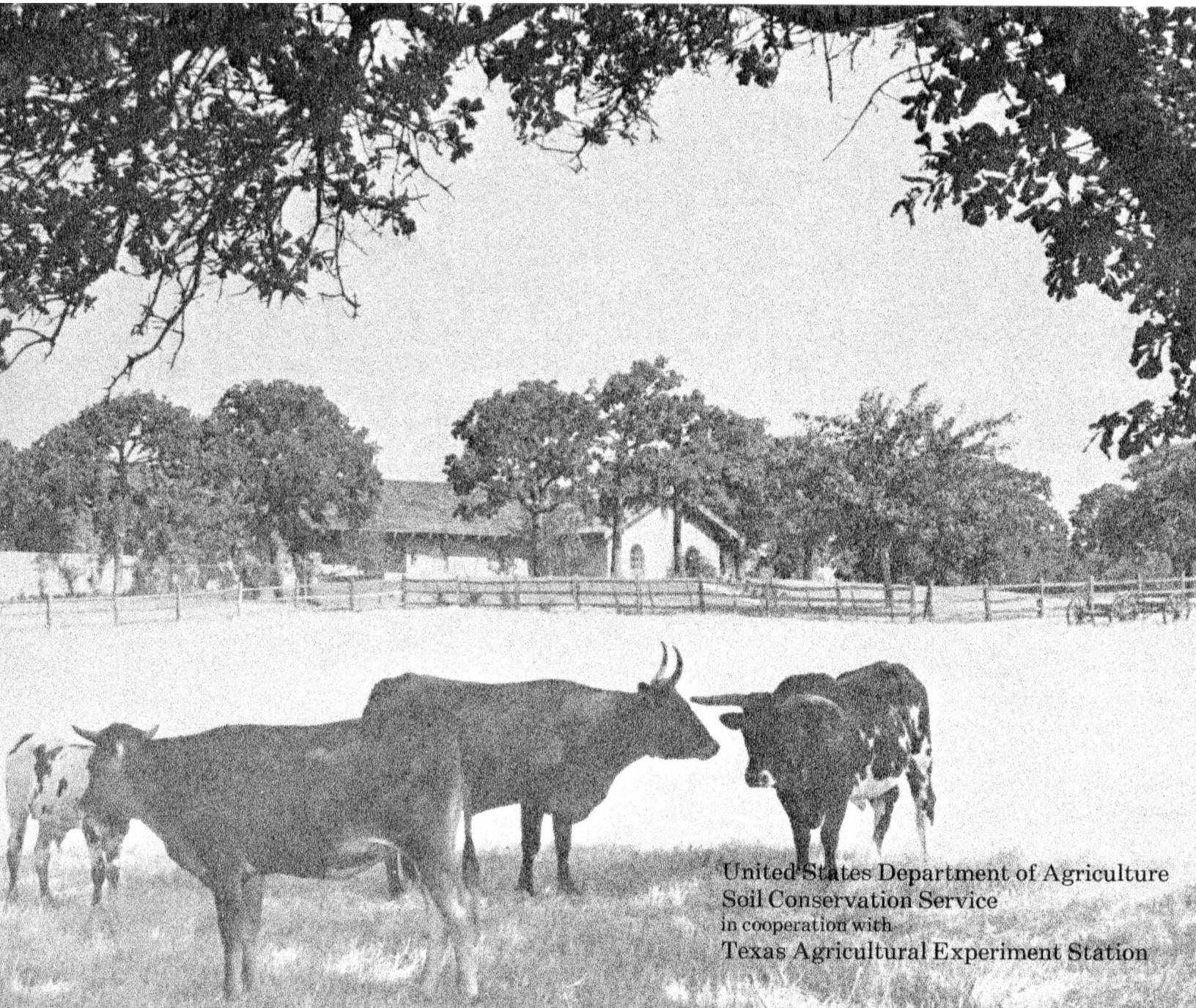
# SOIL SURVEY OF

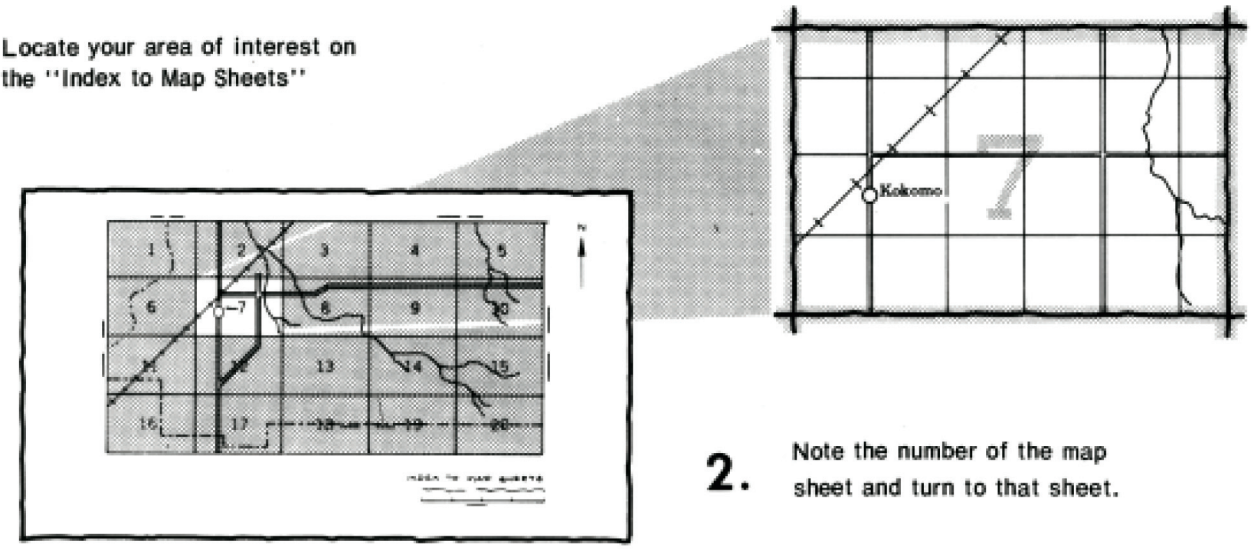
# Tarrant County, Texas



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

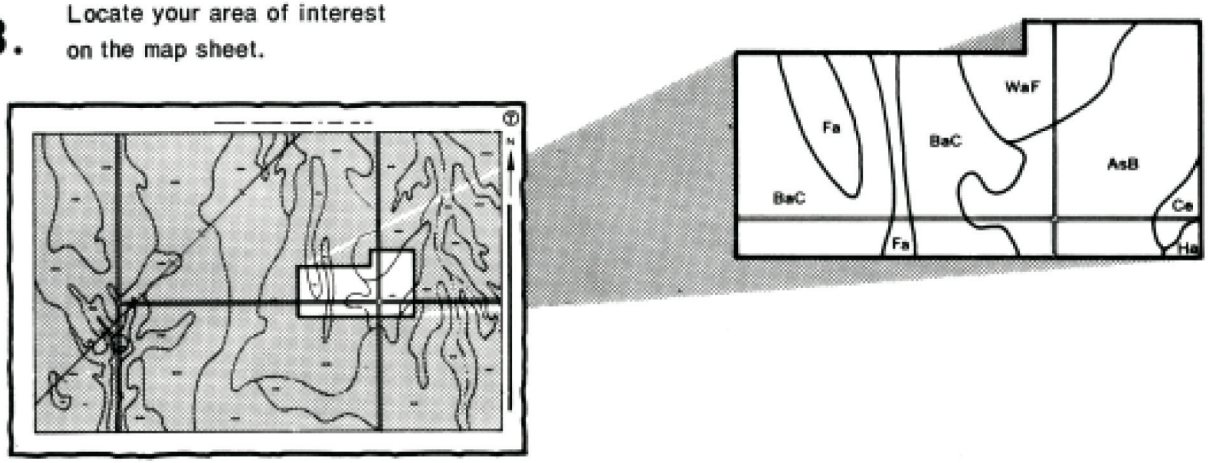
# HOW TO USE

**1.** Locate your area of interest on the "Index to Map Sheets"

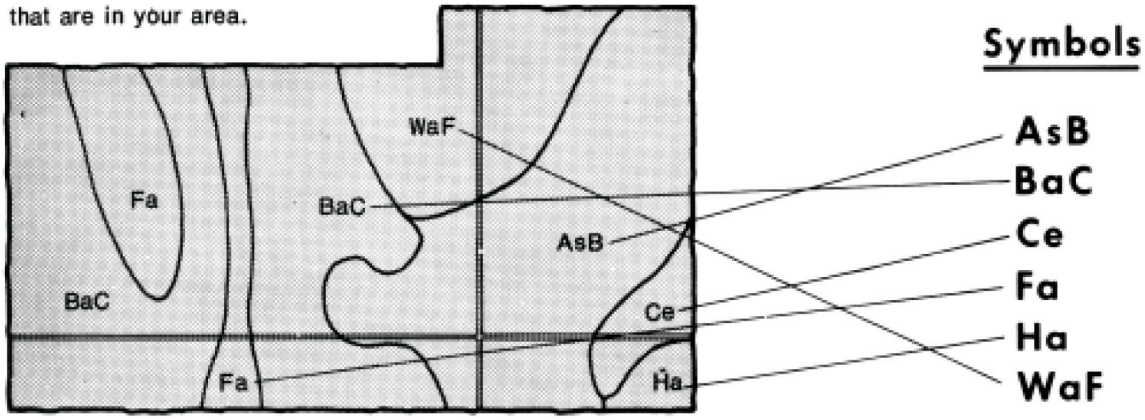



**2.** Note the number of the map sheet and turn to that sheet.

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

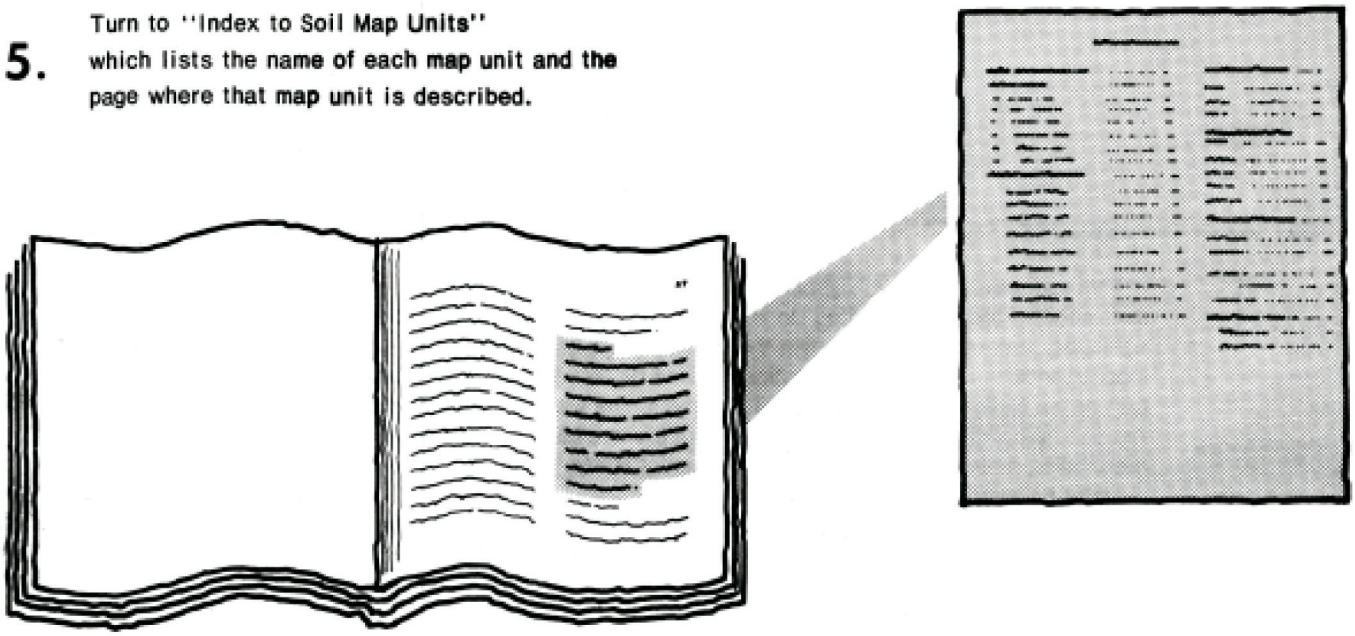



**4.** List the map unit symbols that are in your area.

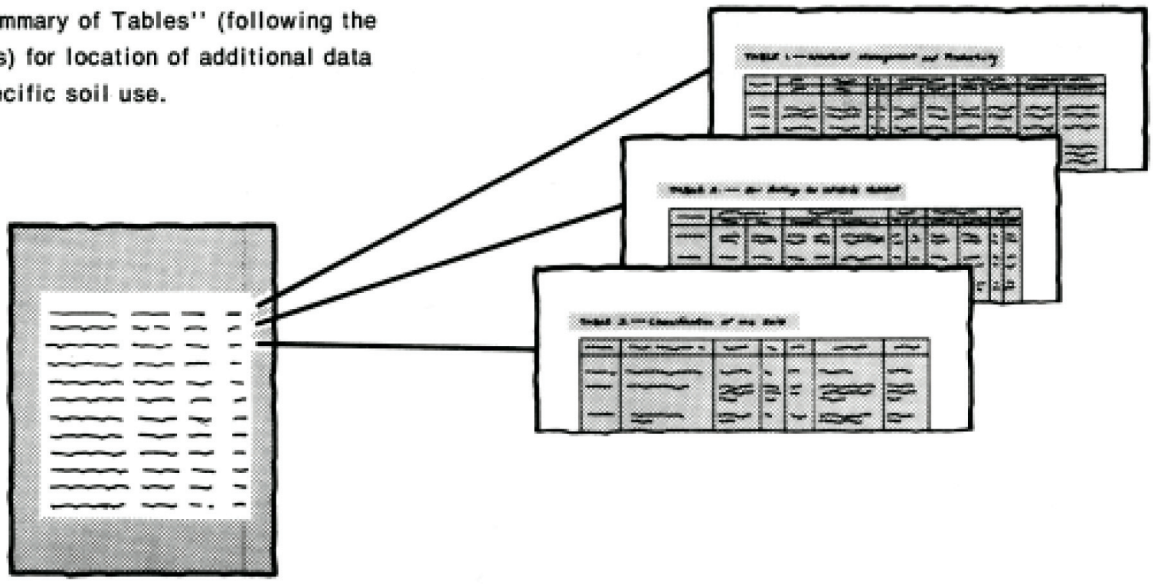


# THIS SOIL SURVEY

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



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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, 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 1974-78. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. 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.

*A suburban farmstead in an area of Crosstell fine sandy loam, 1 to 3 percent slopes.*

# contents


**Index to map units** ..... iv
**Summary of tables** ..... vi
**Foreword** ..... ix
General nature of the county ..... 2
How this survey was made ..... 3
**General soil map units** ..... 5
Soil descriptions ..... 6
**Detailed soil map units** ..... 13
Soil descriptions ..... 13
**Use and management of the soils** ..... 63
Crops and pasture ..... 63
Rangeland ..... 66
Recreation ..... 72
gardening and landscaping ..... 73
Wildlife habitat ..... 73
Engineering ..... 75
**Soil properties** ..... 79
Engineering index properties ..... 79
Physical and chemical properties ..... 80
Soil and water features ..... 81
Engineering index test data ..... 82
**Classification of the soils** ..... 83
Soil series and their morphology ..... 83
**Geology** ..... 115
**Formation of the soils** ..... 117
**References** ..... 119
**Glossary** ..... 121
**Tables** ..... 127


## soil series


Aledo series ..... 83
Altoga series ..... 84
Aquilla series ..... 84
Aubrey series ..... 85
Bastsil series ..... 85
Birome series ..... 86
Bolar series ..... 87
Brackett series ..... 88
Branyon series ..... 88
Burleson series ..... 89
Chatt series ..... 89
Crosstell series ..... 90
Ferris series ..... 91
Frio series ..... 91
Gasil series ..... 92
Heiden series ..... 92
Houston Black series ..... 93
Justin series ..... 94
Konsil series ..... 95
Leson series ..... 95
Lindale series ..... 96
Lott series ..... 96
Luckenbach series ..... 97
Mabank series ..... 98
Maloterre series ..... 98
Medlin series ..... 98
Mingo series ..... 99
Navo series ..... 99
Nimrod series ..... 100
Ovan series ..... 101
Ponder series ..... 101
Pulexas series ..... 102
Purves series ..... 102
Rader series ..... 103
Rayex series ..... 104
Sanger series ..... 104
San Saba series ..... 105
Selden series ..... 106
Silawa series ..... 106
Silstid series ..... 107
Slidell series ..... 107
Speck series ..... 108
Stephenville series ..... 109
Sunev series ..... 109
Trinity series ..... 110
Weatherford series ..... 110
Whitesboro series ..... 111
Wilson series ..... 111
Windthorst series ..... 112


Issued June 1981

# index to map units


1—Aledo gravelly clay loam, 1 to 8 percent slopes. 13
2—Aledo-Bolar complex, 5 to 20 percent slopes ..... 14
3—Aledo-Bolar-Urban land complex, 3 to 20 percent slopes ..... 14
4—Aledo-Urban land complex, 1 to 8 percent slopes..... 15
5—Altoga silty clay loam, 5 to 12 percent slopes..... 16
6—Aquilla loamy fine sand, 1 to 5 percent slopes ... 16
7—Arents, frequently flooded ..... 16
8—Arents, loamy ..... 17
9—Bastsil fine sandy loam, 0 to 3 percent slopes ... 18
10—Bastsil-Urban land complex, 0 to 5 percent slopes..... 18
11—Birome fine sandy loam, 1 to 5 percent slopes .. 18
12—Birome-Aubrey-Rayex complex, 5 to 15 percent slopes..... 19
13—Birome-Aubrey-Urban land complex, 5 to 15 percent slopes ..... 21
14—Bolar clay loam, 1 to 3 percent slopes ..... 21
15—Bolar clay loam, 3 to 5 percent slopes ..... 22
16—Bolar-Urban land complex, 1 to 5 percent slopes..... 22
17—Brackett clay loam, 3 to 8 percent slopes..... 22
18—Branyon clay, 0 to 1 percent slopes..... 24
19—Burleson clay, 0 to 1 percent slopes..... 25
20—Chatt silty clay, 1 to 3 percent slopes..... 26
21—Crosstell fine sandy loam, 1 to 3 percent slopes 26
22—Crosstell fine sandy loam, 3 to 6 percent slopes 26
23—Crosstell-Urban land complex, 1 to 6 percent slopes..... 27
24—Ferris clay, 5 to 12 percent slopes, eroded..... 27
25—Ferris-Heiden complex, 2 to 5 percent slopes .... 28
26—Frio silty clay, occasionally flooded ..... 28
27—Frio silty clay, frequently flooded ..... 29
28—Frio-Urban land complex, occasionally flooded .. 30
29—Gasil fine sandy loam, 1 to 3 percent slopes..... 30
30—Gasil fine sandy loam, 3 to 8 percent slopes..... 30
31—Gasil sandy clay loam, graded, 1 to 5 percent slopes..... 31
32—Gasil-Urban land complex, 1 to 8 percent slopes..... 31
33—Heiden clay, 1 to 3 percent slopes..... 32
34—Houston Black clay, 1 to 3 percent slopes..... 32
35—Houston Black-Urban land complex, 1 to 4 percent slopes ..... 32
36—Justin loam, 1 to 3 percent slopes..... 33
37—Konsil fine sandy loam, 1 to 5 percent slopes.... 34
38—Leson clay, 1 to 3 percent slopes..... 34
39—Lindale clay loam, 1 to 3 percent slopes..... 35
40—Lindale-Urban land complex, 1 to 3 percent slopes..... 35
41—Lott silty clay, 1 to 3 percent slopes..... 35
42—Lott-Urban land complex, 1 to 5 percent slopes. 36
43—Luckenbach clay loam, 1 to 3 percent slopes..... 36
44—Luckenbach-Urban land complex, 1 to 3 percent slopes ..... 37
45—Mabank fine sandy loam, 0 to 1 percent slopes. 37
46—Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes ..... 38
47—Medlin clay, 5 to 15 percent slopes..... 39
48—Mingo clay loam, 1 to 3 percent slopes..... 39
49—Mingo-Urban land complex, 1 to 3 percent slopes..... 40
50—Navo clay loam, 1 to 3 percent slopes ..... 41
51—Navo-Urban land complex, 1 to 3 percent slopes..... 42
52—Nimrod fine sand, 1 to 5 percent slopes..... 42
53—Ovan clay, occasionally flooded..... 43
54—Ovan clay, frequently flooded..... 43
55—Ovan-Urban land complex, occasionally flooded 43
56—Pits, quarries ..... 44
57—Ponder clay loam, 1 to 3 percent slopes..... 44
58—Ponder-Urban land complex, 0 to 3 percent slopes..... 44
59—Pulexas fine sandy loam, frequently flooded..... 45
60—Pulexas-Urban land complex, occasionally flooded ..... 45
61—Purves clay, 0 to 3 percent slopes ..... 45
62—Purves-Urban land complex, 0 to 3 percent slopes..... 46
63—Rader fine sandy loam, 0 to 3 percent slopes.... 46
64—Rader-Urban land complex, 0 to 3 percent slopes..... 47
65—Sanger clay, 1 to 3 percent slopes..... 47
66—Sanger clay, 3 to 5 percent slopes..... 48
67—Sanger-Urban land complex, 1 to 5 percent slopes..... 49
68—San Saba clay, 0 to 2 percent slopes ..... 49
69—Selden loamy fine sand, 1 to 3 percent slopes... 50
70—Silawa fine sandy loam, 3 to 8 percent slopes ... 50
71—Silstid loamy fine sand, 1 to 5 percent slopes .... 50
72—Silstid-Urban land complex, 1 to 5 percent slopes..... 51
73—Slidell clay, 0 to 1 percent slopes..... 51
74—Slidell clay, 1 to 3 percent slopes..... 52
75—Speck clay loam, 0 to 3 percent slopes..... 52
76—Stephenville fine sandy loam, 8 to 15 percent slopes..... 53

77—Sunev clay loam, 1 to 3 percent slopes..... 54
78—Sunev clay loam, 3 to 8 percent slopes..... 54
79—Sunev-Urban land complex, 2 to 8 percent slopes..... 55
80—Trinity clay, frequently flooded..... 57
81—Urban land..... 57
82—Weatherford fine sandy loam, 3 to 8 percent slopes..... 57
83—Whitesboro loam, frequently flooded..... 58
84—Wilson clay loam, 0 to 2 percent slopes..... 58
85—Wilson-Urban land complex, 0 to 2 percent slopes..... 58
86—Windthorst fine sandy loam, 1 to 3 percent slopes..... 59
87—Windthorst fine sandy loam, 3 to 8 percent slopes..... 60
88—Windthorst fine sandy loam, 2 to 8 percent slopes, eroded ..... 60

# summary of tables


Temperature and precipitation (table 1) ..... 128

Freeze dates in spring and fall (table 2) ..... 129
*Probability. Temperature.*

Growing season (table 3) ..... 129
*Probability. Daily minimum temperature.*

Suitabilities and limitations of map units on the general soil map (table 4) 130
*Percent of county. Cultivated farm crops. Pastureland. Rangeland. Urban uses. Recreation areas.*

Acreage and proportionate extent of the soils (table 5) ..... 131
*Acres. Percent.*

Yields per acre of crops and pasture (table 6) ..... 133
*Grain sorghum. Wheat. Oats. Cotton lint. Improved bermudagrass.*

Capability classes and subclasses (table 7) ..... 137
*Total acreage. Major management concerns.*

Rangeland productivity (table 8) ..... 138
*Range site. Potential annual production.*

Recreational development (table 9) ..... 141
*Camp areas. Picnic areas. Playgrounds. Paths and trails.*

Selected suitable plants (table 10) ..... 148
*Flowers and ground cover. Vines. Shrubs. Trees.*

Wildlife habitat (table 11) ..... 161
*Potential for habitat elements. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife, Rangeland wildlife.*

Building site development (table 12) ..... 167
*Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets. Lawns and landscaping.*

Sanitary facilities (table 13) ..... 174
*Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.*

Construction materials (table 14) ..... 181
*Roadfill. Sand. Gravel. Topsoil.*

Water management (table 15) ..... 187
*Limitations for—Pond reservoir areas; Embankments, dikes, and levees. Features affecting—Drainage, Irrigation, Terraces and diversions, Grassed waterways.*

Engineering index properties (table 16) ..... 193
*Depth. USDA texture. Classification—Unified, AASHTO. Fragments more than 3 inches. Percentage passing sieve—4, 10, 40, 200. Liquid limit. Plasticity index.*
Physical and chemical properties of the soils (table 17) ..... 202
*Depth. Clay. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Erosion factors. Wind erodibility group. Organic matter.*
Soil and water features (table 18)..... 209
*Hydrologic group. Flooding. High water table. Bedrock. Risk of corrosion.*
Engineering index test data (table 19) ..... 214
*Classification. Grain-size distribution. Liquid limit. Plasticity index. Specific gravity. Shrinkage.*
Classification of the soils (table 20)..... 218
*Family or higher taxonomic class.*

# foreword

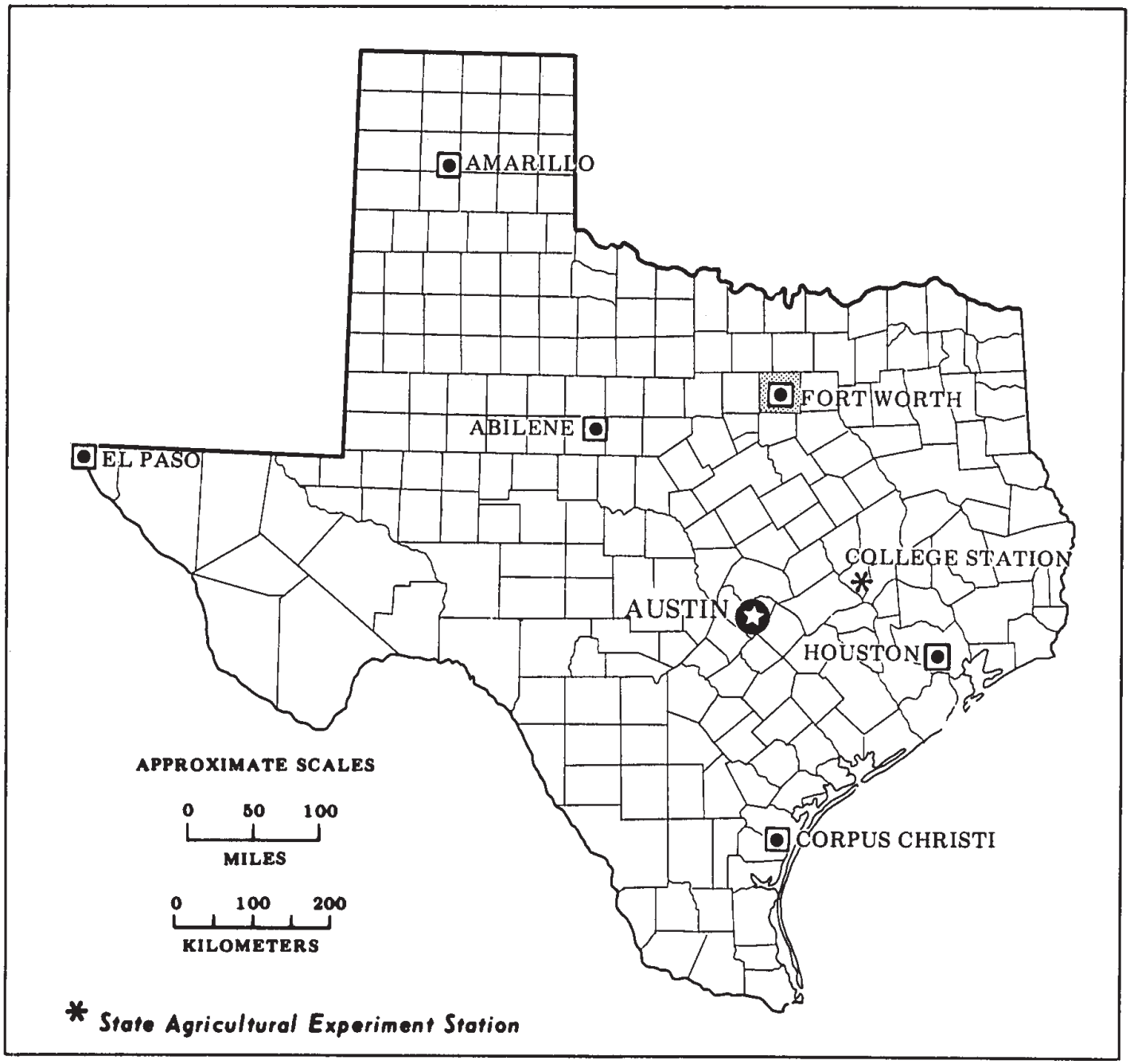
This soil survey contains information that can be used in land-planning programs in Tarrant County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are 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 Tarrant County in Texas.*

# soil survey of
# Tarrant County, Texas

By Dennis D. Ressel, Soil Conservation Service

Fieldwork by Milton Allen, Daniel R. Coffee, Ralph H. Hill, Thomas H. Holt, Edward W. Pauls, Dennis D. Ressel, and Levi Steptoe, Jr., Soil Conservation Service

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

TARRANT COUNTY is in the north-central part of the state. It is square in shape and has an area of about 898 square miles, or 574,720 acres. Fort Worth, the county seat, is near the center of the county. In 1970, according to the Bureau of the Census, the population of the county was about 716,317. The population is rapidly increasing. In 1976, Tarrant County had an estimated population of 760,613.

The county slopes mainly to the east and southeast. It is entirely within the Trinity River drainage system and is drained by the West Fork, Clear Fork, and Elm Fork of the Trinity River. The topography is nearly level to hilly. The elevation ranges from about 960 feet along the Parker County line to about 420 feet in the channel of the West Fork of the Trinity River as it leaves the county (fig. 1). Thus, the maximum relief varies by about 540 feet.

Approximately one-third of Tarrant County is influenced by some kind of urban and industrial development. Major economic enterprises include defense industries; aerospace activities; manufacture of airplanes, helicopters, plastics, and cars; and many other industrial activities. The county has educational centers, agribusiness centers, railroad centers, and large grain storage facilities. Natural resources include soil, cement, sand, gravel, stone, and gas. Shallow to deep wells provide water for home use, livestock, and small industries. Six lakes within the county make up about 19,520 surface acres and provide flood control, recreation, and part of the county's water supply.

The climate is favorable for dairying, ranching, and growing small grain, grain sorghum, and cotton. According to an inventory made in 1976 by the Soil Conservation Service and North Central Texas Council of Governments, about 39 percent of the county is pastureland and rangeland. Beef cattle, dairy cattle, and horses are the main livestock enterprises. Poultry and hogs are also important. About 14 percent of the county is cultivated. The major crops are wheat, grain sorghum, and cotton. The county is a leading producer of nursery stock. Pecans and truck crops are also grown.

There are about 49 kinds of soil in Tarrant County. They range widely in texture, depth, reaction, natural drainage, and other characteristics. Generally, the soils that have a clay loam or clay surface layer formed in alkaline sediment under mid and tall grasses. Soils that have a loamy fine sand or fine sandy loam surface layer formed in acid or alkaline sediments under a savannah of oaks and mid and tall grasses. Slope, depth to bedrock, the hazard of flooding, and natural fertility are major factors which influence agricultural uses of the soils.

The areas of urban development are widely scattered throughout Tarrant County. Most of the soils in the county have limitations that require additional expense and special design for proper construction. These limitations include shrinking and swelling with changes in moisture, shallow depth to limestone bedrock, corrosivity to uncoated steel, slope, very slow permeability, and the hazard of flooding. Most well drained, loamy and sandy soils, however, are well suited to urban development.

The descriptions and names of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of the soils or extent of the soils within the survey area.

A survey of Tarrant County was published in 1924 (*5*). The present survey updates the earlier one and provides additional information and maps that show the soils in greater detail.

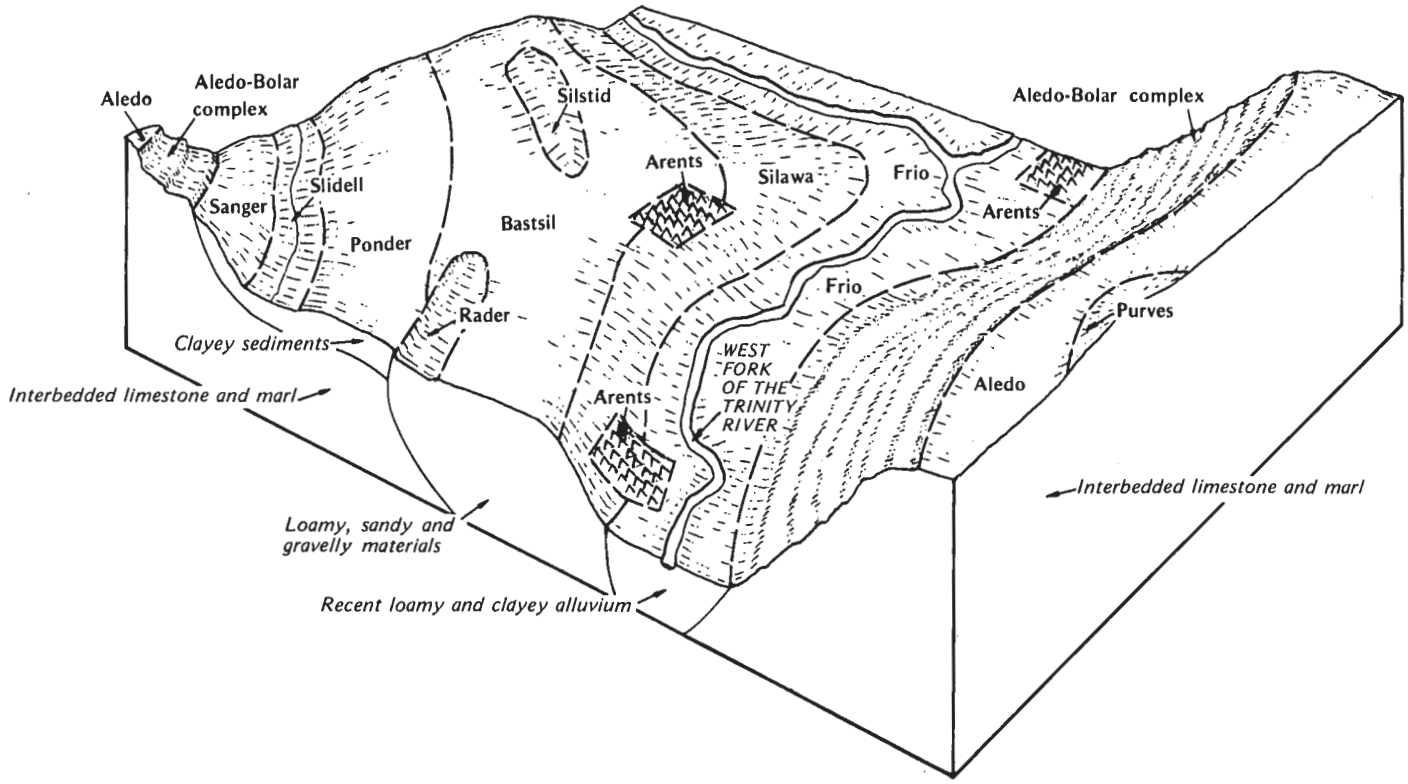



*Figure 1.*—Typical pattern of soils along the West Fork of the Trinity River. Parts of general soil map units 3, 5, 6, and 7 are represented.

# general nature of the county

This section provides general information on the history and settlement, and climate of Tarrant County.

## history and settlement

The Tarrant County area was included in Peters' Colony. The first settlement was made about 1840 at Bird's Fort. At that time, this settlement was the western edge of the frontier. In 1841, M.T. Johnson settled at Mary Le Bone Springs, about three miles south of the present Arlington City Hall, and founded Johnson Station. Soon a few other families settled in the area. Sam Houston, the first President of the Republic of Texas, made a treaty with the regional Indians at Bird's Fort in 1843. In 1849, Major Ripley A. Arnold selected a site for a fort on a high bluff overlooking the West Fork of the Trinity River. This fort was named for General William J. Worth.

Tarrant County was formed in 1849 from a northern part of Navarro County and was named for General Edward H. Tarrant. The county was organized in 1850. Birdville, the largest settlement, was made the county seat. The military post at Fort Worth was abandoned in 1853, but the surrounding village grew rapidly. In 1856, after much contesting, the county seat was moved to Fort Worth.

The population of Tarrant County has rapidly increased. It is now the fourth most populated county in Texas.

## climate

Table 1 gives data on temperature and precipitation for the survey area as recorded in Tarrant County in the period 1938 to 1977. 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.

Tarrant County has a subtropical climate with humid, hot summers. The climate is also continental, characterized by a wide range in annual temperature extremes. Winters are mild, but "northers" occur about three times each month, and often are accompanied by sudden drops in temperature. Periods of extreme cold occasionally occur but are short-lived; so that even in

January, mild weather occurs frequently. In an average year, temperature minima of 20 degrees or below occur on only six days.

The highest temperatures in summer are associated with fair skies, westerly winds, and low humidities. Characteristically, hot spells in summer are broken into three- to five-day periods by thunderstorm activity. There are only a few nights each summer when the minimum temperature exceeds 80 degrees, but a year when the temperature does not exceed 100 degrees is rare.

In winter the average temperature is 47 degrees F, and the average daily minimum temperature is 37 degrees. The lowest temperature on record, which occurred at Fort Worth in February 1899, is -8 degrees. In summer the average temperature is 83 degrees, and the average daily maximum temperature is 94 degrees. The highest recorded temperature, which occurred at Fort Worth on June 26 and 27, 1980, is 113 degrees.

Throughout the year, rainfall occurs more frequently during the night. Usually, periods of rainy weather last for only a day or two, and are followed by several days of fair skies. A large part of the annual precipitation results from thunderstorm activity, with occasional heavy rainfall over brief periods of time. Greatest amounts of rain occur during the months of April and May. July and August are relatively dry months. Thunderstorms occur throughout the year but are most frequent in the spring. Hail falls on about two or three days a year and mostly causes only slight and scattered damage. Windstorms occurring during thunderstorm activity, however, are sometimes destructive.

The total annual precipitation is 32.1 inches. Of this, 19 inches, or 59 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 11 inches. The heaviest 1-day rainfall during the period of record was 9.57 inches at Fort Worth on September 1932. Thunderstorms occur on about 44 days each year, and most occur in spring.

The average length of the warm season (freeze-free period) is 249 days. Since 1940, the longest freeze-free period was 292 days in 1973, and the shortest was 196 days in 1946. The average date of the last occurrence of 32 degrees or below is March 16. During the period 1940-1970, the earliest occurrence was February 14, 1946, and the latest was April 13, 1957. The average date of the first occurrence of 32 degrees or below in the fall is November 21. During the period 1940-1970, the earliest occurrence was October 27, 1957, and the latest was January 4, 1972.

Snowfall is common. In 72 percent of the winters, there is measurable snowfall. In 23 percent, the snowfall, usually of short duration, is more than 5 inches. The heaviest 1-month snowfall on record was more than 12 inches.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines 76 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in March and April.

## how this survey was made

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

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

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

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

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

# general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each 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. The eight general soil map units in Tarrant County make up about 97 percent of the acreage. The rest is water area. The table 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 suitability 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.

Each map unit is rated for cultivated crops, pastureland, urban uses, and recreation areas. Cultivated crops include cotton, grain sorghum, forage sorghum, and small grain. Pastureland refers to land used for growing pasture plants, such as improved bermudagrass, weeping lovegrass, vetch, and arrowleaf clover. Urban uses include residential, commercial, and industrial sites. Recreation areas include playgrounds, nature study areas, paths and trails, campsites, and picnic areas.

Generally the kind of soil, natural fertility of the soil, ability of the soil to store and release moisture for plant use, and the hazard of flooding are the most important factors that influence land use for farming in Tarrant County.

Most map units in the survey area are moderately suited or well suited to cultivated crops. Only the Aledo-Bolar-Sanger map unit is poorly suited to this use. The deep, clayey and loamy soils are mainly farmed to grain sorghum, cotton, forage sorghum, and small grain. The deep, sandy and loamy soils are mainly farmed to small grain, forage sorghum, truck crops, nursery stock, and orchards. All of these soils require good management to prevent water and wind erosion.

Most of the map units in the survey area are moderately suited or well suited to pastureland. Pastureland is moderately suited to the Aledo-Bolar-Sanger map unit, however, because of shallow depth to rock in the Aledo part of the map unit. Commonly grown pasture species include improved bermudagrass, kleingrass, weeping lovegrass, tall fescuegrass, and vetch.

Approximately 178,000 acres have been converted to urban, industrial, strip mining, and recreation uses in Tarrant County. Also included in this acreage are areas that are strip mined for road construction material. Each year several thousand acres scattered throughout the county are used for these purposes. Much of this acreage is well suited to cropland.

Most of the map units in the survey area, except for the Bastsil-Silawa and Windthorst-Weatherford-Nimrod map units, have limitations that affect urban development. Shrinking and swelling with changes in moisture content and corrosivity are limitations in the Crosstell-Gasil-Rader, Sanger-Purves-Slidell, Aldeo-Bolar-Sanger, Houston Black-Navo-Heiden, Ponder-Sanger-Slidell, and Frio-Trinity map units. Shallow depth to limestone bedrock is also a limitation in parts of the Sanger-Purves-Slidell map unit and the Aledo-Bolar-Sanger map unit, and the hazard of flooding is a limitation in the Frio-Trinity map unit. With the exception of the flooding limitation, however, these limitations can be partially overcome by good design and careful installation.

Only the soils in the Bastsil-Silawa and the Windthorst-Weatherford-Nimrod map units are well suited to recreation uses. The large lakes adjacent to these units provide water-related recreational activities. The Crosstell-Gasil-Rader map unit is moderately suited, but slope, very slow permeability, and wetness are limitations. The Sanger-Purves-Slidell, Aledo-Bolar-Sanger, Houston Black-Navo-Heiden, Ponder-Sanger-Slidell, and Frio-Trinity map units are limited by small stones, slope, a clayey texture, depth to rock, permeability, and flooding. These limitations are difficult to overcome. The wooded areas of the Crosstell-Gasil-

Rader, Aldeo-Bolar-Sanger, Bastsil-Silawa, and Windthorst-Weatherford-Nimrod map units are well suited to nature study, hiking and camping, and bird watching.

All of the map units are moderately suited or well suited to the development and improvement of habitat for doves, quail, and songbirds. Habitat can be improved by increasing the amount of native food and cover. Areas can be protected from overgrazing, and grain and seed crops can be grown on nearby soils. Furbearers are present in the wooded parts of the Crosstell-Gasil-Rader, Aledo-Bolar-Sanger, Frio-Trinity, and Windthorst-Weatherford-Nimrod map units, and a few deer are present in some isolated areas.

Information about soils can be used as a guide in planning the orderly growth and development of the county. This information is especially helpful in determining what areas to allocate to each use.

## soil descriptions

### 1. Crosstell-Gasil-Rader

*Nearly level to sloping, deep, loamy soils; on uplands*

This map unit is dominantly made up of moderately well drained to well drained soils that have slopes of 0 to 8 percent (fig. 2). The unit makes up about 23 percent of the county. It is about 24 percent Crosstell soils, 21 percent Gasil soils, 12 percent Rader soils, and 43 percent less extensive areas of Aubrey, Birome, Konsil, Mabank, Navo, Pulexas, Silstid, and Whitesboro soils and Urban land.

The gently sloping and sloping Crosstell soils are on uplands. These soils are moderately well drained, and permeability is very slow. Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil, at a depth of 4 to 41 inches, is clay that is yellowish red in the upper part and brownish yellow in the lower part. Yellowish and brownish mottles are throughout the profile. The underlying material at a depth of 41 to 60 inches is light gray stratified shale.

The gently sloping and sloping Gasil soils are on uplands. A few areas have been desurfaced. These soils are well drained, and permeability is moderate. Typically, the surface layer is brownish fine sandy loam about 10 inches thick. The subsoil, from a depth of 10 to 17 inches, is brown sandy clay loam. From a depth of 17 to 75 inches, it is sandy clay loam that is brownish yellow in

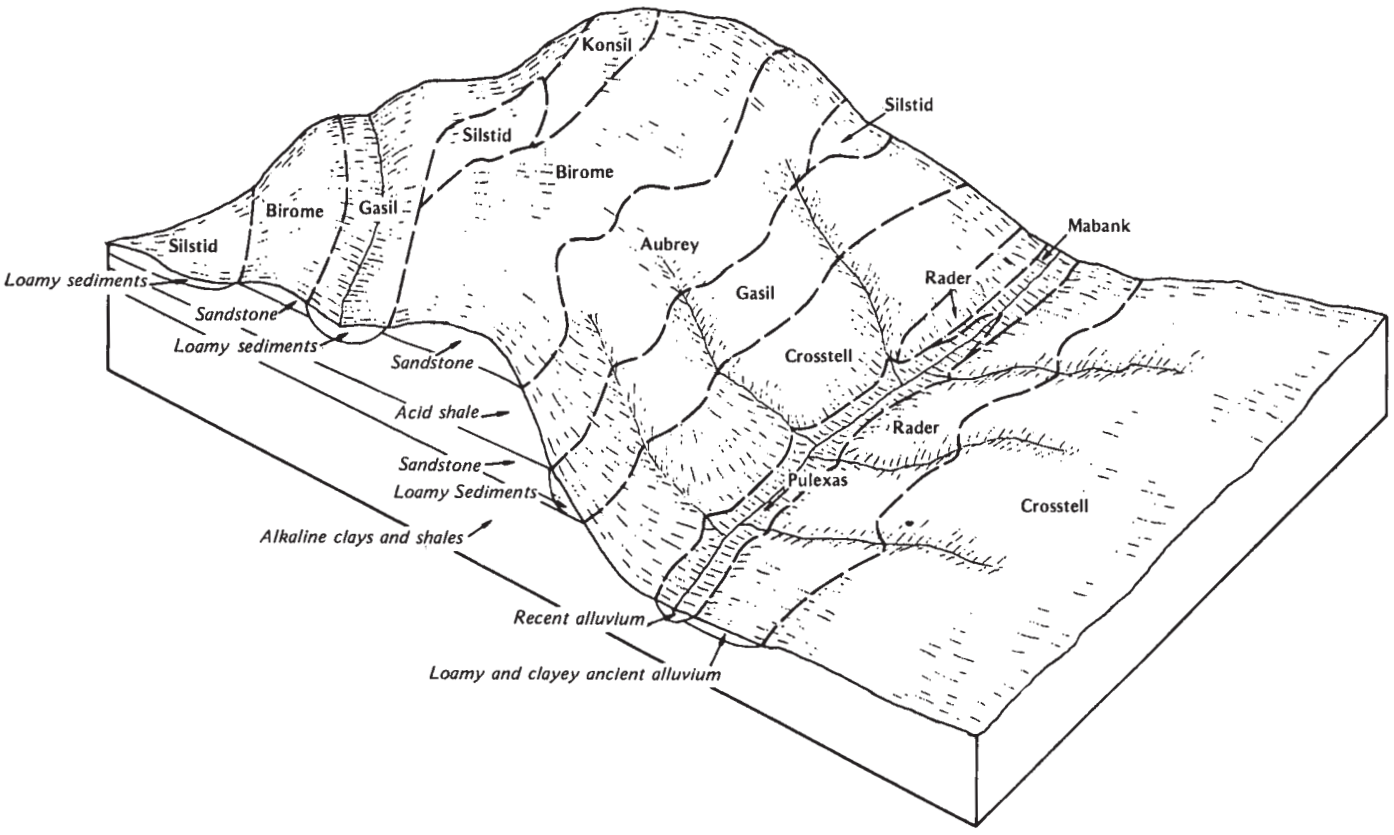



*Figure 2.*—Typical pattern of soils and parent material in the Crosstell-Gasil-Rader map unit.

the upper part and olive brown in the lower part. Brownish and reddish mottles are throughout the profile.

The nearly level and gently sloping Rader soils are on upland terraces and in valley fills. These soils are moderately well drained, and permeability is very slow. Typically, the surface layer is brownish fine sandy loam about 18 inches thick. The subsoil from a depth of 18 to 27 inches is light yellowish brown sandy clay loam. From a depth of 27 to 69 inches, it is sandy clay that grades to sandy clay loam in the lower few inches and is mottled throughout in shades of gray, yellow, and red.

The less extensive soils on uplands are the moderately deep, gently sloping to moderately steep, loamy Aubrey and Birome soils; the deep, loamy, nearly level and gently sloping, Konsil, Mabank, and Navo soils; and the deep, sandy, gently sloping Silstid soils. The deep, loamy nearly level, Pulexas and Whitesboro soils are on flood plains.

The soils in this unit are mainly used as pastureland and rangeland and for urban purposes. These soils are moderately suited to use as pastureland and rangeland and well suited to habitat for wildlife. Yields of improved bermudagrass and native grasses are fair in most years. A few areas are used for truck crops, but large scale farming is limited by low natural fertility and rapid urban development. Gasil soils are well suited to orchards and nursery plants.

The soils in this unit are moderately suited to urban and recreation uses. Shrinking and swelling with changes in moisture, permeability, slope, and wetness are limitations, but they can be partly overcome by good design and careful installation. Areas of these soils that presently have shade trees are desirable for residential development.

### 2. Sanger-Purves-Slidell

*Nearly level and gently sloping, deep and shallow, clayey soils; on uplands*

This map unit is dominantly made up of well drained soils that have slopes of 0 to 5 percent. Wide cracks form in these soils when they are dry. This unit makes up about 21 percent of the county. It is about 28 percent Sanger soils, 15 percent Purves soils, 10 percent Slidell soils, and 47 percent less extensive areas of Aledo, Bolar, Frio, Lindale, Mingo, and San Saba soils and Urban land.

The gently sloping Sanger soils are on uplands. Permeability is very slow. Typically, the surface layer is clay about 20 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. From a depth of 20 to 80 inches is brownish silty clay.

The nearly level and gently sloping Purves soils are on uplands. Permeability is moderately slow. Typically, the surface layer is dark grayish brown clay about 7 inches thick. At a depth of 7 to 15 inches is brown clay. Below that is fractured limestone interbedded with thin layers of clayey marl.

The nearly level and gently sloping Slidell soils are on uplands. Permeability is very slow. Typically, these soils are clay to a depth of 70 inches. They are very dark gray in the upper part, grading to grayish brown in the lower part. The underlying material from a depth of 70 to 80 inches is light brownish gray silty clay containing yellowish mottles.

The less extensive soils on uplands are the shallow, loamy and gravelly, gently sloping to moderately steep Aledo soils; the moderately deep, loamy, gently sloping to moderately steep Bolar soils; the moderately deep, loamy, gently sloping Lindale and Mingo soils; and the moderately deep, clayey, nearly level and gently sloping San Saba soils. The deep, clayey, nearly level Frio soils are on flood plains.

The soils in this unit are used as cropland, pastureland, and rangeland and for urban purposes. The soils are well suited to use as cropland, pastureland, and rangeland. Grain sorghum, small grains, cotton, and hay are the main crops grown on the Sanger and Slidell parts of this unit. Narrow-spaced, cool season crops are mainly grown on the Purves soils; however, the shallow depth to rock limits production. The soils are moderately suited to wildlife habitat. Woody vegetation is invading some areas of rangeland.

The soils in this map unit are moderately suited to most urban uses. Shrink-swell potential, corrosivity, and depth to limestone are limitations, but they can be partly overcome by good design and careful installation. These soils are poorly suited to recreation uses because of permeability, slope, and the clayey texture that causes the soil to form deep, wide cracks when dry and to be sticky when wet.

### 3. Aledo-Bolar-Sanger

*Gently sloping to moderately steep, very shallow to deep, loamy and clayey soils; on uplands*

This map unit is dominantly made up of well drained soils that have slopes of 1 to 20 percent (fig. 3). This unit makes up about 20 percent of the county. It is about 38 percent Aledo soils, 12 percent Bolar soils, 12 percent Sanger soils, and 38 percent less extensive areas of Brackett, Frio, Luckenbach, Maloterre, Purves, San Saba, Slidell, and Sunev soils and Urban land.

The gently sloping to moderately steep Aledo soils are on high ridgetops and moderately steep side slopes, where they are mixed with narrow bands of Bolar and Maloterre soils. Permeability is moderate. Typically, the surface layer is brown gravelly clay loam about 7 inches thick. The next layer, to a depth of 17 inches, is brown very gravelly clay loam. Below that is coarsely fractured limestone bedrock.

The gently sloping to moderately steep Bolar soils are on ridgetops and side slopes, where they are mixed with bands of Aledo soils. Permeability is moderate. Typically, the surface layer is dark grayish brown clay loam about 8 inches thick. The subsoil, to a depth of 31 inches, is clay loam that is brown in the upper part, grading to light

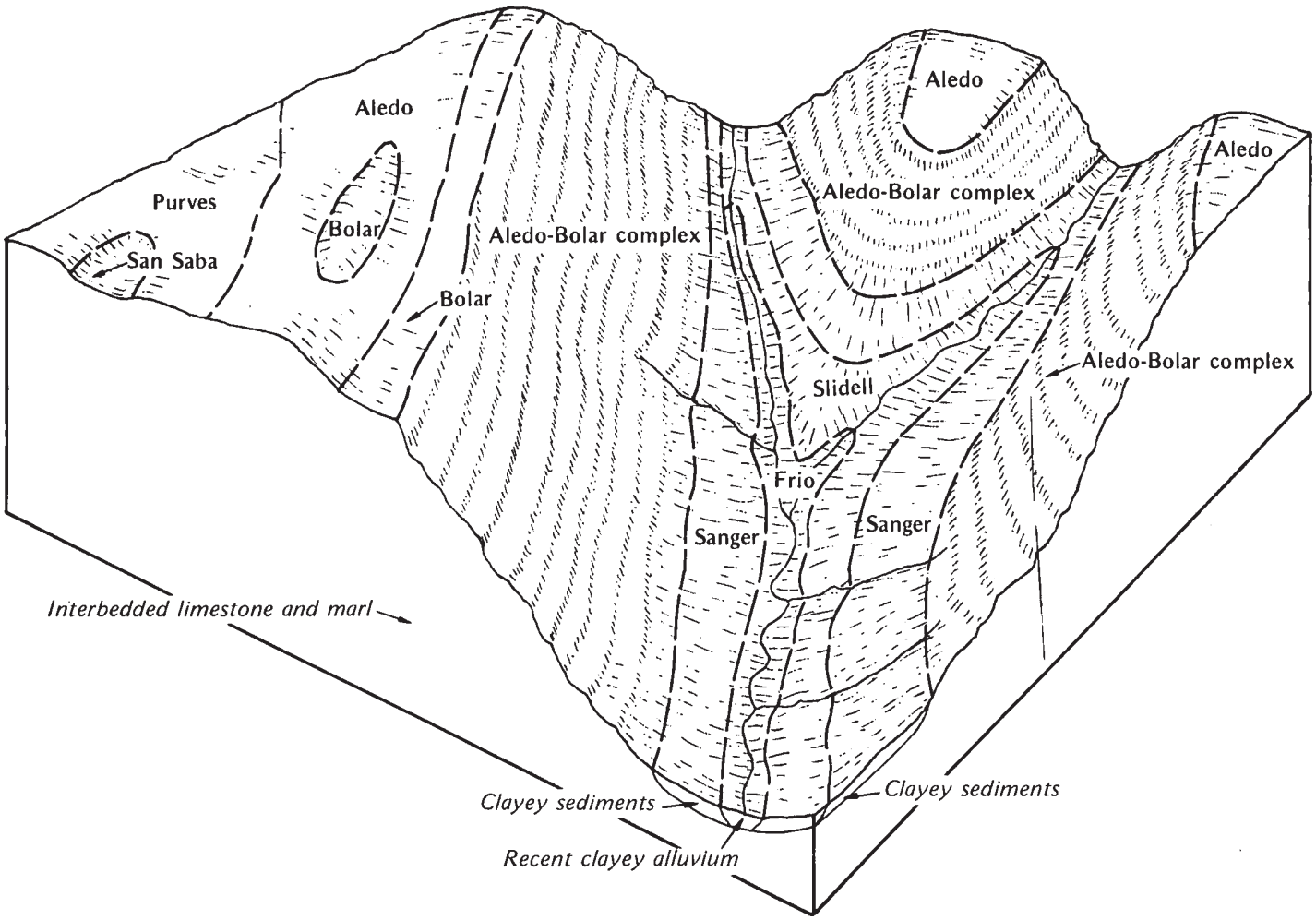



*Figure 3.*—Typical pattern of soils and parent material in the Aledo-Bolar-Sanger map unit.

yellowish brown loam in the lower part. Below that is fractured limestone interbedded with clayey marl.

The gently sloping Sanger soils are on uplands. These soils are very slowly permeable. Typically, the surface layer is clay about 20 inches thick that is very dark grayish brown in the upper part and dark grayish brown in the lower part. From a depth of 20 to 80 inches is brownish silty clay.

The deep, clayey, nearly level Frio soils are on flood plains of streams. The deep, loamy, gently sloping and sloping Luckenbach and Sunev soils are on stream terraces and colluvial foot slopes. The soils on uplands are the very shallow, loamy, gently sloping to moderately steep Maloterre soils; the clayey nearly level to gently sloping, shallow Purves soils and moderately deep San Saba soils; the deep, clayey, nearly level and gently sloping Slidell soils; and the shallow, loamy, gently sloping to sloping Brackett soils.

The soils in this unit are mainly used as rangeland, pastureland, and cropland and for urban purposes. The soils are moderately suited to rangeland. Native vegetation is mid and tall grasses with scattered trees and brush on the steeper slopes. These soils are moderately suited to wildlife habitat if trees and brush are present.

Generally, the soils in this unit are poorly suited to pastureland and cropland. Gravel, shallow root zone, droughtiness, and slope are limitations.

The soils in this unit are moderately suited to urban uses. Slope, depth to rock, and shrink-swell potential of the Sanger soils are limitations, but they can be overcome by good design and careful installation. This mapped area is poorly suited to recreation uses. Depth to rock, small stones, slope, and the clayey texture of the surface are limitations.

### 4. Houston Black-Navo-Heiden

*Gently sloping, deep, clayey and loamy soils; on uplands*

This map unit is dominantly made up of moderately well drained and well drained soils that have slopes of 1 to 5 percent (fig. 4). The unit makes up about 12 percent of the county. It is about 19 percent Houston Black soils, 19 percent Navo soils, 16 percent Heiden soils, and 46 percent less extensive areas of Altoga, Branyon, Burleson, Ferris, Frio, Leson, Lott, Ovan, and Wilson soils and Urban land.

The moderately alkaline, gently sloping Houston Black soils are on broad uplands. These soils are moderately well drained, and permeability is very slow. Typically, the soils are clay to a depth of 80 inches. The surface layer, about 8 inches thick, is very dark gray. These soils are dark gray to a depth of 42 inches. The lower part to a depth of 80 inches is dark grayish brown, grading to light yellowish brown.

The gently sloping Navo soils are on broad uplands. These soils are moderately well drained, and permeability is very slow. Typically, the surface layer is brown clay loam about 12 inches thick. The next layer to a depth of about 72 inches is brownish clay that is mottled in shades of brown, red, and gray.

The moderately alkaline, gently sloping Heiden soils are on uplands. These soils are well drained, and permeability is very slow. Typically, the soils are clay to a depth of about 64 inches. They are dark grayish brown in the upper part, grayish brown in the middle part, and light yellowish brown in the lower part. The underlying material from a depth of 64 to 72 inches is mottled yellowish and grayish, stratified shaly clay.

The less extensive soils on uplands are the

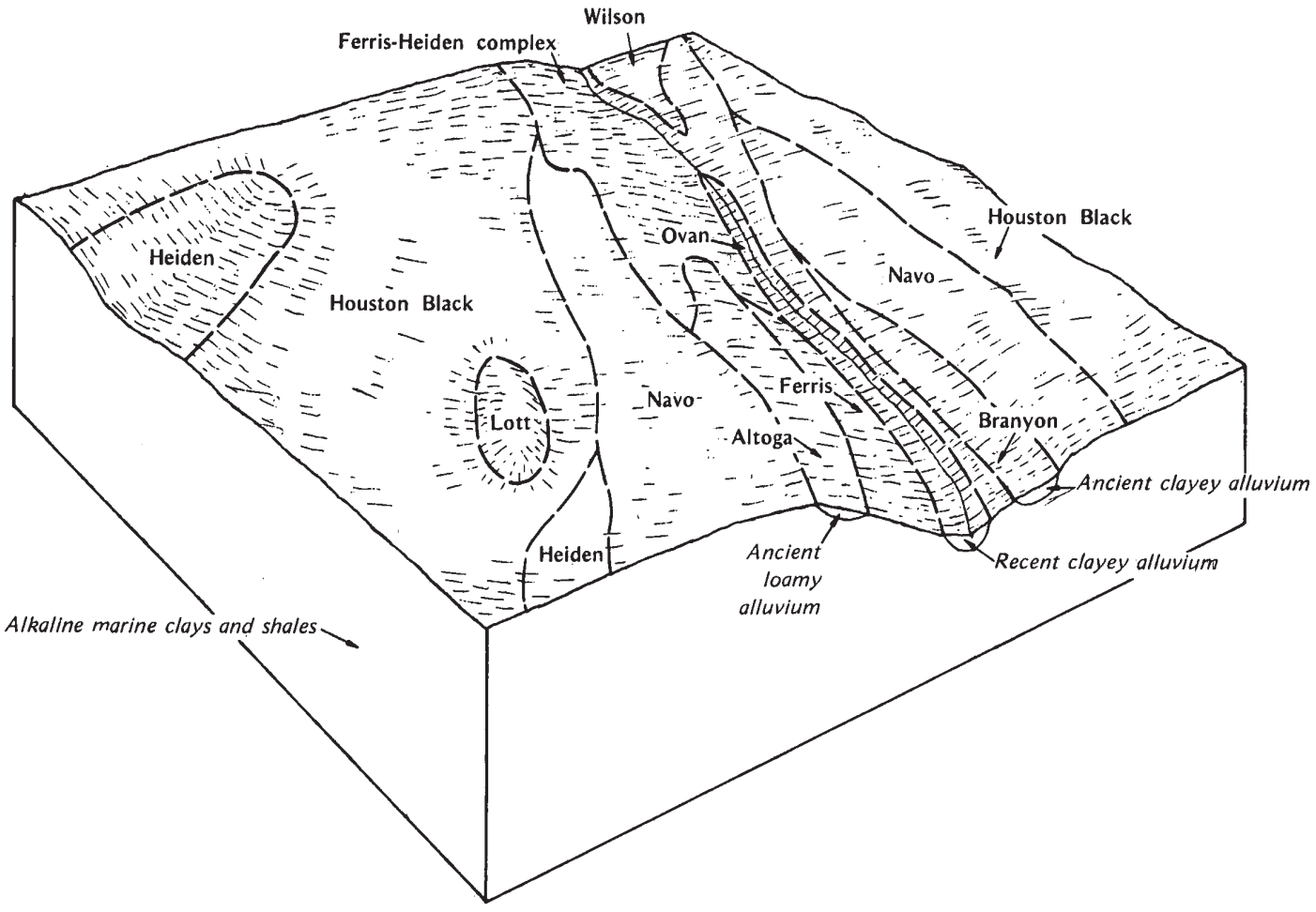



*Figure 4.*—Typical pattern of soils and parent material in the Houston Black-Navo-Heiden map unit.

moderately deep, loamy, sloping to strongly sloping Altoga soils; the deep, clayey, sloping and strongly sloping Ferris soils; the deep, clayey, nearly level and gently sloping, Branyon, Burleson, Leson, and Lott soils; and the deep, loamy, nearly level and gently sloping Wilson soils. The deep, clayey, nearly level Frio and Ovan soils are on flood plains.

The soils in this unit are used as cropland, pastureland, and for urban land. They are well suited to cultivated crops and hay. Grain sorghum, small grains, hay, and cotton are the main crops.

The soils in this unit are well suited to use as pastureland and rangeland. Yields of improved bermudagrass are good if moisture is favorable during the growing season. This mapped area is moderately suited to wildlife habitat.

The soils in this unit are moderately suited to urban uses. Shrink-swell potential, corrosivity, and very slow permeability are limitations, but they can be partly overcome by good design and careful installation. These soils are poorly suited to recreation uses. The clayey texture and very slow permeability are limitations.

### 5. Ponder-Sanger-Slidell

*Nearly level and gently sloping, deep, loamy and clayey soils; on uplands*

This map unit is dominantly made up of moderately well drained and well drained soils that have slopes of 0 to about 5 percent. Deep, wide cracks form in these soils when they are dry. The unit makes up about 8 percent of the county. It is about 30 percent Ponder soils, 15 percent Sanger soils, 10 percent Slidell soils, and 45 percent less extensive areas of Leson, Lott, and Wilson soils and urban land.

The nearly level and gently sloping Ponder soils are on uplands. These soils are moderately well drained, and permeability is slow. Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The upper part of the subsoil, to a depth of 53 inches, is clay that is brown, grading to yellowish brown. The lower part of the subsoil, at a depth of 53 to 80 inches, is brownish silty clay loam and contains many concretions and masses of calcium carbonate.

The gently sloping Sanger soils are on uplands. These soils are well drained, and permeability is very slow. Typically, the surface layer is very dark grayish brown clay about 10 inches thick. The next layer is about 10 inches of dark grayish brown clay. From a depth of 20 to 80 inches is brownish silty clay.

The nearly level and gently sloping Slidell soils are on uplands. These soils are well drained, and permeability is very slow. Typically, this moderately alkaline soil to a depth of 70 inches is clay. It is very dark gray in the upper part, grading to grayish brown in the lower part. The underlying material from a depth of 70 to 80 inches is light brownish gray silty clay that has yellowish mottles.

The less extensive soils on uplands are the deep, clayey, gently sloping Leson and Lott soils and the deep, loamy, nearly level and gently sloping Wilson soils.

The soils in this unit are mainly used as cropland and pastureland and for urban purposes. These soils are well suited to cultivated crops. Grain sorghum, cotton, small grains, and hay are the main crops. The soils are well suited to use as pastureland and rangeland. Yields of improved bermudagrass are high. Rangeland is a mixture of tall and mid grasses.

The soils in this unit are moderately suited to wildlife. These soils are also moderately suited to urban uses. Shrink-swell potential, corrosivity, and slow permeability are limitations, but they can be partly overcome by good design and careful installation.

These soils are poorly suited to recreation use. The clayey surface layer of the Sanger and Slidell soils is sticky when wet.

### 6. Frio-Trinity

*Nearly level, deep, clayey soils; on flood plains*

This map unit is dominantly made up of well drained and somewhat poorly drained soils that have slopes of 0 to 1 percent. The unit makes up 7 percent of the county. It is about 50 percent Frio soils, 9 percent Trinity soils, and 41 percent less extensive areas of Arents, Ovan, Pulexas, and Whitesboro soils, and Urban land.

Frio soils are on broad flood plains. The soils are well drained, and permeability is moderately slow. Typically, the surface layer is silty clay about 24 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. From a depth of 24 to 80 inches is brown silty clay loam.

Trinity soils are on broad flood plains, and the largest areas in the map unit are along the West Fork of the Trinity River in the eastern part of the county. These soils are somewhat poorly drained, and permeability is very slow. Typically, these soils are dark gray clay to a depth of about 63 inches. They have very dark grayish brown mottles below a depth of 32 inches.

The deep, loamy Arents are the piles of overburden and the excavated areas from gravel and sand mining operations on flood plains. Scattered areas of the deep, clayey Ovan soils and the deep, loamy Pulexas and Whitesboro soils are in this mapped area.

The soils in this unit are mainly used as pastureland and for urban purposes. If flooding is controlled, a few areas are used for truck crops and hay. The occasionally flooded areas are moderately suited to cropland. Frequently flooded areas are poorly suited to cultivation.

The soils in this unit are well suited to use as pastureland, rangeland, and wildlife habitat. Good yields

of improved bermudagrass are realized most years. Trees and brush are along stream channels.

The soils are poorly suited to urban and recreation uses. The hazard of flooding, shrink-swell potential, corrosivity, moderately slow and very slow permeability, and the clayey texture are limitations.

### 7. Bastsil-Silawa

*Nearly level to sloping, deep, loamy soils; on stream terraces*

This map unit is dominantly made up of well drained soils that have slopes of 0 to 8 percent. The unit makes up about 4 percent of the county. It is about 40 percent Bastsil soils, 20 percent Silawa soils, and 40 percent less extensive areas of Arents, Aquilla, Pulexas, Rader, and Silstid soils and Urban land.

The nearly level and gently sloping Bastsil soils are on high terraces. Permeability is moderate. Typically, the surface layer is pale brown fine sandy loam about 11 inches thick. The subsoil, from a depth of 11 to 80 inches, is sandy clay loam that is yellowish red in the upper part, red in the middle part, and yellowish red in the lower part.

The gently sloping to sloping Silawa soils are on terraces, typically below the Bastsil soils. Permeability is moderate. Typically, the surface layer is dark yellowish brown fine sandy loam about 6 inches thick. The subsoil, to a depth of about 46 inches, is sandy clay loam. It is red in the upper 15 inches and yellowish red below. From a depth of 46 to 60 inches, it is reddish yellow fine sandy loam.

The loamy Arents are upland soils that have been reclaimed after sand and gravel mining operations were suspended. The deep, sandy, gently sloping Aquilla and Silstid soils are on uplands. The deep, loamy, nearly level Pulexas soils are on flood plains. The deep, loamy nearly level to gently sloping Rader soils are on upland terraces and in valleys.

The soils in this unit are mainly used as pastureland and rangeland and for urban purposes. The soils are well suited to use as pastureland, rangeland, and wildlife habitat. Yields of improved bermudagrass and native grasses are high to medium in most years, depending on the amount of rainfall. These soils are well suited to truck crops, orchards, and nursery plants.

The soils in this unit are well suited to urban and recreation uses. Slope and the hazard of erosion are limitations in some areas, but good design and careful installation help to overcome the hazard of erosion. Slope is a limitation for some playground uses.

### 8. Windthorst-Weatherford-Nimrod

*Gently sloping and sloping, deep, loamy and sandy soils; on uplands*

This map unit is dominantly made up of moderately well drained and well drained soils that have slopes of 1 to about 8 percent (fig. 5). The unit makes up about 2 percent of the county. It is about 35 percent Windthorst soils, 23 percent Weatherford soils, 13 percent Nimrod soils, and 29 percent less extensive areas of Pulexas, Selden, and Stephenville soils.

The gently sloping and sloping Windthorst soils are on broad uplands. These soils are moderately well drained, and permeability is moderately slow. Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil, from a depth of 7 to 56 inches, is reddish clay and has yellowish and red mottles. The underlying material from a depth of 56 to 80 inches is reddish yellow fine sandy clay loam and has yellowish red mottles.

The gently sloping and sloping Weatherford soils are on uplands. These soils are well drained, and permeability is moderate. Typically, the surface layer is brownish fine sandy loam about 6 inches thick. The subsoil, from a depth of 6 to 51 inches, is sandy clay loam that is yellowish red in the upper part, light red in the middle part, and reddish yellow in the lower part. Below that to a depth of 60 inches is pink and white packsand and sandstone.

The gently sloping Nimrod soils are on uplands. These soils are moderately well drained, and permeability is moderately slow. Typically, the surface layer is brownish fine sand about 25 inches thick. The subsoil, from a depth of 25 to 40 inches, is reddish yellow sandy clay loam and has red and light gray mottles. From a depth of 40 to 80 inches, it is sandy clay loam mottled in shades of gray, red, and yellow.

The deep, loamy, nearly level Pulexas soils are on flood plains. The deep, sandy, nearly level to gently sloping Selden soils and the moderately deep, loamy, strongly sloping and moderately steep Stephenville soils are on uplands.

The soils in this unit are mainly used as pastureland and rangeland and for urban purposes. The soils are well suited to use as pastureland, rangeland, and wildlife habitat. Yields of improved bermudagrass and native grasses are medium in most years. The Weatherford and Nimrod soils are well suited to orchards if erosion can be controlled. The soils in this unit are moderately suited to cropland. Low fertility, slope in some areas, and the hazard of erosion are limitations.

The soils in this map unit are well suited to most urban and recreation uses. Slope, moderately slow permeability in some areas, the sandy texture, and the hazard of erosion are limitations, but they can be easily overcome by good design and careful installation.

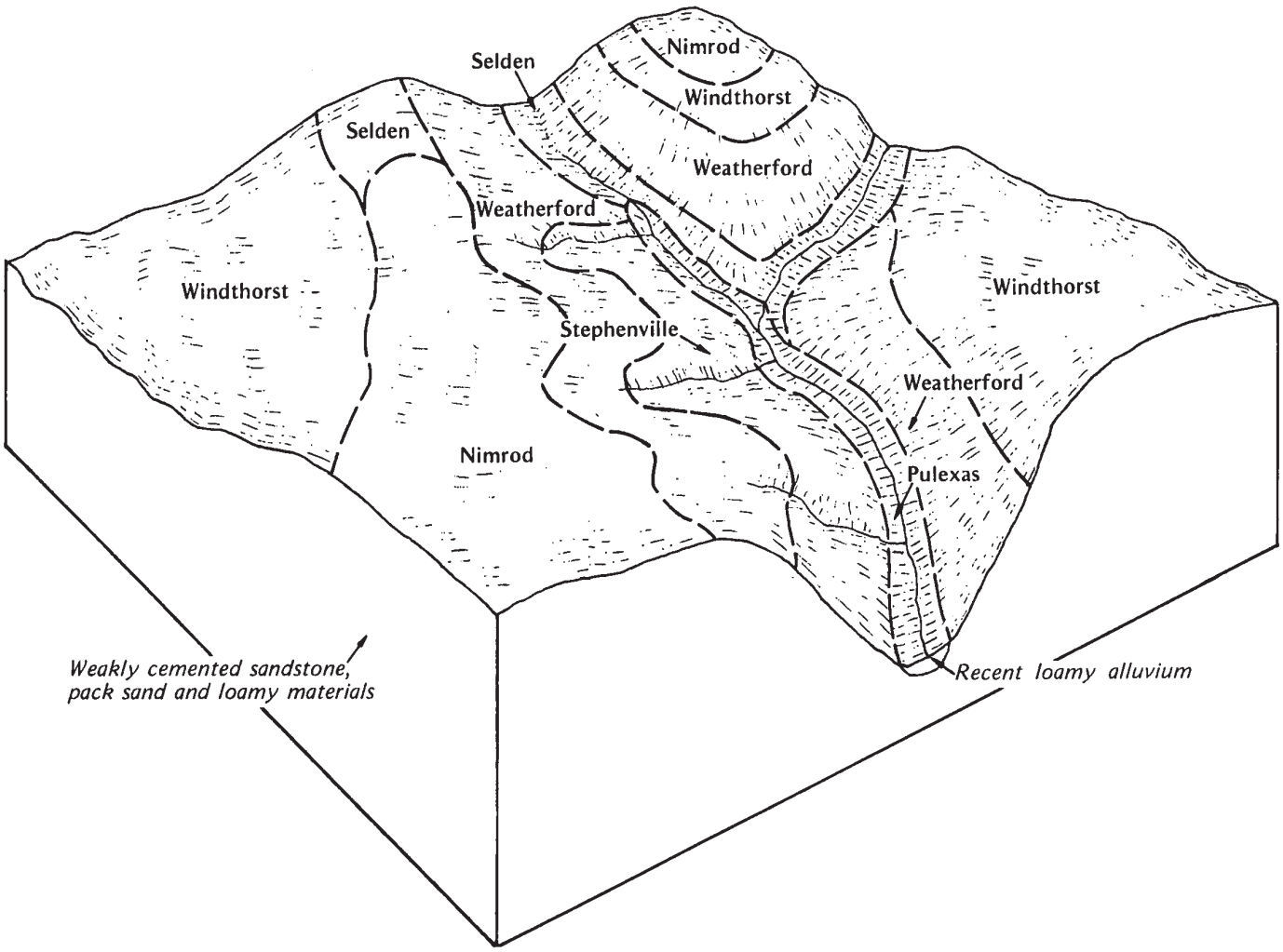



*Figure 5.*—Typical pattern of soils and parent material in the Windthorst-Weatherford-Nimrod map unit.

# detailed soil map units

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

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, Gasil fine sandy loam, 1 to 3 percent slopes, is one of several phases in the Gasil series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups. There are no soil associations in this survey.

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. Aledo-Bolar complex, 5 to 20 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes, is an undifferentiated group in this survey area.

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—Aledo gravelly clay loam, 1 to 8 percent slopes.** This shallow and very shallow, gently sloping and sloping, loamy soil is on ridgetops underlain by fractured limestone. Areas are oblong and average about 20 acres. Slopes average about 3 percent.

Typically, the surface layer is moderately alkaline, brown gravelly clay loam about 7 inches thick. From a depth of 7 to 17 inches is moderately alkaline, brown very gravelly clay loam that is about 60 percent limestone fragments. Below that to a depth of 24 inches is coarsely fractured limestone.

This soil is well drained. Permeability is moderate, and available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate. The root zone is restricted; however, plant roots can penetrate the fractures in the bedrock.

Included in mapping are small areas of Bolar and Purves soils and soils similar to the Aledo soil that are less than 8 inches deep to bedrock. These very shallow soils are in the more sloping positions and make up as much as 30 percent of some mapped areas. Bolar and Purves soils are on ridgetops and comprise 5 to 10 percent of some areas.

This Aledo soil is mainly used as rangeland. A few minor areas near deep soils are cultivated.

This soil is poorly suited to use as pastureland and cropland because of the layers of fractured rock near the

surface and very low available water capacity. Kleingrass is one of the better suited pasture grasses.

The Aledo soil is moderately suited to most urban uses. Depth to rock is the main limitation.

This soil is moderately suited to most recreation uses. Small stones and depth to rock are limitations. Using loamy fill material and maintaining a good grass cover help to overcome these limitations.

Areas of this map unit are preferred by quail and doves for food and cover.

This soil is in capability subclass VIs and the Shallow range site.

**2—Aledo-Bolar complex, 5 to 20 percent slopes.** The soils in this complex are shallow, very shallow, and moderately deep; sloping to moderately steep; and loamy. They are on the higher ridges and side slopes. The side slopes have horizontal limestone strata that outcrop every 5- to 30-foot change in elevation. The outcrops resist weathering and give the area a benched, or terraced, appearance. Areas are subrounded to long and narrow and range from 8 to about 650 acres.

This complex is about 65 percent Aledo soil, 25 percent Bolar soil, and 10 percent other soils and rock outcrops. The Aledo soil is underlain by fractured limestone at a depth of less than 20 inches. The Bolar soil is in areas between bands of the Aledo soil. The soils in this complex are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Aledo soil is moderately alkaline, dark grayish brown gravelly clay loam about 8 inches thick. From a depth of 8 to 17 inches is moderately alkaline, grayish brown very gravelly clay loam. Below that is limestone that is coarsely fractured and interbedded with clayey marl.

The Aledo soil is well drained. Permeability is moderate, and available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe. Water seeps to the surface along rock outcrops during wet seasons. The root zone is very shallow to shallow. Plant roots penetrate the fractures in the limestone.

Typically, the surface layer of the Bolar soil is dark grayish brown clay loam about 10 inches thick. The upper part of the subsoil, from a depth of 10 to 24 inches, is brown silty clay loam that has common fragments of limestone. The lower part, from a depth of 24 to 30 inches, is light gray silty clay loam that has yellowish and brownish mottles and fragments of limestone. Below that is fractured limestone interbedded with clayey marl. Reaction is moderately alkaline throughout.

The Bolar soil is well drained. Permeability is moderate, and available water capacity is low. Runoff is rapid, and the hazard of erosion is severe. The root zone is moderately deep and is easily penetrated by plant roots.

Included with this complex in mapping are small areas of Frio soils on narrow flood plains, Medlin soils on upper slopes, and Sanger soils on foot slopes. These soils make up less than 15 percent of any mapped area. In a few mapped areas, the closely similar Brackett soils make up as much as 20 percent.

These soils are used mostly as rangeland. They are poorly suited to cropland and pastureland because of slope and depth to bedrock.

The soils in this complex are moderately suited to most urban uses. The major limitations are depth to bedrock, slope, corrosivity to uncoated steel, and seepage during the wet seasons. These limitations are difficult to overcome, and good design and planning are essential. Areas in which seepage occurs should be avoided as construction sites. Lawns need frequent watering, and topsoil is needed in places. The high content of lime in these soils causes chlorosis in sensitive plants. The soils is this complex are poorly suited to most recreation uses because of slope, depth to bedrock, and small stones on the surface.

Areas of this map unit are preferred by quail and doves for food and cover.

This complex is in capability subclass VIs. The Aledo soil is in the Shallow range site, and the Bolar soil is in the Clay Loam range site.

**3—Aledo-Bolar-Urban land complex, 3 to 20 percent slopes.** The soils in this complex are gently sloping to moderately steep. They are on narrow ridges and side slopes. The side slopes have horizontal limestone strata that outcrop every 5- to 30-foot change in elevation. These rock outcrops resist weathering and give the areas a benched or terraced appearance. Slopes are convex and average about 8 percent. Areas are generally oblong and range from 20 to about 300 acres.

This complex is about 20 to 30 percent Aledo soil, 15 to 20 percent Bolar soil, 15 to 50 percent Urban land, and 20 percent other soils and rock outcrops. These soils and Urban land are so intricately mixed that it is not practical to map them separately.

The Aledo soil is on ridges and more sloping areas near rock outcrops. Typically, the surface layer is moderately alkaline, dark grayish brown gravelly clay loam about 8 inches thick. From a depth of 8 to 17 inches is moderately alkaline, grayish brown very gravelly clay loam that is about 65 percent by volume limestone fragments. This layer is underlain by a bed of limestone that is coarsely fractured.

The Aledo soil is well drained. Permeability is moderate, and available water capacity is very low; however, in places, water seeps to the surface above bands of limestone outcrops. The root zone is shallow to very shallow. Calcium carbonate concretions restrict the choice of plants that are adapted to this soil.

The Bolar soil is on slightly convex side slopes and the less sloping areas in the complex. Typically, this soil has a very dark grayish brown clay loam surface layer about 10 inches thick. The upper part of the subsoil is

about 14 inches of moderately alkaline, brown silty clay loam that has common limestone fragments. The lower part of the subsoil, from a depth of 24 to 30 inches, is light gray silty clay loam that has yellowish and brownish mottles and common limestone fragments. Below that is coarsely fractured limestone interbedded with clayey marl. Reaction is moderately alkaline throughout.

The Bolar soil is well drained. Permeability is moderate, and available water capacity is low. Runoff is rapid, and the hazard of erosion is severe. Calcium carbonate concretions limit the kinds of plants that can be grown on this soil.

Urban land consists of construction sites, structures, and other disturbed areas where the soil has been altered to the extent that classification is not practical. On these areas are churches, schools, individual dwellings, and small businesses and adjoining streets, driveways, and parking lots. Many areas have been disturbed by cutting, grading, and filling.

Included with this complex in mapping are small areas of Purves soils on ridges and Medlin, Sanger, and Sunev soils on side slopes and foot slopes. These soils make up as much as 15 percent of any mapped area.

The Aledo and Bolar soils are moderately suited to most urban uses. The main limitations are depth to limestone bedrock, corrosivity to uncoated steel, slope, and seepage during wet seasons. These limitations are difficult to overcome, and good planning and design are essential. Lawns need topsoil and frequent watering. Areas in which seasonal seepage occurs should be avoided as construction sites.

These soils are poorly suited to most recreation uses. Slope, depth to rock, and small stones are the main limitations for this use. Woody plantings provide food and cover for songbirds.

This complex is not in a capability unit or range site.

**4—Aledo-Urban land complex, 1 to 8 percent slopes.** The soil in this complex is shallow and very shallow and gently sloping and sloping. It is on convex ridgetops underlain by fractured limestone. Areas are mostly oblong and range from 5 to 60 acres. Slopes average about 3 percent.

This complex is about 50 to 65 percent Aledo soil, 15 to 40 percent Urban land, and less than 20 percent closely similar soils. The Aledo soil and Urban land are so intricately mixed that it is not practical to map them separately.

In an area of Aledo soil, unaltered by construction, the surface layer typically is moderately alkaline, brown gravelly clay loam about 7 inches thick. From a depth of 7 to 17 inches is moderately alkaline, brown very gravelly clay loam that is about 60 percent by volume limestone fragments (fig. 6). Coarsely fractured limestone is at a depth of 17 to 24 inches.

The Aledo soil is well drained. Permeability is moderate, and available water capacity is very low. Runoff is medium, and the hazard of erosion is moderate. The root zone is shallow to fractured limestone, but plant roots can penetrate the fractures.

Urban land mainly consists of residential houses, small businesses, streets, sidewalks, paved parking lots, and patios. Loamy and clayey fill material is present in some areas. Construction has altered the soils so that identification is not feasible in some areas.

Included with this complex in mapping are a few small areas of Bolar and Purves soils. These closely similar soils make up less than 20 percent of any mapped area.

The Aledo soil is moderately well suited to most urban uses. Depth to rock is the main limitation. Most of the bedrock is fractured and can be excavated without using explosives. The high content of calcium carbonate and

*Figure 6.*—Profile of an Aledo soil underlain by fractured limestone bedrock in an area of Aledo-Urban land complex, 1 to 8 percent slopes.

very low available water capacity limit the kinds of plants suited to this soil.

This soil is moderately well suited to recreation uses. Slope, small stones, and depth to rock are the main limitations. Adding loamy fill material and maintaining a good grass cover can help to overcome these limitations. Woody plantings provide food and cover for songbirds.

This complex is not in a capability subclass or a range site.

**5—Altoga silty clay loam, 5 to 12 percent slopes.** This moderately deep to deep, sloping and strongly sloping soil is on side slopes above flood plains. Areas are long and narrow and range from 15 to about 200 acres. Slopes average about 8 percent.

Typically, the surface layer is moderately alkaline, light yellowish brown silty clay loam about 6 inches thick. The subsoil, from a depth of 6 to 36 inches is moderately alkaline, silty clay loam that is light brownish gray in the upper part and light gray in the lower part. From a depth of 36 to 48 inches is moderately alkaline, very pale brown stratified silty clay loam.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is medium, and the hazard of erosion is severe. The root zone is easily penetrated by plant roots. The high content of lime causes chlorosis in some sensitive plants.

Included with this soil in mapping are small areas of Ferris soils in concave areas and eroded Altoga soils in formerly cultivated areas. These closely similar soils make up less than 20 percent of a mapped area.

This Altoga soil is poorly suited to cropland and pastureland. Slope and the severe hazard of erosion are the main limitations. Improved pasture is difficult to establish and manage because of slope. Improved bermudagrass, kleingrass, and weeping lovegrass can be grown if fertilizer is added.

This soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, slope, and corrosivity to uncoated steel are limitations. Septic tank absorption fields are poorly suited to this soil because of permeability and seepage.

This Altoga soil is moderately suited to most recreation uses. Slope is the main limitation.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**6—Aquilla loamy fine sand, 1 to 5 percent slopes.** This deep, gently sloping, sandy soil is on old terraces of major streams. Areas are round to oblong and range from 8 to about 110 acres.

Typically, the surface layer is mildly alkaline, brownish loamy fine sand about 6 inches thick. From a depth of 6 to 28 inches is neutral, reddish yellow loamy fine sand. From a depth of 28 to 80 inches is neutral, pink loamy fine sand that has bands of reddish yellow sandy loam ranging from 1/8 to about 1 inch in thickness.

This soil is somewhat excessively drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is low. This soil has a water table at a depth of 48 to 60 inches for short periods during seasons of heavy rainfall. Soil blowing is a severe hazard if the soil is bare of vegetation. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Silstid soils on upper slopes. In some areas are soils similar to the Aquilla soil but that do not have bands of sandy clay loam lamellae. These included soils make up as much as 20 percent of some mapped areas.

The Aquilla soil is well suited to use as pastureland. The main grasses are common and improved bermudagrass, indiangrass, switchgrass, and weeping lovegrass. Grass seedlings are difficult to establish because of blowing sand and the difficulty of obtaining a firm seedbed. Fertilizer should be added for sustained forage production. Applications should be at planned intervals throughout the growing season.

This soil is moderately suited to use as cropland. The low available water capacity and thick sandy surface are the main limitations. This soil is suited to peanuts, watermelons, and other truck crops. Leaving crop residue on the surface helps to maintain the organic matter content and control soil blowing.

The Aquilla soil is well suited to most urban uses. The main limitation is the seasonal water table. It affects septic tank absorption fields and causes basements to become flooded.

This soil is moderately suited to recreation uses. The main limitation is the deep, loose sand that blows when the soil is bare of vegetation.

Areas of this map unit are used by songbirds, quail, and doves. A variety of smaller animals, such as rabbits and small mammals also use this area.

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

**7—Arents, frequently flooded.** These deep, loamy soil materials are the overburden from excavated areas of gravel and sand mining operations on nearly level flood plains of large streams (fig. 7). Most of the unit consists of mounds and piled-up areas 15 to 40 feet high and pits 5 to 25 feet deep. The rest of the unit has been smoothed and reclaimed. Areas that are not protected by levees are flooded once or twice annually from fall to spring. Water is present in the deeper pits. Areas are irregular in shape and range from 5 to several hundred acres. Slopes generally are 0 to 1 percent.

The soil materials are extremely varied. They are in shades of red, brown, and yellow and contain varied amounts of clay, sand, silt, and gravel. The materials are

*Figure 7.*—Arents, frequently flooded, are the result of gravel mining operations in flood plains of the West Fork of the Trinity River. The ponded areas provide resting and feeding areas for waterfowl.

mainly loamy, moderately alkaline, and calcareous. Natural fertility is low.

Most areas of this unit are idle. Some are grazed or used for wildlife habitat. A few large areas have been used for sanitary landfills and are now smoothed. These soils are poorly suited to use as pastureland because of the slope and because they are inaccessible by livestock and farm equipment. Areas that are reclaimed by leveling and smoothing are well suited to improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and singletary peas.

These soil materials are poorly suited to use as cropland. Flooding is a limitation. They are also poorly suited to urban and recreation uses because of flooding.

This mapped area furnishes excellent wildlife habitat for quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

The smoothed and reclaimed areas are in capability subclass Vw and the Loamy Bottomland range site.

**8—Arents, loamy.** Arents are gently undulating, loamy soils that have been smoothed and reclaimed after sand and gravel mining operations were suspended. These soils are mainly on terraces along major streams. In most places, after smoothing and leveling, the areas are 1 foot to 3 feet lower than the surrounding landscape. Areas are irregularly shaped and range from about 5 to several hundred acres. Slopes range from 1 to about 5 percent.

Arents are extremely varied within a mapped area. They are stratified in shades of red, brown, and yellow. They mainly consist of loamy material that has varied amounts of sand, silt, clay, and gravel. Sandy clay loam is the dominant texture, but fine sand, loamy fine sand,

and fine sandy loam are common. They all can be present in a mapped area. Arents are mainly calcareous and moderately alkaline, but may have a few strata that are neutral or mildly alkaline.

The root zone is deep. These soils are moderately productive if fertilizer is added to offset the loss of organic matter. Because they are lower than the surrounding landscape, some areas of this map unit have ponded water for short periods.

These soils are mainly used as pastureland or for urban development. A few areas have been used for sanitary landfills, and a few have not been smoothed and reclaimed. The soils are well suited to use as pastureland. Reclaimed areas are well suited to improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and singletary peas.

Reclaimed areas of this map unit are moderately suited to use as cropland. Low natural fertility; wet, depressed areas; and soil blowing are limitations. Leaving crop residue on the surface helps to control erosion and to improve soil tilth.

These soils are well suited to urban and recreation uses. Controlling outside runoff and smoothing and shaping are necessary in most places. Areas that have been used for sanitary landfills are not suited to urban development.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

These soils are in capability subclass IVe and the Sandy Loam range site.

**9—Bastsil fine sandy loam, 0 to 3 percent slopes.** This deep, nearly level and gently sloping soil is on high terraces above the flood plains of major streams. Areas are subrounded and range from 5 to 65 acres.

Typically, the surface layer is slightly acid, pale brown fine sandy loam about 11 inches thick. The subsoil, from a depth of 11 to 56 inches, is slightly acid sandy clay loam that is yellowish red in the upper part and red in the lower part. From a depth of 56 to 80 inches, it is neutral, yellowish red sandy clay loam.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is medium, and the hazard of erosion is slight. This soil responds well to fertilizer. It is easily worked throughout a wide range of moisture conditions. The root zone is deep and is easily penetrated by plant roots. Some accessible areas are strip mined for the sand and gravel below the soil.

Included with this soil in mapping are small areas of Rader, Silawa, and Mabank soils. Rader and Mabank soils are in depressions. Silawa soils are in higher positions. These included soils make up as much as 15 percent of some areas.

This Bastsil soil is well suited to use as cropland. Small grains, orchards, and truck crops are grown in some areas. The major objectives of management are to prevent soil blowing and to maintain tilth and fertility. These objectives can be achieved by growing cool season legumes and leaving crop residue on the surface.

This soil is also well suited to use as pastureland. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, arrowleaf clover, and vetch are suitable. Proper management includes weed control, fertilizing with nitrogen and phosphorus, and controlled grazing.

The Bastsil soil is well suited to most urban and recreation uses. It has no limitation that cannot be easily overcome.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**10—Bastsil-Urban land complex, 0 to 5 percent slopes.** The soil in this complex is deep and nearly level and gently sloping. It is on high terraces above the flood plains of major streams. Areas are subrounded and range from 5 to more than 200 acres.

The complex is about 40 to 60 percent Bastsil soil, 15 to 40 percent Urban land, and as much as 25 percent other soils. The Bastsil soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Bastsil soil is slightly acid, pale brown sandy loam about 11 inches thick. The subsoil, from a depth of 11 to 56 inches, is slightly acid, sandy clay loam that is yellowish red in the upper part and red in the lower part. From a depth of 56 to 80 inches, it is neutral, yellowish red sandy clay loam.

The Bastsil soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. The root zone is deep and easily penetrated by plant roots.

The Urban land part of the complex is covered by dwellings, small businesses, and apartments and adjoining streets, driveways, sidewalks, parking lots, and other structures. These areas have been altered to the extent that classification is not practical.

Included with this complex in mapping are small areas of Rader soils in depressions and larger areas of the closely similar Silawa soils. These included soils make up as much as 25 percent of any one mapped area.

The Bastsil soil is well suited to most urban uses. Low strength, which affects roads and streets, is the main limitation. This limitation, however, can be overcome by good design and careful installation.

This soil is well suited to recreation uses. In a few areas, slope is the main limitation. Woody plantings provide food and cover for wildlife.

This complex is not in a capability subclass or range site.

**11—Birome fine sandy loam, 1 to 5 percent slopes.** This moderately deep, gently sloping, loamy soil is on

convex ridges and side slopes of ridges (fig. 8). Areas are subrounded and range from 5 to 50 acres.

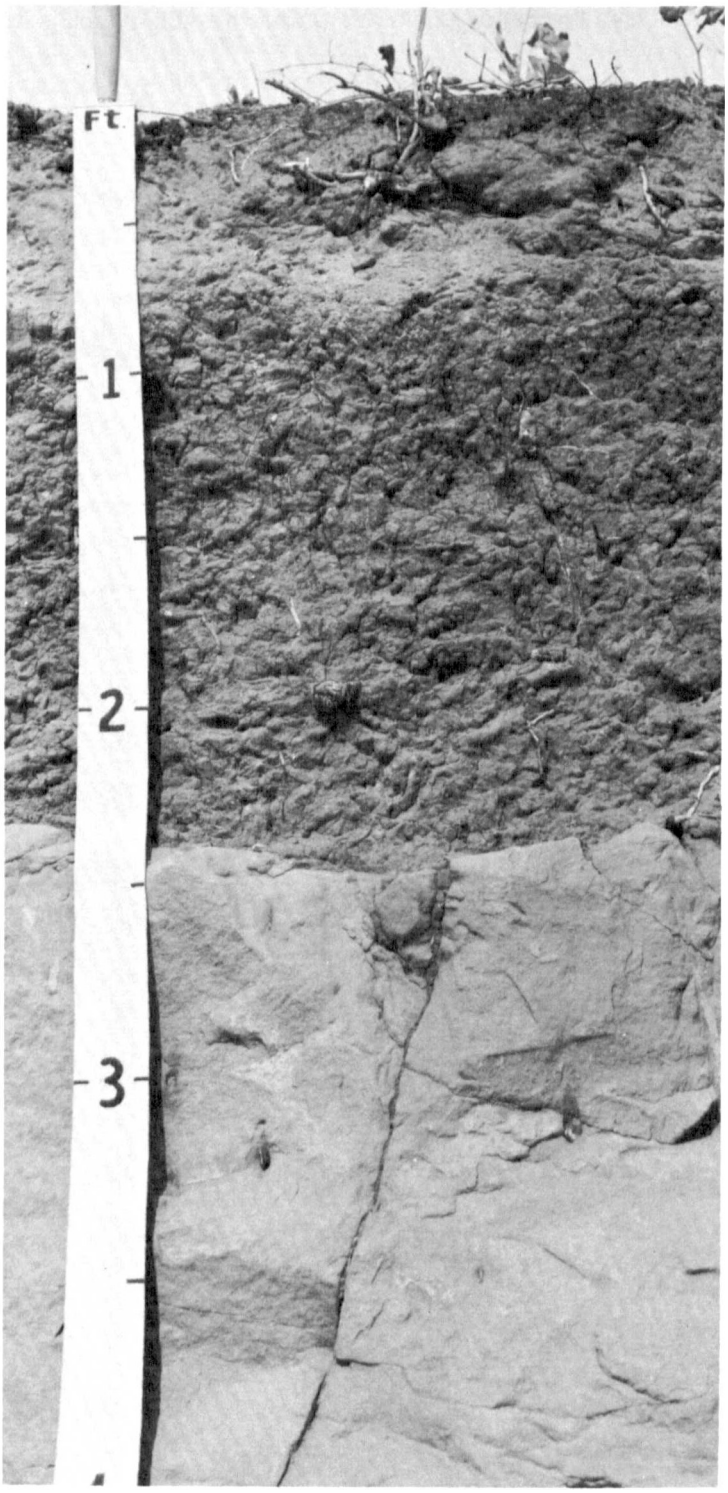



*Figure 8.*—Profile of Birome fine sandy loam, 1 to 5 percent slopes. Reddish sandstone is at a depth of about 30 inches. The scale is in feet.

Typically, the surface layer is neutral, brownish fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 15 inches, is medium acid, yellowish red clay. The lower part of the subsoil, from a depth of 15 to 35 inches, is strongly acid, reddish clay loam with brownish and reddish mottles. Below that to a depth of 50 inches is weakly cemented sandstone that becomes strongly cemented if it is exposed and dried out.

This soil is well drained. Permeability is slow, and available water capacity is low. Runoff is medium, and the hazard of erosion is moderate. The root zone is moderately deep, but penetration by plant roots is slow.

Included with this soil in mapping are small areas of Crosstell and Konsil soils on foot slopes and Rayex soils on narrow ridgetops. The closely similar Crosstell soil makes up 10 to 20 percent of some areas. Konsil and Rayex soils make up 5 to 15 percent of most areas. Small areas of Birome gravelly fine sandy loam are also included.

The Birome soil is well suited to use as pastureland. It is suited to improved bermudagrass, weeping lovegrass, switchgrass, kleingrass, vetch, and arrowleaf clover. Proper management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. Truck crops and small grain are grown. Slope and low available water capacity limit production. Terracing and planting crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is well suited to most urban and recreation uses. The most restrictive limitations are shrinking and swelling with changes in moisture, corrosivity to uncoated steel and concrete, slow permeability, and the hazard of erosion. These limitations can be overcome by good design and careful installation.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**12—Birome-Aubrey-Rayex complex, 5 to 15 percent slopes.** The soils in this complex are shallow and moderately deep, sloping to moderately steep, and loamy. They are on narrow ridges and slopes along drainageways on uplands. Two to about 6 percent of the surface is covered with sandstone and ironstone rocks and angular gravel. Narrow bands of sandstone outcrop on some slopes. On slopes below these outcrops are large sandstone slabs and fragments. Areas are subrounded to long and narrow and range from 6 to about 200 acres.

This complex is about 35 percent Birome soil, 30 percent Aubrey soil, 15 percent Rayex soil, and 20 percent other soils and rock outcrops. Birome and Rayex soils formed from sandstone or sandstone interbedded with clay and shale. These soils commonly are on the

higher parts of the complex. Aubrey soils formed from clays and shales and commonly are at lower elevations. The soils in this complex are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Birome soil is neutral, brownish fine sandy loam about 8 inches thick. The subsoil, from a depth of 8 to 27 inches is red clay that grades to clay loam. Below that to a depth of 47 inches is reddish, bedded, weakly cemented and fractured sandstone that becomes strongly cemented if it is exposed. This soil ranges from neutral to strongly acid.

Typically, the surface layer of the Aubrey soil is brown fine sandy loam about 5 inches thick. The subsoil, from a depth of 5 to 30 inches is clay that is yellowish red in the upper part and reddish brown with grayish mottles in the lower part. From a depth of 30 to 36 inches is yellowish brown clay. Below that to a depth of 56 inches is grayish shale interbedded with yellowish sandstone. This soil ranges from strongly acid to extremely acid.

Typically, the surface layer of the Rayex soil is neutral, brown gravelly fine sandy loam 5 inches thick. The subsoil, from a depth of 5 to 14 inches is medium acid, red clay loam. Below that to a depth of 40 inches is yellowish and reddish stratified sandstone (fig. 9).

The soils in this complex are well drained. Birome and Aubrey soils have slow permeability, and the Rayex soil has moderately slow permeability. Surface runoff is medium to rapid and creates a severe hazard of erosion. Water seeps to the surface in small areas after periods of heavy rainfall. The bedrock restricts root penetration. Natural fertility is low. The available water capacity is medium in the Aubrey soil, low in the Birome soil, and very low in the Rayex soil.

Included with this complex in mapping are the closely similar Crosstell soils and a soil similar to the Birome soil but that is less clayey in the subsoil. Also included are small areas of Gasil and Silstid soils and a shallow, clayey soil. These included soils make up as much as 30 percent of some mapped areas. The closely similar soils make up the larger part of these included soils.

The soils in this complex are poorly suited to use as pastureland and cropland because of slope, stones, and the severe hazard of erosion. A few small areas of the Birome soil are used as pastureland.

The Birome and Rayex soils are moderately suited to most urban and recreation uses, and the Aubrey soils are poorly suited to these uses. Slope, the hazard of erosion, low strength affecting streets and roads, corrosivity to uncoated steel and concrete, and permeability are limitations. The Aubrey soil is extremely acid in the lower part of the subsoil. Deep cuts made across the slope on this soil may result in soil slippage. Lawns are difficult to establish and maintain on these soils. The soils generally need additional topsoil, fertilizer, and frequent watering. Recreation uses of these soils are mainly limited to picnic areas and paths and trails.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

This complex is in capability subclass VIe. The Birome soil is in the Sandy Loam range site, the Aubrey soil is in

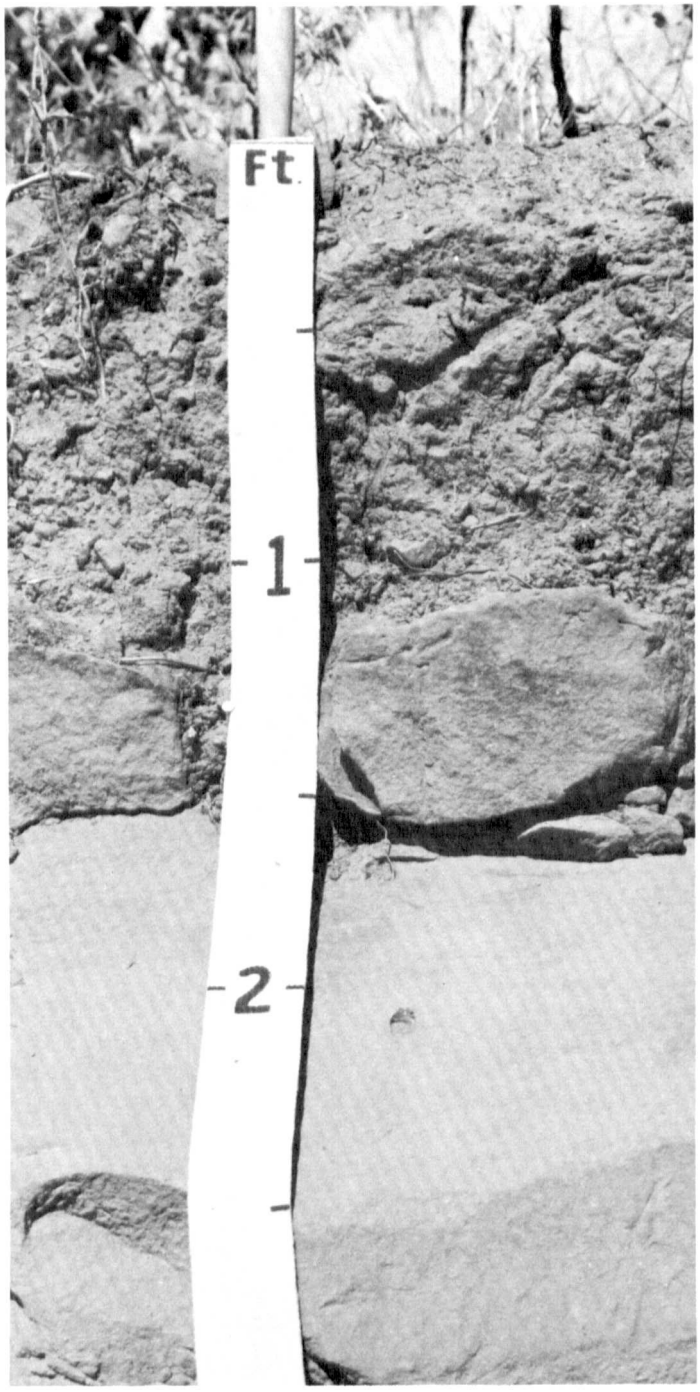



*Figure 9.*—Profile of Rayex gravelly fine sandy loam in an area of Birome-Aubrey-Rayex complex, 5 to 15 percent slopes. The underlying layer is sandstone. The scale is in feet.

the Tight Sandy Loam range site, and the Rayex soil is in the Sandstone Hill range site.

**13—Birome-Aubrey-Urban land complex, 5 to 15 percent slopes.** The soils in this complex are moderately deep and sloping to moderately steep. They are on convex ridges and side slopes. Areas are subrounded and range from 5 to more than 300 acres.

This complex is 25 to 30 percent Birome soil, 15 to 25 percent Aubrey soil, 15 to 40 percent Urban land, and less than 25 percent other soils. These soils and Urban land are so intricately mixed that it is not practical to map them separately.

The Birome soil formed in sandstone strata which commonly is at a higher elevation; but in some areas, thinner beds of sandstone are present at a lower elevation. Typically, the surface layer of the Birome soil is neutral, brownish fine sandy loam about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 20 inches, is strongly acid, red clay. The lower part of the subsoil, from a depth of 20 to 27 inches is strongly acid, red clay loam that has yellowish red mottles and weathered sandstone fragments. Below that to a depth of 47 inches is reddish, weakly cemented, fractured sandstone.

The Aubrey soil formed in stratified beds of clay and shale. The beds are at a lower elevation below the sandstone strata. Typically, the surface layer of the Aubrey soil is slightly acid, brown fine sandy loam about 5 inches thick. The subsoil, from a depth of 5 to 30 inches, is extremely acid clay that is yellowish red in the upper part and reddish brown in the lower part. From a depth of 30 to 36 inches, it is extremely acid, yellowish brown clay. Below that to a depth of 56 inches is grayish shale interbedded with thin strata of yellowish sandstone.

The Birome and Aubrey soils are well drained, and permeability is slow. The available water capacity is low for the Birome soil and medium for the Aubrey soil. Surface runoff is medium to rapid and creates a severe hazard of erosion. The root zone is moderately deep, but roots penetrate the clayey lower layers slowly. Reaction in the clayey layers of the Aubrey soil restricts some root growth.

The Urban land part of this complex consists of dwellings, small businesses, and apartments and adjoining streets, driveways, patios, and other structures that obscure or alter the soils to the extent that identification is not feasible.

Included with this complex in mapping are small areas of Crosstell, Gasil, and Rayex soils and a soil similar to the Birome soil but that has a less clayey subsoil. A few mapped areas have narrow areas of Pulexas soils on flood plains that were not mapped separately. These included soils make up as much as 25 percent of some mapped areas.

The Birome and Aubrey soils are moderately suited to most urban uses. Slope, the severe hazard of erosion, corrosivity to uncoated steel and concrete, and low strength affecting streets and roads are limitations. Soil slippage is likely to occur if deep cuts are made across the slope on the Aubrey soil. These limitations are difficult to overcome, and good design and careful installation are essential.

The soils in this complex are moderately suited to most recreation uses. Playgrounds are poorly suited because of slope. Other limitations are the severe hazard of erosion and slow permeability.

This complex is not in a capability subclass or range site.

**14—Bolar clay loam, 1 to 3 percent slopes.** This moderately deep, gently sloping, loamy soil is on convex upland ridges. Areas are subrounded and range from 6 to about 45 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam about 13 inches thick. The subsoil, from a depth of 13 to 30 inches, is moderately alkaline, brownish clay loam. Below that is fractured limestone interbedded with clayey marl.

This soil is well drained. Permeability is moderate, and available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate. Some plants are subject to chlorosis because of the high content of lime. The root zone is moderately deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Aledo and Purves soils on low ridges. These included soils make up as much as 20 percent of a mapped area.

This Bolar soil is well suited to use as pastureland. Improved bermudagrass, kleingrass, switchgrass, vetch, and singletary peas are suitable. Fertilizer should be added to maintain production.

This soil is moderately suited to use as cropland. Low available water capacity limits production. The soil is best suited to cool season crops. Growing closely spaced crops, such as small grains, and leaving the residue on the surface help to slow runoff and improve soil tilth.

This Bolar soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and depth to rock are the main limitations. The rock layer limits the amount of grading and leveling that can be easily done. Septic tank absorption systems work satisfactorily if the absorption field is the proper size.

This soil is well suited to most recreation uses. Depth to rock and slope are the main limitations. Using loamy fill material and maintaining a good grass cover can help to overcome the limitation of the sticky surface layer during wet periods.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**15—Bolar clay loam, 3 to 5 percent slopes.** This moderately deep, gently sloping, loamy soil is on convex ridges and upland slopes. Areas are long and narrow and range from 8 to about 100 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam about 8 inches thick. The subsoil, from a depth of 8 to 31 inches, is brownish, moderately alkaline clay loam. Below that to a depth of 41 inches is fractured limestone interbedded with clayey marl.

This soil is well drained. Permeability is moderate, and available water capacity is low. Runoff is medium, and the hazard of erosion is moderate. Some sensitive plants are affected by chlorosis because of the high content of calcium carbonate. The root zone is moderately deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Aledo soils over narrow bands of fractured limestone, Sanger soils near heads of drainageways, and soils similar to this Bolar soil but that have more than 35 percent by volume limestone fragments in the subsoil. A few areas of sloping Bolar soils are included. These included soils make up as much as 20 percent of some mapped areas.

This Bolar soil is moderately suited to use as pastureland. The high lime content of the subsoil and the low available water capacity limit production. Improved bermudagrass, kleingrass, switchgrass, vetch, and singletary peas are suitable. Fertilization, weed control, and controlled grazing are needed to produce good yields.

This soil is also moderately suited to use as cropland. Low available water capacity and runoff limit production. Terracing and farming on the contour help to slow runoff and to allow more water to enter the soil. Grassed waterways are needed for safe removal of excess terrace water. Growing closely spaced crops, such as small grains, and leaving the residue on the surface help to control erosion and to improve soil tilth.

The Bolar soil is moderately suited to most urban uses. Depth to rock, shrinking and swelling with changes in moisture, and corrosivity to uncoated steel are the main limitations. The rock layer limits the amount of grading and leveling that can be easily done and restricts downward movement of water. Seepage from septic tank absorption fields may occur on steeper areas.

This soil is moderately suited to most recreation uses (fig. 10). Slope, depth to rock, and the clay loam surface are the main limitations. Use of loamy fill material and maintaining a good grass cover can help overcome the limitation of the sticky surface during wet periods.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**16—Bolar-Urban land complex, 1 to 5 percent slopes.** The soil in this complex is moderately deep and gently sloping. It is on convex ridges and side slopes. Slopes average about 3 percent. Areas are subrounded and range from 20 to more than 100 acres.

This complex is 30 to 70 percent Bolar soil, 15 to 50 percent Urban land, and less than 20 percent other soils. The Bolar soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Bolar soil is moderately alkaline, dark grayish brown clay loam about 8 inches thick. The subsoil from a depth of 8 to 31 inches, is moderately alkaline, brownish clay loam that has common limestone fragments. Below that is fractured limestone interbedded with light yellowish brown clayey marl.

The Bolar soil is well drained. Permeability is moderate, and available water capacity is low. Runoff is medium, and the hazard of erosion is moderate. The root zone is moderately deep and is easily penetrated by plant roots. Some plants are subject to chlorosis because of the high concentrations of calcium carbonate.

The Urban land part of this complex consists of dwellings, small businesses, and apartments and adjoining streets, sidewalks, patios, driveways, and parking lots. Some areas have been disturbed by cutting, grading, and filling during construction. These construction activities have altered the soil to the extent that classification is not practical in many areas.

Included with this complex in mapping are small areas of Aledo soils near areas of rock outcrop and Sanger soils on foot slopes. These included soils make up less than 20 percent of any mapped area.

The Bolar soil is moderately suited to urban uses. Depth to rock, low strength affecting streets and roads, and corrosivity to uncoated steel are the main limitations. The rock layer limits the amount of grading and leveling that can be easily done and restricts downward movement of water. Septic tank filter field systems can be used, if the absorption area is the proper size. Seepage can occur, however, on steeper areas. The Bolar soil is moderately suited to recreation use. The clay loam surface and slope are the main limitations.

Woody plantings provide food and cover for songbirds.

This complex is not in a capability subclass or range site.

**17—Brackett clay loam, 3 to 8 percent slopes.** This shallow, gently sloping and sloping, loamy soil is on convex ridges and side slopes (fig. 11). Areas are weakly benched and elongated. They range from 10 to 45 acres. Slopes average about 5 percent.

Typically, the surface layer is moderately alkaline, light brownish gray clay loam about 4 inches thick. The

*Figure 10.*—A golf course on Bolar clay loam, 3 to 5 percent slopes. The valley fill area where the trees are growing is Sunev clay loam, 3 to 8 percent slopes. In some places the soils have been disturbed and mixed, especially around the greens.

subsoil, from a depth of 4 to 13 inches, is moderately alkaline, light gray clay loam. Below that to a depth of 40 inches is interbedded, pale yellow silty marl and soft weathered chalk.

This soil is well drained. Permeability is moderately slow, and available water capacity is very low. Runoff is rapid, and the hazard of erosion is severe. The root zone is shallow. The high concentration of calcium carbonate causes chlorosis in sensitive plants.

Included with this soil in mapping are small areas of Bolar soils in concave areas. Below rock outcrops are a few areas of Brackett gravelly clay loam. Also included are soils similar to the Brackett soils but that are underlain by indurated limestone. A few mapped areas have narrow bands of Maloterre soils along the rock outcrops. The included soils make up as much as 35 percent of some mapped areas.

This Brackett soil is poorly suited to use as pastureland. Very low available water capacity, the shallow rooting depth, and high content of calcium carbonate limit production. Improved bermudagrass and kleingrass can be grown. Pasture management includes weed control, fertilization, and controlled grazing.

This soil is poorly suited to use as cropland. Depth to rock, slope and very low available water capacity are limitations.

The soil is moderately suited to most urban and

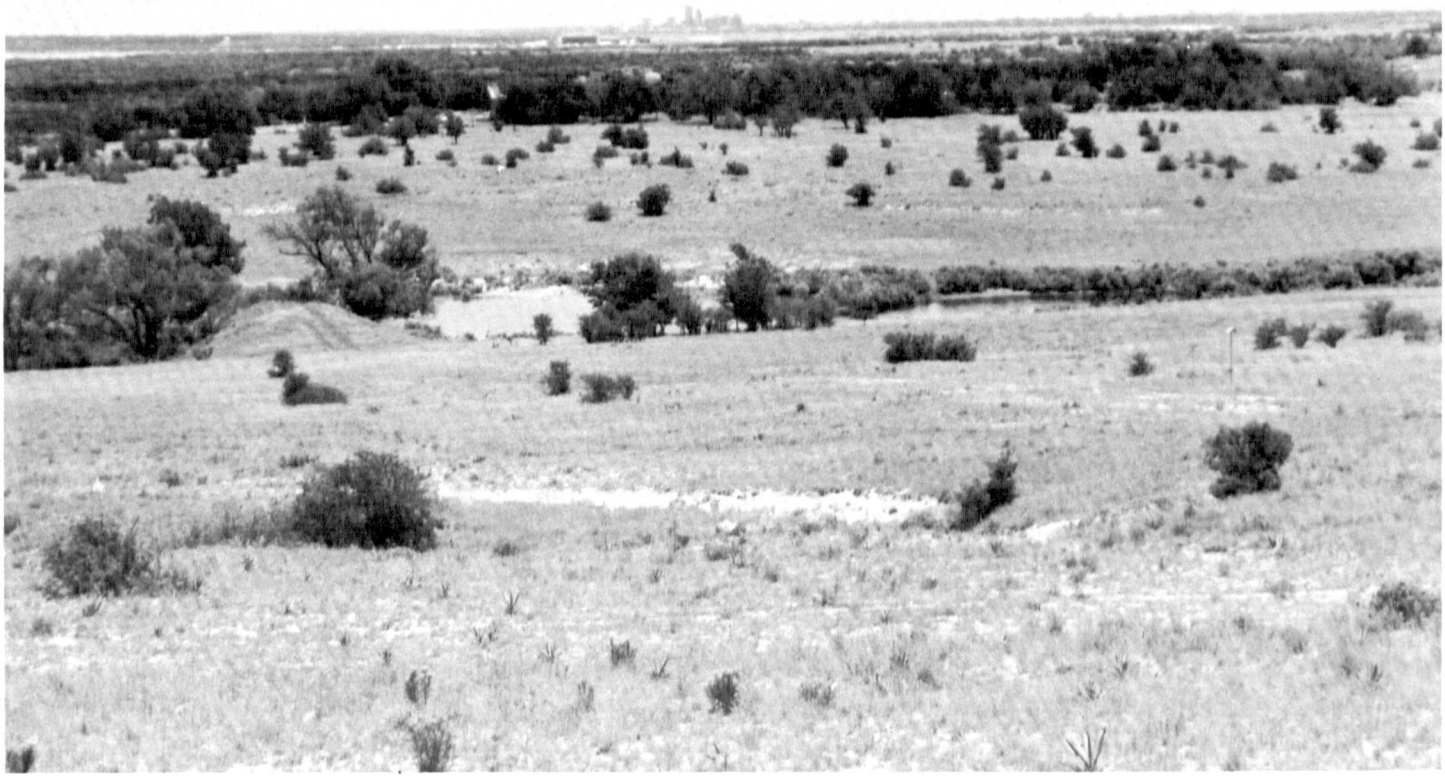


*Figure 11.*—Brackett clay loam, 3 to 8 percent slopes, in the Adobe range site. A stocktank is in the foreground on deeper soils, and the city of Fort Worth is on the horizon.

recreation uses. Depth to rock, permeability, slope, and corrosivity to uncoated steel are the main limitations. Most of the rock is soft. Septic tank absorption fields are poorly suited to this soil. Using loamy fill material and maintaining a good grass cover can help to overcome the limitation of the sticky surface when the soil is wet and the hazard of erosion.

Areas of this map unit are used infrequently by quail and doves. Food is scarce for wildlife.

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

**18—Branyon clay, 0 to 1 percent slopes.** This deep, nearly level, clayey soil is on broad, smooth valley fills and ancient stream terraces. Areas are subrounded and range from 45 to more than 600 acres.

Typically, the surface layer is moderately alkaline, dark gray clay to a depth of about 56 inches. From a depth of 56 to 70 inches is moderately alkaline, grayish brown clay. Below that is moderately alkaline, light brownish gray clay that has yellowish mottles. In some cultivated areas, the plow layer is dark grayish brown.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. At times, flat areas remain wet and delay planting early in spring. The soil is difficult to work during extremes in moisture conditions. The soil cracks when it is dry (fig. 12). The root zone is deep, but plant roots slowly penetrate the clayey lower layers.

Included with this soil in mapping are small areas of Houston Black soils in slightly higher positions on the landscape. These closely similar soils make up as much as 15 percent of some areas.

This Branyon soil is mainly used as cropland. It is well suited to row crops and small grains. Leaving crop residue on the surface and growing deep rooted, soil improving crops help to improve tilth and maintain the organic matter content.

This soil is well suited to use as pastureland. Improved bermudagrass, tall fescue, johnsongrass, kleingrass, and singletary peas are well suited to the soil. Areas are seasonally wet. The soil puddles if it is grazed when wet. Proper pasture management includes fertilization, weed control, and controlled grazing.

The soil is poorly suited to most urban uses. Limitations that affect urban development are shrinking

and swelling with changes in moisture, corrosivity to uncoated steel, and very slow permeability. These limitations can be partly overcome by good design and careful installation.

*Figure 12.*—Deep, wide cracks in Branyon clay, 0 to 1 percent slopes. Cracking is typical in soils of the Vertisol order.

The Branyon soil is poorly suited to recreation use. The clayey surface layer that is sticky when wet, slow runoff, and very slow permeability are limitations.

Doves and quail regularly inhabit the area. Grain crops provide food.

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

**19—Burleson clay, 0 to 1 percent slopes.** This deep, nearly level soil is on ancient upland terraces. Areas are subrounded and range from about 7 to 90 acres.

Typically, the surface layer is dark gray clay about 11 inches thick. From a depth of 11 to 66 inches is clay that is very dark gray in the upper part, dark gray in the middle part, and gray in the lower part. Reaction in this soil typically is slightly acid in the upper part, grading to moderately alkaline in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. When the soil is dry and cracked, water enters rapidly. When the soil is moist, water enters very slowly. Runoff is slow, and the hazard of water erosion is slight. At times, flat areas remain wet in spring and planting is delayed. The soil is difficult to till. A thick crust forms on the surface when the soil is dry. It is sticky when wet. The root zone is deep, but plant roots slowly penetrate the clayey lower layers.

Included with this soil in mapping are small areas of Branyon and Wilson soils. These included soils are in a random pattern and make up less than 15 percent of any mapped area.

This Burleson soil is well suited to use as cropland. It is used for small grains and row crops. Growing deep rooted, soil improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. Delaying cultivation until the soil is dry helps to reduce compaction. Rows should be planned so that excess water can safely drain off.

This soil is well suited to use as pastureland. Improved bermudagrass, tall fescue, kleingrass, and vetch are suitable. Grazing when the soil is wet causes poor tilth in the surface layer. Proper management includes fertilization, weed control, and controlled grazing.

The Burleson soil is poorly suited to most urban uses. Shrinking and swelling with changes in moisture, seasonal wetness, very slow permeability, and corrosivity to uncoated steel are the main limitations.

This soil is poorly suited to recreation use. The clayey texture, which causes deep wide cracks when the soil is dry, and very slow permeability are the main limitations for this use. Surface drainage is needed.

Doves and quail regularly inhabit this area. Forbs and grain crops provide food and cover.

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

**20—Chatt silty clay, 1 to 3 percent slopes.** This deep, gently sloping, clayey soil is on low terraces and foot slopes above flood plains. Areas are long and narrow and range from 12 to more than 200 acres. Slopes average slightly more than 2 percent.

Typically, the surface layer is silty clay about 16 inches thick that is dark grayish brown in the upper part and dark brown in the lower part. The upper part of the subsoil, from 16 to 38 inches, is brownish silty clay. The lower part of the subsoil from a depth of 38 to 66 inches is yellowish clay loam. Reaction is moderately alkaline throughout.

This soil is well drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is moderate. When the soil is dry, it is difficult to work, and wide cracks form in the upper layers. The root zone is deep, and plant roots penetrate the lower layers.

Included with this soil in mapping are small areas of Sanger soils on foot slopes, and Sunev soils on upper slopes. In parts of a few mapped areas, slope ranges to 4 percent. These closely similar soils make up as much as 20 percent of some mapped areas.

This Chatt soil is mainly used as pastureland. It is well suited to improved bermudagrass, johnsongrass, kleingrass, switchgrass, vetch, and singletary peas. Pasture management includes fertilization, weed control, and controlled grazing.

This soil is well suited to use as cropland. The objectives of management are controlling erosion and maintaining tilth. Terracing, contour farming, growing crops that produce large amounts of residue, and growing deep rooted legumes help to control erosion and maintain tilth.

The Chatt soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are the main limitations. Good design and careful installation are needed to overcome these limitations.

This soil is poorly suited to most recreation uses. The main limitations are moderately slow permeability and the silty clay surface that cracks when the soil is dry and is sticky when the soil is wet.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**21—Crosstell fine sandy loam, 1 to 3 percent slopes.** This deep, gently sloping, loamy soil is on convex ridges and side slopes. Areas are subrounded and range from 25 to several hundred acres.

Typically, the surface layer is brown fine sandy loam about 5 inches thick. The subsoil, from a depth of 5 to 44 inches, is clay. It is reddish in the upper part and brownish and grayish in the lower part. From a depth of 44 to 63 inches is stratified shale and loamy material. Reaction is typically strongly acid in the upper part and grades to mildly alkaline in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. The clayey underlying layers release water slowly. Runoff is medium, and the hazard of erosion is moderate. The surface layer is easily worked. If the soil is tilled too deep, however, large clods can be brought up from the subsoil. Plant roots have difficulty penetrating the clayey lower layers.

Included with this soil in mapping are small areas of Birome soils on ridgetops and Gasil soils on lower slopes. Also included are areas of eroded Crosstell soils less than 4 acres in size. Included soils make up as much as 20 percent of some mapped areas.

This Crosstell soil is moderately suited to use as cropland. The thin surface layer; the dense, clayey, acid subsoil; and low natural fertility limit production. Terracing and contour farming are needed to reduce erosion. Growing deep rooted, soil improving crops and leaving crop residue on the surface help to improve soil tilth and reduce erosion. Closely spaced crops grown during the cool season are best suited to this soil.

This soil is moderately suited to use as pastureland. The droughty nature of the clayey subsoil limits the amount of forage produced. Improved bermudagrass, kleingrass, weeping lovegrass, vetch, singletary peas, and arrowleaf clover are suited. Fertilizing with nitrogen, phosphorus, and potassium; weed control; and controlled grazing are needed for high forage production.

The Crosstell soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel and concrete, and very slow permeability are the main limitations. Good design and careful installation can help to overcome these limitations. This soil is also moderately suited to most recreation uses. Permeability is the main limitation. A good grass cover is essential to preventing erosion.

Doves and quail inhabit areas of this map unit. Because of the variety of forbs, this site is mainly used by birds and small mammals.

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

**22—Crosstell fine sandy loam, 3 to 6 percent slopes.** This deep, gently sloping and sloping, loamy soil is on convex ridges and side slopes of ridges. Areas are subrounded or long and narrow and range from about 10 to 250 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 4 inches thick. The subsoil, from a depth of 4 to 41 inches, is clay that is yellowish red in the upper part and brownish yellow in the lower part. Below that is stratified shale. Reaction typically is strongly acid in the upper part of the soil and mildly alkaline in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium.

Runoff is rapid, and the hazard of erosion is severe. The root zone is deep. This soil is droughty because it takes in water slowly and releases it slowly to plants.

Included with this soil in mapping are small areas of Birome soils on ridgetops and Gasil soils at random. Small areas of eroded Crosstell soils are in formerly cultivated areas. In some areas the surface layer is less than 3 inches thick; in other areas the subsoil is exposed. A few shallow gullies are present in places. These included soils make up less than 30 percent of any mapped area.

This Crosstell soil is moderately suited to use as pastureland. Rapid runoff and the droughtiness of the subsoil limit the amount of forage produced. Improved bermudagrass, weeping lovegrass, kleingrass, vetch, and singletary peas are suitable. Fertilizing with nitrogen, phosphorus, and potassium; weed control; and controlled grazing are needed for high forage production.

This soil is poorly suited to use as cropland. The severe hazard of erosion, droughtiness, and low fertility are the main limitations. Terracing and contour farming are needed to reduce erosion. Leaving crop residue on the surface helps to slow runoff, improve soil tilth, and prevent soil blowing.

This soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel and concrete, and the hazard of erosion are limitations that can be partly overcome by good design and careful installation. This soil is poorly suited to septic tank absorption fields because of very slow permeability. Slope and permeability are limitations for recreation uses.

Areas of this map unit are used by doves and quail. Because of the variety of forbs, this site is mainly used by birds and small mammals.

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

**23—Crosstell-Urban land complex, 1 to 6 percent slopes.** The soil in this complex is deep and gently sloping and sloping. It is on ridges and side slopes. Areas are irregular in shape and range from 7 to over 300 acres.

The complex is 50 to 65 percent Crosstell soil, 15 to 40 percent Urban land, and less than 25 percent closely similar soils. The components of this complex are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Crosstell soil is neutral, brown fine sandy loam about 4 inches thick. The upper part of the subsoil, from a depth of 4 to 18 inches, is strongly acid, yellowish red clay. The middle part, to a depth of 28 inches, is medium acid, yellowish red clay that has yellowish mottles. The lower part of the subsoil, to a depth of 41 inches, is neutral, brownish yellow clay that has light gray mottles. Below that to a depth of 60 inches is mildly alkaline, light gray stratified shale.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. Runoff is rapid, and the hazard of erosion is high. The root zone is deep, but root penetration is slow and difficult in the clayey lower layers.

The Urban land part of this complex is covered by individual dwellings, churches, schools, and small businesses and adjoining streets, driveways, parking lots, patios, and other structures that obscure or alter the soils to the extent that identification is not feasible.

Included with this complex in mapping are small areas of closely similar Aubrey, Birome, and Gasil soils. These included soils make up as much as 25 percent of any one mapped area.

The Crosstell soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, permeability, and slope are the main limitations. Good design and careful installation can help to overcome these limitations.

This soil is moderately suited to recreation uses. The main limitations are slope, permeability, and the severe hazard of erosion.

This complex is not in a capability subclass or a range site.

**24—Ferris clay, 5 to 12 percent slopes, eroded.** This deep, sloping and strongly sloping, clayey soil is on side slopes of ridges and on slopes above drainageways. Areas are longer than they are wide, and they follow the contour of the slope. Nearly all areas of this soil were formerly cultivated. Erosion has thinned the surface layer and has left parabolic-shaped gullies 1 foot to 3 feet deep and 4 to 20 feet wide in most areas. The gullies run the length of the slope and are 50 to 300 feet apart. Areas of this soil range from 30 to 75 acres.

Typically, this soil is moderately alkaline clay to a depth of 60 inches. The upper part is dark grayish brown. The lower part is yellowish brown and contains some shale fragments.

This soil is well drained. Permeability is very slow, and available water capacity is high. When the soil is dry and cracked, water enters rapidly; when the soil is moist, water enters very slowly. Runoff is rapid, and the hazard of water erosion is severe.

Included with this soil in mapping are small areas of Altoga soils on upper slopes and the crest of hills and small areas of Heiden soils on foot slopes and along uneroded, concave areas. These included soils make up less than 15 percent of any mapped area.

This Ferris soil is moderately suited to use as pastureland. Improved bermudagrass, kleingrass, indiangrass, switchgrass, johnsongrass, and sweetclover are suitable. Past erosion and rapid runoff limit productivity. Fertilization, weed control, and controlled grazing are necessary to maintain production.

This soil is poorly suited to use as cropland and to urban and recreation uses. The limitations are slope, gullies, water erosion, shrinking and swelling with changes in moisture, and corrosivity to uncoated steel. Soil slippage is likely to occur after deep cuts have been

made across the slope. Permeability restricts the use of this soil for septic tank absorption fields. Because of the clayey texture, deep, wide cracks form when the soil is dry.

Areas of this map unit are inhabited by coyote, rabbits, quail, and doves. Few deer come tc these areas.

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

**25—Ferris-Heiden complex, 2 to 5 percent slopes.** The soils in this complex are deep, gently sloping, and clayey. They are on convex ridges and side slopes above drainageways. Areas are elongated to long and narrow. They range from 8 to about 95 acres. In undisturbed areas, the surface is characterized by gilgai microrelief, consisting of microknolls and microdepressions.

This complex is about 50 percent Ferris soil, about 45 percent Heiden soil, and about 5 percent other soils that are similar. These soils are in such intricate patterns that it is not practical to map them separately.

Typically, the Ferris soil is moderately alkaline clay to a depth of about 60 inches. The upper part is dark grayish brown, grading to light yellowish brown in the lower part. Below that is stratified shale.

Typically, the Heiden soil is moderately alkaline clay to a depth of about 64 inches. It is dark grayish brown in the upper part, grading to yellowish brown in the lower part. From a depth of 64 to 72 inches is shaly clay.

The soils in this complex are well drained. Permeability is very slow, and available water capacity is high. When the surface is dry and cracked, water enters the soil rapidly. When the soil swells and the cracks close, water enters very slowly. Surface runoff is rapid, resulting in a severe hazard of water erosion. The soils are difficult to work during extremes in moisture conditions. The root zone is deep, but plant roots penetrate slowly.

Included with this complex in mapping are small areas of Frio, Houston Black, Lott, and Navo soils. Frio soils are along small drainageways. Lott soils are on the crest of ridges. Houston Black and Navo soils are on lower slopes and areas near drainageways. These included soils make up about 5 percent of some mapped areas.

The soils in this complex are mainly used as pastureland, but some areas are still cultivated. These soils are well suited to use as pastureland. Improved bermudagrass, switchgrass, kleingrass, johnsongrass, sweetclover, and vetch are commonly grown. Pasture management includes fertilization, weed control, and controlled grazing.

These soils are moderately suited to use as cropland. Grain sorghum, cotton, hay, and small grains are the main crops. Erosion has lowered the natural fertility in cultivated areas. The main objects of management are controlling erosion, improving tilth and fertility, and conserving soil moisture. Terracing and farming on the contour help to slow runoff, thereby reducing erosion. Grassed waterways are essential for stabilizing terrace outlets. Growing crops that produce large amounts of residue and leaving the residue on the soil help to improve tilth, control erosion, and conserve soil moisture. Growing deep rooted, warm or cool season legumes helps to control erosion and improve tilth and fertility.

The soils in this complex are moderately suited to most urban uses. The limitations are shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and soil slippage. These limitations can only be partly overcome by good design and careful installation. These soils are poorly suited to septic tank absorption fields because of very slow permeability and are poorly suited to most recreation uses. The main limitations are permeability, slope, and the clayey texture that causes the soil to have deep, wide cracks when dry and to be sticky when wet.

Areas of this map unit are inhabited by coyote, rabbits, quail, and doves. Few deer come to these areas.

This complex is in capability subclass IVe. The Ferris soil is in the Eroded Blackland range site, and the Heiden soil is in the Blackland range site.

**26—Frio silty clay, occasionally flooded.** This deep, nearly level, clayey soil is on flood plains of major streams (fig. 13). It is flooded every 3 to 15 years for several hours each time. Areas are longer than they are wide. They range from 5 to about 500 acres. Slopes range from 0 to 2 percent but are mainly less than 1 percent.

Typically, the surface layer is moderately alkaline, very dark grayish brown silty clay about 15 inches thick. The next layer is about 9 inches of moderately alkaline, dark grayish brown silty clay. From a depth of 24 to 80 inches is moderately alkaline, brown silty clay loam.

This soil is well drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. The soil is difficult to work during extremes in moisture conditions. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Ovan and Trinity soils. These soils are in slightly lower positions near the outer edges of the flood plain. A few areas have a loamy, overwashed surface layer. The included soils make up as much as 20 percent of some mapped areas.

This Frio soil is well suited to use as cropland. It is used for small grain, hay, and grain sorghum. The major objectives of management are maintaining tilth and fertility. Growing deep rooted legumes and crops that produce large amounts of residue helps to maintain tilth and fertility.

This soil is well suited to use as pastureland. It is well suited to improved bermudagrass, tall fescue, indiangrass, kleingrass, switchgrass, vetch, and singletary peas. Proper pasture management includes fertilization, weed control, and controlled grazing.

The hazard of flooding is the main limitation for urban uses. The soil is moderately suited to most recreation

*Figure 13.*—Forage sorghum on Frio silty clay, occasionally flooded. Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes, are in the background behind the flood plain.

uses. The silty clay surface is the main limitation. Because of flooding, this soil is poorly suited to use as campsites.

Areas of this map unit furnish excellent wildlife habitat for quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

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

**27—Frio silty clay, frequently flooded.** This deep, nearly level soil is on flood plains of major streams. It is flooded once to 3 times each year. The floods are very brief, lasting from a few hours to a day. Areas of this map unit are longer than they are wide. They range from 20 to 165 acres. Slopes range from 0 to 2 percent but average less than 1 percent.

Typically, the surface layer is moderately alkaline, dark grayish brown silty clay about 35 inches thick. From a depth of 35 to 59 inches is moderately alkaline, grayish brown clay loam. Below that to a depth of 72 inches is moderately alkaline, dark grayish brown silty clay.

This soil is well drained. Permeability is moderately slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Ovan and Trinity soils in lower positions near the outer edges of the flood plain. Also included are soils near stream channels that are less clayey than the Frio soil. These included soils make up less than 20 percent of any mapped area.

This Frio soil is well suited to use as pastureland. It is well suited to improved bermudagrass, tall fescue, indiangrass, kleingrass, and switchgrass. Proper management includes fertilization, weed control, and controlled grazing.

The hazard of flooding is the main limitation for the use of this soil as cropland and for urban and recreation uses. This limitation can be overcome only by major flood control. The silty clay surface layer is also a limitation for some recreation uses.

Areas of this map unit furnish excellent wildlife habitat for quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

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

**28—Frio-Urban land complex, occasionally flooded.** The soil in this complex is deep and nearly level. It is on flood plains of major streams. Areas that are not protected by levees are briefly flooded about once every 3 to 20 years. Areas of this complex are longer than they are wide and range from 25 to more than 300 acres.

The complex is 40 to 70 percent Frio soil, 15 to 40 percent Urban land, and less than 15 percent closely similar soils. The Frio soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Frio soil is moderately alkaline, very dark grayish brown silty clay about 15 inches thick. From a depth of 15 to 24 inches is moderately alkaline, dark grayish brown silty clay. From a depth of 24 to 80 inches is moderately alkaline, brown silty clay loam.

The Frio soil is well drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. The root zone is deep and is easily penetrated by plant roots. Natural fertility is high. Areas of this soil are subject to brief flooding during long periods of heavy rainfall.

The Urban land part of this complex is covered by individual dwellings, apartments, small businesses, industrial sites, and recreation areas and their adjoining streets, driveways, parking lots, and other structures that obscure or alter the soils to the extent that identification is not feasible.

Included with this complex in mapping are small areas of closely similar Ovan and Trinity soils and soils near stream channels that are less clayey than the Frio soils. These included soils make up as much as 15 percent of any mapped area.

The hazard of flooding, low strength affecting streets and roads, and corrosivity to uncoated steel are the main limitations for urban uses. Unprotected areas are subject to brief, occasional floods that damage urban structures, septic tank filter fields, and sewage lagoons. The hazard of flooding is difficult to overcome.

The Frio soil is moderately suited to recreation uses. Occasional flooding, the silty clay surface, and permeability are the main limitations. Woody plantings provide food and cover for songbirds.

This complex is not in a capability subclass or range site.

**29—Gasil fine sandy loam, 1 to 3 percent slopes.** This deep, gently sloping soil is on convex ridges and side slopes. Areas are mainly longer than they are wide and range from 8 to more than 100 acres.

Typically, the surface layer is fine sandy loam about 10 inches thick that is light yellowish brown in the upper 6 inches and yellowish brown in the lower 4 inches. The upper part of the subsoil, from a depth of 10 to 17 inches, is brown sandy clay loam. The lower part of the subsoil, from a depth of 17 to 75 inches, is brownish yellow sandy clay loam that has brownish and reddish mottles. Reaction typically is neutral in the upper part of the soil, grading to strongly acid in the lower part.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is slow, and the hazard of erosion is moderate. The soil is easily worked throughout a wide range of moisture conditions. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Konsil soils on ridges and Rader soils on foot slopes. A few spots of Gasil loamy fine sand are also included. The included soils make up as much as 25 percent of some mapped areas.

This Gasil soil is well suited to use as pastureland. It is also well suited to improved bermudagrass, weeping lovegrass, switchgrass, and vetch. The objectives of pasture management are fertilization, weed control, and controlled grazing.

The soil is well suited to use as cropland. Low fertility and medium available water capacity limit production. Terracing and growing crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is well suited to most urban and recreation uses. Low strength is a limitation for streets and roads, but it can be overcome by good design and careful installation. Septic tank absorption fields are moderately suited to this soil because of permeability.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**30—Gasil fine sandy loam, 3 to 8 percent slopes.** This deep, gently sloping to sloping soil is on convex ridges and side slopes. Areas are long and narrow and range from 8 to 70 acres.

Typically, the surface layer is neutral, yellowish brown fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 21 inches, is slightly acid, strong brown sandy clay loam. The lower part of the subsoil, to a depth of 80 inches, is strongly acid, yellowish brown sandy clay loam that has red mottles throughout and yellowish mottles in the lower part.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. This soil is easily

worked throughout a wide range of moisture conditions. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Birome and Konsil soils on ridges and scattered areas of Silstid soils. A few spots of Gasil loamy fine sand are also included. The included soils make up as much as 20 percent of some mapped areas.

This Gasil soil is well suited to use as pastureland. Adapted species are improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover. Proper management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. Slope, the hazard of erosion, medium available water capacity, and low natural fertility are limitations. Terracing and contour farming help to slow runoff, thereby reducing soil loss. Growing cover crops and leaving crop residue on the surface help to maintain tilth and to reduce soil blowing and water erosion.

This soil is well suited to most urban uses. Low strength affecting streets and roads and the hazard of erosion are limitations that can be easily overcome by proper design and careful installation. Permeability is a limitation for septic tank absorption fields. This soil is well suited to most recreation uses. Slope is a limitation for playgrounds.

Areas of this unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**31—Gasil sandy clay loam, graded, 1 to 5 percent slopes.** This deep, gently sloping soil is on desurfaced upland areas. The surface layer and, in some areas, part of the upper part of the subsoil have been removed for topsoil for yards and base material for roads. The surface is uneven. A thin, loamy or sandy overwash is present in some areas at the base of slopes. Vegetation is sparse in most areas. Areas are square or subrounded and range from 5 to 50 acres.

Typically, after grading, the exposed subsoil to a depth of 45 inches is medium acid, yellowish brown sandy clay loam that has strong brown mottles below a depth of 10 inches. From a depth of 45 to 60 inches is medium acid sandy clay loam mottled yellowish brown, brown, and red.

This soil is well drained, but most areas receive runoff from adjacent areas because they are lower than the surrounding, undisturbed soils. Permeability is moderate, and available water capacity is medium. Runoff is rapid, and the hazard of erosion is severe if slopes are bare of vegetation. Natural fertility is very low. The root zone is deep.

This Gasil soil is moderately suited to use as pastureland. Improved bermudagrass, bahiagrass, weeping lovegrass, kleingrass, vetch, and arrowleaf clover are adapted. A good stand of grass is difficult to maintain because of the very low natural fertility resulting from the removal of the surface layer and the severe hazard of erosion. Fertilization with nitrogen, phosphorus, and potassium; weed control; and controlled grazing are needed for high production.

The soil is poorly suited to use as cropland. It is limited to this use because of very low fertility and the severe hazard of erosion. Areas can be reclaimed and made suitable for crops by terracing to control erosion, adding organic matter and fertilizer to improve tilth, and growing legumes and crops that produce large amounts of residue. Lime may be needed.

This soil is well suited to most urban uses. The main limitations are low strength affecting streets and roads and the severe hazard of erosion. Good design and careful installation can overcome these limitations.

The Gasil soil is moderately suited to recreation use. The uneven terrain, areas bare of vegetation, and the severe hazard of erosion are limitations. Vegetation is difficult to establish, and extra fertilizer and frequent watering are necessary.

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

**32—Gasil-Urban land complex, 1 to 8 percent slopes.** The soil in this complex is deep and gently sloping. It is on convex uplands. Areas are elongated and range from 6 to more than 700 acres.

The complex is 40 to 70 percent Gasil soil, 15 to 50 percent Urban land, and as much as 20 percent other soils. This soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Gasil soil is neutral fine sandy loam about 10 inches thick that is light yellowish brown in the upper part and yellowish brown in the lower part. The subsoil from a depth of 10 to 75 inches, is brownish sandy clay loam. Reaction is netural in the surface layer. It ranges from slightly acid to strongly acid in the lower layers.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the hazard of erosion is moderate. The root zone is deep, and plant roots penetrate the soil easily.

The Urban land part of this complex is covered by dwellings, apartments, and small businesses and adjoining streets, driveways, parking lots, patios, and other structures that obscure or alter the soil to the extent that identification is not feasible.

Included with this complex in mapping are small areas of Crosstell, Konsil, Rader, and Silstid soils. These included soils make up less than 20 percent of any mapped area.

The Gasil soil is well suited to most urban uses. Slope and the hazard of erosion are limitations. Low strength is a limitation for streets and roads. These limitations can be overcome by good design and careful installation. Areas left bare of vegetation during construction can

erode if they are not protected by terraces or diversions and a grass or small grain cover.

This soil is well suited to recreation uses. In some areas slope is a limitation for playgrounds. Woody plantings provide food and cover for songbirds.

This complex is not in a capability subclass or range site.

**33—Heiden clay, 1 to 3 percent slopes.** This deep, gently sloping, clayey soil is on uplands. Areas are mainly subrounded and range from 12 to about 100 acres.

Typically, this soil, to a depth of about 64 inches, is moderately alkaline clay that is dark grayish brown in the upper part, grayish brown in the middle part, and light yellowish brown in the lower part. The underlying material to a depth of 72 inches is yellowish and grayish shaly clay.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is rapid, and the hazard of erosion is moderate. This soil is difficult to work during extremes in moisture conditions. Tilling at the same depth and tilling when the soil is wet cause a plow pan to develop. This layer slows the movement of roots, air, and water. The root zone is deep, but plant roots penetrate slowly.

Included with this soil in mapping are small areas of the Houston Black soil which are mostly on the lower, less sloping areas. Areas of this closely similar soil make up as much as 20 percent of a mapped area.

This Heiden soil is well suited to use as cropland. It is used for cotton, grain sorghum, and small grains. The main objectives of management are controlling erosion and maintaining tilth. Terracing, farming on the contour, and growing crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is well suited to use as pastureland. Improved bermudagrass, kleingrass, switchgrass, tall fescue, and vetch are well adapted. Seedbeds are difficult to establish. Proper pasture management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture and corrosivity to uncoated steel are the main limitations. Septic tank filter systems are poorly suited to the soil because of the very slow permeability.

The Heiden soil is poorly suited to recreation uses. The main limitations are permeability and the clay surface layer that is sticky when the soil is wet and that cracks when the soil is dry.

Areas of this map unit are inhabited by doves and quail. Grain crops and the abundant forbs in rangeland areas provide food and cover.

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

**34—Houston Black clay, 1 to 3 percent slopes.** This deep, gently sloping soil is on broad, smooth uplands (fig. 14). Areas follow the contour of the slope and are longer than they are wide. They range from 10 to about 150 acres.

Typically, this soil is moderately alkaline clay to a depth of about 80 inches. It is very dark gray in the upper part, grayish brown in the middle, and light yellowish brown in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. The soil is difficult to work during extremes in moisture conditions. Plow pans form if the soil is tilled when it is wet. The root zone is deep, but plant roots penetrate slowly.

Included with this soil in mapping are small areas of the closely similar Heiden and Leson soils. These inclusions make up as much as 25 percent of some mapped areas.

This Houston Black soil is mainly used as cropland, and is well suited to this use. Cotton and grain sorghum are the main crops, but corn and small grain are also grown. The main objectives of management are controlling erosion and maintaining tilth. Terracing and contour farming help to slow runoff and control erosion. Growing crops that produce large amounts of residue or growing deep rooted legumes helps to control erosion, maintain tilth, and aerate the soil.

This soil is well suited to use as pastureland. Improved bermudagrass, tall fescue, kleingrass, indiangrass, johnsongrass, and vetch are well suited to the soil. Some areas are seasonally wet, and seedbeds are difficult to prepare. Proper pasture management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and low strength affecting streets and roads. Septic tank absorption fields are poorly suited because of the very slow permeability.

This Houston Black soil is poorly suited to recreation use. The limitations are the very slow permeability and the clayey texture throughout the soil that causes deep, wide cracks when the soil is dry and stickiness when the soil is wet.

Areas of this map unit are regularly inhabited by doves and quail. Grain crops grown on this soil provide food.

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

**35—Houston Black-Urban land complex, 1 to 4 percent slopes.** The soil in this complex is deep and gently sloping. It is on uplands. Areas are elongated and range from 6 to more than 2,000 acres. Slopes average about 1.5 percent.

The complex is 45 to 65 percent Houston Black soil, 15 to 50 percent Urban land, and less than 25 percent closely similar soils. The Houston Black soil and Urban

*Figure 14.*—Grain sorghum residue on the surface of Houston Black clay, 1 to 3 percent slopes, protects this soil from erosion.

land are so intricately mixed that it is not practical to map them separately.

Typically, the Houston Black soil is moderately alkaline clay to a depth of about 80 inches. It is very dark grayish brown in the upper part, grayish brown in the middle, and light yellowish brown in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate if slopes are left bare of vegetation. The root zone is deep, but plant roots penetrate slowly. Many formerly cultivated areas are infested with cotton root rot, which also affects some ornamental plants.

The Urban land part of this complex is covered by airports, dwellings, apartments, and small businesses and adjoining streets, driveways, parking lots, patios, and other structures that obscure or alter the soil to the extent that identification is not feasible.

Included with this complex in mapping are closely similar Heiden and Leson soils. These included soils make up as much as 20 percent of some mapped areas.

The Houston Black soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, low strength affecting streets and roads, and corrosivity to uncoated steel are limitations that can be partly overcome by proper design and careful installation. Permeability is a limitation for septic tank filter fields.

This soil is poorly suited to most recreation uses. The limitations are the clayey texture that causes stickiness when the soil is wet and cracking when the soil is dry and very slow permeability.

This complex is not in a capability subclass or range site.

**36—Justin loam, 1 to 3 percent slopes.** This deep, gently sloping soil is on convex ridges on uplands. Areas are mainly subrounded and range from 10 to about 60 acres.

Typically, the surface layer, to a depth of 16 inches, is dark grayish brown loam that is neutral in the upper 12 inches and is slightly acid below. The upper part of the subsoil, from a depth of 16 to 23 inches, is neutral, reddish brown clay loam. The lower part of the subsoil, from a depth of 23 to 70 inches is neutral, yellowish brown clay loam that has yellowish and reddish mottles.

This soil is well drained. Permeability is moderately slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. The soil is easily worked. The root zone is deep, and plant roots easily penetrate the lower layers. A wide variety of plants are adapted to this soil.

Included with this soil in mapping are small areas of Navo soils on convex ridges and slopes. This inclusion makes up as much as 10 percent of a mapped area.

This Justin soil is mainly used as pastureland and is well suited to this use. Common bermudagrass, improved bermudagrass, switchgrass, weeping lovegrass, kleingrass, vetch, and arrowleaf clover are well suited to the soil. Management objectives include fertilization, weed control, and controlled grazing.

This soil is well suited to use as cropland. Grain sorghums and small grain are the main crops. Leaving crop residue on the soil helps to maintain organic matter and to control soil blowing. Terracing and contour farming are needed to slow runoff and to control erosion. Cover crops of cool season legumes help to improve tilth.

This soil is well suited to most urban and recreation uses. Shrinking and swelling with changes in moisture and permeability are the main limitations for these uses. These limitations can be overcome by using good design and careful installation.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**37—Konsil fine sandy loam, 1 to 5 percent slopes.** This deep, gently sloping soil is on convex ridges and their side slopes. Areas are subrounded and range from 6 to about 150 acres.

Typically, the surface layer is neutral, reddish brown fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 42 inches is slightly acid, red sandy clay loam. The lower part of the subsoil, from a depth of 42 to 75 inches, is slightly acid, yellowish red sandy clay loam that has reddish yellow mottles and a few fragments of sandstone.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the hazard of erosion is moderate. The root zone is deep and is easily penetrated by plant roots. The soil is easily worked throughout a wide range of moisture conditions. Plants are easily established on this soil.

Included with this soil in mapping are small areas of Birome soils on convex ridges. These soils are underlain by sandstone and comprise as much as 10 percent of some mapped areas. Small areas of Gasil soils are on lower slopes. Scattered areas of Silawa soils are included. Also included is a soil similar to the Konsil soil but that is underlain by sandstone at a depth of less than 60 inches. The included soils make up as much as 25 percent of a mapped area.

This Konsil soil is mainly used as pastureland and is well suited to this use. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover are well suited. Management objectives include fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. Most cultivated areas are used for grain sorghum and small grain. This soil is well suited to truck crops, nursery plants, and orchards. Terracing and contour farming are needed on this soil to slow runoff and reduce erosion. Leaving crop residue on the soil helps to control erosion and maintain soil tilth.

The soil is well suited to most urban and recreation uses. The main limitations are low strength affecting streets and roads, permeability affecting septic tank absorption systems, and slope affecting playgrounds. These limitations can be overcome by good design, careful installation, and selecting less sloping areas for specific recreation uses.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**38—Leson clay, 1 to 3 percent slopes.** This deep, gently sloping soil is on uplands. Areas are longer than they are wide and are about 8 to 40 acres.

Typically, this soil is moderately alkaline clay to a depth of about 70 inches that is dark gray in the upper part, dark grayish brown in the middle, and light olive brown in the lower part. The underlying layer to a depth of 80 inches is yellow shaly clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. When the soil is dry and cracked, water enters rapidly. When the soil is wet and the cracks are sealed, water enters very slowly. Runoff is medium, and the hazard of erosion is moderate. This soil is difficult to work during extremes in moisture conditions. Tilling at the same depth causes this soil to develop a plow pan that impedes the movement of roots, air, and water. Surface crusting is common. The root zone is deep, but penetration by plant roots is restricted by the clayey lower layers.

Included with this soil in mapping are small areas of Heiden and Wilson soils. The loamy Wilson soils are in slight depressions. These closely similar soils make up less than 15 percent of any mapped area.

This Leson soil is mainly used as cropland and is well suited to this use. Grain sorghum, cotton, and small grain are the main crops. Major management objectives include controlling erosion and maintaining tilth. Terracing and farming on the contour help to slow runoff and to control erosion. Growing crops that produce large amounts of residue and growing deep rooted legumes help to maintain tilth and to aerate the soil.

This soil is well suited to use as pastureland. Adapted species include improved bermudagrass, tall fescue,

kleingrass, johnsongrass, and vetch. Seedbeds are difficult to establish, and the soil puddles if grazed when wet. Fertilization, weed control, and controlled grazing help to maintain high production.

The soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and very slow permeability are the major limitations. These limitations can be partly overcome by good design and careful installation.

This Leson soil is poorly suited to recreation uses. The main limitations are permeability and the clay texture throughout the soil that causes deep, wide cracks to form when the soil is dry and stickiness when the soil is wet.

Areas of this map unit are regularly inhabited by doves and quail. Grain crops and an abundant supply of forbs provide food and cover.

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

**39—Lindale clay loam, 1 to 3 percent slopes.** This moderately deep, gently sloping soil is on convex ridges. Areas are subrounded and range from about 8 to 70 acres.

Typically, the surface layer is reddish brown clay loam about 5 inches thick. The upper part of the subsoil, from a depth of 5 to 26 inches, is reddish brown clay. The lower part of the subsoil, from a depth of 26 to 40 inches, is brown very gravelly clay loam that has many fragments of limestone. Below that to a depth of 60 inches is reddish yellow interbedded limy earth and fragments of limestone. Reaction typically is neutral in the upper part of the soil and moderately alkaline in the lower part.

This soil is well drained. Permeability is slow, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. The root zone is somewhat restricted by the gravelly lower layers.

Included with this soil in mapping are small areas of Mingo and Ponder soils. These soils are in slightly lower positions and comprise 5 to 10 percent of some areas. Soils that are similar to the Lindale soil but that have carbonates at a depth of more than 28 inches are also included. These closely similar soils make up 10 to 30 percent of most mapped areas.

This Lindale soil is moderately suited to use as cropland. It is used for forage, grain sorghums, and small grain. The major objectives of management are controlling erosion, maintaining fertility, and improving tilth. Farming on the contour and growing cool season legumes and crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is moderately suited to use as pastureland. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover are adapted. Management objectives include fertilization, weed control, and controlled grazing.

The Lindale soil is well suited to most urban and recreation uses. The main limitations are shrinking and swelling with changes in moisture and corrosivity to uncoated steel. These limitations can be overcome by good design and careful installation. Septic tank absorption fields are poorly suited to this soil because of the slow permeability.

Areas of this map unit are inhabited by deer, turkeys, doves, and quail. The wide variety of native plants provide cover, browse, mast, and seed.

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

**40—Lindale-Urban land complex, 1 to 3 percent slopes.** The soil in this complex is moderately deep and gently sloping. It is on convex ridges. Areas are subrounded and range from 15 to about 50 acres.

The complex is about 50 to 70 percent Lindale soil, 15 to 30 percent Urban land, and less than 15 percent closely similar soils. The Lindale soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Lindale soil is reddish brown, clay loam about 5 inches thick. The upper part of the subsoil, from a depth of about 5 to 26 inches, is reddish brown clay. The lower part of the subsoil, from a depth of 26 to 40 inches, is brown very gravelly clay loam that has many limestone fragments. The underlying material to a depth of 48 inches is reddish yellow, limy earth interbedded with limestone fragments. Reaction typically is neutral in the upper part of the soil and moderately alkaline in the lower part.

This soil is well drained. Permeability is slow, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. The root zone is somewhat limited by the gravelly lower layers.

The Urban land part of the complex is covered by dwellings, small businesses, apartments, and schools and adjoining streets, driveways, sidewalks, and patios. Some areas have been altered by construction to the extent that classification is not practical.

Included with this complex in mapping are small areas of closely similar Mingo, Ponder, and Speck soils. These soils make up as much as 15 percent of any mapped area.

The Lindale soil is well suited to most urban uses. Low strength affecting streets and roads, corrosivity to uncoated steel, and depth to limestone fragments are the main limitations. Good design and careful installation are needed to help overcome these limitations. Slow permeability is a limitation for septic tank filter fields.

The soil is well suited to most recreation uses. Slow permeability is a limitation.

This complex is not in a capability subclass or range site.

**41—Lott silty clay, 1 to 3 percent slopes.** This deep, gently sloping, clayey soil is on low convex ridges. Areas are rounded to oblong and range from 5 to about 40 acres.

Typically, the surface layer is brownish silty clay about 16 inches thick. The upper part of the subsoil, from a depth of 16 to 28 inches, is moderately alkaline, brown silty clay loam. The lower part of the subsoil, from a depth of 28 to 46 inches, is pale yellow silty clay loam. The underlying layer to a depth of 60 inches is moderately alkaline, marly silty clay loam mottled yellowish and grayish that has a few fragments of limestone. Reaction typically is moderately alkaline throughout the soil.

This soil is well drained. Permeability is moderately slow, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. The high concentration of lime causes chlorosis in sensitive plants. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of the closely similar Sanger soils on foot slopes. This inclusion makes up as much as 15 percent of some mapped areas.

This Lott soil is mainly used as cropland and is well suited to this use. Growing deep rooted legumes and leaving crop residue on the soil help to reduce erosion and improve soil tilth. Terracing and farming on the contour slow runoff and reduce erosion.

This soil is well suited to use as pastureland. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and clover are suitable. Fertilization is needed to sustain high forage production. Weed control and controlled grazing are some other management objectives.

The Lott soil is well suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are limitations. They can be overcome by good design and careful installation.

This soil is moderately suited to recreation uses. The silty clay surface layer and moderately slow permeability are the main limitations. Using loamy fill material can help overcome the stickiness during wet periods.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**42—Lott-Urban land complex, 1 to 5 percent slopes.** The soil in this complex is gently sloping. It is on convex uplands. Areas are rounded to oblong and range from 5 to about 140 acres.

The complex is 45 to 70 percent Lott soil, 15 to 40 percent Urban land, and as much as 20 percent other soils. The Lott soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Lott soil is brownish silty clay about 16 inches thick. The upper part of the subsoil, from a depth of 16 to 28 inches, is brown silty clay loam. The lower part of the subsoil, from a depth of 28 to 46 inches, is pale yellow silty clay loam. The underlying layer to a depth of 60 inches is marly silty clay loam mottled yellowish and grayish.

This soil is well drained. Permeability is moderately slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. Chlorosis affects some plants grown on this soil. The root zone is deep, and plant roots easily penetrate the lower layers.

The Urban land part of this complex consists mostly of residential houses, patios, sidewalks, and paved streets. In some areas there is a layer of loamy fill material 3 to 6 inches thick. Construction has altered the soils to the extent that identification is not feasible in many areas.

Included with this complex in mapping are small areas of Heiden and Sanger soils on foot slopes. These included soils make up as much as 20 percent of this map unit.

The Lott soil is well suited to most urban uses. Shrinking and swelling with changes in moisture and corrosivity to uncoated steel are the main limitations affecting construction. These limitations can be overcome by good design and careful installation.

This soil is moderately suited to recreation uses. The silty clay surface is the main limitation.

This complex is not in a capability subclass or range site.

**43—Luckenbach clay loam, 1 to 3 percent slopes.** This deep, gently sloping, loamy soil is on high stream terraces. Areas are subrounded and range from 15 to 65 acres. Slopes are convex and average about 1.8 percent.

Typically, the surface layer is dark grayish brown clay loam about 8 inches thick. The next layer, to a depth of about 15 inches, is dark reddish gray clay loam. The subsoil, from a depth of 15 to 48 inches, is reddish brown clay. From a depth of 48 to 60 inches, it is clay loam that is brown in the upper part and pink in the lower part. Common masses of calcium carbonate and limestone pebbles are in the lower part. Reaction typically is mildly alkaline in the upper part and moderately alkaline in the lower part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. This soil is difficult to till when dry. The root zone is deep, but plant roots slowly penetrate the underlying clayey layers.

Included with this soil in mapping are small areas of similar soils that have concretions of calcium carbonate below a depth of 28 inches. These soils are in slightly concave positions. They make up as much as 15 percent of some mapped areas.

This Luckenback soil is well suited to use as cropland. The major objectives of management are controlling erosion and maintaining tilth. Terracing, growing crops that produce large amounts of residue, and growing

deep-rooted legumes help to control erosion and maintain tilth.

This soil is well suited to use as pastureland. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, arrowleaf clover, and vetch are suitable. Fertilization, weed control, and controlled grazing are needed for high production.

The Luckenbach soil is moderately suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture and corrosivity to uncoated steel. Septic tank absorption fields are poorly suited to this soil because of the moderately slow permeability.

This soil is moderately suited to most recreation uses. The limitations are the moderately slow permeability and the clay loam surface layer that is sticky when the soil is wet.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**44—Luckenbach-Urban land complex, 1 to 3 percent slopes.** The soil in this complex is deep and gently sloping. It is on high stream terraces. Areas are long and subrounded and range from about 15 to 80 acres. Slopes are convex and average about 1.5 percent.

The complex is about 45 to 65 percent Luckenbach soil, 25 to 40 percent Urban land, and less than 15 percent closely similar soils. The Luckenbach soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Luckenbach soil is dark grayish brown clay loam about 8 inches thick. The next layer, to a depth of about 15 inches, is dark reddish gray clay loam. The subsoil, from a depth of 15 to 48 inches, is reddish brown clay. From a depth of 48 to 60 inches, it is clay loam that is brown in the upper part and pink in the lower part. Reaction typically is mildly alkaline in the upper part and moderately alkaline in the lower part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. The root zone is deep, but plant roots slowly penetrate the clayey lower layers.

The Urban land part of the complex is covered by individual dwellings, adjoining streets, driveways, sidewalks, patios, golf courses, and other structures. Some areas have been altered by construction to the extent that classification is not practical.

Included with this complex in mapping are small areas of Sunev soils and soils similar to the Luckenbach soil but that do not have calcium carbonate within a depth of 28 inches. The included soils make up less than 15 percent of any mapped area.

The Luckenbach soil is moderately suited to urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are limitations that can be overcome by good design and careful installation. The moderately slow permeability is a limitation for septic tank filter systems.

This soil is moderately suited to recreation uses. The clay loam texture and permeability are the main limitations.

This complex is not in a capability subclass or range site.

**45—Mabank fine sandy loam, 0 to 1 percent slopes.** This deep, nearly level, loamy soil is in concave areas on uplands. Areas are oblong and range from 5 to 15 acres.

Typically, the surface layer is grayish brown fine sandy loam about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 29 inches, is dark gray clay. The lower part of the subsoil, from a depth of 29 to 66 inches, is grayish brown clay. From a depth of 66 to 80 inches, is light brownish gray clay. Reaction typically is slightly acid in the upper part of the soil and mildly alkaline in the lower part.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is medium. Runoff is slow, and the hazard of erosion is slight. This soil is seasonally wet and seasonally droughty. The root zone is deep, but plant roots slowly penetrate the clayey underlying layers.

Included with this soil in mapping are small, scattered areas of the closely similar Wilson soils and Rader soils near the edges of the mapped areas. These included soils make up as much as 20 percent of any mapped area.

This Mabank soil is mainly used as pastureland and is well suited to this use. Improved bermudagrass, bahiagrass, arrowleaf clover, and singletary peas are adapted. Proper management includes, fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. Seasonal wetness delays planting and harvesting. The dense, clayey subsoil releases moisture slowly to plant roots. The objectives of management are improving tilth and maintaining fertility. Legumes and crops that produce large amounts of residue help to maintain tilth.

The Mabank soil is poorly suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture, corrosivity to uncoated steel, occasional wetness, and the very slow permeability.

This soil is poorly suited to recreation uses. Wetness and very slow permeability are the main limitations.

Areas of this map unit are inhabited by doves and quail, along with prairie dogs, coyote, rabbits, badgers, and skunks. Ample food for songbirds is furnished by the wide variety of forbs.

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

**46—Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes.** These very shallow and shallow, gently sloping to moderately steep soils are on uplands on slopes along drainageways (fig. 15). This map unit consists of about 35 percent Maloterre soil, 30 percent Aledo soil, 20 percent Brackett soil, and 15 percent other soils and rock outcrops. Most areas contain the major soils, but the proportions vary from area to area. The Brackett soil is not present in some areas. The Maloterre soil is on upper slopes near limestone outcrops. Aledo and Brackett soils are mostly on mid and lower side slopes, but there are some scattered areas of these soils where beds of fractured or chalky limestone are near the surface. A few long, narrow bands of limestone boulders and stone size fragments of limestone and shells are scattered on the surface. Areas range from 40 to 600 acres.

Typically, the surface layer of the Maloterre soil is brown gravelly clay loam about 7 inches thick that is about 20 percent fragments of limestone and shells. Below that is indurated limestone containing many imbedded fossil shells. The surface layer is gravelly loam in some areas.

Typically, the surface layer of the Aledo soil is dark grayish brown gravelly clay loam about 7 inches thick. From a depth of 7 to 16 inches is brown very gravelly clay loam containing about 40 percent fragments of limestone and shells. Below that is limestone that is fractured and contains many imbedded fossil shells. This soil is calcareous, and reaction is moderately alkaline throughout. The surface layer is gravelly loam in some areas.

Typically, the surface layer of the Brackett soil is grayish brown clay loam about 7 inches thick. The subsoil, from a depth of 7 to 14 inches is light brownish gray gravelly clay loam. Below that to a depth of 28 inches is alternating layers of marl and chalky limestone

*Figure 15.*—Scattered live oak trees on Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes.

that can be cut with a spade. This soil is calcareous, and reaction is moderately alkaline throughout. The surface layer is loam in some areas. It has varied amounts of coarse fragments.

The Maloterre soil is somewhat excessively drained, and the Aledo and Brackett soils are well drained. Maloterre and Brackett soils have moderately slow permeability, and the Aledo soil has moderate permeability. Because of the slopes, runoff is rapid, and the hazard of erosion is severe. Available water capacity is very low.

Included with these soils in mapping are small areas of Aledo, Brackett, and Maloterre soils with slopes of more than 20 percent; areas of limestone outcrops; areas of soils that are similar to Brackett soils but that have more coarse fragments or are underlain by indurated limestone; and small areas of Bolar and Sunev soils along foot slopes. These included soils and rock outcrops make up 10 to 25 percent of most areas.

Because of the very shallow and shallow rooting depth to limestone or marl, slopes, and the rock outcrops, the soils in this unit are used as rangeland.

These soils are poorly suited to most urban uses. Depth to limestone and the severe hazard of erosion are the main limitations. Good design and careful installation are needed to overcome these limitations.

The soils in this unit are poorly suited to most recreation uses because of slope, the severe hazard of erosion, depth to rock, and rock outcrops. Recreation uses are mainly limited to picnic areas and paths and trails.

Areas of this map unit are used by doves and quail for the food supply. Cover for protection is excellent.

The soils in this unit are in capability subclass VIIs. The Maloterre soil is in the Very Shallow range site. The Aledo soil is in the Rocky Hills range site. The Brackett soil is in the Steep Adobe range site.

**47—Medlin clay, 5 to 15 percent slopes.** This moderately deep and deep, sloping to moderately steep, clayey soil is on side slopes of ridges (fig. 16). Areas are long and narrow and follow the contour of the slope. Gullied, natural drainageways are common to most areas. Areas range from 15 to more than 200 acres.

Typically, the surface layer is moderately alkaline, grayish brown clay about 9 inches thick. The next layer, to a depth of about 33 inches, is moderately alkaline, light olive brown clay. From a depth of 33 to 58 inches is moderately alkaline, light yellowish brown clay. The underlying material to a depth of 67 inches is moderately alkaline, grayish brown and light yellowish brown, stratified shaly clay.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is rapid, and the hazard of erosion is severe. Deep, wide cracks form when the soil is dry. The root zone is deep, but plant roots penetrate slowly.

Included with this soil in mapping are small areas of Frio soils along narrow drainageways, Sanger soils along foot slopes, and a few small areas of gently sloping Medlin soils. A few uncrossable gullies are present in some areas. These included soils make up as much as 15 percent of mapped areas.

This Medlin soil is poorly suited to use as pastureland and cropland and for urban purposes. Slope, the severe hazard of erosion, gullies, shrinking and swelling with changes in moisture, permeability, and corrosivity to uncoated steel are limitations. Soil slippage is likely to occur if deep cuts are made across the slope.

This soil is poorly suited to most recreation uses. The clay surface, slope, and permeability are limitations.

Areas of this map unit are regularly inhabited by doves and quail. Deer from adjacent woods use the abundant supply of forbs as a food supply.

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

**48—Mingo clay loam, 1 to 3 percent slopes.** This moderately deep, gently sloping soil is on convex ridgetops. Areas are subrounded and range from about 12 to 75 acres.

Typically, the surface layer is neutral, dark grayish brown clay loam about 5 inches thick. The subsoil, from a depth of 5 to 25 inches, is brown clay that is neutral in the upper part and mildly alkaline in the lower part. From a depth of 25 to 31 inches, it is moderately alkaline, brown clay. Below that is fractured, platy limestone.

This soil is well drained. Permeability is very slow, and available water capacity is low. Runoff is slow to medium, and the hazard of erosion is moderate. The root zone is moderately deep, but plant roots slowly penetrate the underlying layers. The soil is difficult to work during extremes in moisture conditions.

Included with this soil in mapping are small areas of Lindale and Speck soils along the outer edges of the mapped areas and Ponder soils in the lower, concave areas. These included soils make up as much as 15 percent of some mapped areas.

This Mingo soil is moderately suited to use as cropland. The major crops are grain sorghum and small grains. Depth to limestone limits available moisture. Leaving crop residue on the soil helps to improve soil tilth and conserve moisture. Growing deep rooted legumes helps to aerate the soil and adds nitrogen.

This soil is moderately suited to use as pastureland. Kleingrass, improved bermudagrass, weeping lovegrass, johnsongrass, and vetch are suitable. Proper pasture management includes weed control, fertilization, and controlled grazing.

The Mingo soil is moderately suited to most urban uses. Depth to rock, corrosivity to uncoated steel, and shrinking and swelling with changes in moisture are limitations. Limestone bedrock is difficult to excavate. The soil is poorly suited to septic tank filter fields

*Figure 16.*—An area of Sanger and Medlin soils in the Blackland range site.

because the clayey lower layer and bedrock restrict permeability.

This soil is moderately suited to recreation uses. The clay loam surface and permeability are the main limitations for this use.

Areas of this map unit are inhabited by coyote, rabbits, doves, and quail. The wide variety of native plants provide cover, and seed.

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

**49—Mingo-Urban land complex, 1 to 3 percent slopes.** The soil in this complex is moderately deep and gently sloping. It is on convex ridgetops. Areas are subrounded and range from 10 to about 30 acres. Slopes average about 1.5 percent.

The complex is about 45 to 70 percent Mingo soil, 15 to 50 percent Urban land, and 15 percent closely similar soils. The Mingo soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Mingo soil is dark grayish brown clay loam about 5 inches thick. The subsoil, to a depth of 31 inches, is brown clay. Below that to a depth of 37 inches is fractured limestone interbedded with material from above. Reaction is neutral or mildly alkaline.

The Mingo soil is well drained. Permeability is very slow. Runoff is slow to medium, and available water capacity is low. This soil has a moderately deep root zone, but plant roots have difficulty penetrating the clayey lower layers.

The Urban land part of the complex is covered by individual dwellings, apartments, and small businesses

and adjoining streets, driveways, sidewalks, patios, and other structures. Some areas have been altered by construction to the extent that classification is not practical.

Included with this complex in mapping are small areas of Lindale, Ponder, and Speck soils. The included soils make up as much as 15 percent of any mapped area.

The Mingo soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and depth to rock are limitations that can be partly overcome by good design and careful installation. Permeability is a limitation for septic tank filter fields.

This soil is moderately suited to recreation uses. The clay loam surface and permeability are the main limitations.

This complex is not in a capability subclass or range site.

**50—Navo clay loam, 1 to 3 percent slopes.** This deep, gently sloping, loamy soil is on side slopes and low ridges along drainageways (fig. 17). Areas are subrounded and range from 8 to about 550 acres.

Typically, the surface layer is neutral, brown clay loam about 12 inches thick. The subsoil to a depth of about 72 inches is brownish clay that is mottled in shades of

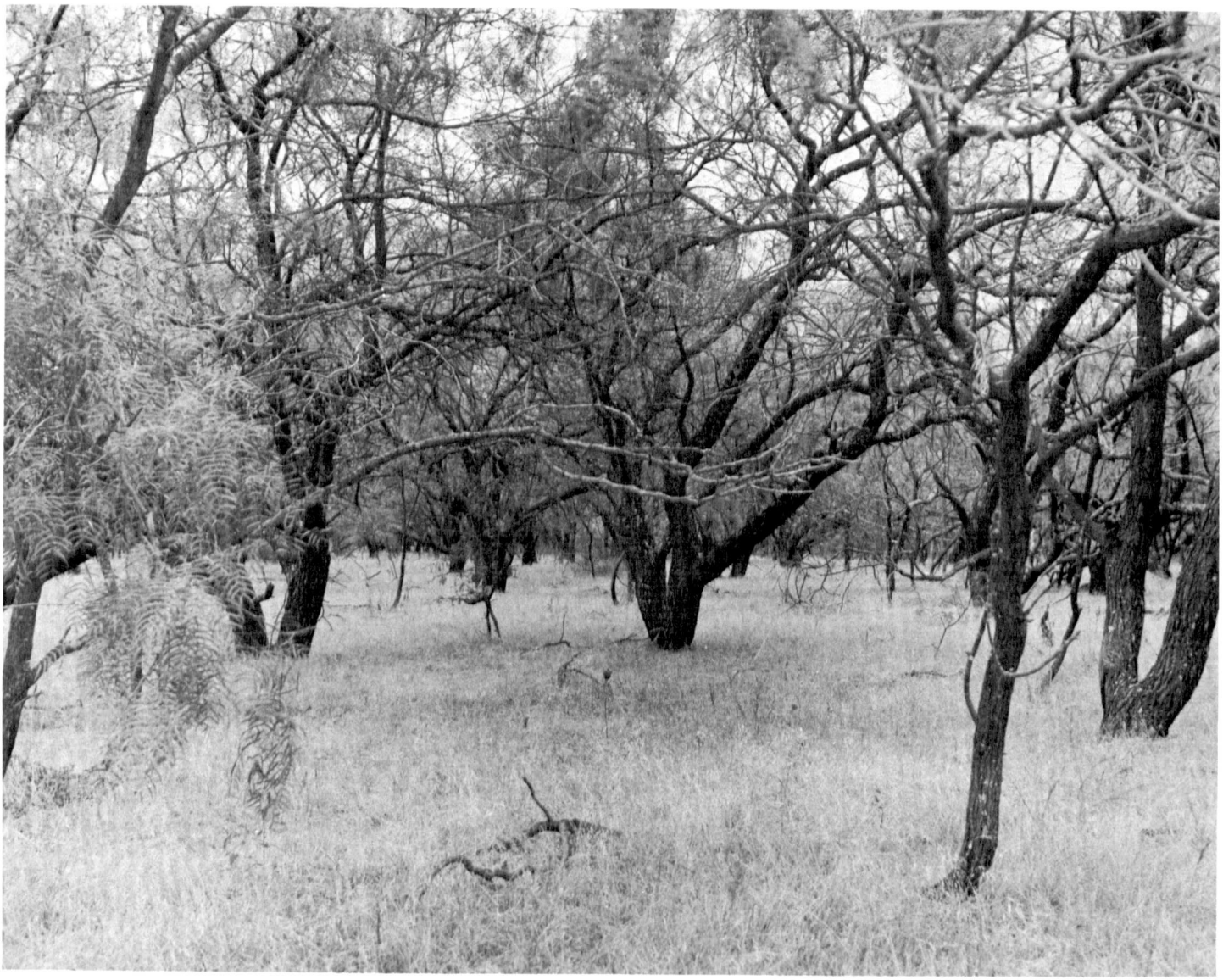


*Figure 17.*—An area of Navo clay loam, 1 to 3 percent slopes, in the claypan Prairie range site that is invaded by mesquite trees.

brown, red, and gray. Reaction typically is neutral in the upper and lower parts of the soil and moderately alkaline in the middle.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. The soil is difficult to work when it is dry. The surface crusts, and dense plowpans form in cultivated areas. The root zone is deep, and plant roots have difficulty penetrating the clayey lower layers.

Included with this soil in mapping are small areas of Wilson soils in depressions. These soils make up less than 10 percent of any mapped area.

This Navo soil is mainly used as pastureland and cropland. It is well suited to pasture. Improved bermudagrass, kleingrass, vetch, weeping lovegrass, indiangrass, and arrowleaf clover are suitable. Fertilizer should be applied to maintain yields.

This soil is moderately suited to use as cropland. Terracing and contour farming are needed to reduce erosion. Leaving crop residue on the soil helps to slow runoff and improves soil tilth. Growing deep rooted legumes helps to aerate the soil and maintain tilth.

The Navo soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are the main limitations. This soil is moderately suited to recreation. Very slow permeability is the main limitation.

Areas of this map unit are inhabited by doves and quail, along with prairie dogs, coyote, rabbits, badgers, and skunks. Ample food for songbirds is furnished by the wide variety of forbs.

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

**51—Navo-Urban land complex, 1 to 3 percent slopes.** The soil in this complex is deep, and gently sloping. It is on broad ridges and slopes above drainageways. Areas are subrounded and range from 12 to more than 650 acres.

The complex is 50 to 70 percent Navo soil, 15 to 40 percent Urban land, and less than 25 percent closely similar soils. The Navo soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Navo soil is brown clay loam about 12 inches thick. The upper part of the subsoil, from 12 to 28 inches, is brown clay. From a depth of 28 to 66 inches, it is yellowish brown clay, grading to light olive brown clay. The lower part of the subsoil to a depth of 72 inches is light yellowish brown clay. Brownish, reddish, and yellowish mottles occur throughout. Reaction ranges from neutral to moderately alkaline.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is severe. The root zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

The Urban land part of this complex is covered by individual dwellings, apartments, and small businesses and adjoining streets, driveways, parking lots, patios, and other structures that obscure or alter the soils to the extent that identification is not feasible.

Included with this complex in mapping are small areas of Crosstell, Heiden, and Wilson soils. The included soils make up less than 25 percent of any mapped area.

The Navo soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are the main limitations. These limitations can be partly overcome by good design and proper installation.

This soil is moderately suited to most recreation uses. The very slow permeability is the main limitation.

This complex is not in a range site or capability subclass.

**52—Nimrod fine sand, 1 to 5 percent slopes.** This deep, gently sloping, sandy soil is on ridges and side slopes. Areas are subrounded and range from 15 to about 500 acres. Slopes average about 2 percent.

Typically, the surface layer is brownish fine sand about 25 inches thick. The subsoil from a depth of 25 to 80 inches is reddish yellow sandy clay loam, grading to mottled grayish, reddish, and yellowish sandy clay loam in the lower part. Reaction is neutral or slightly acid in the upper part of this soil, grading to strongly acid in the lower part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is medium. The surface layer absorbs rainfall rapidly. Runoff is very slow. For short periods following heavy rainfall, a perched water table is at the top of the upper part of the subsoil. The root zone is deep, and plant roots easily penetrate the lower layers. If the soil is left bare of vegetation, the hazard of soil blowing is severe.

Included with this soil in mapping are small, scattered areas of Selden and Windthorst soils. These included soils make up as much as 15 percent of some mapped areas.

This Nimrod soil is mainly used as pastureland, and is well suited to this use. Improved bermudagrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover are commonly grown. Management includes fertilization at planned intervals throughout the grazing season, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. Low natural fertility limits production. Corn, small grain, peanuts, and watermelons are adapted to this soil. The major objectives in management are controlling soil blowing, conserving soil moisture, and improving soil fertility. Growing crops that produce large amounts of residue, stripcropping, and fertilizing help to control soil blowing and improve fertility.

The Nimrod soil is well suited to most urban uses. The perched water table and corrosivity to uncoated steel and concrete are limitations that can be overcome by

good design and careful installation. Moderately slow permeability is a limitation for septic tank absorption systems.

This soil is poorly suited to most recreation uses. The fine sand surface, which blows when bare of vegetation, is the main limitation.

Areas of this map unit are mainly inhabited by deer, doves, and quail. A large variety of herbaceous and woody plants furnish food and cover for many kinds of animals and songbirds.

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

**53—Ovan clay, occasionally flooded.** This deep, nearly level, clayey soil is on flood plains. It is flooded about once every 5 to 20 years. The flooding lasts for several hours. Areas are long and narrow to wide and range from 25 to more than 300 acres. Slopes range from 0 to 1 percent.

Typically, the surface layer is moderately alkaline, dark grayish brown clay to a depth of 60 inches and has brown mottles in the lower 18 inches. Below that to a depth of 72 inches is moderately alkaline, brown clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. The soil is difficult to work during extremes in moisture conditions. Natural fertility is high. Water is usually ponded on the surface following heavy rains. The root zone is deep, but plant roots slowly penetrate this clayey soil.

Included with this soil in mapping are small areas of Frio soils on natural levees near stream channels and small areas of Trinity soils in depressions. These included soils make up less than 15 percent of a mapped area.

This Ovan soil is well suited to use as cropland. Slow runoff during the cool seasons limits the use of this soil mainly to warm season crops. Leaving crop residue on the soil and growing deep rooted legumes help to improve soil tilth.

The soil is well suited to use as pastureland. Improved bermudagrass, johnsongrass, tall fescuegrass, switchgrass, vetch, and singletary peas are well suited. Fertilization, weed control, and controlled grazing are management objectives.

The hazard of flooding is the main limitation for urban and recreation uses. Other limitations are high shrink-swell potential, wetness, very slow permeability, and stickiness when the soil is wet.

Areas of this map unit are excellent for wildlife habitat. Cover, food, and nesting materials are provided for many songbirds, quail, doves, rabbits, squirrels, raccoons, and deer.

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

**54—Ovan clay, frequently flooded.** This deep, nearly level, clayey soil is on flood plains of major streams. Slopes are 0 to 1 percent. This soil is flooded from once to three times annually during the cool seasons. The flooding lasts from several hours to about one day. Meandering scour channels are present in some areas. Areas are long and narrow to broad bands that parallel the stream channel and range from about 20 to 100 acres.

Typically, the surface layer is moderately alkaline, grayish brown clay about 6 inches thick. The next layer, to a depth of 17 inches, is moderately alkaline, very dark grayish brown clay. From a depth of 23 to 66 inches is moderately alkaline, dark grayish brown clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. Sediment is deposited during most overflows. Natural fertility is high. The root zone is deep, but is slowly penetrated by plant roots.

Included with this soil in mapping are small areas of Frio soils on slight ridges, Trinity soils in depressions, and stratified clayey and loamy soils near natural levees. The included soils make up less than 25 percent of any mapped area.

This Ovan soil is well suited to use as pastureland. Improved bermudagrass, johnsongrass, tall fescuegrass, switchgrass, vetch, and singletary peas are commonly grown. Management includes fertilization, weed control, and controlled grazing.

The hazard of flooding is the main limitation for use as cropland and for urban and recreation uses. This limitation can be overcome only by major flood control.

Areas of this map unit are excellent for providing cover, food, and nesting materials for many songbirds, quail, doves, rabbits, squirrels, raccoons, and deer.

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

**55—Ovan-Urban land complex, occasionally flooded.** The soil in this complex is deep and nearly level. It is on wide flood plains of large streams. Areas are protected from flooding by high levees and channeled streams. Areas are subrounded, and slopes are less than 1 percent.

The complex is about 40 to 85 percent Ovan soil, 15 to 40 percent Urban land, and less than 15 percent closely similar soils. The Ovan soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Ovan soil is moderately alkaline, dark grayish brown clay to a depth of 60 inches. It has brownish mottles in the lower part. Below that to a depth of 72 inches is moderately alkaline, brown clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. Natural fertility is high. The soil is difficult to work during extremes in moisture conditions. The root zone is deep and is easily penetrated by plant roots.

The Urban land part of the complex is covered by apartments, small businesses, industries, oil storage tanks, paved parking lots, ball diamonds, golf courses, and other structures. Some areas have been altered by fill material, works, and structures to the extent that classification is not practical.

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

The hazard of flooding, shrinking and swelling with changes in moisture, and corrosivity to uncoated steel are the main limitations for urban uses. These limitations can be overcome by proper installation. Soil reaction limits the kinds of ornamental plants that can be grown on this soil.

The Ovan soil is poorly suited to most recreation uses. The clayey surface layer, the hazard of flooding, permeability, slow runoff, and deep, wide cracks that form during long dry periods are the main limitations.

This complex is not in a capability subclass or range site.

**56—Pits, quarries.** This map unit consists of areas from which the soil and much of the underlying limestone have been excavated. The excavated material is used in road construction, for concrete filler, and for making cement. Most pits are 3 to 8 acres, except one limestone pit that is about 200 acres. Walls are mostly vertical and the pits are 2 to about 50 feet deep.

Most areas are scarcely vegetated or barren. Some pits contain water. In places, they are used as a source of water for livestock.

This map unit is not in a capability subclass or range site.

**57—Ponder clay loam, 1 to 3 percent slopes.** This deep, gently sloping soil is on low, convex slopes on uplands and ancient high stream terraces. Areas are smooth and subrounded. They range from about 8 to more than 200 acres.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The subsoil, from a depth of 7 to 53 inches, is clay that is brown in the upper part, grayish brown in the middle, and yellowish brown in the lower part. Below that to a depth of 80 inches is brownish silty clay loam. This soil is slightly acid in the upper part of the soil, grading to moderately alkaline and calcareous in the lower part.

This soil is moderately well drained. Permeability is slow, and available water capacity is medium. Surface runoff is medium, and the hazard of erosion is moderate. The surface layer is very hard and difficult to till when the soil is dry. The root zone is deep, but plant roots have difficulty penetrating the clayey upper part of the subsoil.

Included with this soil in mapping are small areas of Sanger soils on upper side slopes of ridges, Wilson soils in slightly depressed areas and along small drainageways, and a soil on ridgetops similar to the Ponder soil but that has masses of calcium carbonate in the upper part. Also included are small areas of nearly level Ponder clay loam. The included soils make up as much as 20 percent of some mapped areas.

This Ponder soil is well suited to use as cropland, but the clayey subsoil releases moisture slowly, thereby causing the soil to be somewhat droughty. Grain sorghum and small grain are grown on this soil. The major objectives of management are controlling erosion and improving fertility and tilth. Leaving crop residue on the soil helps to conserve moisture and improve tilth. Terracing and contour farming help to reduce erosion.

This soil is well suited to use as pastureland. Improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch and arrowleaf clover are suitable. Fertilizer should be added to maintain production.

The Ponder soil is moderately suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability. These limitations can be partly overcome by good design and careful installation.

This soil is moderately suited to recreation uses. Slow permeability is the main limitation. Use of loamy fill material and maintaining a good grass cover help to overcome these limitations.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**58—Ponder-Urban land complex, 0 to 3 percent slopes.** The soil in this complex is deep and nearly level and gently sloping. It is on low, convex uplands and high ancient stream terraces. Areas are subrounded and range from about 20 to more than 200 acres.

The complex is about 45 to 70 percent Ponder soil, 15 to 40 percent Urban land, and 15 percent closely similar soils. The Ponder soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Ponder soil is dark grayish brown clay loam about 7 inches thick. The subsoil, from a depth of 7 to 53 inches, is clay that is brown in the upper part, grayish brown in the middle part, and yellowish brown in the lower part. From a depth of 53 to 80 inches, it is brownish silty clay loam. This soil is slightly acid in the upper part and moderately alkaline and calcareous in the lower part.

This soil is moderately well drained. Permeability is slow, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. The root zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

The Urban land part of the complex is covered by dwellings, apartments, and small businesses and adjoining streets, driveways, sidewalks, patios, and other structures. Some areas have been altered to the extent that classification is not practical.

Included with this complex in mapping are small areas of closely similar Crosstell and Navo soils and a few small areas of somewhat poorly drained Wilson soils in depressions. These included soils make up as much as 15 percent of a mapped area.

The Ponder soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are limitations that can be partly overcome by proper design and careful installation.

This soil is moderately suited to most recreation uses. Slow permeability is the main limitation.

This complex is not in a capability subclass or a range site.

**59—Pulexas fine sandy loam, frequently flooded.** This deep, nearly level soil is on narrow flood plains of streams that are within and that drain sandy and loamy areas. It is also on slight benches or overwashes above the more clayey soils on larger flood plains. The soil is flooded once or more every two years for brief periods. Areas are elongated and range from 20 to about 200 acres.

Typically, to a depth of 64 inches, this soil is neutral, light yellowish brown and yellowish brown fine sandy loam containing thin, loamy strata.

This soil is well drained. Permeability is moderately rapid, and available water capacity is medium. Runoff is slow, and the hazard of water erosion is slight. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Whitesboro soils in slightly lower positions on the landscape and in depressions on the outer edges of the flood plain. These included soils make up less than 15 percent of any mapped area.

This Pulexas soil is well suited to use as pastureland. Improved bermudagrass, switchgrass, singletary peas, arrowleaf clover, and vetch are suitable. Fertilization, controlled grazing, and weed control are needed to maintain high forage yields.

This soil is poorly suited to use as cropland and for urban and recreation purposes because of the hazard of flooding. This limitation can be overcome only by major flood control.

Areas of this map unit furnish excellent wildlife habitat for quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

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

**60—Pulexas-Urban land complex, occasionally flooded.** The soil in this complex is deep and nearly level. It is on narrow flood plains of streams that drain sandy and loamy areas. In most areas the natural meandering stream channel has been replaced by a deeper, wider, and straighter channel. The soil is flooded only once every 4 to 20 years. Areas are elongated and range from 20 to more than 125 acres.

The complex is about 50 to 60 percent Pulexas soil, 15 to 30 percent Urban land, and about 25 percent closely similar Whitesboro soils and a few areas that are from a few inches to 2 feet loamy fill material. This soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the Pulexas soil is neutral, light yellowish brown and yellowish brown fine sandy loam containing few to common thin strata of loam, loamy fine sand, and clay loam to a depth of 64 inches.

This soil is well drained. Permeability is moderately rapid, and available water capacity is medium. Runoff is slow, and the hazard of erosion is slight. The root zone is deep and is easily penetrated by plant roots.

The Urban land part of the complex is covered by small businesses, individual dwellings, apartments, golf courses, and parks and adjoining sidewalks, streets, and other structures. Some areas have been filled with material from excavated channels and adjoining uplands. These areas have been altered to the extent that classification is not feasible.

Included with this complex in mapping are small areas of closely similar Whitesboro soils and areas of loamy fill material. These included soils make up as much as 25 percent of any mapped area.

The Pulexas soil is poorly suited to most urban uses. The hazard of flooding is the major limitation. Adequate protection against this limitation is difficult to provide.

This soil is moderately suited to most recreation uses. It is poorly suited to use as campsites because of the hazard of flooding.

This complex is not in a capability subclass or range site.

**61—Purves clay, 0 to 3 percent slopes.** This shallow, nearly level and gently sloping, clayey soil is on ridgetops. Areas are elongated and range from 6 to about 235 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay to a depth of 7 inches. From a depth of 7 to 15 inches is moderately alkaline, brown clay. Below that is fractured limestone interbedded with clayey marl.

This soil is well drained. Permeability is moderately slow, and available water capacity is very low. Surface runoff is slow to medium, and the hazard of erosion is moderate. This soil has good tilth and can be easily worked, but deep plowing often brings up pieces of limestone. The root zone is restricted by rock at a shallow depth.

Included with this soil in mapping are small areas of Aledo soils, a soil similar to the Purves soil but that is less than 8 inches deep to fractured indurated limestone, another soil similar to the Purves soil but that is noncalcareous, and a soil that has more than 35 percent coarse fragments. The included soils make up less than 35 percent of any mapped area.

This Purves soil is moderately suited to use as cropland. Small grain, grain sorghum, and hay crops are

grown. Crops that grow during the cool seasons are better suited to this soil than crops grown during the warm seasons because of the very low available water capacity and droughtiness. The objectives of management are controlling erosion and maintaining soil tilth and fertility. Growing closely spaced crops or crops that produce large amounts of residue and rotating them with cool season legumes help to control erosion and maintain soil tilth.

This soil is moderately suited to use as pastureland. Droughtiness limits production. Improved bermudagrass and kleingrass are commonly grown. Proper management includes fertilization, weed control, and controlled grazing.

The Purves soil is moderately suited to most urban uses. The main limitations are depth to limestone, shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and moderately slow permeability. In most areas the limestone bedrock can be excavated without the use of explosives. Most limitations can be overcome by good design and careful installation.

This soil is poorly suited to most recreation uses. The clay surface that is sticky when the soil is wet and that cracks when the soil is dry and the shallow depth to limestone are the main limitations.

Areas of this map unit are preferred by quail and doves for food and cover.

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

**62—Purves-Urban land complex, 0 to 3 percent slopes.** The soil in this complex is shallow and nearly level and gently sloping. It is on convex ridges. Areas are irregular in shape and are longer than they are wide. They range from 15 to about 70 acres.

This complex is about 45 to 65 percent Purves soil, 15 to 40 percent Urban land, and less than 20 percent closely similar soils. The Purves soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Purves soil is moderately alkaline, dark grayish brown clay about 7 inches thick. From a depth of 7 to 15 inches is moderately alkaline, brown clay. Below that is fractured limestone interbedded with clayey marl.

This soil is well drained. Permeability is moderately slow, and available water capacity is very low. Runoff is slow, and the hazard of erosion is moderate. The root zone is limited by the limestone. Natural fertility is high.

The Urban land part of the complex is covered by individual dwellings, small businesses, and apartments and adjoining streets, driveways, sidewalks, patios, and other structures that alter the soil to the extent that classification is not practical.

Included with this complex in mapping are closely similar Aledo soils and a soil that is similar to the Purves soil but that is gravelly and stony. These included soils make up as much as 20 percent of a mapped area.

The Purves soil is moderately suited to most urban uses. The shallow depth to limestone is the main limitation. This soil is poorly suited to septic tank filter fields. Shrinking and swelling with changes in moisture and corrosivity to uncoated steel are limitations that can be overcome by good design and careful installation.

This soil is poorly suited to most recreation uses. The clay surface that is sticky when the soil is wet and that cracks when the soil is dry and the shallow depth to rock are the main limitations.

This complex is not in a capability subclass or range site.

**63—Rader fine sandy loam, 0 to 3 percent slopes.** This deep, nearly level and gently sloping, loamy soil is on low terraces and in valleys. Areas are slightly moundy and are longer than they are wide. They range from 5 to more than 100 acres. Slopes average about 1 percent.

Typically, the surface layer is fine sand about 18 inches thick. The upper part is brown, and the lower part is pale brown. The subsoil, from a depth of 18 to 27 inches, is yellowish brown sandy clay loam. From a depth of 27 to about 69 inches, it is sandy clay in the upper part and sandy clay loam in the lower part. It is mottled in shades of yellow, gray, brown, and red. Reaction typically is slightly acid in the upper part of the soil and medium acid or strongly acid in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. Runoff is slow, and the hazard of erosion is slight. The soil is easy to work, but a perched water table is present on the clayey lower layers after periods of heavy rainfall. The root zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

Included with this soil in mapping are small areas of Mabank soils in depressions that make up 5 to 15 percent of some mapped areas. Also included is a soil that is similar to the Rader soil but that does not have a transitional layer in the upper part of the subsoil and another soil that is similar but that does not have gray mottles within the upper 30 inches. The included soils make up 5 to 25 percent of most mapped areas.

This Rader soil is mainly used as pastureland and is well suited to this use. Improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, singletary peas, and arrowleaf clover are commonly grown. Pasture management includes fertilization, weed control, and controlled grazing.

This soil is well suited to use as cropland. Low natural fertility and the rapid loss of moisture during the summer are limitations for production. Terracing and contour farming are needed to control erosion in areas where the slope exceeds one percent. Leaving crop residue on the soil and growing deep-rooted legumes help to slow runoff and maintain soil tilth.

The Rader soil is moderately suited to most urban uses. The main limitations are seasonal wetness, shrinking and swelling with changes in moisture,

corrosivity to uncoated steel and concrete, and permeability. Some low-lying areas near drainageways are flooded by runoff from adjacent, higher areas. Good design and careful installation are needed to overcome these limitations.

This soil is moderately suited to recreation uses. Seasonal wetness and very slow permeability are the main limitations.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**64—Rader-Urban land complex, 0 to 3 percent slopes.** The soil in this complex is deep and nearly level and gently sloping. It is on high stream terraces and in valleys. Areas are irregular in shape and mostly longer than they are wide. They range from 10 to more than 100 acres. Slopes average about 1 percent.

The complex is 40 to 65 percent Rader soil, 15 to 40 percent Urban land, and less than 25 percent closely similar soils. The Rader soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer is fine sandy loam about 18 inches thick. The upper part is brown, and the lower part is pale brown. The subsoil, from a depth of 18 to 27 inches, is yellowish brown sandy clay loam. From a depth of 27 to about 69 inches, it is sandy clay in the upper part and sandy clay loam in the lower part. It is mottled in shades of yellow, gray, brown, and red. Reaction typically is slightly acid in the upper part of the soil and medium acid or strongly acid in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. Runoff is slow, and the hazard of erosion is slight. A perched water table is present on the clayey lower layers after periods of heavy rainfall. The root zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

The Urban land part of this complex is covered by individual dwellings, small businesses, and apartments and adjoining streets, sidewalks, driveways, parking lots, patios, and other structures that obscure or alter the soils to the extent that classification is not practical.

Included with this complex in mapping are small areas of Crosstell, Gasil, and Mabank soils. The included soils make up less than 25 percent of any mapped area.

The Rader soil is moderately suited to urban uses. Seasonal wetness, shrinking and swelling with changes in moisture, corrosivity to uncoated steel and concrete, and very slow permeability are the main limitations. Some low-lying areas near drainageways are flooded by runoff from adjacent, higher areas. Good design and careful installation are needed to overcome these limitations.

This soil is moderately suited to recreation uses. Seasonal wetness and permeability are the main limitations. Woody plantings provide food and cover for songbirds.

This complex is not in a capability subclass or range site.

**65—Sanger clay, 1 to 3 percent slopes.** This deep, gently sloping, clayey soil is in valley fill areas between limestone ridges. Areas are broad and subrounded to long and narrow. They range from about 10 to 200 acres. Untilled areas have gilgai microrelief.

Typically, the surface layer is about 20 inches thick. It is clay that is very dark grayish brown in the upper part and dark grayish brown in the lower part.

From a depth of 20 to 49 inches is grayish brown silty clay. From a depth of 49 to 80 inches is light yellowish brown silty clay that has common masses of calcium carbonate and limestone fragments and pebbles. This soil is moderately alkaline and it is calcareous throughout.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. When the soil is dry, cracks extend to the surface and water enters the soil rapidly. When the soil is wet and the cracks are sealed, water enters the soil very slowly. This soil is difficult to work. When it is wet, it is sticky. When it is dry, it is hard and clods form when it is plowed. The high lime content causes chlorosis in sensitive plants. The root zone is deep, but plant roots penetrate slowly because of the clayey texture.

Included with this soil in mapping are small areas of Ponder soils on slight ridges, San Saba soils near the head of drainageways, and Slidell soils on foot slopes. These included soils make up less than 15 percent of any mapped area.

This Sanger soil is mainly used as cropland, but a significant acreage is used as pastureland and rangeland. This soil is well suited to use as cropland (fig. 18). It is mainly used for grain sorghum, small grain, and forage sorghums. Corn and cotton are grown on smaller acreages. The main objectives of management are controlling erosion and maintaining tilth. Terracing and farming on the contour help to slow runoff and to control erosion. Leaving crop residue on the soil helps to improve soil tilth and conserve moisture.

This soil is well suited to use as pastureland. Suitable pasture species are improved bermudagrass, tall fescue, johnsongrass, kleingrass, vetch, and sweetclover. Fertilization, weed control, and controlled grazing are management objectives.

The Sanger soil is moderately suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture and corrosivity to uncoated steel. These limitations can only be partly overcome by good design and careful installation. This soil is poorly suited to septic tank absorption fields because of very slow permeability.

*Figure 18.*—Harvesting wheat on Sanger clay, 1 to 3 percent slopes. Urban development frequently encroaches on farmland in the county.

This soil is poorly suited to most recreation uses. The main limitations are the very slow permeability and the clay surface layer that causes the soil to form deep, wide cracks when it is dry and causes stickiness when it is wet.

Areas of this soil are regularly inhabited by doves and quail. Deer from adjacent woods use the abundant supply of forbs as a food supply.

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

**66—Sanger clay, 3 to 5 percent slopes.** This deep, gently sloping, clayey soil is in valley fill areas and on side slopes of ridges below limestone outcrop. Areas are longer than they are wide and range from about 10 to 130 acres. Untilled areas have gilgai microrelief.

Typically, this soil is moderately alkaline, calcareous clay to a depth of about 46 inches. It is dark grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 63 inches is yellowish and brownish shaly clay.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. When this soil is dry, deep, wide cracks extend to the surface and water enters the soil rapidly. When the soil is wet, however, the cracks are sealed and water enters the soil very slowly. This soil is difficult to work during extremes in moisture conditions. The high content of calcium carbonate causes chlorosis in sensitive plants. The root zone is deep, but plant roots slowly penetrate the clayey layers.

Included with this soil in mapping are small bands of Bolar and Medlin soils on the upper parts of the slope and small areas of San Saba soils near the head of drainageways. The included soils make up as much as 20 percent of some mapped areas.

This Sanger soil is moderately suited to use as cropland. It is used for grain sorghum, small grain, and hay crops. Slope is a limitation. The main objectives of

management are controlling erosion and maintaining tilth. Terracing and contour farming are needed to slow runoff and control erosion. Growing deep rooted legumes and leaving crop residue on the soil help to reduce erosion and maintain tilth.

This soil is well suited to use as pastureland. Improved bermudagrass, indiangrass, switchgrass, johnsongrass, kleingrass, vetch, and sweetclover are suitable. Pasture management includes fertilization, weed control, and controlled grazing.

The Sanger soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and permeability are the main limitations. These limitations can only be partly overcome by good design and careful installation.

This soil is poorly suited to most recreation uses. The limitations are the very slow permeability and the clay surface that cracks when the soil is dry and is sticky when the soil is wet.

Areas of this map unit are regularly inhabited by doves and quail. Deer use the site for cover, but only occasionally because of the lack of woody cover. Deer from adjacent woods use the abundant supply of forbs as a food supply.

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

**67—Sanger-Urban land complex, 1 to 5 percent slopes.** The soil in this complex is deep and gently sloping. It is on uplands. Many areas are in valleys below limestone ridges. Areas are subrounded and range from 10 to more than 200 acres. Slopes average about 3 percent.

This complex is about 45 to 70 percent Sanger soil, 15 to 35 percent Urban land, and less than 25 percent closely similar soils. The Sanger soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the Sanger soil is moderately alkaline, calcareous clay to a depth of about 49 inches. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. From a depth of 20 to 80 inches is moderately alkaline, calcareous, brownish silty clay that has common masses of calcium carbonate and limestone fragments in the lower part.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. Chlorosis is a hazard for some plants grown on this soil. The root zone is deep, and natural fertility is high.

The Urban land part of the complex is covered by individual dwellings, small businesses, and apartments and adjoining streets, driveways, sidewalks, parking lots, and other structures. Some areas have been altered by construction to the extent that classification is not practical.

Included with this complex in mapping are small areas of Ponder and San Saba soils and large areas of Slidell soils on less sloping areas. These included soils make up as much as 25 percent of this map unit.

The Sanger soil is moderately suited to urban uses. Shrinking and swelling with changes in moisture, low strength affecting streets and roads, corrosivity to uncoated steel, and very slow permeability are limitations that can be partly overcome by good design and careful installation.

This soil is poorly suited to recreation uses. The clay texture, slope, permeability and wide cracks that form when the soil is dry are the main limitations.

This complex is not in a capability subclass or range site.

**68—San Saba clay, 0 to 2 percent slopes.** This moderately deep, nearly level and gently sloping, clayey soil is at the head of natural drainageways. Areas are subrounded and range from 5 to about 110 acres.

Typically, the surface layer is moderately alkaline, very dark gray clay about 24 inches thick and has brownish mottles in the lower 8 inches. The subsoil, from a depth of 24 to 30 inches is moderately alkaline, dark grayish brown clay. Below that is indurated, fractured limestone.

This soil is moderately well drained. Permeability is very slow, and available water capacity is low. Runoff is slow, and the hazard of erosion is slight. This soil forms wide cracks when it is dry. The soil is difficult to work during extremes in moisture conditions. The root zone is moderately deep, but plant roots penetrate slowly.

Included with this soil in mapping are small areas of Purves soils near outer edges of mapped areas and a soil similar to the San Saba soil but that has bedrock at a depth of more than 40 inches. The included soils make up as much as 15 percent of some areas.

This San Saba soil is used almost equally for cropland and rangeland. It is well suited to use as cropland, and is used for grain sorghum and small grain. The low available water capacity lowers the yield of summer crops. The management objectives are controlling erosion and maintaining soil tilth. Growing closely spaced crops and crops that produce large amounts of residue helps to control erosion and maintain tilth. Growing deep rooted legumes helps to aerate the soil and improve fertility.

This soil is well suited to use as pastureland. Adapted pasture plants are improved bermudagrass, indiangrass, switchgrass, kleingrass, sweetclover, and vetch. Fertilization, weed control, and controlled grazing are management objectives.

The San Saba soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, depth to rock, permeability, and corrosivity to uncoated steel are the main limitations. Good design and careful installation can help to overcome these limitations.

This soil is poorly suited to most recreation uses. The main limitations are depth to rock, very slow permeability, and the clayey surface layer that forms deep, wide cracks when the soil is dry and that is sticky when the soil is wet.

Areas of this map unit are regularly inhabited by doves and quail. Deer use the site for cover, but only occasionally because of the lack of woody cover. Deer from adjacent woods use the abundant supply of forbs as a food supply.

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

**69—Selden loamy fine sand, 1 to 3 percent slopes.** This deep, gently sloping, sandy soil is on uplands. Areas are irregular to oval in shape and range from 8 to about 85 acres. Slopes are concave and average about 1.5 percent.

Typically, the surface layer is brownish loamy fine sand about 14 inches thick. The subsoil to a depth of about 65 inches is sandy clay loam. It is yellowish brown in the upper part and mottled in shades of yellow, red, and gray in the lower part. Typically, reaction is neutral in the upper part of the soil, grading to strongly acid in the lower part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is medium. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe in areas that are bare of vegetation. The root zone is deep, and roots can easily penetrate the lower layers. This soil is easy to work throughout a wide range of moisture conditions.

Included with this soil in mapping are small areas of Nimrod soils along drainageways. Small eroded areas that have a few isolated gullies are present in a few areas. These included soils make up less than 20 percent of any mapped area.

This Selden soil is mainly used as pastureland, and is well suited to this use. Adapted pasture plants are improved bermudagrass, weeping lovegrass, switchgrass, indiangrass, vetch, and arrowleaf clover. Fertilization at planned intervals, weed control, and controlled grazing are management objectives. Emerging grass seedlings need to be protected from blowing sand.

This soil is moderately suited to use as cropland. Low natural fertility and the droughty surface layer are limitations for production. Small grain, peanuts, truck crops, and orchards are suitable. Leaving crop residue on the soil and growing cool season legumes help to maintain soil tilth and to control soil blowing.

The Selden soil is well suited to most urban uses. The main limitations are seasonal wetness of the lower part of the subsoil, corrosivity to uncoated steel, and low strength affecting streets and roads. The moderately slow permeability is a limitation for septic tank absorption fields. These limitations can be easily overcome by good design and careful installation.

This soil is moderately suited to recreation uses. Permeability and the loamy fine sand surface layer are the main limitations. Maintaining a good grass cover helps to prevent soil blowing.

Areas of this map unit are inhabited by deer, turkeys, squirrels, quail, and doves. These animals feed extensively on acorns and other mast. Good nesting areas and loafing cover are provided.

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

**70—Silawa fine sandy loam, 3 to 8 percent slopes.** This deep, gently sloping and sloping, loamy soil is on high terraces above flood plains of major streams. Areas are elongated and range from 10 to about 250 acres.

Typically, the surface layer is slightly acid, dark yellowish brown fine sandy loam about 6 inches thick. The subsoil, from a depth of 6 to 46 inches, is medium acid sandy clay. It is red in the upper 15 inches and yellowish red below. From a depth of 46 to 60 inches, it is slightly acid, reddish yellow fine sandy loam.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. This soil can be worked throughout a wide range of moisture conditions. The root zone is deep and is easily penetrated by plant roots. Sand and gravel underlies this soil in some areas.

Included with this soil in mapping are small areas of Gasil soils on foot slopes and Konsil soils on upper slopes. These closely similar soils make up less than 20 percent of a mapped area.

This Silawa soil is well suited to use as pastureland. Improved bermudagrass, weeping lovegrass, switchgrass, kleingrass, and vetch are commonly grown. Proper pasture management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. The limitations for this use are slope, the hazard of erosion, and low natural fertility. The major objectives of management are to control erosion and improve fertility and tilth. Terraces, waterways, and diversions are needed to slow runoff and to control erosion. Growing cool season legumes and leaving crop residue on the soil helps to slow runoff, control soil blowing, and improve soil tilth and fertility.

The Silawa soil is well suited to most urban and recreation uses. The main limitations are low strength affecting streets and roads, slope, and the hazard of erosion. These limitations can be easily overcome by good design and careful installation. Slope is a limitation for using this soil for playgrounds.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**71—Silstid loamy fine sand, 1 to 5 percent slopes.** This deep, gently sloping, sandy soil is on high stream terraces and side slopes of ridges. Areas are smooth to gently undulating and subrounded. They range from 7 to about 150 acres.

Typically, the surface layer is loamy fine sand about 27 inches thick. It is brown in the upper part and very pale

brown in the lower part. The upper part of the subsoil, from a depth of 27 to 67 inches, is sandy clay loam that has yellowish red and red mottles. The lower part of the subsoil, from a depth of 67 to 74 inches is reddish yellow fine sandy loam that has red and strong brown mottles. Reaction typically is slightly acid in the upper part of the soil and medium acid in the lower part.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Surface runoff is slow, and the hazard of water erosion is slight. The soil can be worked throughout a wide range of moisture conditions. The surface layer is droughty, and the hazard of soil blowing is severe when the soil is bare of vegetation. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastsil, Gasil, and Konsil soils. Bastsil and Konsil soils are on ridges, and Gasil soils are in slight depressions. These soils make up as much as 10 percent of some mapped areas. Also included is a soil along drainageways that is similar to the Silstid soil but that has gray mottles in the upper part of the subsoil. This closely similar soil makes up as much as 25 percent of some mapped areas.

The Silstid soil is used almost equally for pastureland and rangeland. It is well suited to use as pastureland. Improved bermudagrass, weeping lovegrass, switchgrass, indiangrass, vetch, and arrowleaf clover are commonly grown. Emerging grass seedlings can be killed by blowing sand unless practices that control soil blowing are used. Proper pasture management includes fertilization at planned intervals throughout the growing season, weed control, and controlled grazing.

This soil is moderately suited to use as cropland, but low natural fertility and medium available water capacity are limitations. A few small areas are used for corn, melons, tomatoes, fruit trees, and nursery stock. The main objectives of management are controlling soil blowing, conserving moisture, and improving fertility. Fertilizing, stripcropping, and growing crops that produce large amounts of residue help to control soil blowing, conserve moisture, and improve fertility.

The Silstid soil is well suited to most urban uses. The main limitation is corrosivity to uncoated steel and concrete. This can be easily overcome by good design and careful installation.

This soil is moderately suited to most recreation uses. The loamy fine sand surface that blows when bare of vegetation is the main limitation. Soil blowing can be overcome by maintaining a good grass cover.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**72—Silstid-Urban land complex, 1 to 5 percent slopes.** The soil in this complex is deep and gently sloping. It is on high stream terraces and side slopes of low ridges. Areas are smooth to gently undulating and subrounded. They range from 10 to 130 acres. Slopes average about 3 percent.

This complex is about 45 to 70 percent Silstid soils, 15 to 40 percent Urban land, and less than 15 percent closely similar soils. The Silstid soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Silstid soil is slightly acid loamy fine sand about 27 inches thick. It is brown in the upper part and very pale brown in the lower part. The upper part of the subsoil, from a depth of 27 to about 53 inches, is medium acid, brownish yellow sandy clay loam and has reddish mottles. From a depth of 53 to 67 inches, it is strongly acid, brownish yellow sandy clay loam and has red mottles. The lower part of the subsoil to a depth of 74 inches is medium acid, reddish yellow fine sandy loam and has reddish and brownish mottles.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is slow, and soil blowing is a hazard if the soil is bare of vegetation. The surface layer is droughty, and plant growth is slow until the roots penetrate the lower layers.

The Urban land part of this complex is covered by dwellings, streets, driveways, sidewalks, small businesses, and other structures. Some areas have been altered to the extent that classification is not practical.

Included with this complex in mapping are small areas of the closely similar Bastsil, Gasil, and Konsil soils that make up as much as 15 percent of a mapped area.

The Silstid soil is well suited to urban uses. The gently undulating topography and native trees in most areas are attractive to home builders. The sandy surface layer and corrosivity to uncoated steel and concrete are the main limitations. Good design and careful installation are needed to help overcome these limitations. This soil is suited to septic tank filter fields.

This soil is moderately suited to most recreation uses. The loamy fine sand surface layer and slope are the main limitations.

This complex is not in a capability subclass or range site.

**73—Slidell clay, 0 to 1 percent slopes.** This deep, nearly level, clayey soil is on smooth ridges of uplands. Areas are broad to elongated. They range from 15 to about 200 acres. Untilled areas have gilgai microrelief.

Typically, the surface layer is moderately alkaline, very dark gray clay about 27 inches thick. Below that to a depth of 60 inches is moderately alkaline silty clay. It is grayish brown in the upper part and light yellowish brown in the lower part.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the hazard of erosion is slight. When it is dry, the soil forms deep, wide cracks that extend to the surface. When the

soil is cracked, water enters it rapidly. When the soil is wet and the cracks are sealed, water enters the soil very slowly. This soil is difficult to work during extremes in moisture conditions. The root zone is deep, but plant roots penetrate slowly.

Included with this soil in mapping are areas of Sanger and San Saba soils. These closely similar soils make up about 5 percent of some mapped areas.

This Slidell soil is mainly used as cropland. It is well suited to this use. The main crops are grain sorghum and small grain, but corn and cotton are also grown. The main objectives of management are maintaining tilth and fertility. Growing deep rooted legumes and crops that produce a large amount of residue helps to maintain tilth.

This soil is well suited to use as pastureland. Suitable pasture species are improved bermudagrass, tall fescue, switchgrass, kleingrass, johnsongrass, vetch, and sweetclover. Proper pasture management includes fertilization, weed control, and controlled grazing.

The Slidell soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture, corrosivity to uncoated steel, and very slow permeability are the main limitations. These limitations can only be partly overcome by good design and careful installation.

This soil is poorly suited to most recreation uses. The main limitations are the very slow permeability and the clay surface layer that forms deep, wide cracks when the soil is dry and that is sticky when the soil is wet.

Areas of this map unit are regularly inhabited by doves and quail. Deer use these areas for cover, but only occasionally because of the lack of woody cover. Deer from adjacent woods use the abundant supply of forbs as a food supply.

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

**74—Slidell clay, 1 to 3 percent slopes.** This deep, gently sloping, clayey soil is in valley fill areas along drainageways (fig. 19). Areas are long and narrow to broad. They range from 10 to about 250 acres. Untilled areas have gilgai microrelief.

Typically, the surface layer is moderately alkaline, very dark gray clay about 22 inches thick. From a depth of 22 to 70 inches is moderately alkaline clay that is dark gray in the upper part and grayish brown in the lower part. The underlying material to a depth of 80 inches is moderately alkaline, light brownish gray silty clay that has yellowish mottles and masses and concretions of calcium carbonate.

This soil is well drained. Permeability is very slow, and available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Deep, wide cracks extend to the surface when this soil is dry. Water enters the soil rapidly when the cracks are open. When the soil is wet and the cracks are sealed, water enters the soil very slowly. If the soil is worked when it is dry, it clods. If it is worked when it is wet, dense plowpan layers are formed. The root zone is deep, but plant roots penetrate slowly.

Included with this soil in mapping are small areas of Sanger and San Saba soils. These closely similar soils make up as much as 15 percent of some mapped areas.

This Slidell soil is mainly used as cropland and is well suited to this use. Grain sorghum and small grain are the main crops, but corn, cotton, and forage sorghum are also grown. The main objectives of management are controlling erosion and maintaining tilth. Terracing and farming on the contour help to slow runoff and to control erosion.

Growing deep rooted legumes helps maintain tilth. Leaving crop residue on or near the surface helps to conserve moisture and to slow runoff.

This soil is well suited to use as pastureland. Improved bermudagrass, kleingrass, johnsongrass, vetch, and sweetclover are commonly grown. Proper pasture management includes fertilization, weed control, and controlled grazing.

The Slidell soil is moderately suited to most urban uses. Shrinking and swelling with changes in moisture and corrosivity to uncoated steel are the main limitations. This soil is poorly suited to septic tank absorption fields because of very slow permeability. These limitations can only be partly overcome for recreation uses. The main limitations are permeability and the clayey surface layer that cracks when the soil is dry and is sticky when the soil is wet.

Areas of this map unit are regularly inhabited by doves and quail. Deer use these areas for cover, but only occasionally because of the lack of woody cover. Deer from adjacent woods use the abundant supply of forbs as a food supply.

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

**75—Speck clay loam, 0 to 3 percent slopes.** This shallow, nearly level and gently sloping, loamy soil is on convex ridges. Areas are long and narrow and range from 8 to 120 acres.

Typically, the surface layer is slightly acid, brown clay loam about 7 inches thick. The subsoil, from a depth of 7 to 15 inches, is mildly alkaline, dark reddish brown clay. Below that to a depth of 29 inches is fractured, indurated limestone.

This soil is well drained. Permeability is slow, and available water capacity is very low. The root zone is shallow. Surface runoff is medium, and the hazard of erosion is moderate. This soil is difficult to work because of the crusty surface and dense plowpan layers.

Included with this soil in mapping are a few small areas of Aledo soils. These included soils make up 5 to 15 percent of some mapped areas.

This Speck soil is mainly used as cropland and is moderately suited to this use. The major crops are small

*Figure 19.*—Deferred grazing on Slidell clay, 1 to 3 percent slopes, in the Blackland range site.

grain, grain sorghum, and forage sorghum. The shallow root zone and the very low available moisture capacity are limitations for production. Deep plowing often brings up fragments of limestone. Cool season crops are better suited to this soil than summer grown crops. The objectives of management are controlling erosion, conserving moisture, and improving soil tilth and fertility. Growing closely spaced crops that produce large amounts of residue and leaving the residue on or near the surface help to control erosion, improve tilth, and conserve moisture. Growing cool season legumes helps to improve tilth and fertility.

This soil is moderately suited to use as pastureland. The shallow depth to rock is a limitation for production. Kleingrass is suitable. Management concerns are fertilizing and controlling grazing.

The Speck soil is moderately suited to most urban uses. Depth to rock is a limitation. Septic tank absorption systems are poorly suited to this soil.

This soil is moderately suited to most recreation uses. Depth to rock is the main limitation.

Areas of this map unit, are mainly used by quail, doves, and other birds. Brush cover is too sparse in most places to attract larger mammals.

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

**76—Stephenville fine sandy loam, 8 to 15 percent slopes.** This moderately deep, loamy soil is strongly sloping to moderately steep. Areas are dissected by numerous natural drainageways. Areas of this soil below sandstone outcrops generally have a few sandstone boulders on the surface. Areas range from 10 to more than 250 acres. Slopes average about 10 percent.

Typically, the surface layer is brownish fine sandy loam about 11 inches thick. The subsoil, from a depth of 11 to 32 inches, is very pale brown sandy clay loam, grading to loam. Fragments of sandstone are in the lower part. Below that to a depth of 50 inches is white sandstone.

This soil is well drained. Permeability is moderate, and available water capacity is low. Runoff is rapid, and the hazard of erosion is severe. Natural fertility is low. The root zone is moderately deep and is easily penetrated by plant roots.

Included with this soil in mapping are some soils that are closely similar to it. One soil has a sandier subsoil; another soil, on ridges, is loamy fine sand or sand over weakly cemented sandstone; a soil on ridgetops is less than 20 inches deep to sandstone; and a soil near drainageways, on concave areas, is more than 40 inches deep to sandstone. These closely similar soils make up 20 to 40 percent of most areas. Areas of Aledo and Maloterre soils are above narrow bands of limestone outcrop and make up 5 to 10 percent of some areas.

This Stephenville soil is mainly used as pastureland, rangeland, and resource material for making cement and for recreation purposes. This soil is poorly suited to use as cropland and pastureland. Low available water capacity, low natural fertility, and droughtiness are limitations for production. Improved bermudagrass, weeping lovegrass, indiangrass, switchgrass, vetch, and arrowleaf clover are commonly grown.

Much of this soil is underlain by thick beds of poorly graded, weakly consolidated sand. This material is quarried in scattered areas.

The Stephenville soil is moderately suited to urban and recreation uses. Slope and the severe hazard of erosion are the main limitations. Good design and careful installation are needed to overcome these limitations. Septic tank filter fields are subject to seepage because of slope. This soil is well suited to paths and trails.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**77—Sunev clay loam, 1 to 3 percent slopes.** This deep, gently sloping, loamy soil is on low stream terraces and foot slopes of ridges. Areas are long and narrow and range from 5 to about 140 acres.

Typically, the surface layer is moderately alkaline, dark grayish brown clay loam about 19 inches thick. The subsoil, from a depth of 19 to 72 inches, is moderately alkaline, pale brown clay loam and has many masses and concretions of calcium carbonate.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of erosion is moderate. This soil can be easily worked. When plowed at most moisture levels, the soil crumbles and forms a good seedbed. The root zone is deep and roots can easily penetrate the lower layers. The high content of calcium carbonate causes chlorosis in sensitive plants.

Included with this soil in mapping are small areas of intermingled Chatt and Sanger soils. These included soils make up 5 to 15 percent of a mapped area.

This Sunev soil is mainly used as cropland and is well suited to this use. Forage sorghum, grain sorghum, and small grain are the main crops. Management objectives include terracing and contour farming to slow runoff and reduce erosion. Leaving crop residue on the soil helps to control erosion and improve soil tilth.

This soil is well suited to use as pastureland. Improved bermudagrass, kleingrass, johnsongrass, weeping lovegrass, indiangrass, switchgrass, sweetclover, and vetch are commonly grown. Fertilization, weed control, and controlled grazing are pasture management objectives.

The Sunev soil is well suited to most urban and recreation uses (fig. 20). Low strength affecting streets and roads is the main limitation. This limitation can be overcome by good design and careful installation. Sewage lagoons are poorly suited to this soil because of seepage.

The clay loam surface layer is the main limitation for recreation uses. Using loamy fill material and maintaining a good grass cover can help to overcome this limitation.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**78—Sunev clay loam, 3 to 8 percent slopes.** This deep, gently sloping to sloping, loamy soil is on foot slopes of hills and ridges. Areas follow the contour of the slope and are longer than they are wide. They range from 10 to more than 70 acres. Slopes are convex and average about 5 percent.

Typically, the surface layer is moderately alkaline, clay loam about 15 inches thick. It is dark grayish brown in the upper 9 inches and brown in the lower 6 inches. The subsoil, from a depth of 15 to 63 inches, is moderately alkaline clay loam. It is pale brown in the upper part and reddish yellow with many soft masses of calcium carbonate in the lower part.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of erosion is severe. This soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and is easily penetrated by plant roots. Chlorosis affects some plants grown on this soil.

Included with this soil in mapping are small areas of Bolar soils on upper slopes and Sanger soils along foot slopes. These included soils make up less than 15 percent of any mapped area.

This Sunev soil is well suited to use as pastureland. Adapted pasture species are improved bermudagrass,

*Figure 20.*—Large lakes in the county are used for recreation. This recreation area is in a small area of Sunev clay loam below an area of Aledo-Bolar complex, 5 to 20 percent slopes.

kleingrass, indiangrass, switchgrass, sweetclover, and vetch. Proper management includes weed control, fertilization, and controlled grazing.

This soil is moderately suited to use as cropland. Slope, the severe hazard of erosion, and the high content of lime in the subsoil are the main limitations. Management objectives are controlling erosion, improving soil tilth, and conserving soil moisture. Terracing and farming on the contour help to slow runoff and to control erosion. Grassed waterways are needed for terrace outlets. Growing closely spaced crops that produce large amounts of residue and leaving crop residue on or near the soil surface help to slow runoff, improve tilth, and conserve soil moisture.

The Sunev soil is well suited to most urban and recreation uses. Slope, the hazard of erosion, and low strength affecting streets and roads are the main limitations. Seeding bare construction sites to grass and using good design and careful installation help to overcome these limitations. The clay loam surface that is sticky when the soil is wet is a limitation for recreation uses (fig. 21). Slope is a limitation for the use of this soil for playgrounds.

Areas of this map unit are preferred by quail and ground-nesting birds because the ground cover and food are excellent.

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

**79—Sunev-Urban land complex, 2 to 8 percent slopes.** The soil in this complex is deep and gently sloping and sloping. It is on ancient stream terraces and

*Figure 21.*—Sunev clay loam, 3 to 8 percent slopes, is well suited to use as campsites and for picnic areas.

foot slopes below ridges of limestone outcrop. Areas are long and narrow and follow the contour of the slope. Slopes are convex and average about 5 percent.

This complex is about 40 to 65 percent Sunev soil, 15 to 40 percent Urban land, and less than 25 percent closely similar soils. The Sunev soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Sunev soil is moderately alkaline clay loam about 15 inches thick. It is dark grayish brown in the upper 9 inches and brown in the lower 6 inches. The subsoil, from a depth of 15 to 63 inches is moderately alkaline clay loam. It is pale brown in the upper part and reddish yellow with many soft masses of calcium carbonate in the lower part.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of erosion is severe. The root zone is deep and is easily penetrated by plant roots. Chlorosis affects some plants grown on this soil.

The Urban land part of this complex is covered by dwellings, small businesses, and apartments and their adjoining streets, driveways, sidewalks, patios, and other structures. Some areas have been altered to the extent that classification is not practical.

Included with this complex in mapping are small areas of Frio soils on narrow flood plains and Bolar and Sanger soils on uplands. The included soils make up less than 25 percent of any mapped area.

The Sunev soil is well suited to most urban uses. Slope, the hazard of erosion, and corrosivity to uncoated steel are limitations. Low strength is a limitation for streets and roads. Good design and careful installation are needed to help overcome these limitations.

This soil is moderately suited to most recreation uses. Slope and the hazard of erosion are the main limitations.

This complex is not in a capability subclass or range site.

**80—Trinity clay, frequently flooded.** This deep, nearly level, clayey soil is on flood plains of major streams. It is flooded once every year to once every two years. Flooding lasts from several hours to one day. Areas are long and broad and parallel the stream channel. They range from 20 to about 1,500 acres. Slopes range from 0 to 1 percent.

Typically, this soil is moderately alkaline, dark gray clay to a depth of 63 inches. It has very dark grayish brown mottles below a depth of 32 inches.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is very slow, and the hazard of erosion is slight. When the soil is dry, deep, wide cracks form at the surface. Water ponds on the surface for a few hours following rains. The root zone is deep, but plant roots slowly penetrate the clayey material.

Included with this soil in mapping are small areas of Ovan soils and areas of Trinity soils that have as much as 10 inches of dark grayish brown overwash deposited on the surface. The included soils make up as much as 30 percent of a mapped area.

This soil is used mainly as pastureland and is well suited to this use. Adapted pasture plants commonly grown are improved bermudagrass, tall fescuegrass, indiangrass, switchgrass, kleingrass, johnsongrass, sweetclover, and singletary peas. Fertilization, weed control, and controlled grazing are pasture management objectives.

The hazard of flooding is the main limitation for use as cropland and for urban and recreation uses. This limitation can be overcome only by major flood control. Wetness, very slow permeability, and the clay texture throughout that causes deep, wide cracks to form when the soil is dry and causes stickiness when the soil is wet are also limitations for urban and recreation uses.

Areas of this map unit are excellent for wildlife habitat. These areas furnish cover, food, and nesting for many songbirds, quail, doves, rabbits, squirrels, raccoons, and deer.

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

**81—Urban land.** This unit consists of areas that are 85 to 100 percent works and structures, such as office buildings, hotels, railroad yards, airports, multiple-unit dwellings, shopping centers, churches, schools, streets, sidewalks, and paved parking lots. Most of the sales, service, banking, professional, educational, entertainment, and governmental functions of the cities are concentrated in these areas.

Most of the rainfall in those areas runs off and reaches major drains rapidly.

Included in mapping are some built-up areas on which buildings and structures cover less than 85 percent of the surface. Also included are small areas of soils that have been covered by fill material. These included areas make up as much as 20 percent of the mapped areas.

The soils that make up Urban land have been altered and obscured to the extent that they can not be classified.

This map unit is not in a capability subclass or range site.

**82—Weatherford fine sandy loam, 3 to 8 percent slopes.** This deep, gently sloping and sloping soil is on slopes above drainageways. Areas follow the contour of slope and are longer than they are wide. They range from 10 to about 120 acres. Slopes are convex and average about 5 percent.

Typically, the surface layer is brownish fine sandy loam about 6 inches thick. The subsoil, from a depth of 6 to about 51 inches, is sandy clay loam. It is reddish in the upper part and yellowish in the lower part. Below that is stratified pink and white packsand and weakly cemented sandstone. Reaction typically is neutral in the upper part of the soil and medium acid in the lower part.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the hazard of erosion is severe. Areas that are bare of vegetation are subject to soil blowing. This soil is easy to work throughout a wide range of moisture conditions. The root zone is deep, and plant roots can easily penetrate the lower layers.

Included with this soil in mapping are small areas of Selden soils on lower slopes and Windthorst soils on upper slopes and ridges. A few areas of eroded Weatherford soils, from which most of the surface layer has been removed, are included. A few uncrossable gullies are present in some areas. These included soils make up as much as 20 percent of any mapped area.

This Weatherford soil is mainly used as pastureland and rangeland. It is moderately suited to use as pastureland. Improved bermudagrass, kleingrass, weeping lovegrass, indiangrass, switchgrass, vetch, and arrowleaf clover are commonly grown. Proper pasture management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. Low natural fertility and runoff are limitations for production. Management concerns are controlling water erosion and soil blowing and improving soil tilth. Terracing and farming on the contour help to slow runoff and to reduce erosion. Grassed waterways are needed to stabilize terrace outlets. Leaving crop residue on the surface and growing cool season legumes help to slow runoff, improve soil tilth, and control soil blowing.

The Weatherford soil is well suited to most urban and recreation uses. Low strength affecting streets and roads and slope are the main limitations. Good design and careful installation can easily overcome these limitations. Areas left bare of vegetation during construction are easily erodible. Slope is a limitation for using this soil for playgrounds.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**83—Whitesboro loam, frequently flooded.** This deep, nearly level, loamy soil is on flood plains of major streams. It floods once to 3 times in most years for periods of several hours to two days. Areas are mainly long and narrow and range from 15 to about 240 acres. Slopes range from 0 to 1 percent.

Typically, the surface layer, to a depth of 14 inches, is slightly acid, dark grayish brown loam, grading to clay loam in the lower part. Below that, to a depth of 26 inches, it is dark gray loam. The upper part of the subsoil, from a depth of 26 to 36 inches, is dark grayish brown loam. From a depth of 36 to 80 inches, it is gray clay loam that has brownish mottles. Reaction typically is slightly acid in the upper part of the soil, grading to mildly alkaline in the lower part.

This soil is moderately well drained. Permeability is moderate, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. The root zone is deep and is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Pulexas soils on natural levees along stream channels and near adjacent uplands. Soils similar to the Whitesboro soil but that have a stratified sandy and loamy surface layer are included. The included soils make up as much as 20 percent of some mapped areas.

This Whitesboro soil is mainly used as pastureland and is well suited to this use. Adapted pasture species are improved bermudagrass, tall fescue, switchgrass, johnsongrass, singletary peas, and arrowleaf clover. Proper pasture management includes fertilization, weed control, and controlled grazing.

The hazard of flooding is the main limitation for use as cropland and for most urban and recreation uses. This limitation can only be overcome by major flood control.

Areas of this map unit are excellent for quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

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

**84—Wilson clay loam, 0 to 2 percent slopes.** This deep, nearly level to gently sloping, loamy soil is on upland ridges and in slightly depressed areas above drainageways (fig. 22). Areas are long and narrow to broad and range from 5 to about 350 acres. Slopes average less than 1 percent.

Typically, the surface layer is slightly acid, dark gray clay loam about 6 inches thick. The subsoil, from a depth of 6 to 17 inches, is slightly acid, very dark gray clay loam. From a depth of 17 to 76 inches, it is slightly acid clay that is very dark gray in the upper part, grading to grayish brown in the lower part.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight. In depressed areas, water is ponded on the surface for a few hours following rains. The wetness delays planting early in spring and slows plant growth. This soil is difficult to work because of surface crusts and dense plowpans that form in cultivated areas. The root zone is deep, but plant roots slowly penetrate the clayey underlying layers.

Included with this soil in mapping are small areas of Burleson soils in slightly lower positions on the landscape and Navo and Ponder soils on slight ridges. These included soils make up less than 20 percent of mapped areas.

This Wilson soil is used almost equally as cropland and pastureland. It is moderately suited to use as cropland. The main crops are grain sorghum, cotton, and small grain. Surface crusting and droughtiness are limitations for production. The objectives of management are conserving moisture, improving tilth, and maintaining fertility. Surface drainage may be needed in a few areas. Growing crops that produce large amounts of residue and leaving the residue on the surface helps to conserve moisture, reduce crusting, and improve tilth. Growing warm or cool season legumes helps to improve tilth and fertility.

This soil is well suited to use as pastureland, but seedbed preparation is difficult because of the crusty surface and rapid changes in surface moisture conditions. Improved bermudagrass, kleingrass, arrowleaf clover, and singletary peas are commonly grown. Grazing when the soil is wet causes soil compaction. Proper pasture management includes fertilization, weed control, and controlled grazing.

The Wilson soil is poorly suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture, seasonal wetness, corrosivity to uncoated steel, and permeability. These limitations can only be partly overcome by good design and careful installation.

This soil is poorly suited to most recreation uses. The main limitations are seasonal wetness, very slow permeability, and the clay loam surface that is sticky when the soil is wet. Grading, drainage, and keeping a good grass cover can help to overcome these limitations.

Areas of this map unit are inhabited by doves and quail, along with prairie dogs, coyote, rabbits, badgers, and skunks. Ample food for songbirds is provided by the wide variety of forbs.

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

**85—Wilson-Urban land complex, 0 to 2 percent slopes.** The soil in this complex is deep and nearly level to gently sloping. It is in low, concave areas and on areas above natural drainageways. Areas are mainly

*Figure 22.*—Cotton growing in an area of Wilson clay loam, 0 to 2 percent slopes.

elongated and range from 7 to more than 200 acres. Slopes average less than 1 percent.

This complex is 40 to 70 percent Wilson soils, 15 to 50 percent Urban land, and less than 20 percent closely similar soils. The Wilson soil and Urban land are so intricately mixed that it is not practical to map them separately.

Typically, the surface layer of the Wilson soil is slightly acid, dark gray clay loam about 6 inches thick. The subsoil, from a depth of 6 to about 11 inches, is slightly acid, very dark gray clay loam. From a depth of 17 to 76 inches, it is slightly acid clay that is very dark gray in the upper part, grading to grayish brown in the lower part.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Surface runoff is slow, and the hazard of erosion is moderate. In depressional areas, water is ponded on the surface for a few hours following heavy rains. The root zone is deep, but plant roots slowly penetrate the clayey lower layers.

The Urban land part of this complex is covered by individual dwellings, small businesses, and apartments and adjacent streets, driveways, parking lots, patios, and other structures that obscure or alter the soils to the extent that identification is not feasible.

Included with this complex in mapping are small areas of the closely similar Leson, Mabank, Navo, and Ponder soils. These included soils make up as much as 20 percent of any mapped area. Also included are a few areas of the Wilson soil that are as much as 10 acres and that have little or no urban development.

The Wilson soil is poorly suited to most urban uses. Shrinking and swelling with changes in moisture, seasonal wetness, corrosivity to uncoated steel, and very slow permeability are the main limitations. These can be partly overcome by good design and proper installation.

This soil is poorly suited to most recreation uses. The clay loam surface, permeability, and wetness are the main limitations.

This complex is not in a range site or capability subclass.

**86—Windthorst fine sandy loam, 1 to 3 percent slopes.** This deep, gently sloping, loamy soil is on ridges. Areas are long and narrow to subrounded and range from 6 to about 75 acres.

Typically, the surface layer is neutral, dark yellowish brown fine sandy loam about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 41 inches, is slightly acid, red clay that has reddish and brownish mottles. The lower part of the subsoil, to a depth of 57 inches, is slightly acid, red sandy clay loam that has reddish mottles. The underlying material to a depth of 67 inches is slightly acid, yellowish red, stratified sandy clay loam and sand.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is medium, and the hazard of erosion is moderate. Areas left bare of vegetation are subject to soil blowing. The surface layer is easy to work throughout a wide range of moisture conditions. The root zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

Included with this soil in mapping are small areas of Weatherford soils on ridgetops, Selden soils on lower slopes, and small areas of eroded Windthorst soils. The included soils make up less than 20 percent of any mapped area.

This Windthorst soil is well suited to use as pastureland. Adapted pasture plants are improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover. Proper management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland, but low natural fertility and the droughtiness of the clayey subsoil are limitations. Management includes controlling soil blowing and water erosion, conserving moisture, and improving tilth and fertility. Terracing and farming on the contour help to slow runoff, thereby controlling water erosion. Leaving crop residue on the surface helps to control soil blowing and to conserve moisture. Growing cool season legumes aids in improving tilth and fertility and in controlling erosion.

This soil is well suited to most urban and recreation uses. The most restrictive limitations are shrinking and swelling with changes in moisture and corrosivity to uncoated steel. Septic tank absorption fields are poorly suited to this soil because of moderately slow permeability. Most limitations can be overcome by good design and careful installation.

Areas of this unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**87—Windthorst fine sandy loam, 3 to 8 percent slopes.** This deep, gently sloping to sloping soil is on hillsides and ridges. Areas are irregular in shape. They range from 10 to more than 100 acres. Slopes are convex and average about 5 percent.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil, from a depth of 7 to 56 inches, is clay that is red in the upper part and yellowish red in the lower part with yellowish and reddish mottles. From a depth of 56 to 80 inches is reddish yellow fine sandy loam. Reaction typically is medium acid in the upper part of the soil, grading to mildly alkaline in the lower part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is rapid, and the hazard of erosion is severe. Areas left bare of vegetation are subject to soil blowing. The root zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

Included with this soil in mapping are small areas of Weatherford soils on ridges and foot slopes. Also included are small areas of eroded Windthorst soils that are as much as 5 acres. The included soils make up as much as 20 percent of some areas.

This Windthorst soil is moderately suited to use as pastureland. Low natural fertility and rapid runoff are limitations for production. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover are commonly grown. Pasture management includes fertilization, weed control, and controlled grazing.

This soil is moderately suited to use as cropland. The major objectives of management are controlling water erosion and soil blowing and maintaining tilth and fertility. Terracing and farming on the contour help to slow runoff and to control water erosion. Growing crops that produce large amounts of residue and leaving crop residue on the soil help to control soil blowing and water erosion and help to conserve moisture. Growing cool season legumes helps to maintain tilth and fertility.

The Windthorst soil is well suited to most urban uses. The main limitations are shrinking and swelling with changes in moisture, slope, corrosivity to uncoated steel, and permeability. Areas that are bare of vegetation during construction have a severe hazard of erosion. These limitations can be overcome by good design and careful installation.

This soil is moderately suited to recreation uses. The severe hazard of erosion, moderately slow permeability, and slope are the main limitations. A vegetative cover is needed to prevent erosion.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

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

**88—Windthorst fine sandy loam, 2 to 8 percent slopes, eroded.** This moderately deep, gently sloping and sloping, loamy soil is on narrow ridges and side slopes below ridges. Erosion has removed most of the loamy surface layer. The reddish subsoil is exposed in many places. A few gullies that are 1 foot to 6 feet deep and 4 to 20 feet wide are in some mapped areas. Areas range from 5 to 20 acres. Slopes are convex and average about 4 percent.

Typically, the surface layer is slightly acid, light brown fine sandy loam about 3 inches thick. The upper part of the subsoil, from a depth of 3 to 31 inches, is red clay. The lower part of the subsoil, from a depth of 31 to 38 inches, is reddish yellow sandy clay loam and has light gray mottles. Below that to a depth of 60 inches is weakly cemented sandstone. Reaction typically is medium acid in the upper part of the soil and mildly alkaline in the lower part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is rapid, and the hazard of erosion is severe. This soil is droughty because it takes in water slowly, and it releases water slowly to plants. The root zone is moderately deep, and plant roots have difficulty penetrating the dense clayey layers.

Included with this soil in mapping are small areas of eroded Weatherford soils on foot slopes. These inclusions make up as much as 20 percent of some mapped areas.

This soil is poorly suited to use as pastureland. Improved bermudagrass, weeping lovegrass, kleingrass, vetch, and arrowleaf clover are adapted pasture plants. In some areas, gullies should be shaped before planting to pasture. Fertilizer needs to be applied to maintain grass stands and yields. Weed control and controlled grazing are other management concerns.

This soil is poorly suited to use as cropland. Only small tracts of this soil that are not eroded are suitable for farming. Management concerns are controlling erosion, conserving moisture, and maintaining tilth and fertility. Terracing and contour farming help to slow runoff and to control water erosion. Leaving crop residue on the surface helps to conserve moisture and maintain tilth. Growing cool season legumes helps to control erosion and maintain tilth and fertility.

The Windthorst soil is moderately suited to most urban and recreation uses. The main limitations are the gullies, shrinking and swelling with changes in moisture, corrosivity to uncoated steel, slope, and permeability. These limitations can be overcome by good design and careful installation. Slope and eroded areas are limitations for the use of this soil for playgrounds.

Areas of this map unit furnish an abundance of woody and herbaceous plants that provide food and cover for deer, quail, and doves.

This soil is in capability subclass VIe and the Sandy Loam 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 suitabilities and limitations of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

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

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; 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 suitabilities 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

John L. Kazda, agronomist, Soil Conservation Service, assisted in preparing this section.

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 "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 377,200 acres in the survey area was used for cropland, pastureland, and rangeland in 1976, according to the Tarrant County Land Use Inventory prepared by the Soil Conservation Service in cooperative agreement with North Central Texas Council of Governments. Of this total, about 173,900 acres was used for permanent pasture; 122,800 acres for rangeland; 17,800 acres for row crops, mainly cotton and grain sorghum; and 62,700 acres for close-spaced crops, mainly wheat, oats, vetch, rye, and forage sorghum.

The soils in Tarrant County are well suited to increased production of food. About 137,000 acres of potentially good cropland is currently used for pastureland, and about 51,000 acres is used as rangeland. In addition to the reserve production capacity of these soils, food production could also 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.

Acreage in crops and pasture has been rapidly decreasing as more and more land is used for urban development. In 1976, about 178,000 acres of land in the survey area was used for recreation, active strip mining, and urban and built-up development. This acreage is rapidly increasing. The use of this soil survey to help make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map units."

Water erosion is the major concern on about 70 percent of the cropland and 20 percent of the pastureland in Tarrant County. If the slope is more than 1 percent, water erosion is a hazard. Crosstell, Heiden, Houston Black, Navo, Ponder, and Sanger soils, for example, have slopes of 1 to 5 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey

subsoil, such as Crosstell, Navo, Ponder, and Windthorst soils, and on soils that have restricted rooting depth because of bedrock. Purves and Speck soils are underlain by limestone at a shallow depth. Erosion also reduces productivity on soils that tend to be droughty, such as Crosstell and Navo 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 use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed is difficult on clayey or plowpan spots because the original friable surface soil has been eroded away. Such spots are common in areas of erodible Crosstell and Windthorst soils.

The results of effective erosion control practices are a protective surface cover, a reduced amount of runoff, and an increased rate of infiltration. A cropping system that keeps plant cover on the soil for extended periods holds soil losses to amounts that maintain the productive capacity. On livestock farms, which require pasture and hay, forage crops of legumes and grasses in the cropping system reduce the amount of erosion on sloping land, provide nitrogen, and improve tilth for the following crop.

Because the slopes are so short and irregular, contour tillage or terracing is not practical in most areas of the sloping Gasil, Silawa, Weatherford, and Windthorst soils. On these soils, cropping systems that provide substantial plant cover are required to control erosion, unless minimum tillage is practiced. Minimum tillage practices and leaving crop residue on the soil surface help to increase infiltration and reduce the hazards of runoff, water erosion, and soil blowing. These practices can be adapted to most soils in the survey area, but they are more difficult to use successfully on the eroded soils and on soils that have a clayey surface layer.

Terraces and diversions reduce the length of slope and help to slow runoff and control erosion. They are most practical on deep, moderately well drained and well drained soils that have regular slopes. Crosstell, Heiden, Houston Black, Leson, Navo, Ponder, Sanger, and Slidell soils are suitable for terraces. Other soils in the survey area are less suitable for terraces and diversions because of strong to steep slopes, a sandy surface texture, bedrock at a depth of less than 20 inches, or flooding.

Contour farming and parallel terraces are widespread erosion control practices used in this survey area. They are best adapted to soils that have smooth, uniform slopes, including most Heiden, Houston Black, Leson, Lott, Navo, Ponder, Sanger, and Slidell soils.

Soil blowing is a hazard on the sandy Aquilla, Nimrod, Selden, and Silstid soils. In a few hours, strong winds can damage these soils if they are dry and lack plant cover or surface mulch. Maintaining plant cover, surface mulch, or rough surfaces by proper tillage at timely intervals minimizes soil blowing. Emerging crops also are easily damaged by soil blowing. Old crop residue and stripcropping provide protection to emerging seedlings.

Information on erosion control practices for each kind of soil can be obtained at the local offices of the Soil Conservation Service.

Drainage is not a problem on most soils in Tarrant County. Only Mabank, Trinity, and Wilson soils are somewhat poorly drained. Unless those soils are artificially drained, wetness in depressional areas may damage crops or pasture plants in some years. Branyon, Burleson, and Slidell soils have good natural drainage most of the year, but they tend to dry out slowly after rainfall.

Fertility is naturally high in most soils on flood plains, such as Whitesboro, Trinity, Frio, and Ovan soils. Many of the mildly alkaline soils on uplands, such as Branyon, Heiden, Houston Black, Lott, and Chatt soils, are also high in natural fertility. The loamy Crosstell, Gasil, Rader, and Windthorst soils on uplands are very strongly acid to neutral. Natural fertility is low to medium in these soils. The sandy, strongly acid to slightly acid Nimrod and Silstid soils are low in natural fertility. Most soils in Tarrant county require applications of a complete fertilizer. However, most soils that have a calcareous surface layer are naturally high in potassium. Soils that have a fine sand or loamy fine sand surface layer need a split application of a complete fertilizer to keep fertility in balance and reduce loss of nutrients by leaching. On all soils, the amount and type of fertilizer should be based on the results of soil tests, on the need of the crop, on the expected level of yields, on the previous land use or cropping sequence, and on the amount of available soil moisture. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

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

Most soils used for crops in the survey area have a dark clay or silty clay surface layer and moderately low to medium content of organic matter. Generally such soils have moderate structure. They are difficult to work because they are sticky when wet and extremely hard when dry. Good seedbeds are difficult to prepare. If plowed when wet, these soils tend to become very cloddy when dry. Plowing when wet also causes the development of plowpans that impede the downward movement of plant roots, air, and moisture. Fall plowing generally provides good tilth for spring planting.

Fall plowing is generally not a good practice on the light colored soils that have a clay loam, loam, or fine sandy loam surface layer. A crust forms on these soils during winter and spring. The crust is hard when the soil is dry and is nearly impervious to water. Once formed, the crust reduces the rate of infiltration and increases the amount of runoff. Regular additions of crop residue, manure, and other organic material help to reduce crust formation and improve soil structure.

Field crops suited to the soils and climate of the survey area include cotton, grain sorghum, peanuts, forage sorghum, wheat, oats, and corn.

Frio soils are well suited to alfalfa. Grass seed can be produced from 'Selection 75' kleingrass, weeping lovegrass, or King Ranch bluestem.

At one time, special crops were grown commercially, but now few speciality crops are grown. Crops grown at the present time include black-eyed peas, cabbage, carrots, grapes, melons, okra, onions, tomatoes, turnips, sweet potatoes, squash, and other vegetables. The soils in the survey area can be adapted to other special crops, such as blackberries, peaches, pecans, and many other vegetables.

The deep, loamy and sandy 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, the nearly level to gently sloping Bastsil, Crosstell, Gasil, Justin, Konsil, Nimrod, Rader, Selden, Silstid, and Windthorst soils are well suited. These soils make up about 56,000 acres. Crops can generally be planted and harvested earlier on these soils than on other soils in the survey area.

Most of the well drained, loamy and sandy soils in the survey area are suitable for orchards and nursery plants. Low lying soils, where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Residential development, commercial industries, strip mining, and other land uses are competing for large areas of the survey area. In 1976, about 178,000 acres, or nearly 32 percent of the survey area, was urban or built-up land or was being strip mined, according to the Tarrant County Land use Inventory. Much of this acreage was well suited to cropland, pastureland, and rangeland. Each year, large acreages of additional land are being developed for urban uses.

In general, most of the soils in the survey area that are well suited to crops are only moderately suited to urban development. For example, the soils in the Sanger-Purves-Slidell, Houston Black-Navo-Heiden, and Ponder-Sanger-Slidell map units, (map units 2, 4, and 5 on the general soil map at the back of this publication) are only moderately suited. In these units the dominant soils shrink and swell greatly with changes in moisture and create serious hazards for nonfarm development. The data about specific soils in this soil survey can be used in planning future land use patterns. Potential productive capacity in farming should be weighed against soil limitations and potential for nonfarm development.

Some soils that are moderately suited or poorly suited to farming are moderately suited to well suited to nonfarm development, for example, the soils in the Crosstell-Gasil-Rader, Aldeo-Bolar-Sanger, and Windthorst-Weatherford-Nimrod map units (map units 1, 3, and 8 on the general soil map). These soils are either low in natural fertility, are sloping, or are underlain by bedrock at a depth of less than 40 inches. However, the rolling landscape, good soil drainage, limited shrinking and swelling, and other soil qualities are favorable for residential development and other urban uses.

### 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.

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, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only

class and subclass levels 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 few 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.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

## rangeland

Joe B. Norris, range conservationist, Soil Conservation Service, assisted with the preparation of this section.

Rangeland is land on which native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. The vegetative species are generally suitable for grazing and occur in sufficient amount to be used for grazing. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community is determined by soil, climate, topography, overstory canopy, and grazing management.

According to records of the local field office of the Soil Conservation Service, about 122,800 acres, or 22 percent of the survey area of Tarrant County, is rangeland. Most of this acreage is an open treeless prairie, frequently referred to as the "Fort Worth Prairie". It orginally produced a wide variety of tall and mid growing grasses interspersed with an abundance of forbs. The eastern one-third of the county was a savannah characterized by tall grasses, forbs, post oak, and blackjack oak.

The vegetative community of Tarrant County rangeland has changed drastically over the past 50 years. Heavy grazing has deteriorated most of the grasslands and much of the high quality vegetation has been grazed out. Now, tall grasses flourish in only a few places. A mixture of short to mid grasses and poor quaility forbs grow in their place. However, remnants of the original plant species still are found in protected areas on most grasslands, and in most cases, good grazing management will allow these high quality plants to reestablish themselves.

Although most of the local ranches and livestock farms are cow-calf operations, there are some stocker calf enterprises, and many ranches supplement their herds with stockers. This provides greater flexibility for adjusting the number of livestock to be cared for in periods of drought. Many horses are also raised in the county, but few are used for ranch work. Most horses are sold for recreation.

Livestock operations generally supplement the grazing of native grassland with the grazing of improved pastureland and cropland. Improved bermudagrass, kleingrass, and weeping lovegrass are commonly grown improved pasture grasses. Protein supplement, hay, and grazing of small grain are used to supplement livestock feeding throughout the winter.

Approximately 75 percent of the annual growth of forage production takes place in April, May, and June when spring rains and moderate temperatures are favorable for the growth of warm-season plants. A secondary growth period generally occurs in September and October when fall rains and gradually cooling temperatures are common.

Droughts of varying length are frequent in this area. Each year, short midsummer droughts normally occur. Frequently, longer periods of drought last for several months.

Since the trend toward increased urbanization, many of the old established ranches have been sold to land speculators, investment corporations, and urban land developers.

**range sites and condition classes**

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds, amounts, and proportions of forage make up a range site.

Climax vegetation on the range site is the stabilized plant community that the site is capable of producing. It consists of the plants that were growing there when the region was first settled. This plant community reproduces itself and changes very little as long as the environment remains unchanged. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and are the most palatable to livestock.

Increasers are plants that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. However, invaders grow along with increasers after the climax vegetation has been reduced by grazing value. Some invaders have little value for grazing.

Range condition is judged according to the standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation. The classes show the present condition of the native vegetation on a range site as compared to the native vegetation that could grow there. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during the growing season.

Table 8 shows, for each soil, the range site and the total annual production of vegetation in favorable, normal, and unfavorable years. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 8 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.

A primary objective of good range management is to keep range in excellent or good condition. If the range is well managed water is conserved, yields are improved, and the soils are protected. The main management concern is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, whereas actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods under the supervision of a careful manager may have a degraded appearance that temporarily conceals its quality and ability to recover.

Following years of prolonged overuse of rangeland, seed sources of the desirable vegetation will be eliminated. When this happens, the vegetation needs to be reestablished for management to be effective. Brush control, range seeding, fencing, development of water sites, or other mechanical treatment are methods used to revitilize the stands of native plants. Thereafter, management practices of deferred grazing, proper grazing use, and a planned grazing system are needed to maintain and improve the range.

Good management generally results in 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.

There are 19 sites in the survey area. They are the Adobe, Blackland, Clay Loam, Claypan Prairie, Clayey Bottomland, Deep Redland, Deep Sand, Eroded Blackland, Loamy Bottomland, Loamy Sand, Redland, Rocky Hills, Sandy, Sandy Loam, Sandstone Hill,

Shallow, Steep Adobe, Tight Sandy Loam, and Very Shallow range sites.

**Adobe range site.** The Brackett soil (map unit 17) is in this site. The climax vegetation is mainly tall grasses with scattered clumps of oak. The vegetation is about 80 percent grasses, about 15 percent woody plants, and 5 percent forbs.

Little bluestem makes up 30 percent of the grasses. Indiangrass, sideoats grama, and tall grama together make up 30 percent. The rest is hairy dropseed, silver bluestem, rough tridens, and hairy grama. Woody plants include juniper, Texas oak, live oak, flameleaf sumac, and skunkbush sumac; and forbs include wild alfalfa, bigtop dalea, white milkwort, trailing ratany, prairie-clover, and dotted gayfeather.

If the range site is subjected to prolonged overuse, indiangrass is grazed out. Little bluestem is stunted and has low producing vigor. Sideoats grama is short and appears in weak, unthrifty colonies. Eventually, if abuse is continued, the grasses thin out and bare patches of ground increase. When the range site is in poor condition, only such plants as queensdelight, threeawn, Texas grama, hairy tridens, and red grama continue to grow.

**Blackland range site.** The Branyon, Burleson, Heiden, Houston Black, Leson, Medlin, Sanger, San Saba, and Slidell soils (map units 18, 19, 33, 34, 38, 47, 65, 66, 68, 73, and 74) are in the Blackland range site. The climax plant community is a tall grass prairie. The composition by weight is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Little bluestem, indiangrass, and big bluestem make up about 70 percent of the climax vegetation. The rest is eastern gamagrass, switchgrass, Virginia wildrye, Florida paspalum, sideoats grama, silver bluestem, Texas wintergrass, Texas cupgrass, vine-mesquite, meadow dropseed, white tridens, and plains lovegrass; a wide variety of forbs that include Maximilian sunflower, Englemann-daisy, blacksamson, penstemon, dotted gayfeather, sundrops, bundleflower, sensitivebrier, yellow neptunia, prairie-clover, snoutbean, wildbean, tickclover, scurfpea, western indigo, prairie senna, paintbrush, and gaura; and woody plants in scattered mottes that include live oak, elm, hackberry, bumelia, and coralberry.

When regression of the range site occurs as a result of heavy use, the tall grasses are grazed out. They are replaced by silver bluestem, Texas wintergrass, sideoats grama, and meadow dropseed. If heavy use continues, these plants also are grazed out and are replaced by mesquite, winged elm, honeylocust, osageorange, Texas grama, tumblegrass, and a host of annual grasses and forbs.

**Clay Loam range site.** The Altoga, Bolar, Chatt, Luckenbach, Lott, and Sunev soils (map units 2, 5, 14, 15, 20, 41, 43, 77, and 78) are in the Clay Loam range site. The climax plant community is a true prairie mainly of tall grasses. The composition by weight is about 90 percent grass, 5 percent forbs, and 5 percent woody vegetation.

Little bluestem, switchgrass, big bluestem, and indiangrass make up about 70 percent of the vegetation. Other grasses are wildrye, sideoats grama, Texas wintergrass, vine-mesquite, Texas cupgrass, white tridens, meadow and tall dropseed, and silver bluestem. Forbs include Englemann-daisy, Maximilian sunflower, yellow neptunia, catclaw sensitivebrier, prairie-clover, scurfpea, guara, heath aster, blue salvia, trailing ratany, blacksamson, golden dalea, bigtop dalea, wildbean, tickclover, dotted gayfeather, and bundleflower. Woody vegetation includes elm, hackberry, pecan, plum, and live oak.

When regression of the range site occurs as a result of heavy use, big bluestem is first grazed out, followed by indiangrass, switchgrass, and little bluestem. At the same time, sideoats grama, Texas wintergrass, tall and meadow dropseed increase initially but decrease as regression continues. Eventually, if heavy use continues, the composition will consist mainly of buffalograss, Texas grama, tumblegrass, red threeawn, western ragweed, Baldwin ironweed, queensdelight, mesquite, sumac, and common honeylocust.

**Clayey Bottomland range site.** The Ovan and Trinity soils (map units 53, 54, and 80) are in the Clayey Bottomland range site. The climax vegetation is tall grasses with a woody overstory. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Near the stream channel, where the areas are brushy; sedges, Virginia and Canada wildrye, and rusty seeded paspalum make up about 35 percent of the composition, and beaked panicum, switchgrass, indiangrass, big bluestem, longleaf uniola, and knotroot bristlegrass make up about 30 percent. Away from the stream channel, where the woody canopy cover is less dense (less than 30 percent), the grasses are eastern gamagrass, Florida paspalum, little bluestem, redtop panicum, vine-mesquite, big bluestem, indiangrass, and switchgrass. Woody plants over this site include oak, elm, cottonwood, pecan, hackberry, black willow, grape, hawthorn, and woody vines; and forbs include tickclover, wildbean, snoutbean, lespedeza, Maximilian sunflower, pitcher sage, blood ragweed, ironweed, white crownbeard, and dotted gayfeather.

When regression of the range site occurs as a result of heavy use, trees and shrubs form a dense canopy. Shade-tolerant and winter-growing grasses increase. Plants that invade the rangeland in poor condition are broomsedge bluestem, bushy bluestem, prairie coneflower, baccharis, locust, osageorange, smutgrass, carpetgrass, low panicum, and paspalum.

**Claypan Prairie range site.** The Mabank, Navo, Ponder, and Sunev soils (map units 45, 50, 57, 77, and

78) are in the Claypan Prairie range site. The climax plant community is a prairie mainly of tall grasses. The composition by weight is about 90 percent grass, 5 percent forbs, and 5 percent woody vegetation.

Little bluestem, switchgrass, big bluestem, and indiangrass make up about 70 percent of the vegetation. Other grasses are wildrye, sideoats grama, Texas wintergrass, vine-mesquite, Texas cupgrass, white tridens, meadow and tall dropseed, and silver bluestem. Forbs include Englemann-daisy, Maximilian sunflower, yellow neptunia, catclaw sensitivebrier, prairie-clover, scurfpea, guara, heath aster, blue salvia, trailing ratany, blacksamson, golden dalea, bigtop dalea, wildbean, tickclover, dotted gayfeather, and bundleflower. Woody vegetation includes elm, hackberry, pecan, plum, and live oak.

When regression of the range site occurs as a result of heavy use, big bluestem is first grazed out, followed by indiangrass, switchgrass, and little bluestem. At the same time, sideoats grama, Texas wintergrass, and tall and meadow dropseed increase initially but decrease as regression continues. Eventually, the composition will consist mainly of buffalograss, Texas grama, tumblegrass, red threeawn, western ragweed, Baldwin ironweed, queensdelight, mesquite, sumac, and common honeylocust.

**Deep Redland range site.** The Lindale and Mingo soils (map units 30 and 48) are in the Deep Redland range site. The climax vegetation is mid and tall grasses. The composition by weight is 90 percent grass, 5 percent woody plants, and 5 percent forbs.

Indiangrass, big bluestem, and little bluestem make up 35 percent of the vegetation, and sideoats grama and Texas wintergrass make up about 20 percent. Other grasses are Texas cupgrass, cane bluestem, silver bluestem, buffalograss, Canada wildrye, vine-mesquite, Wright threeawn, tall dropseed, white tridens, meadow dropseed, and plains lovegrass. Woody plants include live oak, greenbrier, hackberry, sumac, Texas oak, and bush honeysuckle. Forbs include Maximilian sunflower, bushsunflower, Englemann-daisy, dotted gayfeather, black samson, Mexican sagewort, pitchersage, halfshrub sundrop, bundleflower, prairie-clover, trailing wildbean, least snoutbean, tickclover, scurfpea, western indigo, knotweed, leafflower, heath aster, ruellia, gauras and mallow.

When regression of the range site occurs as a result of heavy use, the tall grasses are first grazed out and are replaced by sideoats grama, Texas wintergrass, silver bluestem, and buffalograss. Further deterioration results in a stand mostly of buffalograss and Texas wintergrass. The main plants on a range site in poor condition are woody species, such as mesquite, persimmon, juniper, and lotebush; and forbs, such as horehound, eryngo, prairie coneflower, and western ragweed.

**Deep Sand range site.** The Aquilla soil (map unit 6) is in this site. The climax plant community is a tall grass savannah. The composition by weight is about 70 percent grass, 25 percent woody plants, and 5 percent forbs.

Big bluestem, indiangrass, sand lovegrass, purpletop tridens, little bluestem, and switchgrass make up about 60 percent of the vegetation. Other grasses are fringeleaf paspalum, Scribner panicum, silver bluestem, and sand dropseed. Woody plants include post oak, wax myrtle, blackjack oak, greenbrier, ash, elm, hickory, and bumelia. Forbs include lespedeza, tickclover, wildbean, snoutbean, prairie senna, spiderwort, dayflower, snakecotton, and western ragweed.

When regression of the range site occurs as a result of heavy use, big bluestem is first grazed out, followed by indiangrass, switchgrass, and little bluestem. Low panicum and low paspalum invade along with greenbrier, berryvines, and other low growing woody shrubs. Other invading plants are bullnettle, red lovegrass, tumble lovegrass, red sprangletop, sandbur, and queensdelight.

**Eroded Blackland range site.** The Ferris soil (map units 24 and 25) is in this site. The climax plant community is a mid and tall grass prairie. The vegetation is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Little bluestem makes up about 40 percent by weight of all plants, and indiangrass and big bluestem together make up 25 percent. The rest is grasses, such as vine-mesquite, silver bluestem, sideoats grama, tall dropseed, Texas wintergrass, slim and rough tridens, buffalograss, Virginia and Canada wildrye, sedges, purple threeawn, Florida paspalum, and plains lovegrass; forbs that include Maximilian sunflower, Englemann-daisy, halfshrub sundrop, penstemon, dotted gayfeather, black samson, prairie-clover, bundleflower, sensitivebrier, yellow neptunia, snoutbean, wildbean, scurfpea, western indigo, gaura, paintbrush, verbena, scullcap, larkspur, winecup, woolywhite, and prairie parsley; and woody plants, such as oak, hackberry, elm, bumelia, hawthorn, coralberry, and elbowbush.

When little bluestem and the tall grasses are grazed out through heavy use of the range site, silver bluestem, sideoats grama, tall dropseed, and Texas wintergrass take their place. If overgrazing continues, these species also decrease and are replaced mostly by buffalograss. Continued deterioration results in a cover largely of Texas grama, hairy tridens, windmillgrass, tumblegrass, queensdelight, mesquite, and many annual grasses and forbs.

**Loamy Bottomland range site.** The Arents, Frio, Pulexas, and Whitesboro soils (map units 7, 26, 27, 59, and 83) are in this site. The climax plant community is mid and tall grasses, with a tree canopy of pecan, elm, hackberry, post oak, blackjack oak, live oak, cottonwood, and western soapberry shading about 25 percent of the

ground. The vegetation is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Little bluestem, big bluestem, indiangrass, switchgrass, purpletop tridens, and wildrye make up most of the grasses. The rest is tall and meadow dropseed, vine-mesquite, sand lovegrass, Texas bluegrass, and beaked panicum. Woody plants include pecan, American elm, live oak, post oak, hackberry, cedar, elm, greenbrier, sumac, red ash, redbud, red mulberry, downy viburnum, western soapberry, coralberry, and grape. Forbs include Englemann-daisy, Maximilian sunflower, trailing wildbean, lespedeza, gaura, dotted gayfeather, dalea, penstemon, and tickclover.

When regression of the range site occurs as a result of abuse by livestock, the tall grasses decrease in vigor and abundance. Mid grasses increase; however, they can also be grazed out if heavy use is prolonged. Woody plants dominate the range site that is in poor condition, and mesquite, persimmon, milkweed, tumblegrass, Texas grama, and common bermudagrass invade the area.

**Loamy Sand range site.** The Selden soil (map unit 69) is in this site. The climax vegetation is a mid and tall grass savannah with scattered post oak and blackjack oak. The vegetation is 80 percent grasses, about 15 precent woody and brushy plants, and 5 percent forbs.

Typically, 40 percent of the composition is little bluestem, big bluestem, and indiangrass. Other grasses are sand lovegrass, Texas bluegrass, purpletop tridens, cane and silver bluestem, sand and tall dropseed, sideoats grama, Canada wildrye, switchgrass, plains lovegrass, and Scribner panicum. Woody plants include post oak and blackjack oak. Brushy plants are bumelia, greenbrier, sumac, pricklyash, hackberry, and shinnery oak. Forbs include Englemann-daisy, Maximilian sunflower, Mexican sagewort, dotted gayfeather, dalea, yellow neptunia, sensitivebrier, trailing wildbean, primrose, prairie senna, gaura, and buckwheat.

When regression of the range site occurs as a result of heavy use, big bluestem, indiangrass, and switchgrass along with palatable forbs are grazed out. Silver bluestem, tall and sand dropseed, and woody plants increase. If the plant community deteriorates further, fall witchgrass; hooded windmillgrass; red, tumble, and gummy lovegrass; tumblegrass; and threeawn invade. Blackjack oak, post oak, greenbrier, and shinnery oak dominate the range site in poor condition.

**Rocky Hills range site.** The Aledo soil (map unit 46) is in this site. The climax plant community is a prairie of mid and tall grasses interspersed with an abundance of forbs. The composition by weight is about 95 percent grasses and 5 percent forbs.

Little bluestem makes up about 45 percent of the composition, and indiangrass, big bluestem, and switchgrass make up 15 percent. Other grasses include sideoats grama, tall dropseed, slim tridens, silver bluestem, Texas cupgrass, hairy grama, buffalograss, Texas wintergrass, and vine-mesquite. Forbs include Englemann-daisy, scurfpea, prairie-clover, Maximilian sunflower, catclaw sensitivebrier, heath aster, golden dalea, penstemon, guara, false guara, snoutbean, and dotted gayfeather.

When regression of the range site occurs as a result of heavy use, big bluestem is replaced by indiangrass and switchgrass. If regression continues, little bluestem, sideoats grama, and tall dropseed increase. Finally, mesquite, pricklypear, yucca, Texas grama, hairy tridens, tumblegrass, red threeawn, Hall panicum, curlycup gumweed, queensdelight, milkweed, nightshades, and western ragweed dominate the range site.

**Redland range site.** The Speck soil (map unit 75) is in this site. The climax plant community is mid and tall grasses with scattered mottes of live oak, elm, hackberry, and shinnery oak. The composition is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Indiangrass, big bluestem, little bluestem, and sideoats grama make up 65 percent by weight of the composition, and switchgrass, Canada wildrye, Texas wintergrass, hairy grama, silver bluestem, tall dropseed, vine-mesquite, white tridens, and buffalograss make up about 20 percent. Woody plants include live oak, elm, hackberry, greenbrier, elbowbush, bumelia, shinnery oak, and post oak. Forbs include Englemann-daisy, yellow neptunia, catclaw sensitivebrier, wildbean, dalea, prairie-clover, dotted gayfeather, gaura, ruellia, black samson, bushsunflower, and Mexican sagewort.

When regression of the range site occurs as a result of heavy use, Texas wintergrass, tall dropseed, silver bluestem, and buffalograss increase, and the tall grasses are grazed out. If overgrazing continues, the tall grasses die out, and Texas grama, sand dropseed, tumblegrass, tumble windmillgrass, threeawn, curlycup gumweed, pricklypear cactus, and mesquite invade.

**Sandy Loam range site.** The Arents, Bastsil, Birome, Gasil, Justin, Konsil, Rader, Silawa, Stephenville, Weatherford, and Windthorst soils (map units 8, 9, 11, 29, 30, 36, 37, 63, 70, 76, 82, 86, 87, and 88) are in this site. The climax plant community is a post oak-blackjack oak savannah of tall and mid grasses. The oak overstory shades about 20 percent of the ground. Vegetative composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Little bluestem, big bluestem, indiangrass, switchgrass, beaked panicum, purpletop tridens, sand lovegrass, Florida paspalum, Virginia and Canada wildrye make up 70 percent of the grasses. The rest is tall dropseed, silver bluestem, Scribner panicum, Fringeleaf paspalum, purple lovegrass, Carolina jointtail, sideoats grama, meadow dropseed, and sedges. Woody plants include post oak, blackjack oak, elm, greenbrier, plum, grape, hawthorn, American beautyberry, elbowbush, coralberry, Carolina snailseed, and berryvine. Forbs include

Maximilian sunflower, Englemann-daisy, tickclover, lespedeza, snoutbean, wildbean, catclaw sensitivebrier, yellow neptunia, blacksamson, guara, and western indigo.

When regression of the range site occurs as a result of heavy use, big bluestem and sand lovegrass are first grazed out, followed by indiangrass, little bluestem, Canada and Virginia wildrye, beaked panicum, and Florida paspalum. As regression continues, tall dropseed, sideoats grama, and silver bluestem increase initially but decrease if heavy grazing is prolonged. Further deterioration results in an increase in the canopy cover of oak and low growing shrubs and vines. Common persimmon, sumac, winged elm, tumble windmillgrass, narrow-leaf rushfoil, and western ragweed are also present when the range site is in poor condition.

**Sandy range site.** The Nimrod and Silstid soils (map units 52 and 71) are in this site. The climax plant community is a post oak-blackjack oak savannah of tall and mid grasses. The oak overstory shades about 20 percent of the ground. Vegetative composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Little bluestem, big bluestem, indiangrass, switchgrass, beaked panicum, purpletop tridens, sand lovegrass, Florida paspalum, and Virginia and Canada wildrye make up 70 percent of the grasses. The rest is tall dropseed, silver bluestem, Scribner panicum, fringeleaf paspalum, purple lovegrass, Carolina jointtail, sideoats grama, silver bluestem, meadow dropseed, and sedges. Woody plants include post oak, blackjack oak, elm, greenbrier, plum, grape, hawthorn, American beautyberry, elbowbush, coralberry, Carolina snailseed, and berryvine. Forbs include Maximilian sunflower, Englemann-daisy, tickclover, lespedeza, snoutbean, wildbean, catclaw sensitivebrier, yellow neptunia, blacksamson, guara, and western indigo.

When regression of the range site occurs as a result of heavy use, big bluestem and sand lovegrass are first grazed out, followed by indiangrass, little bluestem, Virginia and Canada wildrye, beaked panicum, and Florida paspalum. As regression continues, tall dropseed, sideoats grama, and silver bluestem increase initially, but these plants also decrease if heavy grazing is prolonged. Further abuse from heavy use results in an increase in the canopy cover of oak, and low growing shrubs and vines. Persimmon, sumac, winged elm, tumble windmillgrass, narrowleaf rushfoil, and western ragweed are invaders.

**Sandstone Hill range site.** The Rayex soil (map unit 12) is in this site. The climax plant community is a savannah of mid and tall grasses. There is an abundance of low growing woody vines and shrubs. The vegetation is about 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Little bluestem makes up about 35 percent of the vegetation, and purpletop tridens, indiangrass, and beaked panicum make up about 30 percent. Other grasses are big bluestem, sand lovegrass, sideoats grama, tall dropseed, Texas wintergrass, vine-mesquite, silver bluestem, plains lovegrass, purple threeawn, hairy grama, Scribner panicum, and sedges. Woody plants are post oak and blackjack oak, greenbrier, dewberry, coralberry, bumelia, and sumac. Forbs include lespedeza, wildbean, yellow neptunia, tickclover, snoutbean, and catclaw sensitivebrier.

When regression of the range site occurs as a result of heavy use, little bluestem is first grazed out and the woody overstory increases, creating a shaded habitat which is unsuitable for the more palatable grasses. Areas that undergo prolonged abuse have an overstory largely of oak and sumac, and an understory of western ragweed, curlycup gumweed, broomsedge bluestem, splitbeard bluestem, tumblegrass, Texas grama, red threeawn, sand dropseed, and buffalograss.

**Shallow range site.** The Aledo and Purves soils (map units 1, 2, and 61) are in this site. The climax plant community is a prairie of mid and tall grasses interspersed with an abundance of forbs. The composition by weight is about 95 percent grasses and 5 percent forbs.

Little bluestem makes up about 45 percent of the composition, and indiangrass, big bluestem, and switchgrass make up 15 percent. Other grasses mostly sideoats grama, tall dropseed, slim tridens, silver bluestem, Texas cupgrass, hairy grama, buffalograss, Texas wintergrass, and vine-mesquite. Forbs include Englemann-daisy, scurfpea, prairie-clover, Maximilian sunflower, catclaw sensitivebrier, heath aster, golden dalea, penstemon, guara, false guara, snoutbean, and dotted gayfeather.

When regression of the range site occurs as a result of heavy use, big bluestem is replaced by indiangrass and switchgrass. As regression continues, little bluestem, sideoats grama, and tall dropseed increase initially but decrease with prolonged heavy use. Finally, mesquite, pricklypear, yucca, Texas grama, hairy tridens, tumblegrass, red threeawn, Hall panicum, curlycup gumweed, queensdelight, milkweed, nightshade, and western ragweed invade the range site.

**Steep Adobe range site.** The Brackett soil (map unit 46) is in this site. The climax vegetation is mainly tall grasses with scattered clumps of oak. The vegetation is about 80 percent grasses, about 15 percent woody plants, and 5 percent forbs.

Typically, about 40 percent of the composition is little bluestem, indiangrass, and big bluestem; 25 percent is sideoats grama, tall grama, and hairy grama; and 15 percent is hairy dropseed, silver bluestem, and rough tridens. About 15 percent of the vegetation is Texas oak, live oak, juniper, and sumac; and 5 percent is forbs, such as wild alfalfa, big dalea, white milkwort, trailing ratany, dotted gayfeather, and prairie-clover.

When regression of the range site occurs as a result of heavy use, little bluestem, big bluestem, and indiangrass along with the more palatable grasses are initially grazed out. Sideoats grama, hairy dropseed, silver bluestem, and hairy grama increase. Further deterioration from abuse results in an invasion of Texas grama, perennial threeawn, hairy tridens, red grama, and queensdelight. When the range site is in poor condition, the vegetation is dominantly an overstory of juniper and Texas oak.

**Tight Sandy Loam range site.** The Crosstell soil (map units 21 and 22) is in this site. The climax plant community is a post oak-blackjack oak savannah. The vegetation is about 70 percent grasses, 20 percent woody plants, and 10 percent forbs.

Sideoats grama makes up about 30 percent of the vegetation; little bluestem, silver bluestem, Texas wintergrass, and buffalograss make up 30 percent; and other grasses, such as big bluestem, indiangrass, Canada wildrye, hairy grama, Wright threeawn, and Scribner panicum make up the rest. Woody plants include post oak, blackjack oak, bumelia, greenbrier, coralberry, hackberry, plum, skunkbush sumac, and elm. Forbs are mainly yellow neptunia, lespedeza, catclaw sensitivebrier, Mexican sagewort, tickclover, and wildbean.

When regression of the range site occurs as a result of heavy use, a woody overstory forms a dense canopy. There is also an increase in woody underbrush. If abuse continues, tumble lovegrass, tumble windmillgrass, Texas grama, oldfield threeawn, gummy lovegrass, curlycup gumweed, tasajillo, and mesquite invade. Once the oak trees are removed, little reestablishment of oak can be expected through natural succession, even with proper range use. Mesquite will largely hold its place in the plant community.

**Very Shallow range site.** The Maloterre soil (map unit 46) is in this site. The climax plant community is a prairie of mid and tall grasses interspersed with forbs. The composition by weight is about 90 percent grasses and 10 percent forbs.

Typically, sideoats grama makes up 50 percent of the vegetation; tall dropseed, silver bluestem, and slim and rough tridens make up about 15 percent; and Wright threeawn, hairy grama, buffalograss, Texas wintergrass, fall witchgrass, and little bluestem and indiangrass make up the rest. Forbs include Englemann-daisy, yellow neptunia, plains blackfoot, dotted gayfeather, trailing ratany, scurfpea, Illinois bundleflower, and heath aster.

When regression of the range site occurs as a result of heavy use, little bluestem, indiangrass, and sideoats grama are first grazed out. Buffalograss, slim and rough tridens, silver bluestem, and Wright threeawn increase. If heavy use continues, invading plants, such as Texas grama, red threeawn, tumblegrass, tumble windmillgrass, queensdelight, silver nightshade, and mealycup sage, take over the area.

## recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

*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.

## gardening and landscaping

Suburban homeowners who want to landscape their homes need to know what kinds of soils their properties include and the kinds of flowers and ground cover, vines, shrubs, and trees to which these soils are best suited. In some areas, plants may be needed for erosion control as well as for esthetic purposes.

Soils that are well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, a large amount of organic matter in various stages of decomposition, an adequate water supplying capacity, good drainage, and a granular structure that allows free movement of water, air, and roots. The degree of acidity or alkalinity suitable for the particular plant to be grown is also important. For example, roses and most annual flowers, vegetables, and grasses generally grow best in soils that are noncalcareous, and are neutral or only slightly acid in reaction. Azaleas, camellias, and similar plants need acid soils. Some plants grown on soils that have a high content of lime, such as Houston Black or Sanger soils, develop chlorosis, or yellowing of the leaves. However, many flowers, shrubs, and trees that are grown in Tarrant County are well suited to calcareous, limy soils. Canna, hollyhocks, petunias, zinnias, and gladioli are lime-tolerant flowers, and crapemyrtle, nandina, duranta, crabapple, live oak, and pecan are lime-tolerant shrubs and trees.

Some of the flowers and ground cover, vines, shrubs, and trees suitable for the soils in the survey area are listed in table 10. Some of these plants are native to Tarrant County. Your local nurseryman or County Extension Horticulturist can supply the names of other plants suited to the soils of Tarrant County.

The first column in table 10 lists the soils and map symbols of Tarrant County. Flowers and ground cover are the more common flowers and ground cover plants adapted to each soil. Vines, shrubs, and trees are the most commonly grown vines, shrubs, and trees. Soil texture, drainage, permeability, structure, and other characteristics are given in the map unit descriptions in the section "Detailed soil map units" and the series description in "Soil series and their morphology." Soil reaction (pH), permeability, and available water capacity are given in table 17.

Conditioning the native soil is generally preferable and more economical than replacing it with man-made soil material. The soil should be tested and the fertility needs determined for the plants to be grown. Organic matter is the most important amendment to the soil. This may be peat moss, compost, rotted sawdust, or manure. Compost of leaves, grass clippings, sawdust, and other organic material from the kitchen is an excellent source of organic matter. 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 be added, and 5 pounds of superphosphate (0-20-0) or 16-20-0 fertilizer and 10 pounds of gypsum per 100 square feet broadcast over the surface. This material should be spaded or rototilled into the top 8 inches of the native soil. If an acid soil is needed, 1 to 2 pounds of sulfur should be incorporated. Soil that is too strongly acid can be neutralized by adding bonemeal, lime, wood ashes, or topsoil from a calcareous soil, such as Sunev or Frio soil.

In some areas of the county the soils are so clayey, shallow, or poorly drained that raised beds need to be constructed in order to grow flowers and some kinds of shrubs. Brick, tile, metal, cedar, or redwood makes a good retainer along the edge of the bed. Beds should be filled with soil material that has well balanced physical and chemical amendments.

All plants, whether grown in native soil or in man-made soil, require careful maintenance, especially during the period of establishment. Good management practices include fertilizing, watering, and weed and insect control.

Gardening and landscaping should be included in the basic planning of urban construction. Potential of the native soils for the production of plants should be considered when sites are selected for urban construction. It is also important to protect existing trees during the period of construction. In wooded areas, large healthy trees are a valuable asset to the property. Many trees are killed or damaged beyond restoration because of carelessness in excavation, filling, and construction. The Soil Conservation Service or Cooperative Extension Service can supply guidelines for the protection of existing trees.

## wildlife habitat

Edward M. Schwille, biologist, Soil Conservation Service, prepared this section.

Because urbanization and development have decreased the numbers of wildlife in the survey area, management and manipulation of the habitat for wildlife should be given special emphasis.

The major kinds of wildlife in the survey area include mourning doves, bobwhite quail, various songbirds, shorebirds, raptors, raccoons, opossums, striped skunks, coyotes, red and grey foxes, armadillos, and fox squirrels. A few white-tailed deer are in the wooded, western part of the county. During periods of migration, ducks, such as northern mallard, pintail, and teal use the water areas. Some wood ducks nest in the survey area. Fish, such as largemouth bass, channel

catfish, crappie, sunfish, white bass, carp, gar, flathead catfish, and minnows, are abundant in ponds and lakes. Numerous reptiles and amphibians live in the survey area. Although there are no threatened or endangered species of animals in Tarrant County, endangered species, including the bald eagle, prairie falcon, and whooping crane, occasionally pass through the area.

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 11, 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, millet, grain sorghum, 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 kleingrass, lovegrass, switchgrass, clover, winter peas, and vetch.

*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, dropseed, wild beans, sunflowers, and western ragweed.

*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 oaks, pecan, elms, hackberry, and sumac. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

*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 elbowbush, sumac, greenbrier, blackberry, and plums.

*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, buckwheat, common reedgrass, rushes, and sedges.

*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, sloughs, 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, mourning doves, meadowlarks, numerous songbirds, cottontail rabbits, and red foxes.

*Habitat for wetland wildlife* consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, raccoon, nutria, and beaver.

*Habitat for rangeland wildlife* consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include fox squirrels, white-tailed deer,

coyotes, bobwhite quail, mourning doves, and numerous songbirds.

Many areas in the county can be improved for use as wildlife habitat by increasing the cover, food, and water supply that wildlife need. Areas that are best suited for improvement of wildlife habitat are the oak savannahs and bottom lands.

## engineering

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

*Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 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 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

*Dwellings and small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and

construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

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

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

**sanitary facilities**

Table 13 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 13 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 13 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 13 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 14 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 index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

*Sand and gravel* are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and

cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

**water management**

Table 15 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; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Embankments, dikes, and levees* are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

*Drainage* is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; and subsidence of organic layers. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

*Irrigation* is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

*Grassed waterways* are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

# soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

## engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

*Depth* to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

*Classification* of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 16.

*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 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Clay* as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

*Permeability* refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Soil reaction* is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

*Shrink-swell potential* is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

*Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

## soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Flooding*, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 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 no more than once 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 18 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 18.

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.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

## engineering index test data

Table 19 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 their morphology." The soil samples were tested by 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), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle index)—T 100 (AASHTO), D 653 (ASTM); D 1883 (ASTM); 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 (*4*). 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 20, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciustolls (*Calc*, meaning calcareous, plus *ustoll*, the suborder of Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Calciustolls.

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, carbonatic, thermic Typic Calciustolls.

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. An example is the Sunev series, which is a member of the fine-loamy, carbonatic, thermic family of Typic Calciustolls.

## soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*3*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*4*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

### Aledo series

The Aledo series consists of well drained, very shallow and shallow soils on uplands. These soils formed in fractured limestone bedrock. Slope ranges from 1 to 20 percent.

Typical pedon of Aledo gravelly clay loam, 1 to 8 percent slopes; from the intersection of North Loop 820 and Interstate Highway 35W, this pedon is 1.5 miles north on Interstate Highway 35W, 1.6 miles west, 2.59 miles north, and 150 feet east of a road, in rangeland:

A11—0 to 7 inches; brown (10YR 4/3) gravelly clay loam, dark brown (10YR 3/3) moist; strong fine blocky structure; hard, friable, sticky and plastic; many fine and medium roots; common medium pores; common wormcasts; few black concretions 1 millimeter to 2 millimeters in diameter; calcium carbonate equivalent is 44 percent; about 20 percent fragments of limestone 2 to 30 millimeters in diameter; calcareous; moderately alkaline; clear irregular boundary.

A12—7 to 17 inches; brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 3/3) moist; strong fine granular and blocky structure; hard, friable, sticky and plastic; common fine roots; common medium pores; common wormcasts; calcium carbonate equivalent is 54 percent; about 60 percent fragments of limestone 2 millimeters to 15 centimeters in diameter; calcareous; moderately alkaline; abrupt wavy boundary.

R—17 to 24 inches; bedded limestone that is coarsely fractured; roots and soil material in fractures.

The solum and depth to hard or indurated, coarsely fractured limestone range from 8 to 20 inches in thickness. The average content of limestone fragments is 15 to 30 percent in the A11 horizon and 40 to 80 percent in the A12 horizon. The fragments are mostly less than 6 inches across the long axis. The calcium carbonate equivalent throughout the solum is 40 to 75 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. The A11 horizon is gravelly loam or gravelly clay loam, and the A12 horizon is very gravelly loam or very gravelly clay loam.

The R layer is coarsely fractured limestone. It is interbedded with layers of weakly cemented limestone and marly and loamy soil material. The R layer can generally be cut with conventional ripping equipment.

## Altoga series

The Altoga series consists of well drained, deep and moderately deep, loamy soils that formed in sediment of ancient stream terraces on uplands. Slope ranges from 5 to 12 percent.

Typical pedon of Altoga silty clay loam, 5 to 12 percent slopes; from the intersection of Southeast Loop 820 and Interstate Highway 20, this pedon is 7.2 miles east on Interstate Highway 20, 2.3 miles south on county road, 2.4 miles east, 0.5 mile south, 2.4 miles southeast, and 200 feet east on the road:

A1—0 to 6 inches, light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate fine subangular blocky structure; hard, friable; many fine and medium roots; common wormcasts; common fragments of limestone as much as 5 millimeters in diameter; calcareous; moderately alkaline; clear smooth boundary.

B2—6 to 23 inches; light brownish gray (2.5Y 6/2) silty clay loam, brown (10YR 5/3) moist; strong fine subangular blocky structure; hard, friable; common fine and medium roots; common fine pores; common wormcasts; few fine concretions of calcium carbonate; few fragments of limestone 2 to 5 millimeters in diameter; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—23 to 36 inches; light gray (10YR 7/2) silty clay loam, pale brown (10YR 6/3) moist; moderate very fine and fine subangular blocky structure; hard, friable; few fine roots; few fine concretions of calcium carbonate; common threads of calcium carbonate; few stratified platy fragments in lower part; calcareous; moderately alkaline; gradual smooth boundary.

C—36 to 48 inches; very pale brown (10YR 7/3) stratified silty clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable; few fine and medium roots; many bedding planes; calcareous; moderately alkaline.

The solum ranges from 35 to 65 inches in thickness. The calcium carbonate equivalent below a depth of 10 inches is 40 to 70 percent. Coarse fragments of limestone and chert gravel make up 0 to 5 percent of the solum.

The A horizon is dark grayish brown, grayish brown, brown, yellowish brown, light brownish gray, or light yellowish brown. The dark grayish brown and brown horizons are less than 10 inches thick.

The B horizon is light brownish gray, light gray, yellowish brown, pale brown, light yellowish brown, very pale brown, or pale yellow silty clay loam or clay loam.

The C horizon is light yellowish brown or very pale brown, stratified and platy silty clay loam or clay loam.

## Aquilla series

The Aquilla series consists of somewhat excessively drained, deep, sandy soils on uplands. These soils formed in sandy alluvial sediment on stream terraces. Slope ranges from 1 to 5 percent.

Typical pedon of Aquilla loamy fine sand, 1 to 5 percent slopes; from the west end of the bridge crossing Lake Worth on Texas Highway 199, this pedon is 700 feet northwest, in a city park:

Ap—0 to 3 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak medium granular structure; loose, very friable; common medium roots; mildly alkaline; clear smooth boundary.

A1—3 to 6 inches; yellowish brown (10YR 5/4) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose, very friable; common fine roots; mildly alkaline; gradual smooth boundary.

B1—6 to 28 inches; reddish yellow (7.5YR 6/6) loamy fine sand, strong brown (7.5YR 5/6) moist; single grained; loose, very friable; few fine roots; sand grains are coated; neutral; gradual smooth boundary.

A2&Bt—28 to 80 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 5/4) moist; about 15 percent reddish yellow (5YR 6/6), yellowish red (5YR 5/6) moist, sandy loam lamellae 3 to 20 millimeters thick; single grained between the lamellae and weak fine subangular blocky structure in the lamellae; very friable; few fine roots; lamellae have clay bridging the sand grains; neutral.

The solum ranges from 70 to more than 90 inches in thickness. Reaction ranges from slightly acid to mildly alkaline.

The A horizon is brown, yellowish brown, pale brown, light yellowish brown, very pale brown, or pink.

The B1 horizon is yellowish brown or reddish yellow fine sand or loamy fine sand.

The A2 part of the A2&Bt horizon is light brown or pink fine sand, loamy sand, or loamy fine sand. The Bt part is yellowish red or reddish yellow, thin lamellae that make up 10 to 30 percent of the horizon. The lamellae are generally discontinuous and are less than 2.5 centimeters thick.

## Aubrey series

The Aubrey series consists of well drained, moderately deep, loamy soils on uplands that formed in acid shale containing thin bands of interbedded sandstone. Slope ranges from 5 to 15 percent.

Typical pedon of Aubrey fine sandy loam, in an area of Birome-Aubrey-Rayex complex, 5 to 15 percent slopes; from the intersection of Texas Highway Spur 103 and North Loop 382 in the town of Grapevine, this pedon is 0.6 mile west on North Loop 382, 1.6 miles north on Dove Road, 1,400 feet west, and 400 feet south, in a wooded area:

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; moderate fine granular and subangular blocky structure; hard, friable; common fine, medium, and large roots; common medium pores; common wormcasts; few pebbles of ironstone 2 millimeters to 1 centimeter in diameter; slightly acid; abrupt wavy boundary.

B21t—5 to 16 inches; yellowish red (5YR 5/6) clay, dry and moist; moderate and strong fine and medium blocky structure; extremely hard, very firm; common fine and medium roots; many thick clay films; common pebbles of ironstone; many pressure faces; extremely acid; gradual wavy boundary.

B22t—16 to 30 inches; reddish brown (5YR 5/4) clay, dry and moist; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium and coarse blocky structure; extremely hard, very firm; common fine and medium roots; many thick clay films; few black masses; few pebbles of ironstone; many pressure faces; extremely acid; gradual wavy boundary.

B23t—30 to 36 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; common medium distinct brown (10YR 4/3) and light brownish gray (2.5Y 6/2) mottles; extremely hard, very firm; common medium roots; common black masses; common pressure faces; extremely acid; clear smooth boundary.

Cr—36 to 56 inches; gray (10YR 6/1) and light brownish gray (2.5Y 6/2) shale interbedded with brownish yellow (10YR 6/6) and reddish yellow (7.5YR 6/6) weakly cemented sandstone strata 1 centimeter to 3 centimeters thick; massive; very hard, firm; few fine and medium roots in upper part; very strongly acid.

The solum ranges from 20 to 40 inches in thickness.

The A horizon is dark grayish brown, brown, or yellowish brown, and reaction ranges from medium acid to neutral.

The B21t and B22t horizons are red, yellowish red, reddish yellow, or reddish brown. Mottles of yellowish red, brown, strong brown, light brownish gray, or gray range from none to common in the upper part of the B2t horizon and from few to common in the lower part of the B2t horizon. Reaction ranges from extremely acid to medium acid.

The B23t horizon is red, yellowish red, reddish yellow, reddish brown, yellowish brown, light brownish gray, strong brown, or light gray. Mottles of red, yellowish red, gray, light brownish gray, and light gray range from common to many. Reaction ranges from extremely acid to strongly acid.

The Cr horizon is mostly clayey shale or shale and is mottled in shades of red, brown, gray, and yellow. Strata of sandstone 1 centimeter to 8 centimeters thick are interbedded in some pedons.

## Bastsil series

The Bastsil series consists of well drained deep, loamy soils on uplands. These soils formed in loamy alluvium on ancient terraces. Slope ranges from 0 to 5 percent (fig. 23).

Typical pedon of Bastsil fine sandy loam, 0 to 3 percent slopes; from the intersection of Texas Highway 199 and Farm Road 730 in the town of Azle, this pedon is 2.04 miles north on Farm Road 730, 0.8 mile east on Timber Lake Road, 0.51 mile south, and 1,000 feet south of end of the road, in a Girl Scout Camp:

Ap—0 to 11 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; common grass roots; few wormcasts; slightly acid; clear smooth boundary.

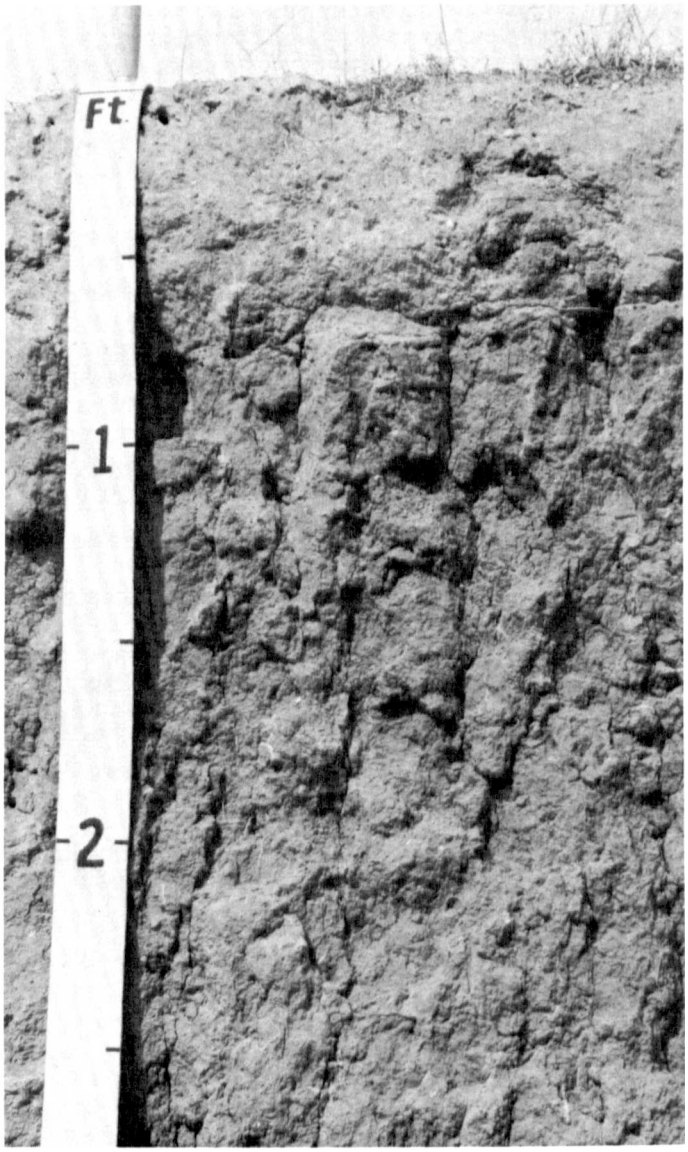



*Figure 23.*—A profile of Bastsil fine sandy loam, 0 to 3 percent slopes, showing prismatic structure in the upper part of the subsoil.

B21t—11 to 30 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine and medium roots; common wormcasts; common fine and medium pores; common thin patchy clay films on faces of peds and bridging sand grains; slightly acid; gradual smooth boundary.

B22t—30 to 56 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, firm; few fine and medium roots; few wormcasts; few fine and medium pores; common thin patchy clay films; few fine black masses; slightly acid; gradual smooth boundary.

Bt&A'2—56 to 80 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine and medium roots; few wormcasts; few fine pores; many thick reddish clay films on faces of prisms; few light gray (10YR 7/2) clay flows and very pale brown (10YR 7/3) sand grains 1 millimeter to 3 millimeters thick; neutral.

The solum ranges from 60 to more than 80 inches in thickness. The clay content within the control section is 22 to 35 percent.

The A horizon is brown, pale brown, light yellowish brown, or light brown. It is 7 to 18 inches thick.

The B2t horizon is brown, reddish brown, red, light red, reddish yellow, or yellowish red loam, sandy clay loam, or clay loam. Mottles are of similar color, and some mottles are dark red. Reaction ranges from medium acid to neutral.

The Bt&A'2 horizon has a reddish matrix of clay loam or sandy clay loam and grayish coatings of sand, silt, and clay on faces of prisms and peds. The coatings are 1 millimeter to 4 millimeters thick. Reaction ranges from medium acid to neutral.

## Birome series

The Birome series consists of well drained, moderately deep, loamy soils on uplands. These soils formed in weakly cemented sandstone. Slope ranges from 1 to 15 percent.

Typical pedon of Birome fine sandy loam, 1 to 5 percent slopes; from the intersection of Interstate Highway 35W and South Loop 820 in the city of Fort Worth, this pedon is 5.9 miles south on Interstate Highway 35W, 6.1 miles east on Farm Road 1187, and 100 feet south.

Ap—0 to 3 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, friable; few fine and medium roots; about 10 percent by volume sandstone fragments as much as 3 inches across long axis; neutral; clear smooth boundary.

A2—3 to 9 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine granular structure; hard, friable; few fine roots; 5 to 10 percent by volume sandstone fragments as much as 3 inches across long axis; neutral; clear smooth boundary.

B21t—9 to 15 inches; red (2.5YR 4/6) clay, dry and moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm, sticky and plastic; few fine roots; many thick dark

red (2.5YR 3/6) clay films; medium acid; gradual smooth boundary.

B22t—15 to 25 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate coarse blocky; very hard, very firm, sticky and plastic; few fine roots; many thick red (2.5YR 4/6) clay films on surface of peds; strongly acid; gradual smooth boundary.

B23t—25 to 35 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; common medium distinct red (2.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; few fine roots; many thick clay films; strongly acid; abrupt smooth boundary.

Cr—35 to 50 inches; weakly cemented fractured reddish sandstone in upper part that decreases in amount of fracturing as depth increases; clay flows and roots penetrate fractures; sandstone hardens when exposed; strongly acid.

The solum is 20 to 40 inches thick over weakly cemented, fractured sandstone. Ironstone pebbles and thin fragments of sandstone as much as 6 inches in diameter make up 0 to 15 percent of the surface.

The Ap horizon is dark brown, brown, or dark grayish brown. The A2 horizon, where present, is light yellowish brown, light brown, or pale brown. Reaction ranges from medium acid to neutral throughout the A horizon.

The B21t horizon is red, reddish yellow, or yellowish red clay or sandy clay. It is strongly acid or medium acid.

The B22t horizon is yellowish red, reddish yellow, or red clay, sandy clay, or clay loam. Many pedons are mottled in these colors and in dark red. Reaction is strongly acid or medium acid.

The B23t horizon is red, reddish yellow, or yellowish red or is mottled in red, yellowish red, strong brown, reddish yellow, or light yellowish brown. It is clay, sandy clay, or clay loam that is strongly acid or medium acid.

The Cr horizon is made up of reddish or yellowish fractured, weakly cemented sandstone strata that is interbedded with shale and clay in some places. The fractured sandstone has a hardness of less than 3 on Mohs' scale.

## Bolar series

The Bolar series consists of well drained, moderately deep, loamy soils on uplands. These soils formed in interbedded fractured limestone and marl. Slope ranges from 1 to 20 percent.

Typical pedon of Bolar clay loam, 3 to 5 percent slopes; from the intersection of West Loop 820 and Interstate Highway 20 in the city of Fort Worth, this pedon is 0.9 mile west on a service road of Interstate Highway 20, and 50 feet north, in rangeland:

A1—0 to 8 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, sticky and plastic; many fine and medium roots; common medium pores; many wormcasts; few fine rounded fragments of limestone; few shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B21—8 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong very fine subangular blocky structure; hard, friable, sticky and plastic; common fine and medium roots; common fine and medium pores; common wormcasts; common coatings on ped faces of very dark grayish brown (10YR 3/2); common fine concretions of calcium carbonate; common fragments of limestone and shells; 50 percent calcium carbonate equivalent; few fragments of ironstone; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—13 to 24 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; strong very fine subangular blocky structure; hard, friable, sticky and plastic; common fine roots; common fine and medium pores; many wormcasts; common concretions of calcium carbonate 1 millimeter to 2 millimeters in diameter; common threads of calcium carbonate; common fragments of limestone and shells; 54 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—24 to 31 inches; light yellowish brown (2.5Y 6/4) loam, light olive brown (2.5Y 5/4) moist; moderate very fine subangular blocky structure; slightly hard, very friable; few fine roots; common fine and medium pores; few wormcasts; common fine and medium concretions of calcium carbonate; many masses of powdery calcium carbonate; common threads of calcium carbonate; about 15 percent by volume fragments of limestone 0.5 centimeter to 3 centimeters in diameter; 59 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

R—31 to 41 inches; fractured limestone interbedded with clayey marl; few roots in fractures and between limestone strata.

The solum is 20 to 40 inches thick. Limestone fragments extend below the A horizon and range from a few to as much as 35 percent by volume. The calcium carbonate equivalent below a depth of 10 inches and to the R layer exceeds 40 percent.

The A horizon is dark grayish brown, dark brown, or brown.

The B horizon is brown, pale brown, very pale brown, grayish brown, light brownish gray, light yellowish brown, or pale yellow loam, clay loam, or silty clay loam.

The R layer is interbedded fractured limestone and clayey marl. Thin layers of fractured shale are in some pedons.

## Brackett series

The Brackett series consists of well drained, shallow, loamy soils on uplands. These soils formed in interbedded limestone and marl. Slope ranges from 3 to 20 percent.

Typical pedon of Brackett clay loam, 3 to 8 percent slopes; from the intersection of West Loop 820 and Interstate Highway 20, 2 miles north on West Loop 820, 3.85 miles west on White Settlement Road, 1.65 miles north on a private road, and 30 feet south of a private road:

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; strong fine subangular blocky structure; hard, friable; many fine and medium roots; common wormcasts and root channels; few thin platy soft limestone fragments; few snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.

B2—4 to 13 inches; light gray (2.5Y 7/2) clay loam, light yellowish brown (2.5Y 6/4) moist; strong fine subangular blocky structure; hard, friable; common fine roots; common wormcasts and root channels; few soft platy limestone fragments in lower part; about 65 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual irregular boundary.

Cr—13 to 40 inches; thinly bedded pale yellow (2.5Y 7/4) silty marl and soft weathered chalk, light yellowish brown (2.5Y 6/4) moist; common medium distinct yellow (2.5Y 7/6) mottles; massive; many cleavage planes; few fine roots in upper part; few masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 10 to 20 inches in thickness. The content of weathered shell and limestone fragments is 5 to 35 percent. The calcium carbonate equivalent of the solum and C horizon is 40 to 80 percent.

The A horizon is grayish brown, light yellowish brown, light brownish gray, or light gray. It ranges from clay loam to loam and has varying amounts of coarse fragments.

The B2 horizon is pale brown, light gray, light brownish gray, or pale yellow loam, gravelly loam, or clay loam.

The Cr horizon is very pale brown, pale yellow, or white silty shale, marl, weakly cemented platy chalk, and limy earths intermingled with limestone.

## Branyon series

The Branyon series consists of moderately well drained, deep, cyclic, clayey soils on uplands that formed in alkaline, clayey sediment on high terraces. Slope ranges from 0 to 1 percent.

Typical pedon of Branyon clay, 0 to 1 percent slope; from intersection of North Loop 820 and Interstate Highway 35W in the city of Fort Worth, this pedon is 1.5 miles north on Interstate Highway 35W, 0.4 mile east, 0.5 mile north, 0.5 mile east, and 100 feet north, in rangeland at the center of a microdepression:

A11—0 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very fine, very sticky and plastic; common fine and medium roots; few fine and medium pores; many pressure faces; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

A12—20 to 30 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderately fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; common coarse grooved slickensides; few concretions of calcium carbonate 1 millimeter to 5 millimeters in diameter; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

A13—30 to 56 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium faint dark grayish brown (10YR 4/2) mottles in lower part; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many intersecting slickensides; common concretions of calcium carbonate 1 millimeter to 5 millimeters in diameter; few fine black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

AC1—56 to 70 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct light olive brown (2.5Y 5/4) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common intersecting slickensides; few vertical streaks as much as 1 centimeter wide of dark gray from horizon above; common concretions of calcium carbonate 1 millimeter to 5 millimeters in diameter; few fine black concretions; calcareous; moderately alkaline; diffuse irregular boundary.

AC2—70 to 80 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; common medium distinct brownish yellow (10YR 6/6) mottles; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; common vertical streaks of dark gray from horizon above; common soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 66 to more than 100 inches in thickness. Cycles of microdepressions and microknolls are repeated every 10 to 24 feet. In native areas, the microknolls are 5 to 18 inches higher than the microdepressions. When the soil is dry, cracks 1 inch to 3 inches wide extend from the surface to a depth of more than 20 inches. The clay content is 45 to 60

percent. Chroma of more than 1.5 is at a depth of 38 to 72 inches in 85 percent or more of each pedon. Some pedons are noncalcareous to a depth of 18 inches in the microdepressions.

The A1 and A12 horizons are dark gray or very dark gray. The A13 horizon is gray or dark gray.

The AC horizon is grayish brown, light brownish gray, pale brown, or light yellowish brown clay and has brownish or yellowish mottles.

## Burleson series

The Burleson series consists of moderately well drained, deep, cyclic, clayey soils on uplands. These soils formed in alluvium on ancient stream terraces. Slope ranges from 0 to 1 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Texas Highway 121 and Spur 103 in the town of Grapevine, this pedon is 3.25 miles northeast on Texas Highway 121 and 200 feet southeast, in the center of a microdepression in cropland:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; gray (10YR 6/1) surface crust as much as 7 millimeters thick; common fine roots; few fine and medium siliceous pebbles; slightly acid; abrupt boundary.

A12—6 to 11 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common pressure faces; few fine siliceous pebbles; medium acid; gradual wavy boundary.

A13—11 to 48 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate coarse angular blocky and blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many intersecting slickensides; few fine black concretions; slightly acid; diffuse wavy boundary.

A14—48 to 56 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium faint dark grayish brown (10YR 4/2) mottles and vertical streaks between peds; moderate coarse angular blocky and blocky structure; extremely hard, very firm, very sticky and plastic; many intersecting slickensides; neutral; diffuse wavy boundary.

AC1—56 to 66 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common medium faint dark grayish brown (10YR 4/2) mottles and streaks of black (10YR 2/1) soil between peds; moderate coarse angular blocky and blocky structure; extremely hard, very firm, very sticky and plastic; many intersecting slickensides; moderately alkaline.

The solum is more than 60 inches thick. Native areas have a gilgai microrelief consisting of microknolls and microdepressions. The microknolls are 3 to 10 inches higher than the microdepressions, and the center of the microknolls is 5 to 15 feet from the center of the microdepressions. When the soil is dry, cracks 1 inch to 3 inches wide extend from the surface to a depth of more than 25 inches. Intersecting slickensides are at a depth of between 20 and 30 inches.

The A horizon is gray, dark gray, or very dark gray. It ranges from medium acid to moderately alkaline and is noncalcareous in the matrix.

The AC horizon is gray, grayish brown, dark grayish brown, or dark gray clay that has few to common brownish, yellowish, or olive mottles. The mottles increase in size and number as depth increases. Reaction is mildly alkaline or moderately alkaline, and the AC horizon is calcareous in some pedons.

## Chatt series

The Chatt series consists of well drained, deep, gently sloping soils on stream terraces. These soils formed in loamy sediment high in calcium carbonate. Slope ranges from 1 to 3 percent.

Typical pedon of Chatt silty clay, 1 to 3 percent slopes; from the intersection of North Loop 820 and U.S. Highway 287, this pedon is 1.1 miles west on North Loop 820, 0.87 mile south on Old Decatur Road, 0.13 mile west on Ten Mile Bridge Road, and 500 feet north, on the Texas Electric Service Company right-of-way:

A11—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium granular and moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; many fine and medium roots; common worm channels; few black concretions; common fine concretions of calcium carbonate; few fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

A12—9 to 16 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; common fine and medium roots; common worm channels; few fine concretions of calcium carbonate; about 25 percent calcium carbonate equivalent; few fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

B21—16 to 24 inches; reddish brown (5YR 4/4) silty clay, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic; few fine and medium roots; few worm channels; few pressure faces; vertical cracks filled with darker material; common fine concretions of calcium carbonate; about 26 percent calcium carbonate equivalent; few fragments of snail shells; calcareous; moderately alkaline; gradual smooth boundary.

B22—24 to 38 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; few worm channels; few pressure faces; vertical cracks filled with darker material; common fine and medium concretions and threads of calcium carbonate; about 27 percent calcium carbonate equivalent; few fragments of snail shells; calcareous; moderately alkaline; gradual smooth boundary.

B23ca—38 to 47 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; very hard, very firm, sticky; few fine roots; few worm channels; small pressure faces; many concretions and threads of calcium carbonate; about 49 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—47 to 66 inches; yellow (10YR 7/6) clay loam, brownish yellow (10YR 6/6) moist; common medium distinct brown (7.5YR 5/4) mottles; moderate medium blocky structure; hard, friable, sticky; few fine roots; few worm channels; common threads of calcium carbonate; many concretions and soft masses of calcium carbonate; common limestone pebbles and shell fragments; calcareous; moderately alkaline.

The solum is more than 60 inches thick. The calcium carbonate equivalent of the control section is 25 to 40 percent, and total clay content is 40 to 55 percent. When the soil is dry, cracks 1 centimeter or more wide form in the upper part of the subsoil.

The A horizon is dark brown, dark grayish brown, or very dark grayish brown. The B horizon is reddish brown, dark brown, brown, reddish yellow, or yellow clay, silty clay, or clay loam.

## Crosstell series

The Crosstell series consists of deep moderately well drained, deep loamy soils on uplands that formed in shaly and clayey sediment containing thin strata of weakly cemented sandstone. Slope ranges from 1 to 6 percent.

Typical pedon of Crosstell fine sandy loam, 3 to 6 percent slopes; from the intersection of Northeast Loop 820 and Airport Freeway 121A in the town of Hurst, this pedon is 5.14 miles east on Airport Freeway 121A, 0.4 mile northwest on Southwest Parkway, and 500 feet southwest, in a wooded pasture:

A1—0 to 4 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium granular structure; hard, friable; many fine roots; common medium pores; common ironstone fragments as much as 5 centimeters across; neutral; abrupt wavy boundary.

B21t—4 to 18 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; few wormcasts; common clay films; common pressure faces; few ironstone fragments; strongly acid; gradual wavy boundary.

B22t—18 to 28 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; common medium distinct brownish yellow (10YR 6/6) mottles; moderate medium blocky structure; very hard, firm, sticky and plastic; few fine roots; common clay films; many pressure faces; few ironstone fragments; medium acid; gradual wavy boundary.

B23t—28 to 41 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; many medium distinct light gray (2.5Y 7/2) mottles; moderate coarse blocky structure; very hard, firm, sticky and plastic; few roots; many thick clay films and clay flows; few ironstone fragments; many black masses; common fragments of shale in lower part; neutral; gradual wavy boundary.

C—41 to 60 inches; light gray (2.5Y 7/2) stratified shale; light brownish gray (2.5Y 6/2) moist; common thin loamy strata of yellowish brown (10YR 5/6), brownish yellow (10YR 6/6), and a few shaly strata of strong brown (7.5YR 5/6); massive; extremely hard, very firm; few roots; common black masses; few concretions of calcium carbonate; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. A few to common coarse fragments of ironstone and sandstone are throughout the solum.

The A horizon is 4 to 10 inches thick. It is brown, light brown, dark grayish brown, or light yellowish brown. Reaction ranges from medium acid to mildly alkaline. Some pedons have a thin A2 horizon that is 1 to 2 units higher in value than the A1 or Ap horizon.

The B21t horizon is reddish yellow, yellowish red, red, brown, or reddish yellow. Mottles in combinations of these colors and in yellow and yellowish brown are in some pedons. Reaction ranges from very strongly acid to medium acid. The B22t horizon is red, yellowish red, reddish yellow, brown, yellowish brown, light yellowish brown, brownish yellow, very pale brown, or yellow clay. Most pedons have common to many reddish, brownish, or yellowish mottles. Reaction ranges from strongly acid to mildly alkaline. The B23t horizon is red, yellowish red, reddish yellow, brown, pale brown, yellowish brown, light yellowish brown, brownish yellow, very pale brown, or yellow clay that has common to many reddish, brownish, yellowish, grayish, or olive mottles. Reaction ranges from medium acid to moderately alkaline. In some pedons the B23t horizon is calcareous.

The C horizon is grayish brown, gray, light brownish gray, light gray, very pale brown, or pale yellow with thin strata and mottles of red, light red, yellowish red, brown,

strong brown, yellowish brown, brownish yellow, and light olive brown. It is stratified clay, shale, and weakly cemented sandstone. In some pedons thin layers of loamy material are between the clay and the shale strata. Reaction ranges from neutral to moderately alkaline, and in some places the horizon is calcareous.

## Ferris series

The Ferris series consists of well drained, moderately deep and deep, cyclic, clayey soils on uplands. These soils formed in calcareous, clayey and shaly marine sediment. Slope ranges from 2 to 12 percent.

Typical pedon of Ferris clay, 5 to 12 percent slopes; from the intersection of U.S. Highway 287 and Broad Street in the town of Mansfield, this pedon is 4.4 miles east of Broad Street and 200 feet north, in rangeland:

A1—0 to 7 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine blocky structure; extremely hard, very firm, very sticky and plastic; common fine and medium roots; common wormcasts; few rounded and flat siliceous pebbles 2 to 5 millimeters in diameter; common very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC—7 to 41 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; common medium faint olive yellow (2.5Y 6/6) mottles; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common black concretions 1 millimeter to 4 millimeters in diameter; few siliceous pebbles 5 to 10 millimeters in diameter; few concretions and soft masses of calcium carbonate; common coarse intersecting slickensides; few cracks filled with dark grayish brown clay; calcareous; moderately alkaline; diffuse wavy boundary.

C—41 to 60 inches; yellowish brown (10YR 5/8) clay, dry and moist; many coarse distinct light gray (2.5Y 7/2) and common medium faint light yellowish brown (2.5Y 6/4) mottles; massive; extremely hard, very firm, very sticky and plastic; few fine black concretions; common shale fragments in lower part; calcareous, moderately alkaline.

The solum ranges from 34 to 60 inches in thickness. When the soil is dry, cracks 1 inch to 3 inches wide extend to a depth of more than 20 inches.

The A horizon is dark grayish brown, grayish brown, brown, olive brown, or light olive brown. When the soil is dry, pedons that have value of less than 6 and chroma of 3 or less are less than 12 inches thick in more than half of the pedon.

The AC horizon is grayish brown, light brownish gray, pale olive, or light yellowish brown. It has none to few siliceous pebbles, and few to common concretions of calcium carbonate.

The C horizon is pale brown, pale olive, light olive brown, yellowish brown, pale yellow clay or shaly clay. Many pedons are coarsely mottled in shades of brown, gray, or olive.

## Frio series

The Frio series consists of well drained, deep, clayey soils on bottom lands. These soils formed in calcareous, recent alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Frio silty clay, occasionally flooded; from the intersection of Interstate Highway 35W and South Loop 820 in the city of Fort Worth, this pedon is 6.1 miles west on South Loop 820 and 200 feet north, in a flood plain of Clear Fork of the Trinity River:

A11—0 to 15 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate fine and medium blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; many wormcasts and channels; common fine pores; few fragments of snail shells; calcareous; moderately alkaline; gradual smooth boundary.

A12—15 to 24 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; many wormcasts and channels; common very fine pores; few fragments of snail shells; calcareous; moderately alkaline; gradual smooth boundary.

A13—24 to 34 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate fine medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common wormcasts; common fine and medium pores; few threads and films of calcium carbonate; few siliceous pebbles; few fragments of snail shells; calcareous; moderately alkaline; gradual smooth boundary.

B2—34 to 80 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few wormcasts; common fine and medium pores; many threads and films of calcium carbonate; few fragments of snail shells; calcareous; moderately alkaline.

The mollic epipedon ranges from 25 to 60 inches in thickness. The clay content makes up 35 to 50 percent to a depth of 40 inches. In some pedons, strata of loamy or gravelly sediment are below a depth of 30 inches. In some pedons the control section is 5 to 15 percent by volume chert and limestone gravel.

The A11, A12, and A13 horizons are very dark grayish brown, dark grayish brown, or brown.

The B2 horizon is dark grayish brown, brown, yellowish brown, or light yellowish brown silty clay loam, clay loam, or gravelly clay loam.

## Gasil series

The Gasil series consists of well drained, deep, loamy soils on uplands. These soils formed in loamy material interbedded with sandstone. Slope ranges from 1 to 8 percent.

Typical pedon of Gasil fine sandy loam, 1 to 3 percent slopes; from the intersection of Interstate Highway 20 and U.S. Highway 287 in the town of Arlington, this pedon is 2.75 miles south on U.S. Highway 287 and 150 feet east of the east service road:

Ap—0 to 6 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular and subangular blocky structure; soft, very friable; common fine roots; few fine pebbles of ironstone; neutral; abrupt smooth boundary.

A12—6 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable; common fine roots; few fine pebbles of ironstone; neutral; clear smooth boundary.

B21t—10 to 17 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common medium faint brown (10YR 5/3) mottles; moderate coarse prismatic structure parting to weak fine subangular blocky; hard, firm; common fine and medium roots; common fine pores; common clay films on faces of prisms; few fine pebbles of ironstone; slightly acid; gradual smooth boundary.

B22t—17 to 29 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, firm; common fine roots; many fine pores; common clay films on faces of peds; few fine pebbles of ironstone; medium acid; gradual smooth boundary.

B23t—29 to 53 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common medium distinct yellowish red (5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; few fine roots in upper part of horizon; common clay films on faces of prisms; common black concretions and masses; few fragments of sandstone; few fine pockets of uncoated sand grains; strongly acid; gradual smooth boundary.

B24t—53 to 75 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; many medium distinct yellowish brown (10YR 5/4, 5/8) and common medium distinct yellowish red (5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; common clay films on faces of prisms; many coarse black concretions and masses; few fragments of sandstone; few pockets of uncoated sand grains; medium acid.

The solum ranges from 60 to more than 100 inches in thickness. Ironstone gravel, fragments of sandstone, black concretions, and soft masses make up 0 to about 5 percent of the solum.

The thickness of the A horizon is 6 to 19 inches. The A1 or Ap horizon is pale brown, brown, light yellowish brown, or yellowish brown. Where an A2 horizon is present, it is one to two units higher in value than the Ap horizon. Reaction ranges slightly acid to mildly alkaline.

The B2t horizon is brown, strong brown, reddish yellow, light yellowish brown, brownish yellow, very pale brown, yellowish brown, or yellow sandy clay loam or loam that has few to common mottles in shades of red, yellow, and brown. The clay content of the upper 20 inches is 18 to 30 percent. In some pedons, gray clay flows and few pockets and streaks of uncoated sand grains are below a depth of 50 inches. Reaction ranges from strongly acid to slightly acid.

## Heiden series

The Heiden series consists of well drained, deep, cyclic, clayey soils on uplands. These soils formed in alkaline, marine clay and material weathered from shale. Slope ranges from 1 to 5 percent.

Typical pedon of Heiden clay, 1 to 3 percent slopes; from the intersection of Interstate Highway 20 and Farm Road 157 in the town of Arlington, this pedon is 1.4 miles south on Farm Road 157, 0.3 mile east on Nathan Lowe Road, and 150 feet north, in a field midway between the center of a microknoll and the center of a microdepression:

Ap—0 to 5 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak fine blocky structure; extremely hard, very firm; very sticky and plastic; common fine roots; few wormcasts; few fine concretions of calcium carbonate; few black concretions 1 millimeter to 3 millimeters in diameter; few fine siliceous pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

A12—5 to 38 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse angular blocky structure parting to moderate fine angular blocky; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; common tilted intersecting slickensides below a depth of 16 inches; common concretions of calcium carbonate; few fine black concretions 1 millimeter to 3 millimeters in diameter; few fine

siliceous pebbles; calcareous; moderately alkaline; diffuse wavy boundary.

AC1—38 to 57 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct light olive brown (2.5Y 5/4) mottles in lower part; common vertical streaks of dark gray (10YR 4/1) clayey soil material; moderate coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many tilted intersecting slickensides; about 2 percent by volume strongly cemented concretions of calcium carbonate; few black concretions 1 millimeter to 3 millimeters in diameter; few fine siliceous pebbles; calcareous; moderately alkaline; diffuse wavy boundary.

AC2—57 to 64 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; common medium distinct grayish brown (2.5Y 5/2) and few medium distinct olive yellow (2.5Y 6/6) mottles; moderate coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common tilted intersecting slickensides; about 3 percent by volume cemented concretions of calcium carbonate; few masses of soft calcium carbonate; few black concretions 1 millimeter to 3 millimeters in diameter; few fine siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.

C—64 to 72 inches; prominently and coarsely mottled, brownish yellow (10YR 6/6) and light brownish gray (2.5Y 6/2) stratified shaly clay, common medium distinct yellow (2.5Y 7/6) mottles; massive; extremely hard, very firm, very sticky and plastic; common concretions and soft powdery bodies of calcium carbonate; few black concretions 1 millimeter to 3 millimeters in diameter; calcareous; moderately alkaline.

The solum is 55 to more than 70 inches thick. Intersecting slickensides begin between a depth of 16 and 25 inches. The texture is clay or silty clay throughout. In some places the upper 12 inches of the soil is noncalcareous and mildly alkaline. In native areas, the microknolls are 3 to 10 inches higher than the microdepressions, and the center of the microknolls is 8 to 16 feet from the center of the microdepressions. When the soil is dry, cracks 1 inch to 3 inches wide extend to a depth of more than 20 inches.

The A horizon is dark gray, very dark grayish brown, or dark grayish brown. When the chroma is less than 1.5, the surface layer is less than 12 inches thick in more than half of the pedon.

The AC1 horizon is brown, grayish brown, or light olive brown. The AC2 horizon is brownish yellow, light yellowish brown, yellowish brown, light olive yellow, or olive yellow. Yellowish or brownish mottles range from none to common in the AC1 and AC2 horizons.

The C horizon is mottled or stratified in shades of gray, brown, and yellow. It is clay, shaly clay, marly silty clay, or slightly weathered shale.

## Houston Black series

The Houston Black series consists of moderately well drained, deep, cyclic, clayey soils on uplands. These soils formed in alkaline, marine clay and material weathered from shale. Slope ranges from 1 to 4 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; from U.S. Highway 287 in the town of Mansfield, this pedon is 3 miles east on Broad Street to Seton Road, 0.3 mile south on Seton Road, and 100 feet east, in a pasture at the center of a microdepression:

A11—0 to 8 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots; common wormcasts; few fine concretions of calcium carbonate; few fine siliceous pebbles as much as 1 centimeter in diameter; calcareous; moderately alkaline; clear wavy boundary.

A12—8 to 17 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine and medium roots; few fine pores; common wormcasts; few fine concretions of calcium carbonate; few fine siliceous pebbles; few fine shiny ped faces; calcareous; moderately alkaline; gradual wavy boundary.

A13—17 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine and medium roots mainly on ped surfaces; few wormcasts; few fine concretions of calcium carbonate; common coarse grooved intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

A14—32 to 42 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on ped surfaces; few wormcasts; few fine siliceous pebbles; common fine concretions of calcium carbonate; common coarse grooved intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

AC1—42 to 61 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; common fine faint grayish brown mottles; strong coarse angular blocky structure; extremely hard, very firm; very sticky and plastic; few fine roots on ped surfaces; common fine concretions of calcium carbonate; common coarse grooved intersecting slickensides; few vertical cracks; calcareous; moderately alkaline; gradual wavy boundary.

AC2—61 to 74 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on ped surfaces; common fine concretions of calcium carbonate; common coarse grooved intersecting slickensides; calcareous; moderately alkaline; diffuse wavy boundary.

AC3—74 to 80 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; common medium distinct yellowish brown (10YR 5/6) and grayish brown (2.5Y 5/2) mottles; strong medium and fine blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few black concretions 1 millimeter to 3 millimeters in diameter; common concretions and soft masses of calcium carbonate; few intersecting slickensides; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. Intersecting slickensides begin between a depth of 16 and 24 inches. The soil is clay or silty clay throughout. When the soil is dry, cracks 1 inch to 4 inches wide extend from the surface to a depth of more than 20 inches. Cycles of microdepressions and microknolls occur every 16 to 24 feet. In native areas, the microknolls are 3 to 12 inches higher than the microdepressions. The soil is typically calcareous and moderately alkaline throughout, but in some microdepressions the upper 12 inches is noncalcareous and mildly alkaline or moderately alkaline.

The A horizon is very dark gray or dark gray. When the soil is dry, the surface has a granular mulch about 1 centimeter thick.

The AC1 horizon is dark grayish brown, grayish brown, or light yellowish brown. Few to common mottles of dark gray, dark grayish brown, grayish brown, or olive yellow are in most pedons. The AC2 horizon is dark grayish brown, grayish brown, brownish gray, olive yellow, or is mottled in shades of brown or gray. The AC3 horizon and the C horizon, where present, are yellowish brown, olive brown, light yellowish brown, or yellow. Few to common grayish, brownish, or yellowish mottles are in most pedons.

## Justin series

The Justin series consists of well drained, deep, loamy soils that formed in clayey and loamy sediment on uplands. Slope ranges from 1 to 3 percent.

Typical pedon of Justin loam, 1 to 3 percent slopes; from intersection of Texas Highway 121 and Spur 103 in the town of Grapevine, this pedon is 2.2 miles northeast on Texas Highway 121, 0.4 mile east on a county road, and 300 feet north:

A11—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable; many fine roots; common fine pores; common wormcasts; neutral; clear smooth boundary.

A12—12 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common wormcasts; slightly acid; gradual smooth boundary.

B21t—16 to 23 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; common medium faint yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; very hard, firm; few fine roots; few wormcasts; common clay films; few black concretions; common siliceous pebbles; neutral; gradual smooth boundary.

B22t—23 to 40 inches; yellowish brown (10YR 5/6) clay loam, dry and moist; common medium distinct reddish yellow (7.5YR 6/8) and yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; very hard, firm; common fine pores; common clay films; few black concretions; common siliceous pebbles; neutral; gradual smooth boundary.

B23t—40 to 51 inches; strong brown (7.5YR 5/6) clay loam, dry and moist; common medium distinct yellowish brown (10YR 5/4) and yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm; many clay films; common black concretions as much as 7 millimeters in diameter; common siliceous and ironstone pebbles; neutral; gradual smooth boundary.

B24t—51 to 70 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky and blocky structure; very hard, firm; continuous clay films; common black concretions as much as 1 centimeter in diameter; about 5 percent siliceous and ironstone pebbles; few concretions of calcium carbonate in the lower part; neutral.

The solum ranges from 60 to more than 70 inches in thickness. The depth to calcium carbonate ranges from 36 to 70 inches. The content of fine nodules and fragments of ironstone is 0 to about 5 percent throughout the solum. Reaction is slightly acid or neutral in the A, B21t, and B22t horizons.

The A horizon is dark grayish brown or brown.

The B21t horizon is brown or reddish brown sandy clay loam, loam, or clay loam. Mottles of yellowish red or strong brown range from none to common. The B22t horizon is reddish brown or yellowish brown clay loam or sandy clay loam. Common mottles of red, yellowish red, or reddish yellow are present in most pedons. The B23t and B24t horizons are strong brown, reddish yellow, or yellowish brown clay loam or clay and are mottled in contrasting shades of red, reddish yellow, reddish brown, yellowish red, and yellowish brown. Below a depth of 40 inches, the mottles are light gray, light brownish gray,

and grayish brown. Reaction ranges from neutral to moderately alkaline.

## Konsil series

The Konsil series consists of well drained, deep, loamy soils on uplands. These soils formed in unconsolidated loamy sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Konsil fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 121 and Texas Highway 382 in the town of Grapevine, this pedon is 1.25 miles west on Highway 382, 1 mile north on Park Boulevard, 0.1 mile east on Dove Street, and 700 feet north:

Ap—0 to 9 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky and granular structure; slightly hard, very friable; many fine to coarse roots; few wormcasts; few fine black concretions; few ironstone pebbles, as much as 15 millimeters in diameter; neutral; clear smooth boundary.

B21t—9 to 21 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; common medium roots; many clay films on ped faces darker by 1/2 unit of chroma; few fine black concretions; few ironstone pebbles, as much as 5 millimeters in diameter; slightly acid; gradual smooth boundary.

B22t—21 to 42 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; weak medium subangular blocky structure; hard, friable; few medium roots; clay films on ped faces darker by 1/2 unit of chroma; few fine black concretions; few ironstone pebbles; slightly acid; gradual smooth boundary.

B23t—42 to 75 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; common medium distinct reddish yellow (7.5YR 6/8) mottles; weak medium subangular blocky structure; hard, friable; few medium roots; thick clay films on ped faces; few fine black concretions; few fragments of sandstone throughout horizon; slightly acid.

The solum ranges from 60 to 100 inches in thickness. Sandstone, ironstone, or chert fragments that are less than 3 inches in diameter make up less than 5 percent by volume throughout.

The thickness of the A horizon ranges from 7 to 17 inches. Reaction ranges from slightly acid to mildly alkaline. The A1 or Ap horizon is reddish brown, light brown, brown, light yellowish brown, or yellowish brown. Where an A2 horizon is present, it is 1 or 2 units higher in value than the A1 horizon.

The Bt horizon is reddish brown, yellowish red, red, or reddish yellow sandy clay loam or loam. In some pedons, few to common mottles of red, gray, yellow, and brown are in the lower part of the Bt horizon. In some pedons, hue of 7.5YR or 10YR is below a depth of 40 inches. Clay content of the upper 20 inches of the Bt horizon is 18 to 33 percent. The Bt horizon ranges from strongly acid to slightly acid.

Some pedons are underlain by sandstone below a depth of 60 inches.

## Leson series

The Leson series consists of moderately well drained, deep, cyclic, clayey soils on uplands. These soils formed in alkaline shale and clay. Slope ranges from 1 to 3 percent.

Typical pedon of Leson clay, 1 to 3 percent slopes; from the intersection of Texas Highway 121 and Texas Highway 382 in the town of Grapevine, this pedon is 0.8 mile east on Texas Highway 382, 1 mile east on Old Grapevine Road, and 600 feet north, in a pasture at the center of a microdepression:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm; common fine to coarse roots; few siliceous pebbles; moderately alkaline; clear wavy boundary.

A12—6 to 26 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and medium blocky structure; extremely hard, very firm; few fine and medium roots; common intersecting slickensides; few siliceous pebbles; moderately alkaline; gradual wavy boundary.

A13—26 to 37 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; many intersecting slickensides; few siliceous pebbles; moderately alkaline; gradual wavy boundary.

AC1—37 to 53 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse angular blocky structure; extremely hard, very firm; few fine roots; many intersecting slickensides; common concretions of calcium carbonate; few siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.

AC2—53 to 70 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common fine distinct olive yellow and white mottles; moderate coarse angular blocky structure; extremely hard, very firm; few fine roots; common intersecting slickensides; common concretions of calcium carbonate; few siliceous pebbles; lower part of layer contains a few shale fragments; calcareous; moderately alkaline; gradual wavy boundary.

C—70 to 80 inches; yellow (10YR 7/6) shaly clay, olive yellow (2.5Y 6/6) moist; common fine distinct white and common medium distinct light gray (10YR 6/1) mottles; extremely hard, very firm; evident cleavage planes; few soft concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 49 to more than 70 inches in thickness. The clay content of the solum is 45 to 60 percent. When the soil is dry, cracks 1 inch to 3 inches wide extend to a depth of 20 inches. Common to many intersecting slickensides are below a depth of 15 inches. Undisturbed areas have a gilgai microrelief. The distance between the center of a microknoll and the center of a microdepression is from 4 to 16 feet.

The A horizon is very dark gray or dark gray. Reaction ranges from neutral to moderately alkaline, and the matrix is noncalcareous. The AC horizon is grayish brown, dark grayish brown, or light olive brown with few to many grayish, brownish, yellowish, and olive mottles. Reaction is moderately alkaline, and the soil is calcareous or noncalcareous.

The C horizon is in shades of brown, yellow, or olive. It is shaly clay or stratified shale and clay.

## Lindale series

The Lindale series consists of well drained, moderately deep, loamy soils on uplands. These soils formed in limestone rubble and marine clay. Slope ranges from 1 to 3 percent.

Typical pedon of Lindale clay loam, 1 to 3 percent slopes; from intersection of Farm Road 731 and Farm Road 1187 in the town of Crowley, this pedon is 0.38 mile west on Farm Road 1187, 0.5 mile south on a county road, and 900 feet west, in a field:

Ap—0 to 5 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; many fine roots; common wormcasts; few ironstone pebbles; neutral; clear smooth boundary.

B21t—5 to 10 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/3) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; few ironstone pebbles; few wormcasts; many thick continuous dark reddish brown (5YR 3/3) clay films on faces of peds; neutral; gradual smooth boundary.

B22t—10 to 26 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few ironstone pebbles; common patchy clay films; few fine concretions of calcium carbonate in lower part; mildly alkaline; gradual smooth boundary.

B3ca—26 to 40 inches; brown (7.5YR 5/4) very gravelly clay loam, dark brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; few fragments of ironstone; about 40 percent by volume fragments of limestone as much as 5 centimeters in diameter; coating of calcium carbonate 2 to 3 millimeters thick on underside of limestone fragments; about 50 percent by volume calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Cca—40 to 60 inches; interbedded reddish yellow (7.5YR 6/6) limy earths and platy limestone fragments; massive; extremely hard, very firm; coating of calcium carbonate on the underside of limestone fragments; about 45 percent by volume limestone fragments; about 10 percent by volume soft masses of calcium carbonate; few fragments of ironstone; calcareous; moderately alkaline.

The solum is from 20 to 40 inches thick. The depth to calcareous soil material is between 18 to 27 inches. Ironstone fragments make up 2 to 10 percent by volume of the solum.

The A horizon is reddish brown or dark brown. Reaction ranges from slightly acid to moderately alkaline.

The B2t horizon is reddish brown, yellowish red, or brown clay or clay loam that is 35 to 50 percent clay. Reaction ranges from slightly acid to moderately alkaline. The B3ca horizon is brown or reddish brown very gravelly clay loam, gravelly clay loam, clay loam, or clay. Concretions of calcium carbonate and fragments of limestone make up 5 to 50 percent by volume of the B3ca horizon.

The Cca horizon is reddish yellow, brownish yellow, brown, or light brown. The material is interbedded limy earths and limestone fragments. The volume of fragments is 45 to 80 percent. The content of stone, cobble, and gravel is variable within short distances. There are common to many soft masses of calcium carbonate.

## Lott series

The Lott series consists of well drained, deep, clayey soils on uplands. These soils formed in marly silty clay loam or chalky marl high in calcium carbonate. Slope ranges from 1 to 5 percent.

Typical pedon of Lott silty clay, 1 to 3 percent slopes; from the intersection of Interstate Highway 35W and South Loop 820 in the city of Fort Worth, this pedon is 2.94 miles south on Interstate Highway 35W and 0.65 mile west, in a cultivated field:

Ap—0 to 6 inches; very dark brown (10YR 2/2) silty clay, dry and moist; moderate fine subangular blocky and granular structure; very hard, firm, sticky and plastic; few fine roots; few wormcasts; few fine black concretions; few fine and medium ironstone, limestone, and siliceous pebbles; few shell fragments; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 16 inches; very dark grayish brown (10YR 3/2) silty clay, dry and moist; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few wormcasts; few fine black concretions; few fine and medium ironstone, limestone, and siliceous pebbles; few shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

B21—16 to 28 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; strong fine subangular blocky structure; hard, friable; few fine roots; few wormcasts; few fine pores; few fine concretions of calcium carbonate; few fine and medium ironstone pebbles; few shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

B22ca—28 to 46 inches; pale yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; strong medium subangular blocky structure; hard, friable; few fine roots and pores; common soft bodies of calcium carbonate; few fine concretions of calcium carbonate; common fine shell fragments; calcareous; moderately alkaline; gradual wavy boundary.

Cca—46 to 60 inches; mottled, pale yellow (2.5Y 7/4) light gray (2.5Y 7/2) and yellow (2.5Y 7/6) marly silty clay loam; massive; hard, firm; about 30 percent soft masses of calcium carbonate; few scattered fragments of limestone 3 to 10 inches in diameter in lower part coated with calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 44 inches thick. Between a depth of 10 and 40 inches, the calcium carbonate equivalent is 45 to 80 percent, and silicate clay is 25 to 35 percent. In most pedons a few pebbles are on the surface and in the soil.

The A horizon is very dark brown, very dark grayish brown, dark grayish brown, or brown.

The B2 and B2ca horizons are brown, pale brown, light yellowish brown, very pale brown, or pale yellow. Some pedons have common to many mottles in these colors and in brownish yellow. Masses of soft calcium carbonate are common to many.

The Cca horizon is mottled in shades of yellow, brown, white, and gray. It is platy or massive chalky marl, marly silty clay loam, or marly clay loam. Masses of soft calcium carbonate are few to many. In some pedons there are a few fragments of limestone.

## Luckenbach series

The Luckenbach series consists of moderately well drained, deep, loamy soils on uplands. These soils formed in ancient, alkaline, loamy alluvium on terraces. Slope ranges from 1 to 3 percent.

Typical pedon of Luckenbach clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 377 and Farm Road 1187 southwest of the town of Benbrook, this pedon is 1.42 miles southeast on Farm Road 1187, 1.36 miles east on a county road to the entrance of Mustang Park, 0.85 mile northeast on a park road to the road intersection, 0.25 mile east and 55 feet north of the park road:

A11—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, firm; common fine and medium roots; common wormcasts; few siliceous pebbles; mildly alkaline; clear smooth boundary.

A12—8 to 15 inches; dark reddish gray (5YR 4/2) clay loam, dark reddish brown (5YR 3/2) moist; moderate fine blocky and subangular blocky structure; hard, firm; common fine and medium roots; common wormcasts; few pitted concretions of calcium carbonate; few siliceous pebbles; moderately alkaline; gradual wavy boundary.

B21t—15 to 27 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine blocky structure; very hard, very firm; few medium roots; few wormcasts; common clay films on faces of peds; common pitted concretions of calcium carbonate; common pressure faces; few very dark brown vertical streaks; few fine siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

B22t—27 to 48 inches; reddish brown (5YR 4/4) clay, dry and moist; moderate coarse prismatic and moderate fine blocky structure; very hard, very firm; few medium roots; common clay films on faces of peds; few black concretions; common pitted concretions of calcium carbonate; common pressure faces; few fine siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—48 to 54 inches; brown (7.5YR 5/4) clay loam; common medium distinct pink (7.5YR 7/4) and yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; very hard, very firm; few brownish clay films on faces of peds; about 10 percent soft masses and concretions of calcium carbonate; about 10 percent by volume rounded limestone pebbles as much as 4 centimeters in diameter; calcareous; moderately alkaline; diffuse smooth boundary.

Cca—54 to 60 inches; pink (7.5YR 7/4) clay loam; massive; very hard, very firm; about 15 percent by volume concretions of calcium carbonate; about 20 percent by volume rounded limestone pebbles; calcareous; moderately alkaline.

The solum is 44 to 60 inches thick. Free carbonates are between a depth of 15 and 28 inches.

The A1 and A12 horizons are dark grayish brown, dark brown, or dark reddish gray. Reaction is neutral or mildly alkaline.

The B2t horizon is reddish brown or brown clay or clay loam, with clay content ranging from 35 to 55 percent. Reaction is mildly alkaline or moderately alkaline. Siliceous pebbles and concretions of calcium carbonate are few to common.

The B3ca and Cca horizons are brown, pink, or light brown clay or clay loam that is 5 to 20 percent by volume rounded limestone fragments. Soft masses, lumps, and weakly and strongly cemented concretions of

calcium carbonate are 5 to 15 percent by volume. The amount of carbonates does not decrease appreciably with depth.

## Mabank series

The Mabank series consists of somewhat poorly drained, deep, loamy soils on uplands. These soils formed in clayey sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Mabank fine sandy loam, 0 to 1 percent slopes; from the intersection of South Loop 820 and Rendon Road in the town of Forest Hill, this pedon is 1.51 miles south on Rendon Road, and 3,650 feet east, in a wooded area:

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; common fine and medium roots; few wormcasts and channels; common fine and medium pores; few fine brown concretions; many white sand grains in lower 2 inches; slightly acid; abrupt wavy boundary.

B21tg—7 to 29 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine to large roots; few fine pores; many patchy clay films; few fine and medium black concretions; few pressure faces; medium acid; gradual wavy boundary.

B22t—29 to 66 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots mostly confined to ped faces; common pressure faces as much as 3 centimeters in diameter; common clay films; few medium black concretions; common strongly cemented concretions of calcium carbonate as much as 1 centimeter in diameter; mildly alkaline; gradual wavy boundary.

B3—66 to 80 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; common fine distinct yellowish brown mottles; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many medium and large black concretions; few fine concretions of calcium carbonate; common vertical streaks as much as 1 centimeter wide of darker clayey material; common large pressure faces; mildly alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The depth to concretions of calcium carbonate is 24 to 35 inches. When the soil is dry, cracks 1 centimeter or more wide form in the upper part of the subsoil.

The A horizon is dark grayish brown or grayish brown and ranges from medium acid to neutral. It is 6 to 9 inches thick.

The B21tg horizon is dark gray clay that ranges from medium acid to mildly alkaline. The lower part of the B horizon is grayish brown, light brownish gray, light gray, or gray clay. They have a few fine brownish mottles and range from neutral to moderately alkaline.

## Maloterre series

The Maloterre series consists of somewhat excessively drained, very shallow, loamy soils that formed in indurated limestone on uplands. Slope ranges from 3 to 20 percent.

Typical pedon of Maloterre gravelly clay loam in an area of Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes; from the intersection of Texas Highway 199 and Farm Road 1886 in the town of Lakeside, this pedon is 1.8 miles west on Farm Road 1886, 2.4 miles south on Silver Creek Road, 0.78 mile west on a county road, 600 feet south on a private road, and 40 feet west:

A1—0 to 7 inches; brown (10YR 5/3) gravelly clay loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; many fine and large roots; about 64 percent calcium carbonate equivalent; about 20 percent by volume fragments of shells and limestone; calcareous; moderately alkaline; abrupt smooth boundary.

R—7 to 10 inches; indurated limestone containing many imbedded fossil shells, massive and unfractured; hardness of more than 3 on Mohs' scale.

The solum is from 3 to 10 inches thick. Gravel size fragments of shell and limestone make up 5 to 35 percent by volume. The calcium carbonate equivalent is 40 to 80 percent.

The A horizon is dark grayish brown, grayish brown, brown, or very pale brown gravelly clay loam to gravelly loam. In pedons where the value and chroma are less than 3.5 moist, the A horizon is less than 4 inches thick.

The R layer is indurated white limestone or conglomerate limestone that has many imbedded fossil shells.

## Medlin series

The Medlin series consists of well drained, moderately deep to deep, cyclic, clayey soils on uplands. These soils formed in shaly and clayey, alkaline marine sediment. Slope ranges from 5 to 15 percent.

Typical pedon of Medlin clay, 5 to 15 percent slopes; from the intersection of Interstate Highway 35W and North Loop 820 in the city of Fort Worth, this pedon is 7.06 miles north on Interstate Highway 35W, 0.4 mile west on Keller-Blue Mound Road, 0.36 mile north on Harmon Road, 0.23 mile west on Avondale School Road, and 200 feet north, in a pasture:

A1—0 to 9 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate fine granular and moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; common fine and medium roots; common fine concretions of calcium carbonate; common fragments of limestone as much as 10 centimeters in diameter on soil surface; common fragments of limestone as much as 1 centimeter in diameter throughout soil horizon; calcareous; moderately alkaline; clear wavy boundary.

AC1—9 to 33 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; many intersecting slickensides; common fine concretions of calcium carbonate; common fragments of limestone as much as 1 centimeter in diameter; calcareous; moderately alkaline; gradual wavy boundary.

AC2—33 to 58 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; many intersecting slickensides; common vertical streaks of dark brown clay; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—58 to 67 inches; stratified grayish brown (2.5Y 5/2) and light yellowish brown (2.5Y 6/4) shaly clay, dark grayish brown (2.5Y 4/2) and light olive brown (2.5Y 5/4) moist; massive; extremely hard, very firm, sticky and plastic; calcareous; moderately alkaline.

The solum ranges from 35 to more than 60 inches in thickness. The texture throughout is calcareous clay that is 40 to 60 percent clay content. The soil is calcareous and moderately alkaline throughout. When the soil is dry, cracks 1 inch to 3 inches wide extend to a depth of 20 inches or more.

The A horizon is dark grayish brown, grayish brown, brown, or light olive brown.

The AC horizon is grayish brown, pale brown, light yellowish brown, light olive brown, yellowish brown, or olive yellow. The C horizon is mottled, stratified, brown, yellow, and olive clayey marl, silty clay, shaly clay, or shale.

## Mingo series

The Mingo series consists of well drained, moderately deep, loamy soils on uplands that formed in interbedded limestone and marl. Slope ranges from 1 to 3 percent.

Typical pedon of Mingo clay loam, 1 to 3 percent slopes; from the intersection of Interstate Highway 35W and North Loop 820 in the city of Fort Worth, this pedon is 0.5 mile west on North Loop 820, 0.5 mile south on Mark IV Parkway, 0.3 mile west on a private road, and 50 feet south from the private road:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong medium blocky structure; extremely hard, very firm, very sticky and plastic; many fine and medium roots; many fine pores; few wormcasts; few fine siliceous pebbles; few black concretions; neutral; clear wavy boundary.

B21t—5 to 13 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; common fine and medium roots; few fine pores; common wormcasts; few fine siliceous pebbles; few black concretions; continuous clay films; neutral; gradual wavy boundary.

B22t—13 to 25 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots mainly confined to ped surfaces; few siliceous pebbles; few black concretions; common coarse slickensides tilted 20 degrees from horizontal; continuous clay films; mildly alkaline; clear wavy boundary.

B23t—25 to 31 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common fine pitted concretions of calcium carbonate; few fine black concretions; few slickensides; common clay films; noncalcareous; moderately alkaline; abrupt smooth boundary.

R—31 to 37 inches; fractured limestone interbedded with material from the upper horizons; few roots in fractures; limestone fragments coated with soft calcium carbonate; limestone is less fractured and indurated as depth increases.

The thickness of the solum to limestone bedrock ranges from 22 to 40 inches. The mollic epipedon is 20 to 40 inches thick.

The A horizon is brown, dark brown, or dark grayish brown. Reaction ranges from neutral to moderately alkaline.

The B2t horizon is reddish brown, brown, or dark brown. The clay content is 35 to 55 percent. Reaction ranges from neutral to moderately alkaline. In many pedons the lower part of the B2t horizon is calcareous.

The R layer is fractured platy limestone that has hardness of more than 3 on Mohs' scale.

## Navo series

The Navo series consists of moderately well drained, deep, loamy soils on uplands. These soils formed in alkaline, clayey sediment. Slope ranges from 1 to 3 percent.

Typical pedon of Navo clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 157 and Interstate Highway 20 in the town of Arlington, this

pedon is 1.4 miles south on Farm Road 157, 400 feet east on Nathan-Lowe Road, and 240 feet south, in a pasture:

A1—0 to 6 inches; brown (10YR 5/3) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; very hard, firm, slightly sticky and plastic; common roots; few wormcasts; few fine black concretions; neutral; clear wavy boundary.

B21t—6 to 12 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; few fine distinct yellowish red mottles; moderate medium blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; few wormcasts; common clay films; few fine black concretions; common vertical streaks of material from upper horizon; neutral; gradual wavy boundary.

B22t—12 to 28 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; common medium distinct reddish brown (5YR 4/4) mottles; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many clay films; few fine black concretions; many slickensides; neutral; gradual wavy boundary.

B23t—28 to 44 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; common medium distinct grayish brown (10YR 5/2) and reddish brown (5YR 4/4) mottles; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many clay films; few fine black concretions; many slickensides; neutral; gradual wavy boundary.

B24t—44 to 66 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; few fine distinct yellowish red mottles; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many clay films; few fine black concretions; many slickensides; few concretions of calcium carbonate; few siliceous pebbles; moderately alkaline; diffuse wavy boundary.

B3—66 to 72 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; common coarse distinct brownish yellow (10YR 6/8) and common medium distinct light gray (N 7/0) mottles; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; few clay flows; many concretions and soft bodies of calcium carbonate; few black concretions; neutral.

The solum ranges from 60 to more than 80 inches in thickness. The depth to soft powdery masses of calcium carbonate ranges from 30 to 80 inches. When the soil is dry, cracks 1 centimeter or more wide form in the upper part of the subsoil.

The A horizon is grayish brown, dark grayish brown, or brown. Reaction ranges from medium acid to neutral.

The B21t, B22t, and B23t horizons are yellowish red, reddish yellow, strong brown, brown, grayish brown, or yellowish brown clay or clay loam with 35 to 55 percent content of clay. Most pedons are mottled in reddish gray, weak red, yellowish red, reddish brown, light reddish brown, grayish brown, or strong brown. Reaction is slightly acid or neutral. The B24t and B3 horizons are reddish brown, grayish brown, light olive brown, light brownish gray, brown, light yellowish brown, or yellow, with few to common reddish, brownish, grayish, or olive mottles. Reaction ranges from slightly acid to moderately alkaline. The lower horizons are calcareous.

In some pedons, the C horizon of shaly clay mottled in shades of red, brown, gray, and olive is below a depth of 60 inches.

## Nimrod series

The Nimrod series consists of moderately well drained, deep, sandy soils on uplands. These soils formed in sandy and loamy sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Nimrod fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 199 and Farm Road 730 in the town of Azle, this pedon is 2.04 miles north on Farm Road 730, 0.3 mile east on Timber Lake Road, and 1,700 feet north:

A1—0 to 10 inches; pale brown (10YR 6/3) fine sand, brown 10YR 5/3) moist; weak medium subangular blocky structure; loose, very friable; many fine and medium roots; slightly acid; clear wavy boundary.

A2—10 to 25 inches; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; few medium faint reddish yellow (7.5YR 7/8) mottles; single grained; loose, very friable; many fine and medium roots; neutral; abrupt wavy boundary.

B21t—25 to 40 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common coarse prominent red (2.5YR 5/6) and many medium distinct light gray (10YR 7/2) mottles; moderate medium blocky structure; very hard, firm; common fine and medium roots; few coarse roots; common patchy clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—40 to 49 inches; light gray (10YR 7/2) sandy clay loam; light brownish gray (10YR 6/2) moist; common prominent red (2.5YR 5/6) and common medium distinct yellow (10YR 7/8) mottles; weak medium prismatic structure; very hard, firm; few fine roots; common clay films on faces of peds; medium acid; gradual wavy boundary.

B23t—49 to 69 inches; coarsely mottled, red (10R 5/6), light gray (10YR 7/2) and yellow (10YR 7/6) sandy clay loam; weak medium prismatic structure; very hard, firm; few fine roots; common thick gray (10YR 6/1) clay films and pockets of uncoated sand on faces of peds; strongly acid; gradual wavy boundary.

B24t—69 to 80 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many

coarse prominent red (10R 5/8) and few medium distinct yellow (10YR 7/6) mottles; weak medium prismatic structure; very hard, firm; few fine roots; common thin clay films and pockets of uncoated sand on faces of peds; strongly acid.

The solum ranges from 60 to 80 inches or more in thickness. The clay content within the control section is 20 to 35 percent.

The A1 horizon is pale brown or light yellowish brown, and the A2 horizon is very pale brown or light yellowish brown. The combined thickness of the A1 and A2 horizons is 20 to 30 inches. Reaction is slightly acid or neutral.

The B2t horizon is light gray, reddish yellow, brownish yellow, or yellowish brown sandy clay loam or clay loam mottled in shades of brown, yellow, red, or gray. Reaction is strongly acid or medium acid.

## Ovan series

The Ovan series consists of moderately well drained, deep, clayey soils on bottom lands. These soils formed in clayey sediment on flood plains. Slope is less than 1 percent.

Typical pedon of Ovan clay, occasionally flooded; from the intersection of Southwest Loop 820 and Vickery Boulevard in the city of Fort Worth, this pedon is 2.42 miles northeast on Vickery Boulevard and 200 feet north, in Ed Collett Park:

A1—0 to 15 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; very hard, very firm, very sticky and plastic; common fine and medium roots; many wormcasts; few fine pebbles of limestone; calcareous; moderately alkaline; clear wavy boundary.

A12—15 to 21 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few wormcasts; many pressure faces; calcareous; moderately alkaline; gradual wavy boundary.

A13—21 to 42 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine concretions of calcium carbonate; many pressure faces; common intersecting slickensides below a depth of 25 inches; calcareous; moderately alkaline; diffuse wavy boundary.

A14—42 to 60 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; common fine faint brown mottles; moderate coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common fine concretions of calcium carbonate; many pressure faces; many intersecting slickensides; calcareous; moderately alkaline; diffuse wavy boundary.

C—60 to 72 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common concretions of calcium carbonate; many pressure faces; many intersecting slickensides; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. When the soil is dry, cracks 1 inch to 3 inches wide extend from the surface to a depth of more than 25 inches. Intersecting slickensides are between a depth of 20 and 30 inches. The soil is calcareous and moderately alkaline throughout.

The A horizon is very dark grayish brown, dark grayish brown, brown, or grayish brown.

The B horizon, where present, is dark grayish brown, grayish brown, brown, or light brownish gray clay or silty clay. Some pedons have brownish mottles.

## Ponder series

The Ponder series consists of moderately well drained, deep, loamy soils on uplands. These soils formed in calcareous, marine sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Ponder clay loam, 1 to 3 percent slopes; from the intersection of Southwest Loop 820 and Old Granbury Road in the city of Fort Worth, this pedon is 3.8 miles south on Old Granbury Road; 0.9 mile east on West Cleburne Road, and 70 feet south:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive when dry, weak fine and medium subangular blocky structure when moist; extremely hard, firm, sticky and plastic; few fine roots; few fine black and brown concretions; slightly acid; abrupt wavy boundary.

B21t—7 to 17 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; weak coarse blocky structure parting to moderate fine blocky; extremely hard, very firm, very sticky and plastic; few fine roots; common pressure faces; patchy clay films; common filled vertical cracks; few fine black concretions; neutral; gradual wavy boundary.

B22t—17 to 47 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, very sticky and plastic; few fine roots; common pressure faces and small slickensides; common clay films; few fine hard pitted concretions of calcium carbonate; few fine black and brown concretions; common filled vertical cracks; mildly alkaline; gradual wavy boundary.

B23t—47 to 53 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common pressure faces and small slickensides; common dark grayish brown vertical streaks; common clay films slightly darker than matrix; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B31ca—53 to 63 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium and fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common clay films; common black concretions; common concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B32ca—63 to 80 inches; very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; few black concretions; many concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The depth to secondary carbonates ranges from 30 to 50 inches. Undisturbed areas have weakly expressed gilgai microrelief. Chert pebbles, small ironstone fragments, and dark concretions are none to few throughout the solum. When the soil is dry, cracks 1 centimeter or more wide form in the upper part of the subsoil.

The A horizon is dark grayish brown or brown. It is 5 to 9 inches thick. Reaction is slightly acid or neutral.

The B21t horizon is mainly brown, yellowish brown, or dark yellowish brown; in places, however, the crest of the subsoil is reddish brown and the center of troughs is dark gray. The texture is clay, silty clay, silty clay loam, or clay loam; content of clay is 35 to 50 percent. Reaction is slightly acid or neutral. The B22t and B23t horizons are dark grayish brown, grayish brown, brown, yellowish brown, or light olive brown. Reddish or brownish mottles are none to common. Reaction ranges from neutral to moderately alkaline. The B3ca horizon is brown, yellowish brown, strong brown, pale brown, light brown, light yellowish brown, reddish yellow, brownish yellow, or very pale brown silty clay loam, silt loam, or clay loam. The calcium carbonate equivalent is 20 to more than 60 percent. Concretions and soft masses of calcium carbonate are common to many.

The C horizon, where present, is brownish, grayish, or whitish, calcareous loamy material that may or may not have weakly cemented chalk strata and limestone fragments.

## Pulexas series

The Pulexas series consists of well drained, deep, loamy soils on bottom lands. These soils formed in recent, loamy alluvial deposits. Slope ranges from 0 to 1 percent.

Typical pedon of Pulexas fine sandy loam, frequently flooded; from the intersection of Texas Highway Spur 103 and North Loop 382 in the town of Grapevine; this pedon is 1.25 miles west on North Loop 382; 1 mile north on Park Boulevard, 0.5 mile west on Dove Street, and 120 yards north, on a flood plain of Jones Branch:

A1—0 to 10 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; common medium faint very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 4/4) mottles; weak fine and medium platy structure; hard, very friable; few fine pores; few thin strata of loam and loamy fine sand with distinct bedding planes; few fine ironstone and siliceous pebbles; neutral; gradual smooth boundary.

C1—10 to 26 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable; common strata of brown (10YR 4/3) loam and thin plates of light yellowish brown (10YR 6/4) fine sandy loam with distinct bedding planes; common ironstone and siliceous pebbles; neutral; gradual smooth boundary.

C2—26 to 33 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; hard, very friable; common strata of brown (10YR 4/3) clay loam 1 inch to 3 inches thick with distinct bedding planes; common ironstone and siliceous pebbles; neutral; gradual smooth boundary.

C3—33 to 64 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, very friable; few thin strata of brown (10YR 4/3) loam; common ironstone and siliceous pebbles; neutral.

The 10- to 40-inch control section is fine sandy loam or loam that is stratified with thin lenses of other textures. The clay content averages 8 to 18 percent. Reaction ranges from slightly acid to mildly alkaline.

The A horizon is grayish brown, brown, pale brown, yellowish brown, or light yellowish brown.

The C horizon is light brownish gray, brown, yellowish brown, or light yellowish brown. It is dominantly fine sandy loam or loam and is stratified with thin lenses of loamy fine sand, sandy clay loam, or clay loam.

## Purves series

The Purves series consists of well drained, shallow, clayey soils on uplands. These soils formed in interbedded fractured limestone and marl. Slope ranges from 0 to 3 percent.

Typical pedon of Purves clay, 0 to 3 percent slopes; from the intersection of South Loop 820 and Hulen Street in the city of Fort Worth, this pedon is 1.3 miles south on Hulen Street and 0.5 mile west:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; extremely hard, friable; many fine and medium roots; common fine and medium pores; calcareous; moderately alkaline; gradual smooth boundary.

A12—7 to 15 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; extremely hard, friable; many fine and medium roots; common fine and medium pores; common concretions of calcium carbonate 1 millimeter to 6 millimeters in diameter; calcareous; moderately alkaline; abrupt smooth boundary.

R—15 to 20 inches; fractured limestone interbedded with thin layers of clayey marl.

The solum is from 8 to 20 inches thick. The clay content makes up 35 to 55 percent and limestone fragments make up as much as 35 percent by volume.

The A horizon is very dark gray, dark gray, very dark grayish brown, dark grayish brown, grayish brown, or brown. In a few places, where the A horizon rests on limestone, it is clay loam.

The R layer is fractured limestone about 4 to 15 inches thick. Below this layer are layers of weakly cemented limestone, marly and clayey material, or limestone rubble. The R layer can usually be cut with conventional ripping equipment.

The Purves soils mapped in Tarrant County are taxadjuncts to the Purves series because they have an R layer that can be ripped and excavated with conventional digging equipment. This is outside the range of the Purves series. Use and management of these soils, however, are the same as for the soils of the Purves series.

## Rader series

The Rader series consists of moderately well drained, deep, loamy soils on uplands. These soils formed in loamy and clayey sediment in terraces and valley fill. Slope ranges from 0 to 3 percent.

Typical pedon of Rader fine sandy loam, 0 to 3 percent slopes; from the intersection of Interstate Highway 20 and U.S. Highway 287 in the town of Arlington, this pedon is 1.25 miles south on the west service road of U.S. Highway 287 and 1,000 feet west, in a pasture:

A1—0 to 12 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine and medium roots; common fine and medium pores; few wormcasts; few fragments of ironstone; slightly acid; clear smooth boundary.

A2—12 to 18 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; slightly hard, very friable; common fine and medium roots; common fine and medium pores; few wormcasts; few fine black concretions; few fragments of ironstone; slightly acid; clear wavy boundary.

B&A—18 to 27 inches; 85 percent B material of light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common medium distinct reddish yellow (7.5YR 6/6) and few medium distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; hard friable; common fine roots; common fine and medium pores; few wormcasts; common clay films on faces of prisms; few fragments of ironstone; about 15 percent A material of light gray (10YR 7/2) fine sandy loam on faces of prisms and in small pockets; slightly acid; clear wavy boundary.

B21t—27 to 35 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; many medium prominent red (2.5YR 4/6) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate coarse blocky structure; very hard, very firm; common fine roots; common fine pores; few wormcasts and channels; many thick grayish brown clay films; few brown concretions; few fragments of ironstone; neutral; gradual smooth boundary.

B22t—35 to 49 inches; light gray (2.5Y 7/2) sandy clay, light brownish gray (2.5Y 6/2) moist; common medium prominent red (2.5YR 4/6) and reddish yellow (7.5YR 6/8) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm; few fine roots; common thick gray clay films on faces of prisms; few black concretions; few fragments of ironstone; strongly acid; gradual smooth boundary.

B23t—49 to 63 inches; distinctly mottled, reddish yellow (7.5YR 6/8) and light gray (2.5Y 7/2) sandy clay, strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) moist; common medium distinct yellowish red (5YR 5/6) and brownish yellow (10YR 6/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots; common thick gray clay films on faces of prisms; few black concretions; few fragments of ironstone; medium acid; gradual smooth boundary.

B3—63 to 69 inches; distinctly mottled, brownish yellow (10YR 6/6) and light gray (2.5Y 7/2) sandy clay loam, yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) moist; common medium distinct yellowish red (5YR 5/6) and yellow (10YR 7/8) mottles; moderate medium prismatic structure parting to weak medium blocky; very hard, firm; few fine roots; common thick light gray (2.5Y 7/2) clay films on faces of prisms; common black concretions and masses; few fragments of ironstone; medium acid.

The solum is more than 60 inches thick. The clay content of the control section is 28 to 35 percent.

The A horizon is loam or fine sandy loam. The A1 horizon is brown or pale brown, and the A2 horizon is light yellowish brown, pale brown, or light brownish gray. Reaction is medium acid or slightly acid.

The B&A horizon is slightly acid or neutral. About 70 to 85 percent by volume is made up of B material that is light yellowish brown, yellowish brown, strong brown, or pale brown sandy clay loam, clay loam, or loam. Few to common mottles in shades of brown, red, and gray are in the interiors of peds. The A material is light gray, white, or very pale brown fine sandy loam. It is in coatings and pockets, intermingled with the B material.

The B21t horizon is light brownish gray, grayish brown, light gray, brown, and yellowish brown clay loam, clay, or sandy clay. It has common to many mottles of these colors and of red, yellowish red, strong brown, and olive yellow. Reaction ranges from medium acid to neutral.

The B22t horizon is light brownish gray, grayish brown, light gray, brown, and yellowish brown sandy clay, clay, or clay loam. It has common to many mottles of these colors and of red, yellowish red, strong brown, reddish yellow, and olive yellow. Reaction ranges from strongly acid to neutral.

The B23t and B3 horizons are sandy clay, sandy clay loam, or clay. They are mottled in shades of gray, yellow, and brown. Reaction is strongly acid or moderately alkaline. Concretions of calcium carbonate are in some B3 horizons.

The Rader soils mapped in Tarrant County are taxadjuncts to the Rader series because they have B&A and B21t horizons that are slightly more alkaline than the range of the official Rader series. These soils, however, are similar in use, management, and behavior to the soils of the Rader series.

## Rayex series

The Rayex series consists of well drained, shallow, sloping to moderately steep soils on uplands. These soils formed in weakly cemented sandstone. Slope ranges from 5 to 15 percent.

Typical pedon of Rayex gravelly fine sandy loam in an area of Birome-Aubrey-Rayex complex, 5 to 15 percent slopes; from the intersection of Texas Highway Spur 103 and North Loop 382 in the town of Grapevine, this pedon is 0.6 mile west on North Loop 382; 1.6 miles north on Dove Road, 0.24 mile west, and 450 feet south, in a wooded area:

A1—0 to 5 inches; brown (7.5YR 5/4) gravelly fine sandy loam, dark brown (7.5YR 4/4) moist; moderate fine and medium granular structure; slightly hard, very friable; many fine, medium, and large roots; common wormcasts; about 15 percent by volume fragments of ironstone and sandstone as much as 3 inches in diameter; neutral; clear smooth boundary.

B2t—5 to 14 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable, common fine and medium roots; many medium and large pores; common wormcasts; few ironstone pebbles; common fragments of brittle sandstone 1 centimeter to 3 centimeters in diameter; medium acid; abrupt gradual boundary.

Cr—14 to 40 inches; brownish yellow (10YR 6/6) and yellowish red (5YR 4/6) stratified sandstone; hardness of less than 3 on Mohs' scale; many thick clay films coat sandstone fractures; medium acid.

The thickness of the solum and the depth to fractured sandstone range from 10 to 20 inches. Fragments of sandstone and ironstone are common throughout.

The A horizon is brown and is slightly acid or neutral. It is 4 to 8 inches thick.

The B2t horizon is yellowish red, reddish brown, reddish yellow, or red clay loam, sandy clay, or clay that is 35 to 50 percent content of clay. Reaction is medium acid or strongly acid.

The Cr horizon is brownish yellow or yellowish red, fractured and stratified, weakly cemented sandstone.

## Sanger series

The Sanger series consists of well drained, deep, cyclic, clayey soils on uplands. These soils formed in alkaline, clayey marine sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Sanger clay, 1 to 3 percent slopes; from the intersection of Lakeway Drive and U.S. Highway 377 in the town of Benbrook, this pedon is 0.7 mile south on U.S. Highway 377 and 110 feet east of right-of-way, in a pasture in the center of a microknoll:

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong medium blocky structure; extremely hard, very firm, very sticky and plastic; many fine and very fine roots; common wormcasts and channels; few fragments of limestone 2 to 25 millimeters in diameter; few fine black and brown concretions; calcareous; moderately alkaline; abrupt smooth boundary.

A11—4 to 10 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate medium and fine blocky structure; extremely hard, very firm, very sticky and plastic; common fine and very fine roots; common wormcasts and channels; few hard fragments of limestone 2 to 10 millimeters in diameter; few black and brown concretions; calcareous; moderately alkaline; gradual wavy boundary.

A12—10 to 20 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky and subangular blocky

structure; extremely hard, very firm, very sticky and plastic; few fine roots; common wormcasts and channels; few fragments of limestone 2 to 20 millimeters in diameter; common fine concretions of calcium carbonate; few fine black concretions; common pressure faces; calcareous; moderately alkaline; clear wavy boundary.

AC1—20 to 31 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few fine roots; few wormcasts and channels; few fragments of limestone 2 to 50 millimeters in diameter; common fine concretions of calcium carbonate; few brown and black concretions; common coarse intersecting slickensides; calcareous; moderately alkaline; clear wavy boundary.

AC2—31 to 49 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate coarse blocky and moderate medium subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common coarse grooved slickensides; few vertical cracks filled with material from above; common fine concretions and soft masses of calcium carbonate; few fragments of limestone 2 to 50 millimeters in diameter; few black and brown concretions; calcareous; moderately alkaline; clear wavy boundary.

AC3—49 to 59 inches; light yellowish brown (10YR 6/4) silty clay, brown (10YR 5/3) moist; common medium distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; hard, firm, sticky and plastic; few very fine roots; many fine concretions and soft masses of calcium carbonate; common rounded coated limestone pebbles 1 centimeter to 8 centimeters in diameter; few fine brown concretions; calcareous; moderately alkaline; clear smooth boundary.

C—59 to 80 inches; light yellowish brown (10YR 6/4) silty clay yellowish brown (10YR 5/4) moist; common medium faint brown (10YR 5/3) and common medium distinct strong brown (7.5YR 5/6) mottles; massive; hard, firm; few fine roots; few fine pores; common limestone fragments 2 to 5 centimeters in diameter; few fine black and brown concretions; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. The texture is clay or silty clay throughout. Intersecting slickensides begin at a depth of 16 to 24 inches. When the soil is dry, cracks 1 inch to 2 inches wide extend to a depth of 20 inches or more. Cycles of microdepressions and microknolls are repeated every 10 to 22 feet across the slope. In some microdepressions the upper 12 inches of the soil is noncalcareous and is mildly alkaline or moderately alkaline. In more than half of each pedon, the calcium carbonate equivalent is 40 to 60 percent in some parts of the 10- to 40-inch control section.

The A horizon is very dark grayish brown, dark gray, dark grayish brown, or grayish brown. Where chroma is less than 2, the surface layer is less than 12 inches thick in more than half of the pedon.

The AC1 horizon is grayish brown, brown, light brownish gray, light yellowish brown, light olive brown, or very pale brown. Mottles of brownish yellow, olive yellow, or yellow range from none to few. The AC2 and AC3 horizons are grayish brown, pale brown, light brownish gray, yellowish brown, light yellowish brown, olive yellow, or very pale brown. Mottles in shades of gray or yellow range from few to common. Concretions and soft masses of calcium carbonate range from few to many throughout the AC2 and AC3 horizons.

The C horizon is clay, silty clay, or shaly clay and is mottled in shades of brown, gray, and yellow. Some pedons have remnants of limestone.

## San Saba series

The San Saba series consists of moderately well drained, moderately deep, clayey soils on uplands. These soils formed in clayey sediment underlain by limestone. Slope ranges from 0 to 2 percent.

Typical pedon of San Saba clay, 0 to 2 percent slopes; from the intersection of Old Grandbury Road and Southwest Loop 820 in the city of Fort Worth, this pedon is 3.9 miles south on Old Grandbury Road, 0.5 mile west, 1 mile south, and 360 feet west, in a cultivated field:

Ap—0 to 4 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; common wormcasts; few fine brown concretions; few fine rounded concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A12—4 to 16 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium subangular blocky and fine angular blocky structure; extremely hard, very firm, very sticky and plastic; few roots; few wormcasts; few fine black concretions; few fragments of limestone and pitted concretions of calcium carbonate as much as 1 centimeter in diameter; common shiny ped faces; calcareous; moderately alkaline; gradual wavy boundary.

A13—16 to 24 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; common medium faint very dark grayish brown (2.5Y 3/2) mottles; moderate coarse blocky structure parting to moderate fine and medium blocky; extremely hard, very firm, very sticky and plastic; few fine roots; few fine black concretions; few fine fragments of limestone and concretions of calcium carbonate; common intersecting slickensides with grooved shiny faces; calcareous; moderately alkaline; gradual wavy boundary.

AC—24 to 30 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common fragments of limestone; common vertical cracks filled with very dark gray clay; common grooved intersecting slickensides; calcareous; moderately alkaline; abrupt smooth boundary.
R—30 to 36 inches; hard fractured limestone.

The solum is 24 to 40 inches thick and overlies hard limestone rock. The texture is clay that has 45 to 60 percent clay content. When the soil is dry, cracks 1 inch to 3 inches wide extend to a depth of 20 inches or more. Native areas have gilgai microrelief of microknolls and microdepressions. The microknolls are 3 to 6 inches higher than the microdepressions, and the center of the microknoll is 6 to 12 feet from the center of the microdepression. Fragments of limestone make up as much as 5 percent of some pedons.

The Ap and A1 horizons are very dark gray or dark gray. They are mildly alkaline or calcareous and moderately alkaline.

The AC horizon is dark gray, gray, grayish brown, or dark grayish brown. There are none to a few mottles of dark grayish brown and very dark grayish brown.

The R layer is coarsely fractured indurated limestone.

## Selden series

The Selden series consists of moderately well drained, deep, sandy soils on uplands. These soils formed in loamy sediment. Slope ranges from 1 to 3 percent.

Typical pedon of Selden loamy fine sand, 1 to 3 percent slopes; from the intersection of Texas Highway 199 and Farm Road 730 in the town of Azle, this pedon is 2.04 miles north on Farm Road 730, 1.7 miles east on Timber Lake Road, 0.3 mile east on Sandy Beach Road, 0.5 mile south on Power Squadron Road, and 700 feet southeast:

A1—0 to 8 inches; light yellowish brown (10YR 6/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine and medium roots; neutral; clear smooth boundary.
A2—8 to 14 inches; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; weak fine granular structure; slightly hard, very friable; common fine and medium roots; neutral; clear wavy boundary.
B21t—14 to 23 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; few medium distinct red (2.5YR 5/8) and common medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; very hard, firm; few fine roots; common clay films on faces of peds; slightly acid; gradual smooth boundary.
B22t—23 to 35 inches; yellowish brown (10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; common medium distinct red (2.5YR 5/6) and light gray (10YR 7/2) mottles; weak medium subangular blocky structure; very hard, firm; few fine roots; common clay films on faces of peds; few fine black concretions; medium acid; gradual smooth boundary.
B23t—35 to 43 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common medium distinct red (2.5YR 4/6), light gray (10YR 7/2), and reddish yellow (7.5YR 7/8) mottles; weak medium prismatic structure parting to weak medium blocky; very hard, firm; few fine roots; common clay films on faces of peds; common medium black concretions; medium acid; gradual smooth boundary.
B24t—43 to 65 inches; coarsely mottled, red (2.5YR 4/6), light gray (10YR 7/2), and reddish yellow (7.5YR 7/8) sandy clay loam; weak medium prismatic structure parting to weak medium blocky; very hard, firm; few fine roots; common clay films on faces of peds; strongly acid.

The solum ranges from 60 to more than 80 inches in thickness. The clay content within the control section is 22 to 35 percent.

The A horizon is loamy fine sand or fine sand and ranges from 8 to 20 inches in thickness. The A1 horizon is pale brown, yellowish brown, light yellowish brown, or brown. The A2 horizon is light yellowish brown or very pale brown loamy fine sand. Reaction is slightly acid or neutral.

The B2t horizon is brownish yellow, yellowish brown, reddish yellow, or yellowish red sandy clay loam or clay loam. The B22t, B23t, and B24t horizons have varying amounts of red, pale brown, light gray, or reddish yellow mottles, or they are light gray and have medium or coarse mottles of yellow and red. Reaction ranges from strongly acid to slightly acid.

## Silawa series

The Silawa series consists of well drained, deep, loamy soils on uplands. These soils formed in sandy and loamy deposits on ancient stream terraces. Slope ranges from 3 to 8 percent.

Typical pedon of Silawa fine sandy loam, 3 to 8 percent slopes; from the intersection of Texas Highway 199 and Farm Road 730 in the town of Azle, this pedon is 2.04 miles north on Farm Road 730, 0.75 mile east on Timber Lake Road, 0.51 mile south on Meridian Street, and 800 feet south, in a Girl Scout Camp:

A1—0 to 6 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable; many fine and medium roots; common wormcasts; common fine and medium pores; slightly acid; clear smooth boundary.

B21t—6 to 21 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, firm; common fine and medium roots; common wormcasts; common fine and medium pores; common thin clay films on faces of peds; medium acid; gradual smooth boundary.
B22t—21 to 46 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine and medium roots; common fine and medium pores; few thin patchy clay films on faces of peds; medium acid; diffuse wavy boundary.
B3—46 to 60 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; hard, firm; few fine roots; many fine and medium pores; few patchy clay films; sand grains bridged and coated; few streaks of uncoated sand grains; slightly acid.

The solum ranges from 40 to more than 72 inches in thickness. Medium and coarse siliceous and ironstone pebbles make up 0 to 10 percent of the solum. The clay content within the control section is 18 to 35 percent.

The A horizon is brown, dark yellowish brown, light brown, or pink. It is 4 to 18 inches thick.

The B2t horizon is reddish brown, red, yellowish red, or reddish yellow fine sandy loam or sandy clay loam. Reaction ranges from strongly acid to slightly acid. The B3 horizon is red, yellowish red, reddish yellow, or strong brown sandy clay loam, fine sandy loam, or loamy fine sand. Reaction ranges from strongly acid to slightly acid.

The C horizon is yellowish red, reddish yellow, or strong brown gravelly loamy sand, fine sandy loam, or loamy fine sand. Reaction ranges from strongly acid to slightly acid.

## Silstid series

The Silstid series consists of well drained, deep, sandy soils on uplands. These soils formed in material weathered from sandy and loamy sediment on uplands and high terraces. Slope ranges from 1 to 5 percent.

Typical pedon of Silstid loamy fine sand, 1 to 5 percent slopes; from the intersection of Northwest Loop 382 and Texas Highway 114 in the town of Grapevine, this pedon is 4 miles northwest of Texas Highway 114, 1.14 miles west on Dove Road, 0.55 mile south on a county road, and 300 feet south, in a pasture:

A1—0 to 9 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; many fine, medium, and coarse roots; few ironstone pebbles; slightly acid; clear wavy boundary.
A2—9 to 27 inches; very pale brown (10YR 7/4) loamy fine sand, brownish yellow (10YR 6/6) moist; weak fine granular structure; soft, very friable; common fine and medium roots; few ironstone pebbles; slightly acid; clear smooth boundary.
B21t—27 to 38 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/6) moist; common medium distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; hard, firm; few medium roots; few fine and medium pores; common clay films on faces of peds; few ironstone pebbles; medium acid; gradual smooth boundary.
B22t—38 to 53 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/8) moist; common medium prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; hard, firm; few medium roots; common clay films on faces of peds; few ironstone pebbles; medium acid; gradual smooth boundary.
B23t—53 to 67 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; many coarse prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; hard, firm; few medium roots; common clay films on faces of peds; few light gray clay flows and uncoated sand grains; common ironstone pebbles; strongly acid; gradual smooth boundary.
B3—67 to 74 inches; reddish yellow (7.5YR 7/6) fine sandy loam, strong brown (7.5YR 5/6) moist; common medium distinct red (2.5YR 4/6) mottles; weak medium subangular blocky structure; slightly hard, friable; common fine and medium pores; few streaks of uncoated sand; medium acid.

The solum is from 60 to more than 75 inches thick.

The A1 horizon is pale brown, brown, yellowish brown, dark brown, light yellowish brown, or very pale brown. The A2 horizon is very pale brown or light yellowish brown and ranges from medium acid to neutral. The combined thickness of the A1 and A2 horizons ranges from 20 to 36 inches. Reaction ranges from medium acid to neutral throughout.

The Bt horizon is sandy clay loam that is 18 to 30 percent clay. It is brownish yellow, reddish yellow, strong brown, or yellowish red. Most pedons have mottles of yellowish red, reddish yellow, red, pale brown, or strong brown. The red mottles increase as depth increases. Light gray clay flows and pockets and streaks of uncoated sand are below a depth of 50 inches. Reaction ranges from strongly acid to slightly acid. Where the B3 horizon is present, it is fine sandy loam or sandy loam. Reaction is strongly acid or medium acid.

## Slidell series

The Slidell series consists of well drained, deep, cyclic, clayey soils on uplands that formed in alkaline, marine sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Slidell clay, 1 to 3 percent slopes; from South Loop 820 and Old Granbury Road in the

southwest part of Fort Worth, 3.9 miles south, 0.5 mile west, and 0.2 mile south on Old Granbury Road, and 220 feet west on right-of-way, in the center of a microdepression in rangeland:

A11—0 to 4 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; many fine and very fine roots; many wormcasts; calcareous; moderately alkaline; abrupt smooth boundary.

A12—4 to 22 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; common wormcasts; few fine siliceous pebbles; common intersecting slickensides below a depth of 16 inches; calcareous; moderately alkaline; gradual wavy boundary.

A13—22 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine fragments of limestone; few vertical cracks; common intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

AC1—32 to 58 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few concretions of calcium carbonate 2 millimeters to 3 centimeters in diameter; common grooved intersecting slickensides; common vertical cracks filled with material from upper horizons; calcareous; moderately alkaline; gradual wavy boundary.

AC2—58 to 70 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium and coarse angular blocky structure; hard, firm, sticky and plastic; few very fine roots; common fine concretions of calcium carbonate; fragments of limestone 1 millimeter to 2 centimeters in diameter; few intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

C—70 to 80 inches; light brownish gray (10YR 6/2) silty clay; many fine and medium brownish yellow (10YR 6/6) and olive yellow (2.5Y 6/6) mottles; massive; hard, firm, sticky and plastic; many concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The texture is silty clay or clay throughout. When the soil is dry, cracks 1 inch to 3 inches wide extend to a depth of more than 20 inches. Intersecting slickensides begin at a depth of between 16 and 25 inches. In more than half of each pedon the calcium carbonate equivalent is from 40 to 60 percent in some parts of the 10- to 40-inch control section. Cycles of microdepressions and microknolls occur every 10 to 20 feet. In native areas, the microknolls are 3 to 16 inches higher than the microdepressions. The soil is calcareous and moderately alkaline, but in some microdepressions the upper 12 inches is noncalcareous and is mildly alkaline or moderately alkaline.

The A horizon is very dark gray or dark gray. The AC1 horizon is dark grayish brown, grayish brown, brown, or light yellowish brown. Mottles of olive brown, brown, yellowish brown, or brownish yellow are none to common. The AC2 horizon is grayish brown, brown, light yellowish brown, very pale brown, or pale yellow. Mottles of dark grayish brown, yellowish brown, grayish brown, brownish yellow, or yellow are few to common.

The C horizon is pale brown or light brownish gray and is mottled with olive brown, gray, brownish yellow, olive yellow, or yellow. In some pedons, fragments of limestone are interbedded with marly silty clay or silty clay loam.

## Speck series

The Speck series consists of well drained, shallow, loamy soils on uplands. These soils formed in clayey material weathered from indurated limestone. Slope ranges from 0 to 3 percent.

Typical pedon of Speck clay loam, 0 to 3 percent slopes; from the intersection of Farm Road 1187 and Farm Road 731 in the town of Crowley, this pedon is 1.12 miles north of Farm Road 731 and 150 feet east, in a cultivated field.

Ap—0 to 7 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; common roots; few wormcasts; few subrounded ironstone pebbles as much as 5 millimeters in diameter; few very fine fragments of limestone; slightly acid; clear smooth boundary.

B2t—7 to 15 inches; dark reddish brown (5YR 3/3) clay, dry and moist; moderate fine blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common clay films on faces of peds; common angular and subrounded pebbles of ironstone as much as 6 millimeters in diameter; mildly alkaline; abrupt wavy boundary.

R—15 to 29 inches; limestone bedrock, fractured in upper part; soil material in fractures; hardness of 3 or more on Mohs' scale; calcareous; calcium carbonate coating in fractures.

The solum is 14 to 20 inches thick over limestone bedrock. Reaction ranges from slightly acid to mildly alkaline.

The A horizon is reddish brown or brown.

The B2t horizon is reddish brown or dark reddish brown clay. Calcium carbonate occurs as coatings on the surfaces of fragments and in fractures.

The R layer is hard limestone that is fractured in the upper part.

## Stephenville series

The Stephenville series consists of well drained, moderately deep, loamy soils on uplands. These soils formed in weakly cemented sandstone. Slope ranges from 8 to 15 percent.

Typical pedon of Stephenville fine sandy loam, 8 to 15 percent slopes; from the intersection of Farm Road 1886 and Texas Highway 199 in the town of Lakeside, this pedon is 2.81 miles northwest on Texas Highway 199, 0.19 mile north on a county road, 0.6 mile northeast on a county road, and 320 feet east, in a wooded area:

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; common fine and medium roots; few wormcasts; neutral; clear smooth boundary.

A2—6 to 11 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; common fine and medium roots; few wormcasts; medium acid; clear smooth boundary.

B21t—11 to 27 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; hard, friable; common fine and medium roots; common fine and medium pores; few wormcasts and channels; clay films on faces of peds; strongly acid; gradual wavy boundary.

B22t—27 to 32 inches; very pale brown (10YR 8/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine and medium roots; few patchy clay films on faces of peds and bridging sand grains; common fragments of weakly cemented sandstone; strongly acid; gradual irregular boundary.

Cr—32 to 50 inches; white (10YR 8/2), weakly cemented fractured sandstone; very pale brown (10YR 7/3) moist; few fine distinct yellow (10YR 7/6) mottles; few roots in fractures; sandstone easy to penetrate with spade when moist; medium acid.

The solum is 20 to 40 inches thick.

The A1 horizon is brown, dark grayish brown, or grayish brown. Reaction is slightly acid or neutral. The A2 horizon is brown, grayish brown, pale brown, light yellowish brown, or very pale brown fine sandy loam or loamy fine sand. Reaction ranges from strongly acid to slightly acid.

The B2t horizon is light yellowish brown, very pale brown, yellow, or reddish yellow fine sandy loam or sandy clay loam. Reaction ranges from strongly acid to slightly acid.

The Cr horizon is white, very pale brown, or yellow sandstone that is weakly cemented when it is moist and strongly cemented when it is dry. Stratified, loose unconsolidated packsand underlies the sandstone.

The Stephenville soils mapped in Tarrant County are taxadjuncts to the Stephenville series because they have hues of 7.5YR and 10YR in the B2t horizon. These colors are outside the range of the Stephenville series. Use, management, and behavior of these soils, however, are similar to the soils of the Stephenville series.

## Sunev series

The Sunev series consists of well drained, deep, loamy soils on uplands. These soils formed in alkaline, loamy material on colluvial foot slopes and on deposits on ancient stream terraces. Slope ranges from 1 to 8 percent.

Typical pedon of Sunev clay loam, 3 to 8 percent slopes; from the intersection of Interstate Highway 35W and South Loop 820 in the city of Fort Worth, this pedon is 5.59 miles west on South Loop 820, 0.45 mile northeast and east on a private road, and 60 feet east, in rangeland:

A11—0 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; hard, friable; many fine and medium roots; common fine and medium pores; common wormcasts; few fragments of snail shells; few fine concretions of calcium carbonate; few fragments of limestone as much as 1 centimeter in diameter; calcareous; moderately alkaline; gradual smooth boundary.

A12—9 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong fine and medium blocky structure; hard, friable; common fine and medium roots; common fine and medium pores; common wormcasts; few fragments of snail shells; common concretions of calcium carbonate; few films and threads of calcium carbonate; common fragments of limestone as much as 2 centimeters in diameter; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—15 to 26 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; common fine and medium pores; common wormcasts; few fine fragments of snail shells; common films and threads of calcium carbonate; common concretions of calcium carbonate as much as 1 centimeter in diameter; about 54 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear smooth boundary.

B3ca—26 to 63 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; strong very

fine and fine subangular blocky structure; hard, friable; common fine roots; common fine and medium pores; common wormcasts; few fine fragments of snail shells; many films, threads, concretions, and soft powdery masses of calcium carbonate; about 60 percent calcium carbonate equivalent; common fragments of limestone as much as 2 centimeters in diameter; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. Siliceous and limestone pebbles are 0 to 15 percent by volume throughout. The calcium carbonate equivalent ranges from 40 to 70 percent between a depth of 10 and 40 inches.

The A horizon is dark grayish brown, dark brown, brown, or grayish brown.

The B2ca and B3ca horizons are brown, pale brown, very pale brown, yellowish brown, reddish yellow, or light yellowish brown loam, clay loam, or silty clay loam. Films and threads of soft calcium carbonate are common to many.

Where the C horizon is present, it is very pale brown or reddish yellow fine sandy loam, loam, or clay loam. Some pedons on stream terraces are underlain by gravel.

## Trinity series

The Trinity series consists of somewhat poorly drained, deep, clayey soils on flood plains. These soils formed in alkaline, clayey alluvial sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Trinity clay, frequently flooded; from the intersection of East Loop 820 and Trinity Boulevard in the city of Fort Worth, 4.38 miles east on Trinity Boulevard, 0.32 mile south on Arlington-Bedford Road, and 400 feet east of a county road, in a field:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; few fragments of snail shells; few fine black concretions; calcareous; moderately alkaline; abrupt smooth boundary.

A12—6 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium angular blocky and moderate fine angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; few fragments of snail shells; few fine black concretions; many intersecting slickensides; calcareous; moderately alkaline; diffuse wavy boundary.

A13—32 to 63 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium distinct very dark grayish brown (10YR 3/2) mottles; moderate fine and coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fragments of snail shells; few fine black concretions; few concretions of calcium carbonate; many intersecting slickensides; calcareous; moderately alkaline.

The solum ranges from 60 to more than 75 inches in thickness. The clay content is 60 to 75 percent throughout. When the soil is dry, cracks 1 inch to 4 inches wide extend to a depth of more than 20 inches. Intersecting slickensides begin at a depth below 24 inches. Cycles of microdepressions and microknolls are present, and in undisturbed areas the microknolls are 2 to 6 inches higher than the microdepressions.

The A horizon is very dark gray or dark gray. Some pedons are gray or dark grayish brown below a depth of 30 inches, and some pedons have few to common brownish or yellowish mottles.

## Weatherford series

The Weatherford series consists of well drained, deep, loamy soils on uplands. These soils formed in weakly cemented sandstone interbedded with packsand. Slope ranges from 3 to 8 percent.

Typical pedon of Weatherford fine sandy loam, 3 to 8 percent slopes; from the intersection of Texas Highway 199 and Farm Road 730 in the town of Azle, this pedon is 4.7 miles north on Farm Road 730 and 100 feet east, in a wooded area:

A1—0 to 3 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable; many fine and medium roots; few wormcasts; few fragments of sandstone on surface; neutral; clear smooth boundary.

A2—3 to 6 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; many fine and medium roots; few wormcasts; slightly acid; abrupt smooth boundary.

B21t—6 to 15 inches; yellowish red (5YR 5/8) clay loam, yellowish red (5YR 4/8) moist; moderate medium blocky structure; very hard, firm; common fine roots; few worm channels; many thick clay films; medium acid; gradual smooth boundary.

B22t—15 to 23 inches; light red (2.5YR 6/8) sandy clay loam, red (2.5YR 5/8) moist; moderate coarse prismatic structure; very hard, firm; common fine roots; many thick clay films; medium acid; gradual smooth boundary.

B23t—23 to 30 inches; reddish yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; common fine roots; many thick clay films with few fine uncoated sand grains between faces of prisms; medium acid; gradual smooth boundary.

B24t—30 to 51 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common medium faint strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; very hard, firm; few fine roots; many fine and medium pores; common reddish brown and light gray clay films; few uncoated light gray sand grains on faces of prisms; medium acid; gradual smooth boundary.

Cr—51 to 60 inches; stratified, pink (7.5YR 7/4) and white (10YR 8/2) packsand and weakly cemented sandstone; common medium distinct reddish yellow (7.5YR 6/6) mottles; massive; hard when dry but becomes friable upon moistening; few reddish brown clay flows in upper part; slightly acid.

The solum ranges from 40 to 60 inches in thickness. The clay content within the control section is 22 to 35 percent.

The A1 horizon is pale brown, brown, or grayish brown. The A2 horizon has value and chroma 1 or 2 units lighter in color than the A1 horizon. The thickness of the A horizon is 6 to 12 inches. Reaction ranges from medium acid to neutral.

The B2t horizon is red, yellowish red, reddish yellow, or light red sandy clay loam or clay loam. In some pedons, yellowish or brownish mottles are in the lower part of the horizon. Reaction is strongly acid or medium acid.

The Cr horizon is pink or white, weakly cemented sandstone interbedded with packsand that hardens when it is dry.

## Whitesboro series

The Whitesboro series consists of moderately well drained, deep, loamy soils on bottom lands. These soils formed in loamy alluvial sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Whitesboro loam, frequently flooded; from the intersection of Texas Highway 114 and Texas Highway 121A (Farm Road 157) in the town of Grapevine, this pedon is 1.3 miles south on Texas Highway 121A, 0.5 mile west on a county road, and 600 feet south, in a flood plain of Big Bear Creek:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; common roots; few wormcasts and channels; few fine black concretions; slightly acid; clear smooth boundary.

A12—6 to 14 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; common medium faint brown (10YR 5/3) mottles; moderate fine and medium blocky structure; hard, firm; common roots; common wormcasts and channels; common fine and medium pores; few fine black concretions; slightly acid; gradual smooth boundary.

A13—14 to 26 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; hard, firm; few roots; few wormcasts; few fine black concretions; neutral; gradual smooth boundary.

B21—26 to 36 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; common medium distinct dark yellowish brown (10YR 4/4) mottles; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; few wormcasts; few fine pores; few fine and medium black concretions; mildly alkaline; diffuse smooth boundary.

B22—36 to 61 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; hard, firm; few fine roots; few fine and medium pores; few fine and medium black concretions; mildly alkaline; diffuse smooth boundary.

B23—61 to 80 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very hard, firm; few fine roots; common medium black concretions; mildly alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The mollic epipedon is 20 to 50 inches thick. The clay content of the control section is 22 to 35 percent.

The A horizon is dark gray, dark grayish brown, dark brown, or very dark gray. There are few to common mottles in shades of gray or brown at a depth of 40 inches. The A12 and A13 horizons are loam or clay loam. Reaction ranges from slightly acid to mildly alkaline.

The B horizon is gray, grayish brown, brown, or dark grayish brown loam, clay loam, or sandy clay loam mottled in shades of gray, brown, or yellow. Reaction ranges from neutral to moderately alkaline.

## Wilson series

The Wilson series consists of somewhat poorly drained, deep, loamy soils on uplands. These soils formed in clayey sediment. Slope ranges from 0 to 2 percent.

Typical pedon of Wilson clay loam, 0 to 2 percent slopes; from the intersection of Texas Highway 121 and Old Grapevine Road in the town of Grapevine, 1 mile east on Old Grapevine Road and 300 feet north, in a pasture:

A1—0 to 6 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak medium granular

structure when moist; massive when dry; very hard, firm, sticky and plastic; common fine and medium roots; common wormcasts and channels; few fine siliceous pebbles; slightly acid; clear wavy boundary.

B21tg—6 to 17 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate medium blocky structure; very hard, firm, sticky and plastic; few fine and medium roots; common wormcasts and channels; many fine and medium pores; common clay films; few fine siliceous pebbles; slightly acid; gradual wavy boundary.

B22tg—17 to 42 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine and medium pores; many thick clay films; few fine siliceous pebbles; slightly acid; gradual wavy boundary.

B23tg—42 to 56 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common medium distinct reddish brown (5YR 4/4) mottles; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; many clay films; common pressure faces; common vertical cracks filled with darker soil material; few fine siliceous pebbles; few fine black concretions; slightly acid; gradual wavy boundary.

B3g—56 to 75 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common medium distinct light olive brown (2.5Y 5/4) mottles; few fine roots; few fine siliceous pebbles; few fine concretions of calcium carbonate; few fine and medium black concretions; common pressure faces; neutral.

The solum is 60 inches or more thick. The control section is 35 to 50 percent clay. When the soil is dry, cracks 1 centimeter or more wide form in the upper part of the subsoil.

The A horizon is very dark gray, dark gray, dark grayish brown, or grayish brown. Reaction ranges from medium acid to neutral.

The B21tg horizon is very dark gray, dark gray, or black clay or clay loam. Reaction ranges from medium acid to mildly alkaline. The B22tg, B23tg, and B3g horizons are dark gray, gray, grayish brown, light brownish gray, or light olive gray clay. Some pedons have olive, brownish, or yellowish mottles. Some pedons have few to common concretions of calcium carbonate. This horizon ranges from neutral to moderately alkaline and calcareous.

## Windthorst series

The Windthorst series consists of moderately well drained, deep, loamy soils on uplands. These soils formed in loamy and clayey material grading to weakly cemented packsand. Slope ranges from 1 to 8 percent.

Typical pedon of Windthorst fine sandy loam, 3 to 8 percent slopes; from the intersection of Texas Highway 199 and Farm Road 730 in the town of Azle, this pedon is 3.65 miles north on Farm Road 730, 0.9 mile east on Peden Road, and 300 feet south, in a pasture:

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; many fine and medium roots; medium acid; abrupt smooth boundary.

B21t—7 to 18 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine and medium roots; common thick clay films; medium acid; gradual smooth boundary.

B22t—18 to 31 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; common medium distinct reddish yellow (7.5YR 6/6) and brownish yellow (10YR 6/6) mottles; moderate medium angular blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots; common thick clay films; slightly acid; gradual smooth boundary.

B23t—31 to 56 inches; yellowish red (5YR 5/8) clay, red (2.5YR 4/8) moist; many coarse distinct red (10R 4/6) and reddish yellow (7.5YR 6/6) mottles; moderate medium angular blocky structure; extremely hard, firm, very sticky and plastic; common fine roots; many thick clay films; medium acid; diffuse wavy boundary.

C—56 to 80 inches; reddish yellow (7.5YR 7/6) fine sandy loam, reddish yellow (7.5YR 6/6) moist; common medium distinct yellowish red (5YR 5/6) mottles; massive; hard, friable; few fine roots; few thin clay flows in upper part; mildly alkaline.

The solum ranges from 35 to 60 inches in thickness. The control section is 35 to 50 percent clay.

The A1 or Ap horizon is brown, yellowish brown, dark grayish brown, or light yellowish brown. Where an A2 horizon is present, it has value and chroma 1 or 2 units higher than the A1 horizon. Reaction ranges from medium acid to neutral. Thickness of the A horizon is 2 to 13 inches.

The B21t horizon is red or yellowish red clay, sandy clay, or clay loam. Reaction is medium acid or slightly acid. The B22t and B23t horizons are red, reddish brown, or yellowish red clay, sandy clay, or sandy clay loam and have reddish, yellowish, brownish, or grayish mottles. Reaction ranges from medium acid to neutral.

Where the B3 horizon is present, it is sandy clay loam or clay loam and is prominently mottled with red, yellowish red, reddish yellow, brownish yellow, pale brown, strong brown, or yellow. Reaction ranges from

medium acid to moderately alkaline, and the soil is calcareous. Lenses or films of sandy loam and fragments of sandstone are in some pedons. Films or threads or soft masses of calcium carbonate are in some horizons.

The C horizon is massive clay, stratified sandy clay loam and clay, or stratified sandy loam and weakly cemented sandstone. Calcium carbonate is in the upper part of some pedons. Reaction ranges from medium acid to moderately alkaline, and the soil is calcareous.

# geology

Roy B. Fields, Jr., geologist, Soil Conservation Service, assisted in preparing this section.

Except for the sediment of the Quaternary age, which is above and in the flood plains, the geologic formations in Tarrant County are of the Cretaceous age (fig. 24). These formations lie in more or less parallel bands or outcrops extending across the county in a north-north-easterly direction. The stratigraphic units are oldest in the northwest corner of the county, and are progressively younger to the southeast.

The Paluxy Sand is the oldest unit (see geology table) in the county. It is more than 100 million years old. This formation ranges from 140 to 190 feet in thickness and is a secondary aquifer. It is capable of furnishing water to households, small cities, and various industries. Soils that formed within this outcrop are the Weatherford, Windthorst, Nimrod, and Selden soils.

Formations of the Fredericksburg Group are the next oldest. They are in the northwestern and western parts of the county. These formations consist of limestone, shell agglomerate, and clay shale. In some places; sandstone occurs within the upper 40 feet. The maximum thickness of the Fredricksburg Group is approximately 175 feet. Soils that formed over these formations are the Aledo, Brackett, Bolar, Maloterre, Purves, and Sunev soils.

Formations of the Washita Group are next in age. They are in the west-central and central parts of the county. These formations consist of alternating beds of limestone, shale, and clay shale. Amounts of shell agglomerate and numerous fossils occur throughout this group. The maximum thickness of the Washita Group is approximately 400 feet. The material in these beds has weathered to form such soils as the Aledo, Bolar, Lott, Ponder, Purves, Sanger, and Slidell soils.

The Woodbine Formation in the east and east-central part of the county is next in age. This formation is predominantly sandstone with some shale and clay. The formation ranges from 200 to 250 feet in maximum thickness and is a secondary aquifer. It is an important source for domestic water where it is not highly mineralized. Soils that formed in this material are the Aubrey, Birome, Crosstell, Gasil, Rader, and Silstid soils.

| System | Group | Formation |
|---|---|---|
| Cretaceous | Trinity | Paluxy. |
| Cretaceous | Fredericksburg | Kiamichi, Goodland Limestone, Walnut. |
| Cretaceous | Washita | Grayson Marl, Main Street Limestone, Pawpaw, Weno Limestone, Denton clay, Fort Worth Limestone, Duck creek. |
| Cretaceous | --- | Woodbine. |
| Cretaceous | Eagle Ford | (undivided). |
| Quaternary | --- | Alluvium. |

*Figure 24.*—Geologic systems, groups, and formations in Tarrant County.

The undivided Eagle Ford is the youngest group of Cretaceous age in Tarrant County. This group is predominantly soft shale with some sandstone and limestone. It ranges from 200 to 300 feet in maximum thickness. The Eagle Ford Group crops out in the extreme eastern part of the county. Heiden, Houston Black, Leson, and Navo soils are common in this outcrop area.

The Quaternary sediment ranges in age from 3 million years to the present time and is in and above present day river and creek flood plains. This sediment consists of unconsolidated sand, gravel, silt, and clay. The Quaternary sediment includes the fluviatile terrace deposits of Pleistocene age, which are remnants of old stream flood plains that overlie the present day flood plains. Many of these terraces provide gravel for construction and minor amounts of water for household use. Among the soils that formed from the ancient alluvial deposits are the Aquilla, Bastsil, Silawa, and Silstid soils (general soil map unit 7). The present day alluvial deposits on flood plains (general soil map unit 6) are the parent material for such soils as Frio, Ovan, Trinity, and Whitesboro soils.

Four land resource areas are within Tarrant County. They are the West Cross Timbers, Grand Prairie, East Cross Timbers, and Blackland Prairie Resource Areas. The West Cross Timbers Resource Area is on Paluxy Sand outcrop, (general soil map unit 8) and is typified by hummocky topography and in places by heavy woods of oak trees. The Grand Prairie Resource Area is on clay and limestone outcrops of the Fredericksburg and Washita Groups, (general soil map units 2, 3, and 5). Typically, it is low escarpments, grassy slopes, and relatively few trees. The East Cross Timbers Resource Area, (general soil map unit 1), is on the Woodbine outcrop and typically is low hills, reddish sandy soils, and in places heavy woods of oak trees. The Blackland Prairie Resource Area, (general soil map unit 4), is an outcrop of Eagle Ford Shale and typically is gently rolling, treeless slopes. The soils are highly plastic.

# formation of the soils

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given place are determined by (1) the physical and mineral composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the material. All five factors influence the present characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor may dominate soil formation; in another area a different factor may be important.

The interrelationships of these factors are complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient, however, to discuss each factor separately and to indicate the probable effects of each.

## parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineral composition of the soil. The soils of Tarrant County have developed from parent material that was deposited by or in water.

Most of the soils in Tarrant County formed from parent material deposited during the Cretaceous geological periods. This parent material included weakly cemented acid sandstone and packsand from which such soils as Birome, Rayex, Stephenville, and Weatherford soils developed; beds of limestone from which Aledo, Purves, and Speck soils developed; calcareous marl, clay, and shale from which Sanger, Slidell, and Houston Black soils developed; and acid shale from which Aubrey soils developed.

Other soils formed from parent materal deposited during the Quaternary geological period. The Pleistocene and Recent ages are subdivisions of the Quaternary period. Parent material deposited during the Pleistocene age is on ancient stream terraces above present day flood plains. This parent material includes sandy sediment from which Aquilla soils developed; loamy sediment from which Bastsil and Silawa soils developed; and clayey sediment from which Branyon soils developed. Parent material of Recent age is on flood plains of streams. It includes loamy sediment from which such soils as Pulexas and Whitesboro soils developed, and calcareous clayey sediment from which Frio, Ovan, and Trinity soils developed.

## climate

The climate contributes to the formation of soils in several ways. The high temperatures, periods of high humidity, and adequate rainfall have encouraged deep penetration of water into the earth's crust. The moisture and warm temperatures favor the development of deep penetration of plant roots, micro-organisms, and chemical weathering. As a result, many deep soils have formed in the county. The removal of calcium and other chemicals from some of the soils by leaching has resulted in the formation of some soils that are low in some kinds of essential plant nutrients.

Patterns of rainfall distribution cause the soils to be alternately wet and dry. When clay soils, such as Houston Black and Sanger soils, become dry, they crack and the rainfall washes some of the surface layer into the cracks. However, if wetting continues, the cracks swell shut. This alternate shrinking and swelling of the soils causes churning and heaving of the soils and prevents formation of clay accumulations. Other soils, such as Crosstell, Wilson, and Windthorst soils, have clayey lower layers. Water moving through the soil detaches clay particles from the surface layer and deposits these particles in lower layers as water movement slows. As clay accumulates, the water moves more slowly and the deposition of clay accelerates. Thus, the accumulative process tends to speed up, and the lower layers become more clayey.

Wind also affects the formation of the soils. The sandy and loamy soil material in which the Aquilla, Nimrod, and Silstid soils formed has been reworked by wind.

## plant and animal life

Vegetation, animals, micro-organisms, earthworms, other organisms, and, more recently, man that live on and in the soil contribute to its development. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are caused by living organisms. In the nearly treeless prairies of Tarrant County, tall grasses had more influence on soil development than other plants. These grasses provided litter that protected the surface and added

organic matter to dark soils, such as those of the Houston Black, Bolar, and Slidell series. The grass roots reached deep into the soil and utilized minerals at a lower depth. Lime, other minerals, and organic matter were distributed throughout the soil profile as these plants died and decomposed. The decomposed plant roots left channels that increased the intake of water and the aeration of the soil. Earthworms and other soil organisms fed on the decomposed roots. The borings of earthworms also helped channel water and air through the soil.

In parts of the county where the native vegetation is mostly oak savannah, organic matter has mainly accumulated only in the top few inches of the soil. This organic matter is quickly destroyed if the soil is cultivated. Soils such as the Crosstell, Gasil, and Windthorst soils have a light colored surface layer and are acid in the upper part of the subsoil. Burrowing animals, such as crayfish, gophers, and badgers, help mix the soil and parent material.

Man and his methods of tillage and grazing animals have also influenced soil formation. Much of the savannahs and the prairies have been cleared for cropland. Cultivation has encouraged runoff and erosion, and reduced the content of organic matter. Tillage and continuous grazing have compacted the clayey soils and reduced aeration, infiltration, and permeability. All of these changes are reflected in the present productivity of the soil and will have some affect on the rate and kinds of future development of the soils.

## relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature.

The relief in Tarrant County ranges from nearly level to moderately steep. On nearly level and gently sloping soils, such as the Heiden, Navo, Slidell, and Wilson soils, most of the rainfall enters the soil and allows for deep development. Some of the stronger sloping soils, such as the Ferris and Medlin soils, formed in similar parent material, but natural erosion or rapid runoff has kept the surface layer thin and light colored. The solum of these soils is not so thick as that of the soils which formed on less sloping topography.

Some soils, such as the Frio, Ovan, Trinity, and Whitesboro soils, are affected by relief in another way. Flooding deposits sediment from the surrounding watersheds.

The strongly sloping to steep Aledo and Bolar soils that are on east- and north-facing slopes have a thicker and darker surface layer than those soils on slopes that face toward the south and west. Where slopes are less exposed to sunlight, the soil temperature is lower and more organic matter accumulates.

## time

Time, usually a long time, is required for formation of soils that have distinct horizons. However, the effects of time are modified by the other four factors of soil development. The differences in the length of time that parent materials have been in place are generally reflected in the degree of development of the soil profile.

The soils in Tarrant County range from young to old. The young soils have very little horizon development, and the older soils have well expressed soil horizons.

Pulexas soils, which are young soils, show little development. The soil horizons still show the evidence of stratification, and there has been little change from the original stream deposited alluvium. Navo and Bastsil soils, which are older soils, have well developed soil horizons. The parent material of these soils has been in place for a long time. There has been a downward movement and accumulation of soil particles, resulting in a distinct Bt horizon.

# references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(4) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(5) United States Department of Agriculture. 1924. Soil survey of Tarrant County, Texas. Bureau of Soils, 46 pp., maps.

# glossary

**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.

**Area reclaim** (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**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 |

**Bedding planes.** Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Bottom land.** The normal flood plain of a stream, subject to flooding.

**Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that 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.

**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.** If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

**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.** 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.

**Deferred grazing.** Postponing grazing or arresting grazing for a prescribed period.

**Depth to rock** (in tables). Bedrock is too near the surface for the specified use.

**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.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

**Excess fines** (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

**Excess lime** (in tables). Excess carbonates in the soil that restrict the growth of some plants.

**Fast intake** (in tables). The rapid movement of water into the soil.

**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.

**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.

**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.

**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.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Increasers.** Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**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.

**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.

**Low strength.** The soil is not strong enough to support loads.

**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.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition.

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percs slowly** (in tables). The slow movement of water through the soil adversely affecting the specified use.

**Permeability.** The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

| | |
|---|---|
| Very slow | less than 0.06 inch |
| Slow | 0.06 to 0.20 inch |
| Moderately slow | 0.2 to 0.6 inch |
| Moderate | 0.6 inch to 2.0 inches |
| Moderately rapid | 2.0 to 6.0 inches |
| Rapid | 6.0 to 20 inches |
| Very rapid | more than 20 inches |

**Phase, soil.** A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**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.

**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.

**Rippable.** Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

**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.

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sandstone.** Sedimentary rock containing dominantly sand-size particles.

**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.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**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.

**Slope** (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

**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.

**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).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. 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 loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Thin layer** (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.

**Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

# tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1938-77 at Meacham Field Airport, Greater Southwest International Airport, and Dallas-Fort Worth Regional Airport]

| Month | Temperature | | | Precipitation | | | |
|---|---|---|---|---|---|---|---|
| | | | | | 2 years in 10 will have-- | | |
| | Average daily maximum | Average daily minimum | Average daily | Average | Less than-- | More than-- | Average snowfall |
| | °F | °F | °F | In | In | In | In |
| January | 55.8 | 35.1 | 45.5 | 1.80 | .58 | 2.79 | 1.5 |
| February | 59.7 | 38.2 | 49.0 | 1.98 | .73 | 3.42 | .7 |
| March | 68.0 | 45.8 | 56.9 | 2.29 | .80 | 3.69 | .3 |
| April | 75.8 | 54.6 | 65.2 | 3.97 | 2.23 | 5.97 | 0 |
| May | 82.7 | 62.7 | 72.7 | 4.57 | 2.02 | 6.88 | 0 |
| June | 91.0 | 70.7 | 80.9 | 2.91 | .67 | 5.27 | 0 |
| July | 94.7 | 74.2 | 84.5 | 2.28 | .59 | 3.60 | 0 |
| August | 95.1 | 74.0 | 84.6 | 2.26 | .44 | 3.64 | 0 |
| September | 88.1 | 67.4 | 77.8 | 2.95 | .87 | 5.04 | 0 |
| October | 78.5 | 56.8 | 67.7 | 2.91 | .55 | 5.82 | 0 |
| November | 66.5 | 45.5 | 56.0 | 2.23 | .51 | 3.82 | .2 |
| December | 57.7 | 37.5 | 47.6 | 1.95 | .68 | 2.84 | .2 |
| Year | 76.1 | 55.2 | 65.7 | 32.10 | 23.37 | 39.63 | 2.9 |

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Dallas]

| 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]

| Probability | Daily minimum temperature during growing season | | |
|---|---|---|---|
| | Higher than 24° F | Higher than 28° F | Higher than 32° F |
| | Days | Days | Days |
| 9 years in 10 | 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.--SUITABILITIES AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

| Map unit | Percent of county | Cultivated crops | Pastureland | Rangeland | Urban Uses | Recreation areas |
|---|---|---|---|---|---|---|
| 1. Crosstell-Gasil-Rader | 23 | Moderate: low fertility, droughty. | Moderate: low fertility, droughty. | Moderate: low fertility, droughty. | Moderate: shrink-swell, wetness, corrosivity. | Moderate: percs slowly, slope. |
| 2. Sanger Purves-Slidell | 21 | Well suited | Well suited | Well suited | Moderate: shrink-swell, depth to rock, corrosivity. | Poor: too clayey, percs slowly. |
| 3. Aledo-Bolar-Sanger | 20 | Poor: slope, shallow soil, small stones, droughty. | Poor: shallow soil, small stones, droughty. | Moderate: shallow soil, droughty, | Moderate: slope, depth to rock, shrink-swell. | Poor: small stones, slope, depth to rock, too clayey. |
| 4. Houston Black-Navo-Heiden | 12 | Well suited | Well suited | Well suited | Moderate: shrink-swell, percs slowly, corrosivity. | Poor: too clayey, percs slowly. |
| 5. Ponder-Sanger-Slidell | 8 | Well suited | Well suited | Well suited | Moderate: shrink-swell, percs slowly, corrosivity. | Poor: too clayey, percs slowly. |
| 6. Frio-Trinity | 7 | Moderate: floods. | Well suited | Well suited | Poor: floods, shrink-swell, corrosivity, percs slowly. | Poor: floods, too clayey, percs slowly. |
| 7. Bastsil-Silawa | 4 | Well suited | Well suited | Well suited | Well suited | Well suited. |
| 8. Windthorst-Weatherford-Nimrod | 2 | Moderate: slope, low fertility, erodes easily. | Well suited | Well suited | Well suited | Well suited. |

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| 1 | Aledo gravelly clay loam, 1 to 8 percent slopes | 23,120 | 4.0 |
| 2 | Aledo-Bolar complex, 5 to 20 percent slopes | 22,090 | 3.8 |
| 3 | Aledo-Bolar-Urban land complex, 3 to 20 percent slopes | 13,550 | 2.4 |
| 4 | Aledo-Urban land complex, 1 to 8 percent slopes | 9,230 | 1.6 |
| 5 | Altoga silty clay loam, 5 to 12 percent slopes | 750 | 0.1 |
| 6 | Aquilla loamy fine sand, 1 to 5 percent slopes | 620 | 0.1 |
| 7 | Arents, frequently flooded | 5,580 | 1.0 |
| 8 | Arents, loamy | 4,040 | 0.7 |
| 9 | Bastsil fine sandy loam, 0 to 3 percent slopes | 5,350 | 1.0 |
| 10 | Bastsil-Urban land complex, 0 to 5 percent slopes | 7,720 | 1.3 |
| 11 | Birome fine sandy loam, 1 to 5 percent slopes | 2,570 | 0.4 |
| 12 | Birome-Aubrey-Rayex complex, 5 to 15 percent slopes | 6,490 | 1.1 |
| 13 | Birome-Aubrey-Urban land complex, 5 to 15 percent slopes | 5,730 | 1.0 |
| 14 | Bolar clay loam, 1 to 3 percent slopes | 2,400 | 0.4 |
| 15 | Bolar clay loam, 3 to 5 percent slopes | 4,020 | 0.7 |
| 16 | Bolar-Urban land complex, 1 to 5 percent slopes | 2,080 | 0.4 |
| 17 | Brackett clay loam, 3 to 8 percent slopes | 1,580 | 0.3 |
| 18 | Branyon clay, 0 to 1 percent slopes | 3,500 | 0.6 |
| 19 | Burleson clay, 0 to 1 percent slopes | 1,220 | 0.2 |
| 20 | Chatt silty clay, 1 to 3 percent slopes | 1,320 | 0.2 |
| 21 | Crosstell fine sandy loam, 1 to 3 percent slopes | 10,410 | 1.8 |
| 22 | Crosstell fine sandy loam, 3 to 6 percent slopes | 15,040 | 2.6 |
| 23 | Crosstell-Urban land complex, 1 to 6 percent slopes | 16,720 | 2.9 |
| 24 | Ferris clay, 5 to 12 percent slopes, eroded | 2,360 | 0.4 |
| 25 | Ferris-Heiden complex, 2 to 5 percent slopes | 2,790 | 0.5 |
| 26 | Frio silty clay, occasionally flooded | 11,370 | 2.0 |
| 27 | Frio silty clay, frequently flooded | 7,560 | 1.3 |
| 28 | Frio-Urban land complex, occasionally flooded | 6,900 | 1.2 |
| 29 | Gasil fine sandy loam, 1 to 3 percent slopes | 11,100 | 1.9 |
| 30 | Gasil fine sandy loam, 3 to 8 percent slopes | 8,480 | 1.5 |
| 31 | Gasil sandy clay loam, graded, 1 to 5 percent slopes | 1,540 | 0.3 |
| 32 | Gasil-Urban land complex, 1 to 8 percent slopes | 13,850 | 2.4 |
| 33 | Heiden clay, 1 to 3 percent slopes | 9,800 | 1.7 |
| 34 | Houston Black clay, 1 to 3 percent slopes | 7,470 | 1.3 |
| 35 | Houston Black-Urban land complex, 1 to 4 percent slopes | 13,700 | 2.4 |
| 36 | Justin loam, 1 to 3 percent slopes | 760 | 0.1 |
| 37 | Konsil fine sandy loam, 1 to 5 percent slopes | 3,850 | 0.7 |
| 38 | Leson clay, 1 to 3 percent slopes | 2,600 | 0.5 |
| 39 | Lindale clay loam, 1 to 3 percent slopes | 3,050 | 0.5 |
| 40 | Lindale-Urban land complex, 1 to 3 percent slopes | 1,290 | 0.2 |
| 41 | Lott silty clay, 1 to 3 percent slopes | 4,260 | 0.7 |
| 42 | Lott-Urban land complex, 1 to 5 percent slopes | 1,940 | 0.3 |
| 43 | Luckenbach clay loam, 1 to 3 percent slopes | 1,390 | 0.2 |
| 44 | Luckenbach-Urban land complex, 1 to 3 percent slopes | 1,050 | 0.2 |
| 45 | Mabank fine sandy loam, 0 to 1 percent slopes | 1,040 | 0.2 |
| 46 | Maloterre, Aledo, and Brackett soils, 3 to 20 percent slopes | 7,860 | 1.4 |
| 47 | Medlin clay, 5 to 15 percent slopes | 2,610 | 0.5 |
| 48 | Mingo clay loam, 1 to 3 percent slopes | 2,240 | 0.4 |
| 49 | Mingo-Urban land complex, 1 to 3 percent slopes | 1,190 | 0.2 |
| 50 | Navo clay loam, 1 to 3 percent slopes | 10,850 | 1.9 |
| 51 | Navo-Urban land complex, 1 to 3 percent slopes | 5,510 | 1.0 |
| 52 | Nimrod fine sand, 1 to 5 percent slopes | 1,760 | 0.3 |
| 53 | Ovan clay, occasionally flooded | 1,770 | 0.3 |
| 54 | Ovan clay, frequently flooded | 2,200 | 0.4 |
| 55 | Ovan-Urban land complex, occasionally flooded | 900 | 0.2 |
| 56 | Pits, quarries | 880 | 0.2 |
| 57 | Ponder clay loam, 1 to 3 percent slopes | 10,950 | 1.9 |
| 58 | Ponder-Urban land complex, 0 to 3 percent slopes | 6,600 | 1.1 |
| 59 | Pulexas fine sandy loam, frequently flooded | 5,330 | 0.9 |
| 60 | Pulexas-Urban land complex, occasionally flooded | 1,850 | 0.3 |
| 61 | Purves clay, 0 to 3 percent slopes | 17,130 | 3.0 |
| 62 | Purves-Urban land complex, 0 to 3 percent slopes | 5,010 | 0.9 |
| 63 | Rader fine sandy loam, 0 to 3 percent slopes | 13,370 | 2.3 |
| 64 | Rader-Urban land complex, 0 to 3 percent slopes | 8,010 | 1.4 |
| 65 | Sanger clay, 1 to 3 percent slopes | 32,840 | 5.8 |
| 66 | Sanger clay, 3 to 5 percent slopes | 11,360 | 2.0 |
| 67 | Sanger-Urban land complex, 1 to 5 percent slopes | 23,250 | 4.0 |
| 68 | San Saba clay, 0 to 2 percent slopes | 3,100 | 0.5 |
| 69 | Selden loamy fine sand, 1 to 3 percent slopes | 1,050 | 0.2 |
| 70 | Silawa fine sandy loam, 3 to 8 percent slopes | 5,350 | 0.9 |
| 71 | Silstid loamy fine sand, 1 to 5 percent slopes | 7,340 | 1.3 |
| 72 | Silstid-Urban land complex, 1 to 5 percent slopes | 3,970 | 0.7 |

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| 73 | Slidell clay, 0 to 1 percent slopes | 3,840 | 0.7 |
| 74 | Slidell clay, 1 to 3 percent slopes | 18,060 | 3.1 |
| 75 | Speck clay loam, 0 to 3 percent slopes | 1,980 | 0.3 |
| 76 | Stephenville fine sandy loam, 8 to 15 percent slopes | 660 | 0.1 |
| 77 | Sunev clay loam, 1 to 3 percent slopes | 1,610 | 0.3 |
| 78 | Sunev clay loam, 3 to 8 percent slopes | 7,090 | 1.2 |
| 79 | Sunev-Urban land complex, 2 to 8 percent slopes | 2,660 | 0.5 |
| 80 | Trinity clay, frequently flooded | 3,830 | 0.7 |
| 81 | Urban land | 16,590 | 2.9 |
| 82 | Weatherford fine sandy loam, 3 to 8 percent slopes | 3,230 | 0.6 |
| 83 | Whitesboro loam, frequently flooded | 3,690 | 0.6 |
| 84 | Wilson clay loam, 0 to 2 percent slopes | 6,320 | 1.1 |
| 85 | Wilson-Urban land complex, 0 to 2 percent slopes | 2,570 | 0.4 |
| 86 | Windthorst fine sandy loam, 1 to 3 percent slopes | 1,350 | 0.2 |
| 87 | Windthorst fine sandy loam, 3 to 8 percent slopes | 2,330 | 0.4 |
| 88 | Windthorst fine sandy loam, 2 to 8 percent slopes, eroded | 1,020 | 0.2 |
| | Water, areas more than 40 acres | 19,520 | 3.5 |
| | Water, areas 5 to 40 acres | 810 | 0.1 |
| | Total | 574,720 | 100.0 |

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]

| Map symbol and soil name | Grain sorghum | Wheat | Oats | Cotton lint | Improved bermudagrass |
|---|---|---|---|---|---|
| | Bu | Bu | Bu | Lb | AUM* |
| 1--- Aledo | --- | --- | --- | --- | --- |
| 2--- Aledo-Bolar | --- | --- | --- | --- | --- |
| 3--- Aledo-Bolar-Urban land | --- | --- | --- | --- | --- |
| 4--- Aledo-Urban land | --- | --- | --- | --- | --- |
| 5--- Altoga | --- | --- | --- | --- | 4.0 |
| 6--- Aquilla | --- | --- | --- | --- | 6.0 |
| 7,** 8.** Arents | | | | | |
| 9--- Bastsil | 80 | 55 | 80 | 350 | 7.0 |
| 10--- Bastsil-Urban land | --- | --- | --- | --- | --- |
| 11--- Birome | --- | --- | 30 | --- | 6.5 |
| 12--- Birome-Aubrey-Rayex | --- | --- | --- | --- | 3.4 |
| 13--- Birome-Aubrey-Urban land | --- | --- | --- | --- | --- |
| 14--- Bolar | 40 | 30 | 50 | --- | 5.5 |
| 15--- Bolar | 35 | 25 | 35 | --- | 5.0 |
| 16--- Bolar-Urban land | --- | --- | --- | --- | --- |
| 17. Brackett | | | | | |
| 18--- Branyon | 90 | 35 | 85 | 550 | 9.5 |
| 19--- Burleson | 85 | 35 | 90 | 450 | 8.0 |
| 20--- Chatt | 70 | 40 | 70 | 400 | 8.0 |
| 21--- Crosstell | 40 | 20 | 45 | 250 | 5.0 |
| 22--- Crosstell | 35 | --- | --- | 200 | 4.5 |

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Map symbol and soil name | Grain sorghum | Wheat | Oats | Cotton lint | Improved bermudagrass |
|---|---|---|---|---|---|
| | Bu | Bu | Bu | Lb | AUM* |
| 23--Crosstell-Urban land | --- | --- | --- | --- | --- |
| 24--Ferris | --- | --- | --- | --- | 4.0 |
| 25--Ferris-Heiden | 40 | 25 | 45 | 250 | 5.5 |
| 26--Frio | 75 | 45 | 90 | 450 | 8.0 |
| 27--Frio | --- | --- | --- | --- | 8.0 |
| 28--Frio-Urban land | --- | --- | --- | --- | --- |
| 29--Gasil | 55 | 30 | 60 | --- | 5.5 |
| 30--Gasil | --- | --- | --- | --- | 5.0 |
| 31--Gasil | --- | 20 | --- | --- | 4.0 |
| 32--Gasil-Urban land | --- | --- | --- | --- | --- |
| 33--Heiden | 80 | 35 | 70 | 400 | 8.0 |
| 34--Houston Black | 85 | 35 | 90 | 550 | 9.5 |
| 35--Houston Black-Urban land | --- | --- | --- | --- | --- |
| 36--Justin | 60 | 35 | 70 | 350 | 6.0 |
| 37--Konsil | --- | 25 | 50 | --- | 6.0 |
| 38--Leson | 80 | 35 | 65 | 450 | 7.0 |
| 39--Lindale | 50 | 30 | 45 | --- | 5.0 |
| 40--Lindale-Urban land | --- | --- | --- | --- | --- |
| 41--Lott | 80 | 35 | 70 | 400 | 6.5 |
| 42--Lott-Urban land | --- | --- | --- | --- | --- |
| 43--Luckenbach | 55 | 30 | 50 | 400 | 6.5 |
| 44--Luckenbach-Urban land | --- | --- | --- | --- | --- |
| 45--Mabank | 55 | --- | --- | 330 | 6.0 |

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Map symbol and soil name | Grain sorghum | Wheat | Oats | Cotton lint | Improved bermudagrass |
|---|---|---|---|---|---|
| | Bu | Bu | Bu | Lb | AUM* |
| 46---------- Maloterre, Aledo, and Brackett | --- | --- | --- | --- | --- |
| 47---------- Medlin | --- | --- | --- | --- | 4.0 |
| 48---------- Mingo | 40 | 30 | 50 | 250 | 5.0 |
| 49---------- Mingo-Urban land | --- | --- | --- | --- | --- |
| 50---------- Navo | 50 | 30 | 55 | 300 | 7.0 |
| 51---------- Navo-Urban land | --- | --- | --- | --- | --- |
| 52---------- Nimrod | --- | --- | 30 | --- | 5.5 |
| 53---------- Ovan | 90 | 35 | 80 | 400 | 8.0 |
| 54---------- Ovan | --- | --- | --- | --- | 8.0 |
| 55---------- Ovan-Urban land | --- | --- | --- | --- | --- |
| 56.** Pits | | | | | |
| 57---------- Ponder | 65 | 35 | 50 | 300 | 6.0 |
| 58---------- Ponder-Urban land | --- | --- | --- | --- | --- |
| 59---------- Pulexas | --- | --- | --- | --- | 7.5 |
| 60---------- Pulexas-Urban land | --- | --- | --- | --- | --- |
| 61---------- Purves | 35 | 20 | 45 | --- | 4.0 |
| 62---------- Purves-Urban land | --- | --- | --- | --- | --- |
| 63---------- Rader | 70 | 30 | 65 | --- | 8.0 |
| 64---------- Rader-Urban land | --- | --- | --- | --- | --- |
| 65---------- Sanger | 70 | 35 | 70 | 350 | 6.5 |
| 66---------- Sanger | 65 | 30 | 65 | 300 | 6.0 |
| 67---------- Sanger-Urban land | --- | --- | --- | --- | --- |

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

| Map symbol and soil name | Grain sorghum | Wheat | Oats | Cotton lint | Improved bermudagrass |
|---|---|---|---|---|---|
| | Bu | Bu | Bu | Lb | AUM* |
| 68--- San Saba | 75 | 30 | 55 | 350 | 6.0 |
| 69--- Selden | 40 | --- | 30 | --- | 6.0 |
| 70--- Silawa | --- | --- | --- | --- | 5.5 |
| 71--- Silstid | --- | --- | --- | --- | 5.0 |
| 72--- Silstid-Urban land | --- | --- | --- | --- | --- |
| 73--- Slidell | 80 | 40 | 80 | 400 | 7.0 |
| 74--- Slidell | 70 | 40 | 80 | 350 | 7.0 |
| 75--- Speck | --- | 20 | 35 | --- | 4.0 |
| 76--- Stephenville | --- | --- | --- | --- | 4.5 |
| 77--- Sunev | 55 | 35 | 60 | 350 | 7.0 |
| 78--- Sunev | --- | --- | 45 | --- | 6.0 |
| 79--- Sunev-Urban land | --- | --- | --- | --- | --- |
| 80--- Trinity | --- | --- | --- | --- | 8.0 |
| 81.** Urban land | | | | | |
| 82--- Weatherford | --- | --- | 35 | --- | 5.0 |
| 83--- Whitesboro | --- | --- | --- | --- | 8.0 |
| 84--- Wilson | 55 | 30 | 65 | 350 | 6.0 |
| 85--- Wilson-Urban land | --- | --- | --- | --- | --- |
| 86--- Windthorst | --- | --- | 40 | --- | 6.0 |
| 87--- Windthorst | --- | --- | 25 | --- | 4.5 |
| 88--- Windthorst | --- | --- | --- | --- | 3.5 |

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

| Class | Total acreage | Major management concerns (Subclass) | | | |
|---|---|---|---|---|---|
| | | Erosion (e) | Wetness (w) | Soil problem (s) | Climate (c) |
| | | Acres | Acres | Acres | Acres |
| I | --- | --- | --- | --- | --- |
| II | 131,190 | 111,260 | 19,930 | --- | --- |
| III | 103,830 | 80,710 | 9,130 | 13,990 | --- |
| IV | 56,380 | 56,380 | --- | --- | --- |
| V | 28,190 | --- | 28,190 | --- | --- |
| VI | 54,190 | 7,400 | --- | 46,790 | --- |
| VII | 7,860 | --- | --- | 7,860 | --- |
| VIII | --- | --- | --- | --- | --- |

TABLE 8.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

| Map symbol and soil name | Range site name | Potential annual production for kind of growing season | | |
|---|---|---|---|---|
| | | Favorable Lb/acre | Average Lb/acre | Unfavorable Lb/acre |
| 1---Aledo | Shallow | 3,000 | 2,000 | 1,800 |
| 2:* | | | | |
| Aledo | Shallow | 2,500 | 1,800 | 1,200 |
| Bolar | Clay Loam | 6,000 | 5,000 | 3,000 |
| 5---Altoga | Clay Loam | 6,500 | 5,000 | 3,800 |
| 6---Aquilla | Deep Sand | 5,000 | 4,000 | 3,000 |
| 7---Arents | Loamy Bottomland | 6,000 | 5,000 | 3,500 |
| 8---Arents | Sandy Loam | 5,000 | 3,500 | 3,000 |
| 9---Bastsil | Sandy Loam | 6,500 | 5,000 | 3,500 |
| 11---Birome | Sandy Loam | 6,500 | 5,000 | 3,500 |
| 12:* | | | | |
| Birome | Sandy Loam | 4,500 | 3,000 | 2,000 |
| Aubrey | Tight Sandy Loam | 4,000 | 2,500 | 1,500 |
| Rayex | Sandstone Hill | 3,500 | 2,500 | 1,500 |
| 14, 15---Bolar | Clay Loam | 6,000 | 5,000 | 3,000 |
| 17---Brackett | Adobe | 4,000 | 3,200 | 1,800 |
| 18---Branyon | Blackland | 7,000 | 5,500 | 3,500 |
| 19---Burleson | Blackland | 7,000 | 5,500 | 4,000 |
| 20---Chatt | Clay Loam | 6,500 | 6,000 | 4,000 |
| 21, 22---Crosstell | Tight Sandy Loam | 4,500 | 3,500 | 2,000 |
| 24---Ferris | Eroded Blackland | 4,500 | 3,000 | 2,000 |
| 25:* | | | | |
| Ferris | Eroded Blackland | 4,500 | 3,000 | 2,000 |
| Heiden | Blackland | 5,500 | 4,500 | 3,500 |
| 26, 27---Frio | Loamy Bottomland | 8,000 | 5,500 | 4,000 |
| 29, 30---Gasil | Sandy Loam | 6,500 | 5,000 | 3,500 |
| 31---Gasil | Sandy Loam | 5,000 | 3,500 | 1,500 |

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY--Continued

| Map symbol and soil name | Range site name | Potential annual production for kind of growing season | | |
|---|---|---|---|---|
| | | Favorable | Average | Unfavorable |
| | | Lb/acre | Lb/acre | Lb/acre |
| 33---Heiden | Blackland | 7,000 | 6,000 | 3,500 |
| 34---Houston Black | Blackland | 7,000 | 6,000 | 3,500 |
| 36---Justin | Sandy Loam | 6,000 | 4,500 | 3,500 |
| 37---Konsil | Sandy Loam | 6,500 | 5,000 | 3,500 |
| 38---Leson | Blackland | 7,000 | 6,000 | 3,500 |
| 39---Lindale | Deep Redland | 6,000 | 5,000 | 4,000 |
| 41---Lott | Clay Loam | 6,500 | 5,000 | 3,000 |
| 43---Luckenbach | Clay Loam | 5,000 | 4,000 | 3,000 |
| 45---Mabank | Claypan Prairie | 6,000 | 5,000 | 3,000 |
| 46:* | | | | |
| Maloterre | Very Shallow | 1,500 | 1,200 | 750 |
| Aledo | Rocky Hills | 2,500 | 1,800 | 1,200 |
| Brackett | Steep Adobe | 3,000 | 2,200 | 1,500 |
| 47---Medlin | Blackland | 6,000 | 5,000 | 3,000 |
| 48---Mingo | Deep Redland | 5,500 | 4,500 | 3,500 |
| 50---Navo | Claypan Prairie | 6,000 | 4,000 | 3,500 |
| 52---Nimrod | Sandy | 4,500 | 3,500 | 2,000 |
| 53, 54---Ovan | Clayey Bottomland | 7,500 | 6,000 | 4,000 |
| 57---Ponder | Claypan Prairie | 5,500 | 4,000 | 2,000 |
| 59---Pulexas | Loamy Bottomland | 6,500 | 5,000 | 3,500 |
| 61---Purves | Shallow | 3,000 | 2,500 | 1,800 |
| 63---Rader | Sandy Loam | 6,000 | 4,500 | 3,500 |
| 65, 66---Sanger | Blackland | 6,000 | 5,000 | 3,000 |
| 68---San Saba | Blackland | 6,000 | 5,000 | 3,500 |

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY--Continued

| Map symbol and soil name | Range site name | Potential annual production for kind of growing season | | |
|---|---|---|---|---|
| | | Favorable | Average | Unfavorable |
| | | Lb/acre | Lb/acre | Lb/acre |
| 69----------<br>Selden | Loamy Sand---------- | 5,000 | 4,200 | 3,500 |
| 70----------<br>Silawa | Sandy Loam---------- | 5,500 | 4,500 | 2,500 |
| 71----------<br>Silstid | Sandy---------- | 4,500 | 4,000 | 2,000 |
| 73, 74----------<br>Slidell | Blackland---------- | 6,000 | 5,000 | 3,000 |
| 75----------<br>Speck | Redland---------- | 3,800 | 3,000 | 2,000 |
| 76----------<br>Stephenville | Sandy Loam---------- | 4,500 | 3,300 | 2,500 |
| 77, 78----------<br>Sunev | Clay Loam---------- | 7,000 | 5,500 | 3,500 |
| 80----------<br>Trinity | Clayey Bottomland---------- | 7,500 | 6,000 | 4,500 |
| 82----------<br>Weatherford | Sandy Loam---------- | 5,500 | 4,500 | 3,000 |
| 83----------<br>Whitesboro | Loamy Bottomland---------- | 8,000 | 6,000 | 5,000 |
| 84----------<br>Wilson | Claypan Prairie---------- | 6,000 | 4,500 | 3,000 |
| 86, 87, 88----------<br>Windthorst | Sandy Loam---------- | 6,000 | 4,500 | 3,000 |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 1<br>Aledo | Severe:<br>depth to rock. | Severe:<br>depth to rock. | Severe:<br>small stones,<br>depth to rock. | Slight. |
| 2:*<br>Aledo | Severe:<br>depth to rock. | Severe:<br>depth to rock. | Severe:<br>slope,<br>small stones,<br>depth to rock. | Slight. |
| Bolar | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Slight. |
| 3:*<br>Aledo | Severe:<br>depth to rock. | Severe:<br>depth to rock. | Severe:<br>slope,<br>small stones,<br>depth to rock. | Slight. |
| Bolar | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Slight. |
| Urban land. | | | | |
| 4:*<br>Aledo | Severe:<br>depth to rock. | Severe:<br>depth to rock. | Severe:<br>small stones,<br>depth to rock. | Slight. |
| Urban land. | | | | |
| 5<br>Altoga | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Slight. |
| 6<br>Aquilla | Moderate:<br>too sandy. | Moderate:<br>too sandy. | Moderate:<br>slope,<br>too sandy. | Moderate:<br>too sandy. |
| 7,* 8.*<br>Arents | | | | |
| 9<br>Bastsil | Slight | Slight | Slight | Slight. |
| 10:*<br>Bastsil | Slight | Slight | Moderate:<br>slope. | Slight. |
| Urban land. | | | | |
| 11<br>Birome | Slight | Slight | Moderate:<br>slope. | Slight. |
| 12:*<br>Birome | Severe:<br>small stones. | Severe:<br>small stones. | Severe:<br>slope,<br>small stones. | Slight. |
| Aubrey | Moderate:<br>slope. | Moderate:<br>slope. | Severe:<br>slope. | Slight. |

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 12:* | | | | |
| Rayex | Severe: small stones, depth to rock. | Severe: small stones, depth to rock. | Severe: slope, small stones, depth to rock. | Slight. |
| 13:* | | | | |
| Birome | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| Aubrey | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| Urban land. | | | | |
| 14, 15 Bolar | Slight | Slight | Moderate: small stones, slope. | Slight. |
| 16:* | | | | |
| Bolar | Slight | Slight | Moderate: small stones, slope. | Slight. |
| Urban land. | | | | |
| 17 Brackett | Severe: depth to rock. | Severe: depth to rock. | Severe: small stones, depth to rock. | Slight. |
| 18 Branyon | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: too clayey. | Moderate: too clayey. |
| 19 Burleson | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: small stones, too clayey. | Moderate: too clayey. |
| 20 Chatt | Moderate: too clayey. | Moderate: too clayey. | Moderate: slope, too clayey. | Moderate: too clayey. |
| 21, 22 Crosstell | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Severe: erodes easily. |
| 23:* | | | | |
| Crosstell | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Severe: erodes easily. |
| Urban land. | | | | |
| 24 Ferris | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey, percs slowly. | Severe: slope. | Moderate: too clayey. |
| 25:* | | | | |
| Ferris | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| Heiden | Moderate: percs slowly, too clayey. | Moderate: percs slowly, too clayey. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 26--- Frio | Severe: floods. | Severe: too clayey. | Severe: too clayey. | Moderate: too clayey. |
| 27--- Frio | Severe: floods. | Severe: floods, too clayey. | Severe: too clayey, floods. | Moderate: too clayey, floods. |
| 28:* Frio--- Urban land. | Severe: floods. | Severe: too clayey. | Severe: too clayey. | Moderate: too clayey. |
| 29, 30, 31--- Gasil | Slight--- | Slight--- | Moderate: slope. | Slight. |
| 32:* Gasil--- Urban land. | Slight--- | Slight--- | Moderate: slope. | Slight. |
| 33--- Heiden | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 34--- Houston Black | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey. | Moderate: too clayey. |
| 35:* Houston Black--- Urban land. | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey. | Moderate: too clayey. |
| 36--- Justin | Slight--- | Slight--- | Moderate: slope. | Slight. |
| 37--- Konsil | Slight--- | Slight--- | Moderate: slope. | Slight. |
| 38--- Leson | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 39--- Lindale | Slight--- | Slight--- | Moderate: slope, small stones. | Slight. |
| 40:* Lindale--- Urban land. | Slight--- | Slight--- | Moderate: slope, small stones. | Slight. |
| 41--- Lott | Moderate: too clayey. | Moderate: too clayey. | Moderate: slope, too clayey. | Moderate: too clayey. |
| 42:* Lott--- | Moderate: too clayey. | Moderate: too clayey. | Moderate: slope, too clayey. | Moderate: too clayey. |

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 42:* Urban land. | | | | |
| 43--- Luckenbach | Slight | Slight | Moderate: slope. | Slight. |
| 44:* Luckenbach--- | Slight | Slight | Moderate: slope. | Slight. |
| Urban land. | | | | |
| 45--- Mabank | Severe: wetness, percs slowly. | Severe: wetness, percs slowly. | Severe: wetness, percs slowly. | Severe: wetness, erodes easily. |
| 46:* Maloterre--- | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, small stones, depth to rock. | Slight. |
| Aledo--- | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, small stones, depth to rock. | Slight. |
| Brackett--- | Severe: depth to rock. | Severe: depth to rock. | Severe: slope, small stones, depth to rock. | Slight. |
| 47--- Medlin | Moderate: slope, percs slowly, too clayey. | Moderate: slope, too clayey, percs slowly. | Severe: slope. | Moderate: too clayey. |
| 48--- Mingo | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, small stones, depth to rock. | Severe: erodes easily. |
| 49:* Mingo--- | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, small stones, depth to rock. | Severe: erodes easily. |
| Urban land. | | | | |
| 50--- Navo | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Slight. |
| 51:* Navo--- | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Slight. |
| Urban land. | | | | |
| 52--- Nimrod | Severe: too sandy. | Severe: too sandy. | Severe: too sandy. | Severe: too sandy. |
| 53--- Ovan | Severe: floods. | Moderate: too clayey, percs slowly. | Moderate: too clayey, floods, percs slowly. | Moderate: too clayey. |

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 54--- Ovan | Severe: floods. | Moderate: too clayey, floods, percs slowly. | Severe: floods. | Moderate: too clayey, floods. |
| 55:* Ovan--- Urban land. | Severe: floods. | Moderate: too clayey, floods, percs slowly. | Moderate: too clayey, floods, percs slowly. | Moderate: too clayey. |
| 56.* Pits | | | | |
| 57--- Ponder | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: slope, percs slowly. | Slight. |
| 58:* Ponder--- Urban land. | Moderate: percs slowly. | Moderate: percs slowly. | Moderate: percs slowly. | Slight. |
| 59--- Pulexas | Severe: floods. | Moderate: floods. | Severe: floods. | Moderate: floods. |
| 60:* Pulexas--- Urban land. | Severe: floods. | Slight--- | Moderate: floods. | Slight. |
| 61--- Purves | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Moderate: too clayey. |
| 62:* Purves--- Urban land. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Moderate: too clayey. |
| 63--- Rader | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Slight. |
| 64:* Rader--- Urban land. | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Moderate: wetness, percs slowly. | Slight. |
| 65, 66--- Sanger | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 67:* Sanger--- Urban land. | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 68--- San Saba | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: small stones, too clayey. | Moderate: too clayey. |

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 69--Selden | Slight | Slight | Moderate: slope. | Slight. |
| 70--Silawa | Slight | Slight | Moderate: slope, small stones. | Slight. |
| 71--Silstid | Moderate: too sandy. | Moderate: too sandy. | Moderate: slope, too sandy. | Moderate: too sandy. |
| 72:* | | | | |
| Silstid | Moderate: too sandy. | Moderate: too sandy. | Moderate: slope, too sandy. | Moderate: too sandy. |
| Urban land. | | | | |
| 73--Slidell | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: too clayey, percs slowly. | Moderate: too clayey. |
| 74--Slidell | Moderate: percs slowly, too clayey. | Moderate: too clayey, percs slowly. | Moderate: slope, too clayey, percs slowly. | Moderate: too clayey. |
| 75--Speck | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight. |
| 76--Stephenville | Moderate: slope. | Moderate: slope. | Severe: slope. | Slight. |
| 77, 78--Sunev | Slight | Slight | Moderate: slope, small stones. | Slight. |
| 79:* | | | | |
| Sunev | Slight | Slight | Moderate: slope, small stones. | Slight. |
| Urban land. | | | | |
| 80--Trinity | Severe: floods, wetness, percs slowly. | Severe: wetness, too clayey, percs slowly. | Severe: too clayey, wetness, floods. | Severe: wetness, too clayey. |
| 81.* Urban land | | | | |
| 82--Weatherford | Slight | Slight | Moderate: slope. | Severe: erodes easily. |
| 83--Whitesboro | Severe: floods. | Moderate: floods, wetness. | Severe: floods. | Moderate: floods. |
| 84--Wilson | Severe: wetness, percs slowly. | Severe: wetness, percs slowly. | Severe: wetness, percs slowly. | Severe: wetness, erodes easily. |
| 85:* | | | | |
| Wilson | Severe: wetness, percs slowly. | Severe: wetness, percs slowly. | Severe: wetness, percs slowly. | Severe: wetness, erodes easily. |
| Urban land. | | | | |

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

| Map symbol and soil name | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| 86, 87, 88---------- Windthorst | Slight---------- | Slight---------- | Moderate: slope. | Severe: erodes easily. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SELECTED SUITABLE PLANTS

[Only those map units suitable for flowers and ground cover, vines, shrubs, or trees are listed]

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 1, 2, 3,* 4,* 46* Aledo | Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia. | Banjsua rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca. | Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, junipers, live oak, Mexican plum, redbud, red cedar, Texas oak, Texas persimmon. |
| 5---------- Altoga | Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper. | Abelia, acuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca. | Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan, plum, redbud, red cedar. |
| 6---------- Aquilla | Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, junipers, marigold, ornamental pepper, pansies, periwinkle, petunia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, azalea, barberry, boxwood, camellias, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses. | Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow. |
| 7---------- Arents | Ajuga, amaryllis, aspidistra, blue fescue, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, hibiscus, hollies, hollyhock, jessamine, junipers, lantana, marigold, ornamental pepper, pansies, periwinkle, petunia, phlox, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, althea, azalea, Barbados-cherry, barberry, bottlebrush, bougainvillea, boxwood, bridalwreath, camellias, duranta, goldflower, guava, indian hawthorn, jasmine, loquat, mahonia, pomegranate, roses, Texas laurel, Texas sage. | American elm, arborvitae, baldcypress, bur oak, cottonless cottonwood, Japanese black pine, live oak, magnolia, maple, mountain laurel, peach, pecan, plum, sweetgum, sycamore, tulip-poplar, water oak. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 8----------<br>Arents | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |
| 12,* 13*----------<br>Aubrey | Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca. | Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage. | American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, mulberry, post oak, tulip-poplar. |
| 9, 10*----------<br>Bastsil | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |
| 11, 12,* 13*--------<br>Birome | Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca. | Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage. | American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, mulberry, post oak, tulip-poplar. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 2,* 3,* 14, 15, 16 Bolar | Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, perwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper. | Abelia, acuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca. | Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan, plum, redbud, red cedar. |
| 17, 46*---------- Brackett | Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia. | Banjsua rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca. | Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, junipers, live oak, Mexican plum, redbud, red cedar, Texas oak, Texas persimmon. |
| 18---------- Branyon | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 19---------- Burleson | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 20----------<br>Chatt | Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper. | Abelia, acuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca. | Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan, plum, redbud, red cedar. |
| 21, 22, 23*---------<br>Crosstell | Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca. | Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage. | American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, mulberry, post oak, tulip-poplar. |
| 24, 25*----------<br>Ferris | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 26, 27, 28*---------<br>Frio | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 29, 30, 31, 32*----- Gasil | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |
| 33----------- Heiden | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 34, 35*----------- Houston Black | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 36----------- Justin | Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper. | Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca. | American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 37----------<br>Konsil | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |
| 38----------<br>Leson | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 39, 40----------<br>Lindale | Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper. | Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca. | American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar. |
| 41, 42*----------<br>Lott | Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper, | Abelia, acuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca. | Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan, plum, redbud, red cedar. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 43, 44*---------- Luckenbach | Agapanthus, alyssum, Amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper. | Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca. | American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar. |
| 45---------- Mabank | Agapanthus, ajuga, amaryllis, aspidistra, aster, caladium, canna, cornflower, daylily, dwarf bamboo, euonymus, hollyhock, honeysuckle, lantana, liriope, moneywart, ophiopogon, plumbago, potentilla, salvia, Shasta daisy, vinca, zinnia. | Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | American holly, bottlebrush, bridalwreath, deutzia, forsythia, goldflower, hydrangea, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince. | American elm, Arizona ash, baldcypress, bur oak, cedar elm, cedrus, Chinese pistache, Chinese tallowtree, deodar cedar, hackberry, halepensis, live oak, magnolia, mulberry, peach, pecan, plum, redbud, red cedar, sweetgum, tulip-poplar, water oak, weeping willow. |
| 46*---------- Maloterre | Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, smallflower, verbena, vinca, zinnia. | Banjsua rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca. | Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, junipers, live oak, Mexican plum, redbud, red cedar, Texas oak, Texas persimmon. |
| 47---------- Medlin | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 48, 49*---------- Mingo | Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper. | Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca. | American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar. |
| 50, 51*---------- Navo | Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper. | Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca. | American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar. |
| 52---------- Nimrod | Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, junipers, marigold, ornamental pepper, pansies, periwinkle, petunia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, azalea, barberry, boxwood, camellias, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses. | Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel oaks, pear, pecan, pines, plum, sweetgum, weeping willow. |
| 53, 54, 55*---------- Ovan | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 57, 58*<br>Ponder | Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper. | Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca. | American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar. |
| 59, 60*<br>Pulexas | Ajuga, amaryllis, aspidistra, blue fescue, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, hibiscus, hollies, hollyhock, jessamine, junipers, lantana, marigold, ornamental pepper, pansies, periwinkle, petunia, phlox, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, althea, azalea, Barbados-cherry, barberry, bottlebrush, bougainvillea, boxwood, bridalwreath, camellias, duranta, goldflower, guava, indian hawthorn, jasmine, loquat, mahonia, pomegranate, roses, Texas laurel, Texas sage. | American elm, arborvitae, baldcypress, bur oak, cottonless cottonwood, Japanese black pine, live oak, magnolia, maple, mountain laurel, peach, pecan, plum, sweetgum, sycamore, tulip-poplar, water oak. |
| 61, 62*<br>Purves | Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia. | Banjsua rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca. | Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, junipers, live oak, Mexican plum, redbud, red cedar, Texas oak, Texas persimmon. |
| 63, 64*<br>Rader | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 12*----------<br>Rayex | Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywart, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca. | Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage. | American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, halepensis, mulberry, post oak, tulip-poplar. |
| 65, 66, 67*---------<br>Sanger | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 68----------<br>San Saba | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 69----------<br>Selden | Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, junipers, marigold, ornamental pepper, pansies, periwinkle, petunia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, azalea, barberry, boxwood, camellias, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses. | Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 70---------- Silawa | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |
| 71, 72*---------- Silstid | Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, junipers, marigold, ornamental pepper, pansies, periwinkle, petunia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, azalea, barberry, boxwood, camellias, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses. | Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow. |
| 73, 74---------- Slidell | Asiatic jasmine, canna, Caroline jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 75---------- Speck | Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia. | Banjsua rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca. | Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, junipers, live oak, Mexican plum, redbud, red cedar, Texas oak, Texas persimmon. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 76---------- Stephenville | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |
| 77, 78, 79*---------- Sunev | Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper. | Abelia, acuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca. | Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan, plum, redbud, red cedar. |
| 80---------- Trinity | Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Caroline jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper. | Abelia, acuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage. | American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, halepensis, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum. |
| 82---------- Weatherford | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |

See footnote at end of table.

TABLE 10.--SELECTED SUITABLE PLANTS--Continued

| Map symbol and soil name | Flowers and ground cover | Vines | Shrubs | Trees |
|---|---|---|---|---|
| 83---------- Whitesboro | Ajuga, amaryllis, aspidistra, blue fescue, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, hibiscus, hollies, hollyhock, jessamine, junipers, lantana, marigold, ornamental pepper, pansies, periwinkle, petunia, phlox, potentilla, Shasta daisy, verbena, zinnia. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Abelia, acuba, althea, azaleas, Barbados-cherry, barberry, bottlebrush, bougainvillea, boxwood, bridalwreath, camellias, duranta, goldflower, guava, indian hawthorn, jasmine, loquat, mahonia, pomegranate, roses, Texas laurel, Texas sage. | American elm, arborvitae, baldcypress, bur oak, cottonless cottonwood, Japanese black pine, live oak, magnolia, maple, mountain laurel, peach, pecan, plum, sweetgum, sycamore, tulip-poplar, water oak. |
| 84, 85*---------- Wilson | Agapanthus, ajuga, amaryllis, aspidistra, aster, caladium, canna, cornflower, daylily, dwarf bamboo, euonymus, hollyhock, honeysuckle, lantana, liriope, moneywart, ophiopogon, plumbago, potentilla, salvia, Shasta daisy, vinca, zinnia. | Boston ivy, honeysuckle, trumpet creeper, Virginia creeper. | American holly, bottlebrush, bridalwreath, deutzia, forsythia, goldflower, hydrangea, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince. | American elm, Arizona ash, baldcypress, bur oak, cedar elm, cedrus, Chinese pistache, Chinese tallowtree, deodar cedar, hackberry, halepensis, live oak, magnolia, mulberry, peach, pecan, plum, redbud, red cedar, sweetgum, tulip-poplar, water oak, weeping willow. |
| 86, 87, 88---------- Windthorst | Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox. | Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, confederate jasmine, English ivy, grapes, Virginia creeper, wisteria. | Acuba, azalea, barberry, butterflybush, camellias, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, pfitzer juniper, pittosporum, pomegranate, pyracantha, roses. | American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum. |

*This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

| Map symbol and soil name | 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 |
| 1---------- Aledo | Poor | Poor | Poor | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Poor. |
| 2:* | | | | | | | | | | | | |
| Aledo---------- | Very poor. | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Bolar---------- | Poor | Poor | Fair | --- | --- | Fair | Poor | Very poor. | Poor | --- | Very poor. | Fair. |
| 3:* | | | | | | | | | | | | |
| Aledo---------- | Poor | Poor | Poor | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Poor. |
| Bolar---------- | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 4:* | | | | | | | | | | | | |
| Aledo---------- | Poor | Poor | Poor | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Poor. |
| Urban land. | | | | | | | | | | | | |
| 5---------- Altoga | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 6---------- Aquilla | Fair | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 7---------- Arents | Very poor. | Fair | Good | --- | --- | Good | Fair | Fair | Fair | --- | Fair | Good. |
| 8---------- Arents | Good | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |
| 9---------- Bastsil | Good | Fair | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 10:* | | | | | | | | | | | | |
| Bastsil---------- | Good | Fair | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| Urban land. | | | | | | | | | | | | |
| 11---------- Birome | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 12:* | | | | | | | | | | | | |
| Birome---------- | Poor | Fair | Good | --- | --- | Good | Very poor. | Very poor. | Fair | --- | Very poor. | Good. |
| Aubrey---------- | Poor | Fair | Good | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Good. |
| Rayex---------- | Poor | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Map symbol and soil name | 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 |
| 13:* | | | | | | | | | | | | |
| Birome | Poor | Fair | Good | --- | --- | Good | Very poor. | Very poor. | Fair | --- | Very poor. | Good. |
| Aubrey | Poor | Fair | Good | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Good. |
| Urban land. | | | | | | | | | | | | |
| 14--- Bolar | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 15--- Bolar | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 16:* | | | | | | | | | | | | |
| Bolar | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 17--- Brackett | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 18--- Branyon | Good | Good | Poor | --- | --- | Fair | Poor | Poor | Fair | --- | Poor | Fair. |
| 19--- Burleson | Good | Good | Poor | --- | --- | Poor | Very poor. | Very poor. | Fair | --- | Very poor. | Poor. |
| 20--- Chatt | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 21, 22--- Crosstell | Fair | Fair | Good | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 23:* | | | | | | | | | | | | |
| Crosstell | Fair | Fair | Good | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 24--- Ferris | Poor | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 25:* | | | | | | | | | | | | |
| Ferris | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| Heiden | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 26--- Frio | Good | Good | Fair | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 27--- Frio | Fair | Fair | Fair | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 28:* | | | | | | | | | | | | |
| Frio | Good | Good | Fair | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 29, 30, 31--- Gasil | Good | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Map symbol and soil name | 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 |
| 32:* | | | | | | | | | | | | |
| Gasil | Good | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |
| Urban land. | | | | | | | | | | | | |
| 33--- Heiden | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 34--- Houston Black | Good | Good | Poor | --- | --- | Fair | Poor | Poor | Fair | --- | Poor | Fair. |
| 35:* | | | | | | | | | | | | |
| Houston Black | Good | Good | Poor | --- | --- | Fair | Poor | Poor | Fair | --- | Poor | Fair. |
| Urban land. | | | | | | | | | | | | |
| 36--- Justin | Good | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 37--- Konsil | Good | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |
| 38--- Leson | Good | Good | Poor | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 39--- Lindale | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 40:* | | | | | | | | | | | | |
| Lindale | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| Urban land. | | | | | | | | | | | | |
| 41--- Lott | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 42:* | | | | | | | | | | | | |
| Lott | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 43--- Luckenbach | Good | Good | Fair | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 44:* | | | | | | | | | | | | |
| Luckenbach | Good | Good | Fair | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 45--- Mabank | Fair | Good | Good | --- | --- | Fair | Fair | Fair | Good | --- | Fair | Fair. |
| 46:* | | | | | | | | | | | | |
| Maloterre | Very poor. | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Aledo | Very poor. | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| Brackett | Very poor. | Poor | Fair | --- | --- | Fair | Very poor. | Very poor. | Poor | --- | Very poor. | Fair. |
| 47--- Medlin | Fair | Fair | Poor | --- | --- | Poor | Very poor. | Very poor. | Fair | --- | Very poor. | Poor. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Map symbol and soil name | 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 |
| 48---------- Mingo | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 49:* Mingo---------- Urban land. | Fair | Good | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 50---------- Navo | Fair | Fair | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 51:* Navo---------- Urban land. | Fair | Fair | Fair | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 52---------- Nimrod | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 53---------- Ovan | Fair | Fair | Fair | --- | --- | Fair | Poor | Good | Fair | --- | Fair | Fair. |
| 54---------- Ovan | Fair | Fair | Fair | --- | --- | Fair | Poor | Good | Fair | --- | Fair | Fair. |
| 55:* Ovan---------- Urban land. | Fair | Fair | Fair | --- | --- | Fair | Poor | Good | Fair | --- | Fair | Fair. |
| 56.* Pits | | | | | | | | | | | | |
| 57---------- Ponder | Fair | Fair | Good | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 58:* Ponder---------- Urban land. | Fair | Fair | Good | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Fair. |
| 59---------- Pulexas | Poor | Good | Good | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Good. |
| 60:* Pulexas---------- Urban land. | Good | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 61---------- Purves | Fair | Good | Poor | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Poor |
| 62:* Purves---------- Urban land. | Fair | Good | Poor | --- | --- | Fair | Poor | Very poor. | Fair | --- | Very poor. | Poor |
| 63---------- Rader | Fair | Good | Good | --- | --- | Good | Poor | Poor | Good | --- | Poor | Good |
| 64:* Rader---------- Urban land. | Fair | Good | Good | --- | --- | Good | Poor | Poor | Good | --- | Poor | Good. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Map symbol and soil name | 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 |
| 65----------<br>Sanger | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 66----------<br>Sanger | Fair | Good | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 67:*<br>Sanger---------- | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| Urban land. | | | | | | | | | | | | |
| 68----------<br>San Saba | Fair | Fair | Fair | --- | --- | Fair | Poor | Poor | Fair | --- | Poor | Fair. |
| 69----------<br>Selden | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 70----------<br>Silawa | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 71----------<br>Silstid | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 72:*<br>Silstid---------- | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| Urban land. | | | | | | | | | | | | |
| 73, 74----------<br>Slidell | Good | Good | Fair | --- | --- | Fair | Poor | Very poor. | Good | --- | Very poor. | Fair. |
| 75----------<br>Speck | Fair | Fair | Fair | --- | --- | Fair | Very poor. | Very poor. | Fair | --- | Very poor. | Fair. |
| 76----------<br>Stephenville | Fair | Good | Good | --- | --- | Good | Very poor. | Very poor. | Good | --- | Very poor. | Good. |
| 77----------<br>Sunev | Good | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 78----------<br>Sunev | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 79:*<br>Sunev---------- | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| Urban land. | | | | | | | | | | | | |
| 80----------<br>Trinity | Poor | Fair | Fair | --- | --- | Fair | Fair | Good | Fair | --- | Fair | Fair. |
| 81.*<br>Urban land | | | | | | | | | | | | |
| 82----------<br>Weatherford | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 83----------<br>Whitesboro | Fair | Good | Good | --- | --- | Good | Poor | Poor | Good | --- | Poor | Good. |
| 84----------<br>Wilson | Fair | Fair | Good | --- | --- | Fair | Fair | Fair | Fair | --- | Fair | Fair. |

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

| Map symbol and soil name | 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 |
| 85:* Wilson | Fair | Fair | Good | --- | --- | Fair | Fair | Fair | Fair | --- | Fair | Fair. |
| Urban land. | | | | | | | | | | | | |
| 86 Windthorst | Good | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 87 Windthorst | Fair | Good | Good | --- | --- | Good | Poor | Very poor. | Good | --- | Very poor. | Good. |
| 88 Windthorst | Poor | Fair | Good | --- | --- | Good | Poor | Very poor. | Fair | --- | Very poor. | Good. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--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]

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 1<br>Aledo | Severe:<br>depth to rock. | Moderate:<br>depth to rock. | Severe:<br>depth to rock. | Moderate:<br>depth to rock,<br>slope. | Moderate:<br>depth to rock. | Severe:<br>thin layer. |
| 2:*<br>Aledo | Severe:<br>depth to rock. | Moderate:<br>depth to rock,<br>slope. | Severe:<br>depth to rock. | Severe:<br>slope. | Moderate:<br>depth to rock. | Severe:<br>thin layer. |
| Bolar | Moderate:<br>depth to rock,<br>slope. | Moderate:<br>shrink-swell,<br>slope. | Moderate:<br>depth to rock,<br>slope,<br>shrink-swell. | Severe:<br>slope. | Moderate:<br>low strength,<br>slope,<br>shrink-swell. | Moderate:<br>slope,<br>thin layer. |
| 3:*<br>Aledo | Severe:<br>depth to rock,<br>slope. | Moderate:<br>depth to rock,<br>slope. | Severe:<br>depth to rock,<br>slope. | Severe:<br>slope. | Moderate:<br>depth to rock,<br>slope. | Severe:<br>thin layer,<br>slope. |
| Bolar | Moderate:<br>depth to rock,<br>slope. | Moderate:<br>shrink-swell,<br>slope. | Moderate:<br>depth to rock,<br>shrink-swell,<br>slope. | Moderate:<br>shrink-swell,<br>slope. | Moderate:<br>low strength,<br>shrink-swell,<br>slope. | Moderate:<br>thin layer,<br>slope. |
| Urban land. | | | | | | |
| 4:*<br>Aledo | Severe:<br>depth to rock. | Moderate:<br>depth to rock. | Severe:<br>depth to rock. | Moderate:<br>depth to rock,<br>slope. | Moderate:<br>depth to rock. | Severe:<br>thin layer. |
| Urban land. | | | | | | |
| 5<br>Altoga | Moderate:<br>too clayey,<br>slope. | Severe:<br>shrink-swell. | Moderate:<br>slope,<br>shrink-swell. | Severe:<br>shrink-swell,<br>slope. | Severe:<br>low strength,<br>shrink-swell,<br>slope. | Moderate:<br>slope. |
| 6<br>Aquilla | Severe:<br>cutbanks cave. | Slight | Moderate:<br>wetness. | Slight | Slight | Moderate:<br>droughty. |
| 7,* 8.*<br>Arents | | | | | | |
| 9<br>Bastsil | Slight | Moderate:<br>shrink-swell. | Moderate:<br>shrink-swell. | Moderate:<br>shrink-swell. | Moderate:<br>low strength,<br>shrink-swell. | Slight. |
| 10:*<br>Bastsil | Slight | Moderate:<br>shrink-swell. | Moderate:<br>shrink-swell. | Moderate:<br>shrink-swell. | Moderate:<br>low strength,<br>shrink-swell. | Slight. |
| Urban land. | | | | | | |
| 11<br>Birome | Moderate:<br>depth to rock,<br>too clayey. | Moderate:<br>shrink-swell. | Moderate:<br>depth to rock,<br>shrink-swell. | Moderate:<br>shrink-swell. | Severe:<br>low strength. | Moderate:<br>thin layer. |
| 12:*<br>Birome | Moderate:<br>depth to rock,<br>too clayey,<br>slope. | Moderate:<br>shrink-swell,<br>slope. | Moderate:<br>depth to rock,<br>slope,<br>shrink-swell. | Severe:<br>slope. | Severe:<br>low strength,<br>slope. | Severe:<br>small stones. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 12:* | | | | | | |
| Aubrey | Moderate: depth to rock, too clayey, slope. | Moderate: shrink-swell, slope. | Moderate: depth to rock, slope, shrink-swell. | Severe: slope. | Severe: low strength, slope. | Moderate: slope, thin layer. |
| Rayex | Severe: depth to rock. | Moderate: shrink-swell, slope, depth to rock. | Severe: depth to rock. | Severe: slope. | Severe: low strength, slope. | Severe: small stones, thin layer. |
| 13:* | | | | | | |
| Birome | Moderate: depth to rock, too clayey, slope. | Moderate: shrink-swell, slope. | Moderate: depth to rock, slope, shrink-swell. | Severe: slope. | Severe: low strength, slope. | Moderate: slope, thin layer. |
| Aubrey | Moderate: depth to rock, too clayey, slope. | Moderate: shrink-swell, slope. | Moderate: depth to rock, slope, shrink-swell. | Severe: slope. | Severe: low strength, slope. | Moderate: slope, thin layer. |
| Urban land. | | | | | | |
| 14 Bolar | Moderate: depth to rock. | Moderate: shrink-swell. | Moderate: depth to rock, shrink-swell. | Moderate: shrink-swell. | Moderate: low strength, shrink-swell. | Moderate: thin layer. |
| 15 Bolar | Moderate: depth to rock. | Moderate: shrink-swell. | Moderate: depth to rock, shrink-swell. | Moderate: shrink-swell, slope. | Moderate: low strength, shrink-swell. | Moderate: thin layer. |
| 16:* | | | | | | |
| Bolar | Moderate: depth to rock. | Moderate: shrink-swell. | Moderate: depth to rock, shrink-swell. | Moderate: shrink-swell. | Moderate: low strength, shrink-swell. | Moderate: thin layer. |
| Urban land. | | | | | | |
| 17 Brackett | Severe: depth to rock. | Moderate: depth to rock. | Severe: depth to rock. | Moderate: slope, depth to rock. | Severe: low strength. | Severe: thin layer. |
| 18 Branyon | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 19 Burleson | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 20 Chatt | Moderate: too clayey. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 21, 22 Crosstell | Moderate: too clayey. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Slight. |
| 23:* | | | | | | |
| Crosstell | Moderate: too clayey. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Slight. |
| Urban land. | | | | | | |
| 24 Ferris | Severe: cutbanks cave, slope. | Severe: shrink-swell, slope. | Severe: shrink-swell, slope. | Severe: shrink-swell, slope. | Severe: low strength, shrink-swell, slope. | Severe: too clayey, slope. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 25:* | | | | | | |
| Ferris | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| Heiden | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 26 Frio | Moderate: too clayey, floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: low strength, floods. | Severe: too clayey. |
| 27 Frio | Moderate: too clayey, floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: low strength, floods. | Severe: floods, too clayey. |
| 28:* | | | | | | |
| Frio | Moderate: too clayey, floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: low strength, floods. | Severe: too clayey. |
| Urban land. | | | | | | |
| 29 Gasil | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Slight. |
| 30 Gasil | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell, slope. | Moderate: shrink-swell. | Slight. |
| 31 Gasil | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: low strength, shrink-swell. | Slight. |
| 32:* | | | | | | |
| Gasil | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Slight. |
| Urban land. | | | | | | |
| 33 Heiden | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 34 Houston Black | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 35:* | | | | | | |
| Houston Black | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| Urban land. | | | | | | |
| 36 Justin | Slight | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |
| 37 Konsil | Slight | Moderate: shrink-swell. | Moderate: low strength, shrink-swell. | Moderate: shrink-swell. | Moderate: low strength. | Slight. |
| 38 Leson | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 39 Lindale | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 40:* Lindale | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |
| Urban land. | | | | | | |
| 41--- Lott | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Severe: too clayey. |
| 42:* Lott | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Severe: too clayey. |
| Urban land. | | | | | | |
| 43--- Luckenbach | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |
| 44:* Luckenbach | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |
| Urban land. | | | | | | |
| 45--- Mabank | Severe: wetness. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: low strength, wetness, shrink-swell. | Severe: wetness. |
| 46:* Maloterre | Severe: depth to rock, slope. | Severe: depth to rock, slope. | Severe: depth to rock, slope. | Severe: slope, depth to rock. | Severe: depth to rock, slope. | Severe: thin layer, slope. |
| Aledo | Severe: depth to rock, slope. | Moderate: depth to rock, slope. | Severe: depth to rock, slope. | Severe: slope. | Moderate: depth to rock, slope. | Severe: thin layer, slope. |
| Brackett | Severe: depth to rock, slope. | Moderate: slope, depth to rock. | Severe: depth to rock, slope. | Severe: slope. | Severe: low strength, slope. | Severe: thin layer, slope. |
| 47--- Medlin | Severe: cutbanks cave, slope. | Severe: shrink-swell, slope. | Severe: shrink-swell, slope. | Severe: shrink-swell, slope. | Severe: low strength, shrink-swell, slope. | Severe: too clayey, slope. |
| 48--- Mingo | Severe: depth to rock. | Severe: shrink-swell. | Severe: depth to rock, shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Moderate: thin layer. |
| 49:* Mingo | Severe: depth to rock. | Severe: shrink-swell. | Severe: depth to rock, shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Moderate: thin layer. |
| Urban land. | | | | | | |
| 50--- Navo | Moderate: too clayey. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Slight. |
| 51:* Navo | Moderate: too clayey. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Slight. |
| Urban land. | | | | | | |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 52----------<br>Nimrod | Severe:<br>cutbanks cave,<br>wetness. | Moderate:<br>wetness. | Severe:<br>wetness. | Moderate:<br>wetness. | Moderate:<br>wetness. | Moderate:<br>wetness,<br>droughty. |
| 53, 54----------<br>Ovan | Severe:<br>cutbanks cave. | Severe:<br>floods,<br>shrink-swell. | Severe:<br>floods,<br>shrink-swell. | Severe:<br>floods,<br>shrink-swell. | Severe:<br>low strength,<br>floods,<br>shrink-swell. | Severe:<br>too clayey. |
| 55:*<br>Ovan----------<br><br>Urban land. | Severe:<br>cutbanks cave. | Severe:<br>floods,<br>shrink-swell. | Severe:<br>floods,<br>shrink-swell. | Severe:<br>floods,<br>shrink-swell. | Severe:<br>low strength,<br>floods,<br>shrink-swell. | Severe:<br>too clayey. |
| 56.*<br>Pits | | | | | | |
| 57----------<br>Ponder | Moderate:<br>too clayey. | Severe:<br>shrink-swell. | Severe:<br>shrink-swell. | Severe:<br>shrink-swell. | Severe:<br>low strength,<br>shrink-swell. | Slight. |
| 58:*<br>Ponder----------<br><br>Urban land. | Moderate:<br>too clayey. | Severe:<br>shrink-swell. | Severe:<br>shrink-swell. | Severe:<br>shrink-swell. | Severe:<br>low strength,<br>shrink-swell. | Slight. |
| 59----------<br>Pulexas | Moderate:<br>floods. | Severe:<br>floods. | Severe:<br>floods. | Severe:<br>floods. | Severe:<br>floods. | Severe:<br>floods. |
| 60:*<br>Pulexas----------<br><br>Urban land. | Moderate:<br>floods. | Severe:<br>floods. | Severe:<br>floods. | Severe:<br>floods. | Severe:<br>floods. | Moderate:<br>floods. |
| 61----------<br>Purves | Severe:<br>depth to rock. | Severe:<br>shrink-swell,<br>depth to rock. | Severe:<br>depth to rock,<br>shrink-swell. | Severe:<br>shrink-swell,<br>depth to rock. | Severe:<br>depth to rock,<br>low strength,<br>shrink-swell. | Severe:<br>thin layer,<br>too clayey. |
| 62:*<br>Purves----------<br><br>Urban land. | Severe:<br>depth to rock. | Severe:<br>shrink-swell,<br>depth to rock. | Severe:<br>depth to rock,<br>shrink-swell. | Severe:<br>shrink-swell,<br>depth to rock. | Severe:<br>depth to rock,<br>low strength,<br>shrink-swell. | Severe:<br>thin layer,<br>too clayey. |
| 63----------<br>Rader | Severe:<br>wetness. | Moderate:<br>wetness. | Severe:<br>wetness,<br>shrink-swell. | Moderate:<br>wetness. | Moderate:<br>wetness. | Slight. |
| 64:*<br>Rader----------<br><br>Urban land. | Severe:<br>wetness. | Moderate:<br>wetness. | Severe:<br>wetness,<br>shrink-swell. | Moderate:<br>wetness. | Moderate:<br>wetness. | Slight. |
| 65, 66----------<br>Sanger | Severe:<br>cutbanks cave. | Severe:<br>shrink-swell. | Severe:<br>shrink-swell. | Severe:<br>shrink-swell. | Severe:<br>low strength,<br>shrink-swell. | Severe:<br>too clayey. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 67:* Sanger | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| Urban land. | | | | | | |
| 68--- San Saba | Severe: depth to rock, cutbanks cave. | Severe: shrink-swell. | Severe: depth to rock, shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 69--- Selden | Slight--- | Slight--- | Slight--- | Slight--- | Slight--- | Slight. |
| 70--- Silawa | Slight--- | Slight--- | Slight--- | Moderate: slope. | Slight--- | Slight. |
| 71--- Silstid | Severe: cutbanks cave. | Slight--- | Slight--- | Slight--- | Slight--- | Moderate: droughty. |
| 72:* Silstid | Severe: cutbanks cave. | Slight--- | Slight--- | Slight--- | Slight--- | Moderate: droughty. |
| Urban land. | | | | | | |
| 73, 74--- Slidell | Severe: cutbanks cave. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: low strength, shrink-swell. | Severe: too clayey. |
| 75--- Speck | Severe: depth to rock. | Severe: shrink-swell, depth to rock. | Severe: depth to rock, shrink-swell. | Severe: shrink-swell, depth to rock. | Severe: depth to rock, low strength, shrink-swell. | Severe: thin layer. |
| 76--- Stephenville | Moderate: depth to rock, slope. | Moderate: slope. | Moderate: depth to rock, slope. | Severe: slope. | Moderate: slope. | Moderate: slope, thin layer. |
| 77--- Sunev | Slight--- | Slight--- | Slight--- | Slight--- | Slight--- | Slight. |
| 78--- Sunev | Slight--- | Slight--- | Slight--- | Moderate: slope. | Slight--- | Slight. |
| 79:* Sunev | Slight--- | Slight--- | Slight--- | Moderate: slope. | Slight--- | Slight. |
| Urban land. | | | | | | |
| 80--- Trinity | Severe: cutbanks cave, wetness. | Severe: floods, wetness, shrink-swell. | Severe: floods, wetness, shrink-swell. | Severe: floods, wetness, shrink-swell. | Severe: low strength, wetness, floods. | Severe: wetness, floods, too clayey. |
| 81.* Urban land | | | | | | |
| 82--- Weatherford | Slight--- | Slight--- | Slight--- | Moderate: slope. | Moderate: low strength. | Slight. |
| 83--- Whitesboro | Severe: wetness. | Severe: floods. | Severe: floods, wetness. | Severe: floods. | Severe: low strength, floods. | Severe: floods. |
| 84--- Wilson | Severe: wetness. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: low strength, wetness, shrink-swell. | Severe: wetness. |

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

| Map symbol and soil name | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets | Lawns and landscaping |
|---|---|---|---|---|---|---|
| 85:* | | | | | | |
| Wilson | Severe: wetness. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: wetness, shrink-swell. | Severe: low strength, wetness, shrink-swell. | Severe: wetness. |
| Urban land. | | | | | | |
| 86--- Windthorst | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. | Slight. |
| 87, 88--- Windthorst | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell, slope. | Severe: low strength. | Slight. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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]

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 1---------- Aledo | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| 2:* | | | | | |
| Aledo---------- | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| Bolar---------- | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim. |
| 3:* | | | | | |
| Aledo---------- | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| Bolar---------- | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim. |
| Urban land. | | | | | |
| 4:* | | | | | |
| Aledo---------- | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| Urban land. | | | | | |
| 5---------- Altoga | Moderate: percs slowly, slope. | Severe: slope. | Severe: too clayey. | Moderate: slope. | Poor: too clayey. |
| 6---------- Aquilla | Severe: poor filter. | Severe: seepage. | Severe: seepage. | Severe: seepage. | Poor: seepage. |
| 7,* 8.* Arents | | | | | |
| 9---------- Bastsil | Moderate: percs slowly. | Severe: seepage. | Slight---------- | Slight---------- | Good. |
| 10:* | | | | | |
| Bastsil---------- | Moderate: percs slowly. | Severe: seepage. | Slight---------- | Slight---------- | Good. |
| Urban land. | | | | | |
| 11---------- Birome | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| 12:* | | | | | |
| Birome---------- | Severe: depth to rock, percs slowly. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 12:* | | | | | |
| Aubrey | Severe: depth to rock, percs slowly. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| Rayex | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey. |
| 13:* | | | | | |
| Birome | Severe: depth to rock, percs slowly. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| Aubrey | Severe: depth to rock, percs slowly. | Severe: depth to rock, slope. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| Urban land. | | | | | |
| 14, 15--- Bolar | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim. |
| 16:* | | | | | |
| Bolar | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim. |
| Urban land. | | | | | |
| 17--- Brackett | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| 18--- Branyon | Severe: percs slowly. | Slight | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 19--- Burleson | Severe: percs slowly. | Slight | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 20--- Chatt | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 21, 22--- Crosstell | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 23:* | | | | | |
| Crosstell | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 24--- Ferris | Severe: percs slowly. | Severe: slope. | Severe: too clayey. | Moderate: slope. | Poor: too clayey, hard to pack. |
| 25:* | | | | | |
| Ferris | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 25:* Heiden | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 26 Frio | Severe: floods, percs slowly. | Severe: floods. | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey, hard to pack. |
| 27 Frio | Severe: floods, percs slowly. | Severe: floods. | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey, hard to pack. |
| 28:* Frio | Severe: floods, percs slowly. | Severe: floods. | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 29, 30 Gasil | Slight | Moderate: seepage, slope. | Slight | Slight | Good. |
| 31 Gasil | Moderate: percs slowly. | Moderate: slope, seepage. | Slight | Slight | Good. |
| 32:* Gasil | Slight | Moderate: seepage, slope. | Slight | Slight | Good. |
| Urban land. | | | | | |
| 33 Heiden | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 34 Houston Black | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 35:* Houston Black | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 36 Justin | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| 37 Konsil | Moderate: percs slowly. | Moderate: seepage, slope. | Slight | Slight | Good. |
| 38 Leson | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 39 Lindale | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 40:* | | | | | |
| Lindale | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 41 | | | | | |
| Lott | Severe: percs slowly. | Moderate: seepage, slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 42:* | | | | | |
| Lott | Severe: percs slowly. | Moderate: seepage, slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 43 | | | | | |
| Luckenbach | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey. |
| 44:* | | | | | |
| Luckenbach | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey. |
| Urban land. | | | | | |
| 45 | | | | | |
| Mabank | Severe: wetness, percs slowly. | Severe: wetness. | Severe: wetness, too clayey. | Severe: wetness. | Poor: too clayey, hard to pack, wetness. |
| 46:* | | | | | |
| Maloterre | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim. |
| Aledo | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| Brackett | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock. | Poor: area reclaim, small stones. |
| 47 | | | | | |
| Medlin | Severe: percs slowly. | Severe: slope. | Severe: too clayey. | Moderate: slope. | Poor: too clayey, hard to pack. |
| 48 | | | | | |
| Mingo | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| 49:* | | | | | |
| Mingo | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| Urban land. | | | | | |
| 50 | | | | | |
| Navo | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 51:* | | | | | |
| Navo | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 52--- Nimrod | Severe: wetness, percs slowly, poor filter. | Severe: seepage, wetness. | Severe: wetness. | Severe: seepage. | Fair: wetness. |
| 53, 54--- Ovan | Severe: floods, percs slowly. | Severe: floods. | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey, hard to pack. |
| 55:* | | | | | |
| Ovan | Severe: floods, percs slowly. | Severe: floods. | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 56.* Pits | | | | | |
| 57--- Ponder | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 58:* | | | | | |
| Ponder | Severe: percs slowly. | Slight | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 59--- Pulexas | Severe: floods. | Severe: seepage, floods. | Severe: floods, seepage. | Severe: floods, seepage. | Good. |
| 60:* | | | | | |
| Pulexas | Severe: floods. | Severe: seepage, floods. | Severe: floods, seepage. | Severe: floods, seepage. | Good. |
| Urban land. | | | | | |
| 61--- Purves | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| 62:* | | | | | |
| Purves | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| Urban land. | | | | | |
| 63--- Rader | Severe: wetness, percs slowly. | Slight | Severe: too clayey. | Moderate: wetness. | Poor: too clayey, hard to pack. |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 64:* | | | | | |
| Rader | Severe: wetness, percs slowly. | Slight | Severe: too clayey. | Moderate: wetness. | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 65, 66--- Sanger | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 67:* | | | | | |
| Sanger | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| Urban land. | | | | | |
| 68--- San Saba | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| 69--- Selden | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| 70--- Silawa | Severe: poor filter. | Severe: seepage. | Severe: seepage. | Severe: seepage. | Good. |
| 71--- Silstid | Slight | Severe: seepage. | Moderate: too sandy. | Severe: seepage. | Poor: seepage. |
| 72:* | | | | | |
| Silstid | Slight | Severe: seepage. | Moderate: too sandy. | Severe: seepage. | Poor: seepage. |
| Urban land. | | | | | |
| 73--- Slidell | Severe: percs slowly. | Slight | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 74--- Slidell | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey, hard to pack. |
| 75--- Speck | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock, too clayey. | Severe: depth to rock. | Poor: area reclaim, too clayey, hard to pack. |
| 76--- Stephenville | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Severe: depth to rock, seepage. | Poor: area reclaim. |
| 77, 78--- Sunev | Slight | Moderate: seepage, slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| 79:* | | | | | |
| Sunev | Slight | Moderate: seepage, slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| Urban land. | | | | | |

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

| Map symbol and soil name | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| 80----------<br>Trinity | Severe:<br>floods,<br>wetness,<br>percs slowly. | Slight---------- | Severe:<br>floods,<br>wetness,<br>too clayey. | Severe:<br>floods,<br>wetness. | Poor:<br>too clayey,<br>hard to pack,<br>wetness. |
| 81.*<br>Urban land | | | | | |
| 82----------<br>Weatherford | Moderate:<br>depth to rock,<br>percs slowly. | Moderate:<br>seepage,<br>depth to rock,<br>slope. | Severe:<br>depth to rock. | Moderate:<br>depth to rock. | Fair:<br>area reclaim,<br>too clayey,<br>thin layer. |
| 83----------<br>Whitesboro | Severe:<br>floods,<br>wetness. | Severe:<br>floods,<br>wetness. | Severe:<br>floods,<br>wetness. | Severe:<br>floods,<br>wetness. | Fair:<br>too clayey,<br>wetness. |
| 84----------<br>Wilson | Severe:<br>wetness,<br>percs slowly. | Slight---------- | Severe:<br>wetness,<br>too clayey. | Severe:<br>wetness. | Poor:<br>too clayey,<br>hard to pack,<br>wetness. |
| 85:*<br>Wilson---------- | Severe:<br>wetness,<br>percs slowly. | Slight---------- | Severe:<br>wetness,<br>too clayey. | Severe:<br>wetness. | Poor:<br>too clayey,<br>hard to pack,<br>wetness. |
| Urban land. | | | | | |
| 86, 87, 88----------<br>Windthorst | Severe:<br>percs slowly. | Moderate:<br>slope. | Severe:<br>too clayey. | Slight---------- | Poor:<br>too clayey,<br>hard to pack. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

| Map symbol and soil name | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| 1--- Aledo | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| 2:* Aledo--- | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| Bolar--- | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones. |
| 3:* Aledo--- | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| Bolar--- | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones. |
| Urban land. | | | | |
| 4:* Aledo--- | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| Urban land. | | | | |
| 5--- Altoga | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey, slope. |
| 6--- Aquilla | Good--- | Improbable: thin layer. | Improbable: too sandy. | Fair: too sandy. |
| 7,* 8.* Arents | | | | |
| 9--- Bastsil | Fair: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| 10:* Bastsil--- | Fair: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| Urban land. | | | | |
| 11--- Birome | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, too clayey. |
| 12:* Birome--- | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, too clayey. |
| Aubrey--- | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Map symbol and soil name | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| 12:* | | | | |
| Rayex | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| 13:* | | | | |
| Birome | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, too clayey. |
| Aubrey | Poor: area reclaim, low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| Urban land. | | | | |
| 14, 15 | | | | |
| Bolar | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones. |
| 16:* | | | | |
| Bolar | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones. |
| Urban land. | | | | |
| 17 | | | | |
| Brackett | Poor: area reclaim, low strength, thin layer. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| 18 | | | | |
| Branyon | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 19 | | | | |
| Burleson | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 20 | | | | |
| Chatt | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 21, 22 | | | | |
| Crosstell | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 23:* | | | | |
| Crosstell | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 24 | | | | |
| Ferris | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 25:* | | | | |
| Ferris | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Heiden | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 26, 27 | | | | |
| Frio | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Map symbol and soil name | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| 28:* | | | | |
| Frio | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 29, 30---- Gasil | Fair: shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| 31---- Gasil | Fair: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey. |
| 32:* | | | | |
| Gasil | Fair: shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| Urban land. | | | | |
| 33---- Heiden | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 34---- Houston Black | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 35:* | | | | |
| Houston Black | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 36---- Justin | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: thin layer. |
| 37---- Konsil | Fair: low strength. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| 38---- Leson | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 39---- Lindale | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, area reclaim, too clayey. |
| 40:* | | | | |
| Lindale | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: small stones, area reclaim, too clayey. |
| Urban land. | | | | |
| 41---- Lott | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 42:* | | | | |
| Lott | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 43---- Luckenbach | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Map symbol and soil name | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| 44:* | | | | |
| Luckenbach | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 45--- Mabank | Poor: low strength, wetness, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, wetness. |
| 46:* | | | | |
| Maloterre | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| Aledo | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| Brackett | Poor: area reclaim, low strength, thin layer. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, small stones. |
| 47--- Medlin | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 48--- Mingo | Poor: area reclaim, low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| 49:* | | | | |
| Mingo | Poor: area reclaim, low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| Urban land. | | | | |
| 50--- Navo | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 51:* | | | | |
| Navo | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 52--- Nimrod | Fair: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: too sandy. |
| 53, 54--- Ovan | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 55:* | | | | |
| Ovan | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 56.* Pits | | | | |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Map symbol and soil name | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| 57--Ponder | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| 58:* Ponder | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |
| Urban land. | | | | |
| 59--Pulexas | Good | Improbable: excess fines. | Improbable: excess fines. | Good. |
| 60:* Pulexas | Good | Improbable: excess fines. | Improbable: excess fines. | Good. |
| Urban land. | | | | |
| 61--Purves | Poor: area reclaim, low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, too clayey, small stones. |
| 62:* Purves | Poor: area reclaim, low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim, too clayey, small stones. |
| Urban land. | | | | |
| 63--Rader | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: thin layer. |
| 64:* Rader | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Fair: thin layer. |
| Urban land. | | | | |
| 65, 66--Sanger | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 67:* Sanger | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| Urban land. | | | | |
| 68--San Saba | Poor: area reclaim, low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 69--Selden | Good | Improbable: excess fines. | Improbable: excess fines. | Fair: too sandy. |
| 70--Silawa | Good | Improbable: excess fines. | Improbable: excess fines. | Good. |
| 71--Silstid | Good | Improbable: thin layer. | Improbable: too sandy. | Fair: too sandy. |

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

| Map symbol and soil name | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| 72:* Silstid | Good | Improbable: thin layer. | Improbable: too sandy. | Fair: too sandy. |
| Urban land. | | | | |
| 73, 74--- Slidell | Poor: low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey. |
| 75--- Speck | Poor: area reclaim, low strength, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: area reclaim. |
| 76--- Stephenville | Poor: area reclaim. | Improbable: excess fines. | Improbable: excess fines. | Fair: area reclaim, thin layer. |
| 77, 78--- Sunev | Good | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey, small stones. |
| 79:* Sunev | Good | Improbable: excess fines. | Improbable: excess fines. | Fair: too clayey, small stones. |
| Urban land. | | | | |
| 80--- Trinity | Poor: wetness. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, wetness. |
| 81.* Urban land | | | | |
| 82--- Weatherford | Fair: area reclaim, low strength, thin layer. | Improbable: excess fines. | Improbable: excess fines. | Fair: thin layer. |
| 83--- Whitesboro | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Good. |
| 84--- Wilson | Poor: low strength, wetness, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, wetness. |
| 85:* Wilson | Poor: low strength, wetness, shrink-swell. | Improbable: excess fines. | Improbable: excess fines. | Poor: too clayey, wetness. |
| Urban land. | | | | |
| 86, 87, 88--- Windthorst | Poor: low strength. | Improbable: excess fines. | Improbable: excess fines. | Poor: thin layer. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--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]

| Map symbol and soil name | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| 1----------<br>Aledo | Severe: depth to rock. | Severe: thin layer. | Deep to water | Large stones, droughty, depth to rock. | Large stones, depth to rock. | Large stones, droughty. |
| 2:*<br>Aledo---------- | Severe: depth to rock, slope. | Severe: thin layer. | Deep to water | Large stones, droughty, depth to rock. | Slope, large stones, depth to rock. | Large stones, slope, droughty. |
| Bolar---------- | Severe: slope. | Moderate: thin layer, piping. | Deep to water | Depth to rock, slope. | Slope, depth to rock. | Slope, depth to rock. |
| 3:*<br>Aledo---------- | Severe: depth to rock, slope. | Severe: thin layer. | Deep to water | Large stones, droughty, depth to rock. | Slope, large stones, depth to rock. | Large stones, slope, droughty. |
| Bolar---------- | Severe: seepage, depth to rock, slope. | Moderate: thin layer, piping. | Deep to water | Depth to rock, slope. | Depth to rock, slope. | Depth to rock, slope. |
| Urban land. | | | | | | |
| 4:*<br>Aledo---------- | Severe: depth to rock. | Severe: thin layer. | Deep to water | Large stones, droughty, depth to rock. | Large stones, depth to rock. | Large stones, droughty. |
| Urban land. | | | | | | |
| 5----------<br>Altoga | Severe: slope. | Slight--------- | Deep to water | Slope---------- | Slope---------- | Slope. |
| 6----------<br>Aquilla | Severe: seepage. | Severe: seepage, piping. | Deep to water | Droughty, fast intake, slope. | Favorable------ | Droughty. |
| 7,* 8.*<br>Arents | | | | | | |
| 9----------<br>Bastsil | Moderate: seepage. | Moderate: piping. | Deep to water | Favorable------ | Favorable------ | Favorable. |
| 10:*<br>Bastsil---------- | Moderate: seepage. | Moderate: piping. | Deep to water | Favorable------ | Favorable------ | Favorable. |
| Urban land. | | | | | | |
| 11----------<br>Birome | Moderate: seepage, depth to rock, slope. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Depth to rock | Slope, depth to rock. |
| 12:*<br>Birome---------- | Severe: slope. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Slope, depth to rock. | Slope, depth to rock. |
| Aubrey---------- | Severe: slope. | Severe: thin layer. | Deep to water | Soil blowing, percs slowly, depth to rock. | Slope, depth to rock, soil blowing. | Slope, depth to rock, percs slowly. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Map symbol and soil name | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| 12:* | | | | | | |
| Rayex | Severe: depth to rock, slope. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Slope, depth to rock. | Slope, depth to rock. |
| 13:* | | | | | | |
| Birome | Severe: slope. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Slope, depth to rock. | Slope, erodes easily, depth to rock. |
| Aubrey | Severe: slope. | Severe: thin layer. | Deep to water | Soil blowing, percs slowly, depth to rock. | Slope, depth to rock, soil blowing. | Slope, depth to rock, percs slowly. |
| Urban land. | | | | | | |
| 14---- Bolar | Moderate: seepage, depth to rock. | Moderate: thin layer, piping. | Deep to water | Depth to rock | Depth to rock | Depth to rock. |
| 15---- Bolar | Moderate: seepage, depth to rock, slope. | Moderate: thin layer, piping. | Deep to water | Depth to rock, slope. | Depth to rock | Depth to rock. |
| 16:* | | | | | | |
| Bolar | Moderate: seepage, depth to rock, slope. | Moderate: thin layer, piping. | Deep to water | Depth to rock, slope. | Depth to rock | Depth to rock. |
| Urban land. | | | | | | |
| 17---- Brackett | Severe: depth to rock. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Large stones, depth to rock. | Large stones, depth to rock. |
| 18---- Branyon | Slight---- | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly--- | Percs slowly. |
| 19---- Burleson | Slight---- | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly--- | Percs slowly. |
| 20---- Chatt | Slight---- | Moderate: hard to pack. | Deep to water | Slow intake---- | Favorable------ | Favorable. |
| 21---- Crosstell | Slight---- | Moderate: hard to pack. | Deep to water | Soil blowing, percs slowly. | Erodes easily, soil blowing. | Erodes easily, percs slowly. |
| 22---- Crosstell | Moderate: slope. | Moderate: hard to pack. | Deep to water | Soil blowing, percs slowly, slope. | Erodes easily, soil blowing. | Erodes easily, percs slowly. |
| 23:* | | | | | | |
| Crosstell | Moderate: slope. | Moderate: hard to pack. | Deep to water | Soil blowing, percs slowly, slope. | Erodes easily, soil blowing. | Erodes easily, percs slowly. |
| Urban land. | | | | | | |
| 24---- Ferris | Severe: slope. | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, slope. | Slope, percs slowly. | Slope, percs slowly. |
| 25:* | | | | | | |
| Ferris | Moderate: slope. | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, slope. | Percs slowly--- | Percs slowly. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Map symbol and soil name | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| 25:* Heiden | Moderate: slope. | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, slope. | Percs slowly | Percs slowly. |
| 26, 27 Frio | Slight | Moderate: hard to pack. | Deep to water | Slow intake, floods. | Favorable | Favorable. |
| 28:* Frio | Slight | Moderate: hard to pack. | Deep to water | Slow intake, floods. | Favorable | Favorable. |
| Urban land. | | | | | | |
| 29 Gasil | Moderate: seepage. | Severe: piping. | Deep to water | Soil blowing | Soil blowing | Favorable. |
| 30 Gasil | Moderate: seepage. | Severe: piping. | Deep to water | Soil blowing, slope. | Soil blowing | Favorable. |
| 31 Gasil | Moderate: seepage. | Slight | Slope | Slope | Favorable | Favorable. |
| 32:* Gasil | Moderate: seepage. | Severe: piping. | Deep to water | Soil blowing, slope. | Soil blowing | Favorable. |
| Urban land. | | | | | | |
| 33 Heiden | Slight | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly | Percs slowly. |
| 34 Houston Black | Slight | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly | Percs slowly. |
| 35:* Houston Black | Slight | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly | Percs slowly. |
| Urban land. | | | | | | |
| 36 Justin | Slight | Moderate: hard to pack. | Deep to water | Favorable | Favorable | Favorable. |
| 37 Konsil | Moderate: seepage. | Slight | Deep to water | Soil blowing, slope. | Soil blowing | Favorable. |
| 38 Leson | Slight | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly | Percs slowly. |
| 39 Lindale | Slight | Moderate: hard to pack. | Deep to water | Percs slowly | Percs slowly | Percs slowly. |
| 40:* Lindale | Slight | Moderate: hard to pack. | Deep to water | Percs slowly | Percs slowly | Percs slowly. |
| Urban land. | | | | | | |
| 41 Lott | Moderate: seepage. | Severe: piping. | Deep to water | Slow intake | Favorable | Favorable. |
| 42:* Lott | Moderate: seepage. | Severe: piping. | Deep to water | Slow intake, slope. | Favorable | Favorable. |
| Urban land. | | | | | | |
| 43 Luckenbach | Slight | Slight | Deep to water | Favorable | Favorable | Favorable. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Map symbol and soil name | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| 44:* | | | | | | |
| Luckenbach | Slight | Slight | Deep to water | Favorable | Favorable | Favorable. |
| Urban land. | | | | | | |
| 45--- Mabank | Slight | Severe: wetness. | Percs slowly | Wetness, percs slowly. | Erodes easily, wetness, percs slowly. | Wetness, erodes easily, percs slowly. |
| 46:* | | | | | | |
| Maloterre | Severe: depth to rock. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Slope, depth to rock. | Slope, depth to rock. |
| Aledo | Severe: depth to rock, slope. | Severe: thin layer. | Deep to water | Large stones, droughty, depth to rock. | Slope, large stones, depth to rock. | Large stones, slope, droughty. |
| Brackett | Severe: depth to rock, slope. | Severe: thin layer. | Deep to water | Depth to rock, slope. | Large stones, slope, depth to rock. | Large stones, slope, depth to rock. |
| 47--- Medlin | Severe: slope. | Moderate: hard to pack. | Deep to water | Slow intake, percs slowly, slope. | Slope, percs slowly. | Slope, percs slowly. |
| 48--- Mingo | Severe: depth to rock. | Severe: thin layer. | Deep to water | Percs slowly, depth to rock. | Depth to rock, erodes easily, percs slowly. | Erodes easily, depth to rock, percs slowly. |
| 49:* | | | | | | |
| Mingo | Severe: depth to rock. | Severe: thin layer. | Deep to water | Percs slowly, depth to rock. | Depth to rock, erodes easily, percs slowly. | Erodes easily, depth to rock, percs slowly. |
| Urban land. | | | | | | |
| 50--- Navo | Slight | Severe: hard to pack. | Deep to water | Percs slowly | Percs slowly | Percs slowly. |
| 51:* | | | | | | |
| Navo | Slight | Severe: hard to pack. | Deep to water | Percs slowly | Percs slowly | Percs slowly. |
| Urban land. | | | | | | |
| 52--- Nimrod | Severe: seepage. | Moderate: thin layer, piping, wetness. | Slope | Wetness, droughty, fast intake. | Wetness, soil blowing. | Droughty. |
| 53, 54--- Ovan | Slight | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, floods. | Percs slowly | Percs slowly. |
| 55:* | | | | | | |
| Ovan | Slight | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, floods. | Percs slowly | Percs slowly. |
| Urban land. | | | | | | |
| 56.* Pits | | | | | | |
| 57--- Ponder | Slight | Severe: hard to pack. | Deep to water | Percs slowly | Percs slowly | Percs slowly. |
| 58:* | | | | | | |
| Ponder | Slight | Severe: hard to pack. | Deep to water | Percs slowly | Percs slowly | Percs slowly. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Map symbol and soil name | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| 58:* Urban land. | | | | | | |
| 59---------- Pulexas | Severe: seepage. | Severe: piping. | Deep to water | Floods---------- | Favorable------ | Favorable. |
| 60:* Pulexas---------- | Severe: seepage. | Severe: piping. | Deep to water | Floods---------- | Favorable------ | Favorable. |
| Urban land. | | | | | | |
| 61---------- Purves | Severe: depth to rock. | Severe: thin layer. | Deep to water | Slow intake, depth to rock. | Depth to rock | Depth to rock. |
| 62:* Purves---------- | Severe: depth to rock. | Severe: thin layer. | Deep to water | Slow intake, depth to rock. | Depth to rock | Depth to rock. |
| Urban land. | | | | | | |
| 63---------- Rader | Slight--------- | Moderate: hard to pack, wetness. | Percs slowly--- | Wetness, percs slowly, | Wetness, percs slowly. | Percs slowly. |
| 64:* Rader---------- | Slight--------- | Moderate: hard to pack, wetness. | Percs slowly--- | Wetness, percs slowly. | Wetness, percs slowly. | Percs slowly. |
| Urban land. | | | | | | |
| 65---------- Sanger | Slight--------- | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly--- | Percs slowly. |
| 66---------- Sanger | Slight--------- | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, slope. | Percs slowly--- | Percs slowly. |
| 67:* Sanger---------- | Slight--------- | Severe: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly--- | Percs slowly. |
| Urban land. | | | | | | |
| 68---------- San Saba | Severe: depth to rock. | Severe: hard to pack. | Deep to water | Slow intake, percs slowly, depth to rock. | Depth to rock, percs slowly. | Depth to rock, percs slowly. |
| 69---------- Selden | Slight--------- | Moderate: piping. | Deep to water | Fast intake, soil blowing. | Soil blowing--- | Favorable. |
| 70---------- Silawa | Severe: seepage. | Moderate: piping. | Deep to water | Slope---------- | Favorable------ | Favorable. |
| 71---------- Silstid | Moderate: seepage. | Severe: seepage, piping. | Deep to water | Droughty, fast intake, slope. | Too sandy------ | Droughty. |
| 72:* Silstid---------- | Moderate: seepage. | Severe: seepage, piping. | Deep to water | Droughty, fast intake, slope. | Too sandy------ | Droughty. |
| Urban land. | | | | | | |
| 73, 74---------- Slidell | Slight--------- | Moderate: hard to pack. | Deep to water | Slow intake, percs slowly. | Percs slowly--- | Percs slowly. |

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

| Map symbol and soil name | Limitations for-- | | Features affecting-- | | | |
|---|---|---|---|---|---|---|
| | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Irrigation | Terraces and diversions | Grassed waterways |
| 75----------<br>Speck | Severe:<br>depth to rock. | Severe:<br>thin layer. | Deep to water | Percs slowly,<br>depth to rock. | Depth to rock,<br>percs slowly. | Depth to rock,<br>percs slowly. |
| 76----------<br>Stephenville | Severe:<br>slope. | Severe:<br>thin layer. | Deep to water | Depth to rock | Slope,<br>depth to rock. | Slope,<br>depth to rock. |
| 77----------<br>Sunev | Moderate:<br>seepage. | Moderate:<br>piping. | Deep to water | Favorable------ | Favorable------ | Favorable. |
| 78----------<br>Sunev | Severe:<br>seepage,<br>slope. | Moderate:<br>piping. | Deep to water | Slope---------- | Favorable------ | Favorable. |
| 79:*<br>Sunev---------- | Severe:<br>seepage,<br>slope. | Moderate:<br>piping. | Deep to water | Slope---------- | Favorable------ | Favorable. |
| Urban land. | | | | | | |
| 80----------<br>Trinity | Slight--------- | Severe:<br>hard to pack,<br>wetness. | Percs slowly,<br>floods. | Wetness,<br>slow intake,<br>percs slowly. | Wetness,<br>percs slowly. | Wetness,<br>percs slowly. |
| 81.*<br>Urban land | | | | | | |
| 82----------<br>Weatherford | Moderate:<br>seepage,<br>depth to rock,<br>slope. | Moderate:<br>thin layer. | Deep to water | Favorable------ | Erodes easily | Erodes easily. |
| 83----------<br>Whitesboro | Moderate:<br>seepage. | Moderate:<br>piping,<br>wetness. | Floods--------- | Wetness,<br>floods. | Wetness-------- | Favorable. |
| 84----------<br>Wilson | Slight--------- | Severe:<br>hard to pack,<br>wetness. | Percs slowly--- | Wetness,<br>percs slowly. | Erodes easily,<br>wetness,<br>percs slowly. | Wetness,<br>erodes easily,<br>percs slowly. |
| 85:*<br>Wilson---------- | Slight--------- | Severe:<br>hard to pack,<br>wetness. | Percs slowly--- | Wetness,<br>percs slowly. | Erodes easily,<br>wetness,<br>percs slowly. | Wetness,<br>erodes easily,<br>percs slowly. |
| Urban land. | | | | | | |
| 86----------<br>Windthorst | Slight--------- | Moderate:<br>thin layer,<br>hard to pack. | Deep to water | Soil blowing,<br>erodes easily. | Erodes easily,<br>soil blowing. | Erodes easily. |
| 87, 88----------<br>Windthorst | Slight--------- | Moderate:<br>thin layer,<br>hard to pack. | Deep to water | Soil blowing,<br>slope,<br>erodes easily. | Erodes easily,<br>soil blowing. | Erodes easily. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 1---------- Aledo | 0-7 | Gravelly clay loam. | CL, GC, SC | A-4, A-6 | 0-20 | 65-95 | 60-90 | 55-90 | 40-70 | 27-40 | 8-20 |
| | 7-17 | Very gravelly clay loam, very gravelly loam. | GC, SC | A-2-4, A-2-6 | 5-30 | 35-65 | 30-50 | 25-50 | 15-35 | 27-40 | 8-20 |
| | 17-24 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2:* | | | | | | | | | | | |
| Aledo---------- | 0-8 | Gravelly clay loam. | CL, GC, SC | A-4, A-6 | 0-20 | 65-95 | 60-90 | 55-90 | 40-70 | 27-40 | 8-20 |
| | 8-17 | Very gravelly clay loam, very gravelly loam. | GC, SC | A-2-4, A-2-6 | 5-30 | 35-65 | 30-50 | 25-50 | 15-35 | 27-40 | 8-20 |
| | 17-24 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bolar---------- | 0-10 | Clay loam-------- | CL, SC | A-6, A-7, A-4 | 0-5 | 75-100 | 75-100 | 70-98 | 40-80 | 25-45 | 9-26 |
| | 10-30 | Clay loam, loam, silty clay loam. | CL, SC | A-6, A-7 | 0-10 | 75-98 | 75-95 | 70-90 | 40-75 | 25-48 | 11-29 |
| | 30-36 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3:* | | | | | | | | | | | |
| Aledo---------- | 0-8 | Gravelly clay loam. | CL, GC, SC | A-4, A-6 | 0-20 | 65-95 | 60-90 | 55-90 | 40-70 | 27-40 | 8-20 |
| | 8-17 | Very gravelly clay loam, very gravelly loam. | GC, SC | A-2-4, A-2-6 | 5-30 | 35-65 | 30-50 | 25-50 | 15-35 | 27-40 | 8-20 |
| | 17-24 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bolar---------- | 0-10 | Clay loam-------- | CL, SC | A-6, A-7, A-4 | 0-5 | 75-100 | 75-100 | 70-98 | 40-80 | 25-45 | 9-26 |
| | 10-30 | Clay loam, loam, silty clay loam. | CL, SC | A-6, A-7 | 0-10 | 75-98 | 75-95 | 70-90 | 40-75 | 25-48 | 11-29 |
| | 30-36 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Urban land. | | | | | | | | | | | |
| 4:* | | | | | | | | | | | |
| Aledo---------- | 0-7 | Gravelly clay loam. | CL, GC, SC | A-4, A-6 | 0-20 | 65-95 | 60-90 | 55-90 | 40-70 | 27-40 | 8-20 |
| | 7-17 | Very gravelly clay loam, very gravelly loam. | GC, SC | A-2-4, A-2-6 | 5-30 | 35-65 | 30-50 | 25-50 | 15-35 | 27-40 | 8-20 |
| | 17-24 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Urban land. | | | | | | | | | | | |
| 5---------- Altoga | 0-36 | Silty clay loam | CL, CH | A-6, A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 80-99 | 35-51 | 20-31 |
| | 36-48 | Silty clay, silty clay loam, clay loam. | CL | A-6, A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 65-99 | 30-48 | 15-30 |
| 6---------- Aquilla | 0-28 | Loamy fine sand | SM, SP-SM | A-2-4 | 0 | 98-100 | 95-100 | 90-100 | 10-20 | <21 | NP-3 |
| | 28-80 | Loamy fine sand, fine sandy loam, sandy loam. | SM, SP-SM | A-2-4 | 0 | 98-100 | 95-100 | 90-100 | 10-25 | <21 | NP-3 |
| 7,* 8.* Arents | | | | | | | | | | | |
| 9---------- Bastsil | 0-11 | Fine sandy loam | ML, SM, CL-ML, SM-SC | A-4 | 0 | 95-100 | 80-100 | 75-95 | 36-70 | <25 | NP-7 |
| | 11-80 | Loam, clay loam, sandy clay loam. | CL, SC | A-6 | 0 | 95-100 | 80-100 | 75-100 | 40-70 | 26-40 | 11-24 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 10:* | | | | | | | | | | | |
| Bastsil | 0-11 | Fine sandy loam | ML, SM, CL-ML, SM-SC | A-4 | 0 | 95-100 | 80-100 | 75-95 | 36-70 | <25 | NP-7 |
| | 11-80 | Loam, clay loam, sandy clay loam. | CL, SC | A-6 | 0 | 95-100 | 80-100 | 75-100 | 40-70 | 26-40 | 11-24 |
| Urban land. | | | | | | | | | | | |
| 11 Birome | 0-9 | Fine sandy loam | SM, SM-SC, ML, CL-ML | A-4, A-2-4 | 0-5 | 90-100 | 90-100 | 70-100 | 25-70 | <30 | NP-7 |
| | 9-15 | Clay, sandy clay, clay loam. | CL, CH | A-6, A-7 | 0-2 | 80-100 | 80-100 | 70-100 | 51-85 | 35-55 | 15-35 |
| | 15-35 | Clay, sandy clay, clay loam. | CL, SC | A-6, A-7 | 2-30 | 70-100 | 60-100 | 50-70 | 40-60 | 30-45 | 15-25 |
| | 35-50 | Stratified weathered bedrock to clay. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 12:* | | | | | | | | | | | |
| Birome | 0-8 | Fine sandy loam | SM, SM-SC | A-1, A-2, A-4 | 0-5 | 90-100 | 90-100 | 70-100 | 25-70 | <30 | NP-7 |
| | 8-27 | Clay, sandy clay, clay loam. | CL, CH | A-6, A-7 | 0-2 | 80-100 | 80-100 | 70-100 | 51-85 | 35-55 | 15-35 |
| | 27-47 | Stratified weathered bedrock to clay. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Aubrey | 0-5 | Fine sandy loam | ML, SM, CL-ML, SM-SC | A-4, A-2-4 | 0 | 95-100 | 90-100 | 70-90 | 20-55 | <30 | NP-7 |
| | 5-36 | Clay | CL, CH | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 51-85 | 41-60 | 20-38 |
| | 36-56 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rayex | 0-5 | Gravelly fine sandy loam. | GM, SM, GM-GC, SM-SC | A-1, A-2 | 0-5 | 55-75 | 40-75 | 40-65 | 20-35 | <25 | NP-4 |
| | 5-14 | Clay loam, sandy clay, clay. | CL, SC | A-6, A-7 | 0-10 | 80-100 | 80-100 | 80-100 | 48-88 | 30-45 | 15-28 |
| | 14-40 | Variable | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 13:* | | | | | | | | | | | |
| Birome | 0-8 | Fine sandy loam | SM, SM-SC, ML, CL-ML | A-4, A-2-4 | 0-5 | 90-100 | 90-100 | 70-100 | 25-70 | <30 | NP-7 |
| | 8-27 | Clay, sandy clay, clay loam. | CL, CH | A-6, A-7 | 0-2 | 80-100 | 80-100 | 70-100 | 51-85 | 35-55 | 15-35 |
| | 27-47 | Stratified weathered bedrock to clay. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Aubrey | 0-5 | Fine sandy loam | ML, SM, CL-ML, SM-SC | A-4, A-2-4 | 0 | 95-100 | 90-100 | 70-90 | 20-55 | <30 | NP-7 |
| | 5-36 | Clay | CL, CH | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 51-85 | 41-60 | 20-38 |
| | 36-56 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Urban land. | | | | | | | | | | | |
| 14 Bolar | 0-13 | Clay loam | CL, SC | A-6, A-7, A-4 | 0-5 | 75-100 | 75-100 | 70-98 | 40-80 | 25-45 | 9-26 |
| | 13-30 | Clay loam, loam, silty clay loam. | CL, SC | A-6, A-7 | 0-10 | 75-98 | 75-95 | 70-90 | 40-75 | 25-48 | 11-29 |
| | 30-40 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15 Bolar | 0-8 | Clay loam | CL, SC | A-6, A-7, A-4 | 0-5 | 75-100 | 75-100 | 70-98 | 40-80 | 25-45 | 9-26 |
| | 8-31 | Clay loam, loam, silty clay loam. | CL, SC | A-6, A-7 | 0-10 | 75-98 | 75-95 | 70-90 | 40-75 | 25-48 | 11-29 |
| | 31-41 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Frag-ments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plas-ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 16:* | | | | | | | | | | | |
| Bolar | 0-8 | Clay loam | CL, SC | A-6, A-7, A-4 | 0-5 | 75-100 | 75-100 | 70-98 | 40-80 | 25-45 | 9-26 |
| | 8-31 | Clay loam, loam, silty clay loam. | CL, SC | A-6, A-7 | 0-10 | 75-98 | 75-95 | 70-90 | 40-75 | 25-48 | 11-29 |
| | 31-41 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Urban land. | | | | | | | | | | | |
| 17 Brackett | 0-13 | Clay loam | CL, SC, GC | A-6, A-4, A-7-6 | 0-20 | 70-100 | 60-100 | 54-95 | 40-85 | 28-45 | 9-26 |
| | 13-40 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 18 Branyon | 0-56 | Clay | CH | A-7-6 | 0 | 95-100 | 85-100 | 80-100 | 75-100 | 60-80 | 35-55 |
| | 56-80 | Clay, silty clay, clay loam. | CH, CL, GC, SC | A-2, A-4, A-6, A-7 | 0-10 | 40-100 | 35-100 | 30-100 | 25-100 | 25-80 | 8-60 |
| 19 Burleson | 0-48 | Clay | CH | A-7-6, A-7-5 | 0-2 | 83-100 | 80-100 | 80-100 | 80-96 | 51-90 | 27-55 |
| | 48-66 | Clay, silty clay | CH | A-7-6, A-7-5 | 0-1 | 95-100 | 80-100 | 75-99 | 70-95 | 51-90 | 30-55 |
| 20 Chatt | 0-16 | Silty clay | CH | A-7 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 54-74 | 28-47 |
| | 16-66 | Clay loam, clay, silty clay. | CL, CH | A-6, A-7 | 0 | 80-100 | 70-100 | 60-98 | 55-95 | 35-55 | 18-35 |
| 21 Crosstell | 0-5 | Fine sandy loam | SM, ML, SC, CL | A-2-4, A-4 | 0 | 90-100 | 90-100 | 75-95 | 28-78 | 15-31 | 2-10 |
| | 5-44 | Clay | CH, CL | A-7-6 | 0 | 80-100 | 80-100 | 75-98 | 51-85 | 42-60 | 25-40 |
| | 44-63 | Stratified clay to weathered bedrock. | CH, CL, SC | A-7-6, A-6 | 0 | 80-100 | 80-98 | 70-96 | 36-88 | 35-55 | 15-35 |
| 22 Crosstell | 0-4 | Fine sandy loam | SM, ML, SC, CL | A-2-4, A-4 | 0 | 90-100 | 90-100 | 75-95 | 28-78 | 15-31 | 2-10 |
| | 4-41 | Clay | CH, CL | A-7-6 | 0 | 80-100 | 80-100 | 75-98 | 51-85 | 42-60 | 25-40 |
| | 41-60 | Stratified clay to weathered bedrock. | CH, CL, SC | A-7-6, A-6 | 0 | 80-100 | 80-98 | 70-96 | 36-88 | 35-55 | 15-35 |
| 23:* | | | | | | | | | | | |
| Crosstell | 0-4 | Fine sandy loam | SM, ML, SC, CL | A-2-4, A-4 | 0 | 90-100 | 90-100 | 75-95 | 28-78 | 15-31 | 2-10 |
| | 4-41 | Clay | CH, CL | A-7-6 | 0 | 80-100 | 80-100 | 75-98 | 51-85 | 42-60 | 25-40 |
| | 41-60 | Stratified clay to weathered bedrock. | CH, CL, SC | A-7-6, A-6 | 0 | 80-100 | 80-98 | 70-96 | 36-88 | 35-55 | 15-35 |
| Urban land. | | | | | | | | | | | |
| 24 Ferris | 0-60 | Clay | CH | A-7-6 | 0 | 95-100 | 95-100 | 75-100 | 75-98 | 51-70 | 35-50 |
| 25:* | | | | | | | | | | | |
| Ferris | 0-60 | Clay | CH | A-7-6 | 0 | 95-100 | 95-100 | 75-100 | 75-98 | 51-70 | 35-50 |
| Heiden | 0-38 | Clay | CH | A-7-6 | 0 | 95-100 | 90-100 | 80-100 | 75-99 | 51-80 | 32-55 |
| | 38-72 | Clay, silty clay | CH, CL | A-7-6 | 0 | 90-100 | 90-100 | 75-100 | 70-99 | 50-80 | 32-55 |
| 26 Frio | 0-24 | Silty clay | CL, CH | A-6, A-7 | 0-2 | 80-100 | 80-100 | 70-100 | 60-95 | 35-52 | 20-34 |
| | 24-80 | Silty clay loam, clay loam, silty clay loam. | CL, CH | A-6, A-7 | 0-5 | 80-100 | 80-100 | 70-100 | 60-95 | 30-52 | 18-34 |
| 27 Frio | 0-35 | Silty clay | CL, CH | A-6, A-7 | 0-2 | 80-100 | 80-100 | 70-100 | 60-95 | 35-52 | 20-34 |
| | 35-72 | Silty clay loam, clay loam, silty clay loam. | CL, CH | A-6, A-7 | 0-5 | 80-100 | 80-100 | 70-100 | 60-95 | 30-52 | 18-34 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 28:* | | | | | | | | | | | |
| Frio | 0-24 | Silty clay | CL, CH | A-6, A-7 | 0-2 | 80-100 | 80-100 | 70-100 | 60-95 | 35-52 | 20-34 |
| | 24-80 | Silty clay loam, clay loam, silty clay loam. | CL, CH | A-6, A-7 | 0-5 | 80-100 | 80-100 | 70-100 | 60-95 | 30-52 | 18-34 |
| Urban land. | | | | | | | | | | | |
| 29 | 0-10 | Fine sandy loam | CL, ML, SC, SM | A-4 | 0 | 95-100 | 95-100 | 85-99 | 36-55 | 20-28 | 3-10 |
| Gasil | 10-75 | Sandy clay loam, loam, fine sandy loam. | CL, SC, CL-ML, SM-SC | A-6, A-4 | 0 | 95-100 | 95-100 | 85-100 | 36-71 | 22-40 | 7-20 |
| 30 | 0-9 | Fine sandy loam | CL, ML, SC, SM | A-4 | 0 | 95-100 | 95-100 | 85-99 | 36-55 | 20-28 | 3-10 |
| Gasil | 9-80 | Sandy clay loam, loam, fine sandy loam. | CL, SC, CL-ML, SM-SC | A-6, A-4 | 0 | 95-100 | 95-100 | 85-100 | 36-71 | 22-40 | 7-20 |
| 31 | 0-60 | Sandy clay loam | CL, SC, CL-ML, SM-SC | A-6, A-4 | 0 | 95-100 | 90-100 | 85-100 | 36-70 | 18-40 | 7-25 |
| Gasil | | | | | | | | | | | |
| 32:* | | | | | | | | | | | |
| Gasil | 0-10 | Fine sandy loam | CL, ML, SC, SM | A-4 | 0 | 95-100 | 95-100 | 85-99 | 36-55 | 20-28 | 3-10 |
| | 10-75 | Sandy clay loam, loam, fine sandy loam. | CL, SC, CL-ML, SM-SC | A-6, A-4 | 0 | 95-100 | 95-100 | 85-100 | 36-71 | 22-40 | 7-20 |
| Urban land. | | | | | | | | | | | |
| 33 | 0-38 | Clay | CH | A-7-6 | 0 | 95-100 | 90-100 | 80-100 | 75-99 | 51-80 | 32-55 |
| Heiden | 38-72 | Clay, silty clay | CH, CL | A-7-6 | 0 | 90-100 | 90-100 | 75-100 | 70-99 | 50-80 | 32-55 |
| 34 | 0-42 | Clay | CH | A-7-6 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 58-98 | 34-72 |
| Houston Black | 42-80 | Clay, silty clay | CH | A-7-6 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 51-100 | 34-75 |
| 35:* | | | | | | | | | | | |
| Houston Black | 0-42 | Clay | CH | A-7-6 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 58-98 | 34-72 |
| | 42-80 | Clay, silty clay | CH | A-7-6 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 51-100 | 34-75 |
| Urban land. | | | | | | | | | | | |
| 36 | 0-16 | Loam | SC, CL | A-4, A-6 | 0 | 95-100 | 90-100 | 90-100 | 40-60 | 20-30 | 8-18 |
| Justin | 16-40 | Sandy clay loam, loam, clay loam. | SC, CL | A-6 | 0 | 95-100 | 90-100 | 90-100 | 40-75 | 30-40 | 15-25 |
| | 40-70 | Clay loam, clay | CL, CH | A-6, A-7-6 | 0 | 95-100 | 90-100 | 80-100 | 50-85 | 30-52 | 15-30 |
| 37 | 0-9 | Fine sandy loam | CL, ML, SC, SM | A-4 | 0 | 90-100 | 90-100 | 85-98 | 36-55 | <28 | NP-10 |
| Konsil | 9-75 | Sandy clay loam, loam, fine sandy loam. | CL, SC | A-6 | 0 | 90-100 | 90-100 | 85-99 | 40-60 | 28-40 | 11-20 |
| 38 | 0-70 | Clay | CH | A-7-6 | 0 | 98-100 | 90-100 | 90-100 | 85-100 | 60-90 | 35-60 |
| Leson | 70-80 | Stratified shaly clay. | CH | A-7-6 | 0 | 98-100 | 90-100 | 90-100 | 90-100 | 65-100 | 40-75 |
| 39 | 0-5 | Clay loam | CL, SC | A-4, A-6 | 0 | 90-100 | 85-100 | 70-100 | 40-80 | 20-40 | 8-20 |
| Lindale | 5-26 | Clay, silty clay, clay loam. | CH, CL | A-7 | 0 | 75-100 | 70-100 | 60-100 | 51-95 | 40-65 | 18-45 |
| | 26-48 | Very gravelly clay, very gravelly clay loam, very cobbly clay. | GC | A-6, A-7, A-2-6, A-2-7 | 10-30 | 40-59 | 35-50 | 30-50 | 25-48 | 35-65 | 15-45 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 40:* | | | | | | | | | | | |
| Lindale | 0-5 | Clay loam | CL, SC | A-4, A-6 | 0 | 90-100 | 85-100 | 70-100 | 40-80 | 20-40 | 8-20 |
| | 5-26 | Clay, silty clay, clay loam. | CH, CL | A-7 | 0 | 75-100 | 70-100 | 60-100 | 51-95 | 40-65 | 18-45 |
| | 26-48 | Very gravelly clay, very gravelly silty clay loam, very cobbly clay. | GC | A-6, A-7, A-2-6, A-2-7 | 10-30 | 40-59 | 35-50 | 30-50 | 25-48 | 35-65 | 15-45 |
| Urban land. | | | | | | | | | | | |
| 41 | 0-16 | Silty clay | CL, CH | A-7-6 | 0 | 95-100 | 95-100 | 85-100 | 75-95 | 41-55 | 22-35 |
| Lott | 16-46 | Silty clay, silty clay loam, clay. | CL, CH | A-7-6, A-6 | 0 | 95-100 | 95-100 | 85-100 | 75-95 | 33-52 | 18-35 |
| | 46-60 | Marl, silty clay loam, silt loam. | CL, CL-ML | A-4, A-6 | 0-5 | 90-100 | 90-100 | 85-100 | 75-95 | 21-39 | 6-21 |
| 42:* | | | | | | | | | | | |
| Lott | 0-16 | Silty clay | CL, CH | A-7-6 | 0 | 95-100 | 95-100 | 85-100 | 75-95 | 41-55 | 22-35 |
| | 16-46 | Silty clay, silty clay loam, clay. | CL, CH | A-7-6, A-6 | 0 | 95-100 | 95-100 | 85-100 | 75-95 | 33-52 | 18-35 |
| | 46-60 | Marl, silty clay loam, silt loam. | CL, CL-ML | A-4, A-6 | 0-5 | 90-100 | 90-100 | 85-100 | 75-95 | 21-39 | 6-21 |
| Urban land. | | | | | | | | | | | |
| 43 | 0-15 | Clay loam | CL | A-6 | 0-3 | 95-100 | 95-100 | 75-95 | 55-65 | 29-40 | 14-25 |
| Luckenbach | 15-48 | Clay loam, clay | CL, CH | A-7 | 0-3 | 90-100 | 80-100 | 80-100 | 60-85 | 40-55 | 22-35 |
| | 48-60 | Clay loam, clay | CL, SC, GC | A-6, A-7 | 0-5 | 70-100 | 60-95 | 45-95 | 36-80 | 35-45 | 20-30 |
| 44:* | | | | | | | | | | | |
| Luckenbach | 0-15 | Clay loam | CL | A-6 | 0-3 | 95-100 | 95-100 | 75-95 | 55-65 | 29-40 | 14-25 |
| | 15-48 | Clay loam, clay | CL, CH | A-7 | 0-3 | 90-100 | 80-100 | 80-100 | 60-85 | 40-55 | 22-35 |
| | 48-60 | Clay loam, clay | CL, SC, GC | A-6, A-7 | 0-5 | 70-100 | 60-95 | 45-95 | 36-80 | 35-45 | 20-30 |
| Urban land. | | | | | | | | | | | |
| 45 | 0-7 | Fine sandy loam | CL, ML, SM, SC | A-4 | 0 | 95-100 | 95-100 | 80-98 | 40-70 | <30 | NP-10 |
| Mabank | 7-80 | Clay, clay loam | CH, CL | A-7, A-6 | 0 | 95-100 | 95-100 | 95-100 | 60-85 | 35-65 | 20-40 |
| 46:* | | | | | | | | | | | |
| Maloterre | 0-7 | Gravelly clay loam. | SC, CL, GC | A-6 | 0-10 | 60-95 | 50-95 | 45-90 | 36-80 | 30-40 | 11-20 |
| | 7-10 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Aledo | 0-7 | Gravelly clay loam. | CL, GC, SC | A-4, A-6 | 0-20 | 65-95 | 60-90 | 55-90 | 40-70 | 27-40 | 8-20 |
| | 7-16 | Very gravelly clay loam, very gravelly loam. | GC, SC | A-2-4, A-2-6 | 5-30 | 35-65 | 30-50 | 25-50 | 15-35 | 27-40 | 8-20 |
| | 16-20 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Brackett | 0-14 | Clay loam | CL, SC, GC | A-6, A-4, A-7-6 | 0-20 | 70-100 | 60-100 | 54-95 | 40-85 | 28-45 | 9-26 |
| | 14-28 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 47 | 0-33 | Clay | CH, CL | A-7 | 0 | 95-100 | 95-100 | 95-100 | 80-95 | 48-70 | 25-45 |
| Medlin | 33-67 | Clay, silty clay | CL, CH | A-7, A-6 | 0 | 95-100 | 95-100 | 95-100 | 80-95 | 35-55 | 15-35 |
| 48 | 0-5 | Clay loam | CL, CH | A-6, A-4, A-7 | 0 | 75-100 | 75-100 | 70-100 | 60-94 | 25-54 | 8-32 |
| Mingo | 5-31 | Clay | CH, CL | A-7 | 0 | 80-100 | 75-100 | 75-100 | 65-95 | 42-65 | 22-40 |
| | 31-37 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 49:* | | | | | | | | | | | |
| Mingo | 0-5 | Clay loam | CL, CH | A-6, A-4, A-7 | 0 | 75-100 | 75-100 | 70-100 | 60-94 | 25-54 | 8-32 |
| | 5-31 | Clay | CH, CL | A-7 | 0 | 80-100 | 75-100 | 75-100 | 65-95 | 42-65 | 22-40 |
| | 31-37 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Urban land. | | | | | | | | | | | |
| 50 | 0-12 | Clay loam | CL | A-6, A-7 | 0 | 95-100 | 95-100 | 90-100 | 55-85 | 25-48 | 11-25 |
| Navo | 12-72 | Clay, clay loam | CL, CH | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 60-90 | 40-65 | 20-45 |
| 51:* | | | | | | | | | | | |
| Navo | 0-12 | Clay loam | CL | A-6, A-7 | 0 | 95-100 | 95-100 | 90-100 | 55-85 | 25-48 | 11-25 |
| | 12-72 | Clay, clay loam | CL, CH | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 60-90 | 40-65 | 20-45 |
| Urban land. | | | | | | | | | | | |
| 52 | 0-25 | Fine sand | SP-SM, SM, SM-SC | A-2-4, A-3 | 0 | 95-100 | 95-100 | 90-100 | 8-28 | <25 | NP-4 |
| Nimrod | 25-49 | Sandy clay loam | SC, CL | A-6, A-2-6 | 0 | 95-100 | 95-100 | 90-100 | 25-55 | 22-30 | 11-16 |
| | 49-80 | Sandy loam, sandy clay loam, loamy fine sand. | SC, CL, SM-SC, CL-ML | A-4, A-6, A-2-4, A-2-6 | 0 | 95-100 | 95-100 | 90-100 | 15-55 | 18-23 | 2-11 |
| 53 | 0-72 | Clay | CL, CH | A-7-6 | 0 | 100 | 100 | 90-100 | 85-100 | 48-70 | 25-45 |
| Ovan | | | | | | | | | | | |
| 54 | 0-66 | Clay | CL, CH | A-7-6 | 0 | 100 | 100 | 90-100 | 85-100 | 48-70 | 25-45 |
| Ovan | | | | | | | | | | | |
| 55:* | | | | | | | | | | | |
| Ovan | 0-72 | Clay | CL, CH | A-7-6 | 0 | 100 | 100 | 90-100 | 85-100 | 48-70 | 25-45 |
| Urban land. | | | | | | | | | | | |
| 56.* | | | | | | | | | | | |
| Pits | | | | | | | | | | | |
| 57 | 0-7 | Clay loam | CL | A-6 | 0 | 95-100 | 95-100 | 90-100 | 50-85 | 30-40 | 15-30 |
| Ponder | 7-53 | Clay, silty clay, silty clay loam. | CH, CL | A-7 | 0 | 95-100 | 95-100 | 95-100 | 75-95 | 43-65 | 25-45 |
| | 53-80 | Silty clay loam, silt loam, clay loam. | CH, CL | A-7, A-6 | 0 | 95-100 | 95-100 | 95-100 | 75-95 | 35-58 | 20-42 |
| 58:* | | | | | | | | | | | |
| Ponder | 0-7 | Clay loam | CL | A-6 | 0 | 95-100 | 95-100 | 90-100 | 50-85 | 30-40 | 15-30 |
| | 7-53 | Clay, silty clay, silty clay loam. | CH, CL | A-7 | 0 | 95-100 | 95-100 | 95-100 | 75-95 | 43-65 | 25-45 |
| | 53-80 | Silty clay loam, silt loam, clay loam. | CH, CL | A-7, A-6 | 0 | 95-100 | 95-100 | 95-100 | 75-95 | 35-58 | 20-42 |
| Urban land. | | | | | | | | | | | |
| 59 | 0-10 | Fine sandy loam | SM, SC, ML, CL | A-4 | 0 | 100 | 95-100 | 90-100 | 36-85 | <30 | NP-10 |
| Pulexas | 10-64 | Stratified fine sandy loam to loam. | SM, SC, ML, CL | A-4 | 0 | 100 | 95-100 | 90-100 | 36-85 | <30 | NP-10 |
| 60:* | | | | | | | | | | | |
| Pulexas | 0-10 | Fine sandy loam | SM, SC, ML, CL | A-4 | 0 | 100 | 95-100 | 90-100 | 36-85 | <30 | NP-10 |
| | 10-64 | Stratified fine sandy loam to loam. | SM, SC, ML, CL | A-4 | 0 | 100 | 95-100 | 90-100 | 36-85 | <30 | NP-10 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 60:* | | | | | | | | | | | |
| Urban land. | | | | | | | | | | | |
| 61---------- | 0-15 | Clay---------- | CH | A-7-6 | 0-5 | 90-100 | 80-100 | 80-95 | 70-95 | 51-65 | 30-40 |
| Purves | 15-20 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 62:* | | | | | | | | | | | |
| Purves---------- | 0-15 | Clay---------- | CH | A-7-6 | 0-5 | 90-100 | 80-100 | 80-95 | 70-95 | 51-65 | 30-40 |
| | 15-20 | Unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Urban land. | | | | | | | | | | | |
| 63---------- | 0-18 | Fine sandy loam | ML, CL, SC, SM | A-2, A-4 | 0 | 98-100 | 98-100 | 70-100 | 30-70 | 18-28 | 3-10 |
| Rader | 18-27 | Sandy clay loam, loam, clay loam. | SC, CL | A-6 | 0 | 98-100 | 98-100 | 80-100 | 36-75 | 26-40 | 11-22 |
| | 27-63 | Sandy clay, clay, clay loam. | CL, CH | A-6, A-7 | 0 | 98-100 | 98-100 | 85-100 | 51-90 | 36-60 | 18-40 |
| | 63-69 | Sandy clay loam, sandy clay, clay. | SC, CL | A-6, A-7 | 0 | 98-100 | 98-100 | 75-100 | 36-75 | 30-50 | 11-30 |
| 64:* | | | | | | | | | | | |
| Rader---------- | 0-18 | Fine sandy loam | ML, CL, SC, SM | A-2, A-4 | 0 | 98-100 | 98-100 | 70-100 | 30-70 | 18-28 | 3-10 |
| | 18-27 | Sandy clay loam, loam, clay loam. | SC, CL | A-6 | 0 | 98-100 | 98-100 | 80-100 | 36-75 | 26-40 | 11-22 |
| | 27-63 | Sandy clay, clay, clay loam. | CL, CH | A-6, A-7 | 0 | 98-100 | 98-100 | 85-100 | 51-90 | 36-60 | 18-40 |
| | 63-69 | Sandy clay loam, sandy clay, clay. | SC, CL | A-6, A-7 | 0 | 98-100 | 98-100 | 75-100 | 36-75 | 30-50 | 11-30 |
| Urban land. | | | | | | | | | | | |
| 65---------- | 0-20 | Clay---------- | CH, CL | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 80-95 | 40-60 | 28-42 |
| Sanger | 20-49 | Clay, silty clay | CH, CL | A-7-6 | 0 | 95-100 | 94-100 | 90-100 | 85-100 | 40-60 | 20-36 |
| | 49-80 | Clay, silty clay, clay loam. | CH, CL | A-7-6, A-6 | 0 | 95-100 | 94-100 | 85-100 | 75-100 | 39-55 | 20-35 |
| 66---------- | 0-16 | Clay---------- | CH, CL | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 80-95 | 40-60 | 28-42 |
| Sanger | 16-46 | Clay, silty clay | CH, CL | A-7-6 | 0 | 95-100 | 94-100 | 90-100 | 85-100 | 40-60 | 20-36 |
| | 46-63 | Clay, silty clay, clay loam. | CH, CL | A-7-6, A-6 | 0 | 95-100 | 94-100 | 85-100 | 75-100 | 39-55 | 20-35 |
| 67:* | | | | | | | | | | | |
| Sanger---------- | 0-20 | Clay---------- | CH, CL | A-7-6 | 0 | 95-100 | 95-100 | 90-100 | 80-95 | 40-60 | 28-42 |
| | 20-49 | Clay, silty clay | CH, CL | A-7-6 | 0 | 95-100 | 94-100 | 90-100 | 85-100 | 40-60 | 20-36 |
| | 49-80 | Clay, silty clay, clay loam. | CH, CL | A-7-6, A-6 | 0 | 95-100 | 94-100 | 85-100 | 75-100 | 39-55 | 20-35 |
| Urban land. | | | | | | | | | | | |
| 68---------- | 0-30 | Clay---------- | CH | A-7-6 | 0 | 90-100 | 85-100 | 80-100 | 75-100 | 55-70 | 30-45 |
| San Saba | 30-36 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 69---------- | 0-14 | Loamy fine sand | SP-SM, SM, SM-SC | A-2-4, A-3 | 0 | 95-100 | 95-100 | 90-100 | 8-28 | <25 | NP-4 |
| Selden | 14-65 | Sandy clay loam, clay loam. | SC, CL | A-2-6, A-6 | 0 | 95-100 | 95-100 | 90-100 | 25-55 | 20-35 | 8-20 |
| 70---------- | 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 |
| Silawa | 6-46 | 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 |
| | 46-60 | 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 | 70-100 | 70-100 | 38-100 | 18-60 | 21-34 | 4-14 |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 71---------- Silstid | 0-27 | Loamy fine sand | SM, SP-SM | A-2-4 | 0 | 95-100 | 95-100 | 90-100 | 10-25 | <25 | NP-3 |
| | 27-67 | Sandy clay loam, loam, fine sandy loam. | SC, CL, SM-SC, CL-ML | A-4, A-6, A-2-4, A-2-6 | 0 | 95-100 | 95-100 | 80-100 | 30-55 | 20-40 | 4-22 |
| | 67-74 | Sandy clay loam, loam, fine sandy loam. | SC, CL, SM-SC, CL-ML | A-4, A-6, A-2-4, A-2-6 | 0 | 95-100 | 85-100 | 70-100 | 22-55 | 20-40 | 4-22 |
| 72:* | | | | | | | | | | | |
| Silstid---------- | 0-27 | Loamy fine sand | SM, SP-SM | A-2-4 | 0 | 95-100 | 95-100 | 90-100 | 10-25 | <25 | NP-3 |
| | 27-67 | Sandy clay loam, loam, fine sandy loam. | SC, CL, SM-SC, CL-ML | A-4, A-6, A-2-4, A-2-6 | 0 | 95-100 | 95-100 | 80-100 | 30-55 | 20-40 | 4-22 |
| | 67-74 | Sandy clay loam, loam, fine sandy loam. | SC, CL, SM-SC, CL-ML | A-4, A-6, A-2-4, A-2-6 | 0 | 95-100 | 85-100 | 70-100 | 22-55 | 20-40 | 4-22 |
| Urban land. | | | | | | | | | | | |
| 73---------- Slidell | 0-27 | Clay---------- | CH | A-7-6 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 51-68 | 28-42 |
| | 27-60 | Silty clay, clay | CH, CL | A-7-6 | 0 | 95-100 | 93-100 | 85-100 | 73-100 | 40-60 | 20-39 |
| 74---------- Slidell | 0-22 | Clay---------- | CH | A-7-6 | 0 | 95-100 | 95-100 | 95-100 | 85-100 | 51-68 | 28-42 |
| | 22-80 | Silty clay, clay | CH, CL | A-7-6 | 0 | 95-100 | 93-100 | 85-100 | 73-100 | 40-60 | 20-39 |
| 75---------- Speck | 0-7 | Clay loam-------- | CL | A-6, A-7-6 | 0 | 90-100 | 90-100 | 80-95 | 70-90 | 30-45 | 15-25 |
| | 7-15 | Clay, clay loam | CL, CH | A-7-6 | 0 | 85-100 | 80-100 | 70-100 | 55-95 | 45-65 | 25-40 |
| | 15-29 | Indurated, unweathered bedrock. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 76---------- Stephenville | 0-11 | Fine sandy loam | SM, SC, ML, CL | A-4 | 0 | 100 | 98-100 | 94-100 | 36-60 | <30 | NP-10 |
| | 11-32 | Fine sandy loam, sandy clay loam. | SC, CL | A-4, A-6 | 0 | 100 | 98-100 | 90-100 | 36-65 | 25-37 | 7-16 |
| | 32-50 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 77---------- Sunev | 0-19 | Clay loam-------- | CL, SC | A-4, A-6 | 0 | 90-100 | 80-100 | 80-100 | 45-60 | 25-40 | 8-18 |
| | 19-72 | Loam, clay loam, silty clay loam. | CL | A-4, A-6 | 0 | 90-100 | 80-100 | 80-100 | 51-65 | 28-40 | 8-18 |
| 78---------- Sunev | 0-15 | Clay loam-------- | CL, SC | A-4, A-6 | 0 | 90-100 | 80-100 | 80-100 | 45-60 | 25-40 | 8-18 |
| | 15-63 | Loam, clay loam, silty clay loam. | CL | A-4, A-6 | 0 | 90-100 | 80-100 | 80-100 | 51-65 | 28-40 | 8-18 |
| 79:* | | | | | | | | | | | |
| Sunev---------- | 0-15 | Clay loam-------- | CL, SC | A-4, A-6 | 0 | 90-100 | 80-100 | 80-100 | 45-60 | 25-40 | 8-18 |
| | 15-63 | Loam, clay loam, silty clay loam. | CL | A-4, A-6 | 0 | 90-100 | 80-100 | 80-100 | 51-65 | 28-40 | 8-18 |
| Urban land. | | | | | | | | | | | |
| 80---------- Trinity | 0-63 | Clay---------- | CH | A-7 | 0 | 100 | 98-100 | 85-100 | 80-100 | 55-90 | 30-60 |
| 81.* Urban land | | | | | | | | | | | |
| 82---------- Weatherford | 0-6 | Fine sandy loam | SM, SM-SC, ML, CL-ML | A-4, A-2-4 | 0 | 95-100 | 95-100 | 75-90 | 30-60 | <25 | NP-7 |
| | 6-23 | Sandy clay loam, clay loam. | SC, CL | A-6 | 0 | 95-100 | 95-100 | 80-100 | 36-60 | 30-40 | 15-24 |
| | 23-51 | Sandy clay loam, clay loam, fine sandy loam. | SC, CL | A-4, A-6 | 0 | 95-100 | 95-100 | 80-100 | 40-65 | 20-40 | 8-20 |
| | 51-60 | Weathered bedrock | --- | --- | --- | --- | --- | --- | --- | --- | --- |

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number-- | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| 83---------- Whitesboro | 0-6 | Loam---------- | CL | A-6, A-7-6 | 0 | 100 | 98-100 | 85-100 | 60-80 | 30-43 | 11-24 |
| | 6-80 | Loam, clay loam, sandy clay loam. | CL | A-6, A-7-6 | 0 | 100 | 98-100 | 85-100 | 60-85 | 30-45 | 11-25 |
| 84---------- Wilson | 0-6 | Clay loam-------- | CL | A-6 | 0 | 95-100 | 85-100 | 80-100 | 60-96 | 25-36 | 10-20 |
| | 6-42 | Silty clay, clay, clay loam. | CL, CH | A-7-6, A-6 | 0 | 90-100 | 80-100 | 80-100 | 65-96 | 38-55 | 21-35 |
| | 42-75 | Silty clay, clay, silty clay loam. | CL, CH | A-7-6, A-6 | 0 | 95-100 | 90-100 | 85-100 | 70-96 | 38-65 | 24-48 |
| 85:* | | | | | | | | | | | |
| Wilson---------- | 0-6 | Clay loam-------- | CL | A-6 | 0 | 95-100 | 85-100 | 80-100 | 60-96 | 25-36 | 10-20 |
| | 6-42 | Silty clay, clay, clay loam. | CL, CH | A-7-6, A-6 | 0 | 90-100 | 80-100 | 80-100 | 65-96 | 38-55 | 21-35 |
| | 42-75 | Silty clay, clay, silty clay loam. | CL, CH | A-7-6, A-6 | 0 | 95-100 | 90-100 | 85-100 | 70-96 | 38-65 | 24-48 |
| Urban land. | | | | | | | | | | | |
| 86---------- Windthorst | 0-7 | Fine sandy loam | SM, SM-SC, CL-ML, ML | A-4 | 0 | 95-100 | 90-100 | 75-100 | 36-75 | <28 | NP-7 |
| | 7-41 | Clay, sandy clay, clay loam. | CL, CH | A-6, A-7-6 | 0 | 95-100 | 95-100 | 85-100 | 51-90 | 35-53 | 20-35 |
| | 41-57 | Sandy clay loam, clay, fine sandy loam. | SC, CL | A-4, A-6, A-7-6 | 0 | 85-100 | 80-100 | 75-100 | 36-90 | 25-45 | 8-28 |
| | 57-67 | Stratified variable. | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 87---------- Windthorst | 0-7 | Fine sandy loam | SM, SM-SC, CL-ML, ML | A-4 | 0 | 95-100 | 90-100 | 75-100 | 36-75 | <28 | NP-7 |
| | 7-56 | Clay, sandy clay, clay loam. | CL, CH | A-6, A-7-6 | 0 | 95-100 | 95-100 | 85-100 | 51-90 | 35-53 | 20-35 |
| | 56-80 | Sandy clay loam, clay, fine sandy loam. | SC, CL | A-4, A-6, A-7-6 | 0 | 85-100 | 80-100 | 75-100 | 36-90 | 25-45 | 8-28 |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 1---------- | 0-7 | 20-35 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate----- | 0.32 | 1 | 8 | 1-3 |
| Aledo | 7-17 | 20-35 | 0.6-2.0 | 0.05-0.12 | 7.9-8.4 | Low---------- | 0.10 | | | |
| | 17-24 | --- | --- | --- | --- | ---------- | --- | | | |
| 2:* | | | | | | | | | | |
| Aledo---------- | 0-8 | 20-35 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate----- | 0.32 | 1 | 8 | 1-3 |
| | 8-17 | 20-35 | 0.6-2.0 | 0.05-0.12 | 7.9-8.4 | Low---------- | 0.10 | | | |
| | 17-24 | --- | --- | --- | --- | ---------- | --- | | | |
| Bolar---------- | 0-10 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate----- | 0.32 | 2 | 4L | 1-3 |
| | 10-30 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate----- | 0.17 | | | |
| | 30-36 | --- | --- | --- | --- | ---------- | --- | | | |
| 3:* | | | | | | | | | | |
| Aledo---------- | 0-8 | 20-35 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate----- | 0.32 | 1 | 8 | 1-3 |
| | 8-17 | 20-35 | 0.6-2.0 | 0.05-0.12 | 7.9-8.4 | Low---------- | 0.10 | | | |
| | 17-24 | --- | --- | --- | --- | ---------- | --- | | | |
| Bolar---------- | 0-10 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate----- | 0.32 | 2 | 4L | 1-3 |
| | 10-30 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate----- | 0.17 | | | |
| | 30-36 | --- | --- | --- | --- | ---------- | --- | | | |
| Urban land. | | | | | | | | | | |
| 4:* | | | | | | | | | | |
| Aledo---------- | 0-7 | 20-35 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate----- | 0.32 | 1 | 8 | 1-3 |
| | 7-17 | 20-35 | 0.6-2.0 | 0.05-0.12 | 7.9-8.4 | Low---------- | 0.10 | | | |
| | 17-24 | --- | --- | --- | --- | ---------- | --- | | | |
| Urban land. | | | | | | | | | | |
| 5---------- | 0-36 | 27-40 | 0.6-2.0 | 0.15-0.18 | 7.9-8.4 | High--------- | 0.32 | 5 | 4 | .5-1 |
| Altoga | 36-48 | 27-50 | 0.6-2.0 | 0.15-0.18 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| 6---------- | 0-28 | 0-12 | >20 | 0.05-0.10 | 5.6-7.8 | Very low----- | 0.17 | 5 | 2 | <1 |
| Aquilla | 28-80 | 3-18 | >20 | 0.07-0.12 | 5.6-7.8 | Very low----- | 0.17 | | | |
| 7,* 8.* | | | | | | | | | | |
| Arents | | | | | | | | | | |
| 9---------- | 0-11 | 7-20 | 2.0-6.0 | 0.11-0.17 | 5.1-6.5 | Low---------- | 0.24 | 5 | 3 | <2 |
| Bastsil | 11-80 | 18-35 | 0.6-2.0 | 0.15-0.19 | 5.6-7.8 | Moderate----- | 0.32 | | | |
| 10:* | | | | | | | | | | |
| Bastsil---------- | 0-11 | 7-20 | 2.0-6.0 | 0.11-0.17 | 5.1-6.5 | Low---------- | 0.24 | 5 | 3 | <2 |
| | 11-80 | 18-35 | 0.6-2.0 | 0.15-0.19 | 5.6-7.8 | Moderate----- | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 11---------- | 0-9 | 8-20 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low---------- | 0.32 | 3 | 3 | <1 |
| Birome | 9-15 | 35-55 | 0.2-0.6 | 0.15-0.20 | 3.6-6.0 | Moderate----- | 0.28 | | | |
| | 15-35 | 30-50 | 0.6-2.0 | 0.12-0.18 | 3.6-6.0 | Moderate----- | 0.28 | | | |
| | 35-50 | --- | --- | --- | --- | ---------- | --- | | | |
| 12:* | | | | | | | | | | |
| Birome---------- | 0-8 | 8-20 | 0.6-2.0 | 0.08-0.12 | 5.6-7.3 | Low---------- | 0.20 | 3 | 3 | <1 |
| | 8-27 | 35-55 | 0.2-0.6 | 0.15-0.20 | 3.6-6.0 | Moderate----- | 0.28 | | | |
| | 27-47 | --- | --- | --- | --- | ---------- | --- | | | |
| Aubrey---------- | 0-5 | 5-15 | 2.0-6.0 | 0.11-0.17 | 5.6-7.3 | Low---------- | 0.32 | 3 | 3 | <1 |
| | 5-36 | 40-60 | 0.06-0.2 | 0.15-0.20 | 3.6-6.0 | Moderate----- | 0.32 | | | |
| | 36-56 | --- | --- | --- | --- | ---------- | --- | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 12:* | | | | | | | | | | |
| Rayex | 0-5 | 5-15 | 0.6-2.0 | 0.08-0.15 | 5.6-7.3 | Low | 0.32 | 1 | 8 | <1 |
| | 5-14 | 35-55 | 0.2-0.6 | 0.12-0.20 | 4.5-6.0 | Moderate | 0.32 | | | |
| | 14-40 | --- | --- | --- | --- | --- | --- | | | |
| 13:* | | | | | | | | | | |
| Birome | 0-8 | 8-20 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low | 0.32 | 3 | 3 | <1 |
| | 8-27 | 35-55 | 0.2-0.6 | 0.15-0.20 | 3.6-6.0 | Moderate | 0.28 | | | |
| | 27-47 | --- | --- | --- | --- | --- | --- | | | |
| Aubrey | 0-5 | 5-15 | 2.0-6.0 | 0.11-0.17 | 5.6-7.3 | Low | 0.32 | 3 | 3 | <1 |
| | 5-36 | 40-60 | 0.06-0.2 | 0.15-0.20 | 3.6-6.0 | Moderate | 0.32 | | | |
| | 36-56 | --- | --- | --- | --- | --- | --- | | | |
| Urban land. | | | | | | | | | | |
| 14 | 0-13 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | 0.32 | 2 | 4L | 1-3 |
| Bolar | 13-30 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | 0.17 | | | |
| | 30-40 | --- | --- | --- | --- | --- | --- | | | |
| 15 | 0-8 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | 0.32 | 2 | 4L | 1-3 |
| Bolar | 8-31 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | 0.17 | | | |
| | 31-41 | --- | --- | --- | --- | --- | --- | | | |
| 16:* | | | | | | | | | | |
| Bolar | 0-8 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | 0.32 | 2 | 4L | 1-3 |
| | 8-31 | 25-40 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | 0.17 | | | |
| | 31-41 | --- | --- | --- | --- | --- | --- | | | |
| Urban land. | | | | | | | | | | |
| 17 | 0-13 | 15-35 | 0.2-0.6 | 0.10-0.20 | 7.9-8.4 | Low | 0.32 | 2 | 4L | <1 |
| Brackett | 13-40 | --- | --- | --- | --- | --- | --- | | | |
| 18 | 0-56 | 45-60 | <0.06 | 0.15-0.18 | 7.9-8.4 | Very high | 0.32 | 5 | 4 | 2-4 |
| Branyon | 56-80 | 30-60 | <2.0 | 0.11-0.18 | 7.9-8.4 | Very high | 0.32 | | | |
| 19 | 0-48 | 35-60 | <0.06 | 0.12-0.18 | 5.6-8.4 | High | 0.32 | 5 | 4 | 1-3 |
| Burleson | 48-66 | 35-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High | 0.32 | | | |
| 20 | 0-16 | 40-60 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | High | 0.32 | 5 | 4 | 1-3 |
| Chatt | 16-66 | 27-50 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | High | 0.32 | | | |
| 21 | 0-5 | 5-15 | 0.6-2.0 | 0.10-0.14 | 5.6-7.8 | Low | 0.43 | 3 | 3 | <1 |
| Crosstell | 5-44 | 40-60 | <0.06 | 0.14-0.18 | 4.5-8.4 | High | 0.37 | | | |
| | 44-63 | 40-60 | <0.06 | 0.14-0.18 | 6.6-8.4 | High | 0.37 | | | |
| 22 | 0-4 | 5-15 | 0.6-2.0 | 0.10-0.14 | 5.6-7.8 | Low | 0.43 | 3 | 3 | <1 |
| Crosstell | 4-41 | 40-60 | <0.06 | 0.14-0.18 | 4.5-8.4 | High | 0.37 | | | |
| | 41-60 | 40-60 | <0.06 | 0.14-0.18 | 6.6-8.4 | High | 0.37 | | | |
| 23:* | | | | | | | | | | |
| Crosstell | 0-4 | 5-15 | 0.6-2.0 | 0.10-0.14 | 5.6-7.8 | Low | 0.43 | 3 | 3 | <1 |
| | 4-41 | 40-60 | <0.06 | 0.14-0.18 | 4.5-8.4 | High | 0.37 | | | |
| | 41-60 | 40-60 | <0.06 | 0.14-0.18 | 6.6-8.4 | High | 0.37 | | | |
| Urban land. | | | | | | | | | | |
| 24 | 0-60 | 40-60 | <0.06 | 0.15-0.18 | 7.9-8.4 | Very high | 0.32 | 4 | 4 | .5-2 |
| Ferris | | | | | | | | | | |
| 25:* | | | | | | | | | | |
| Ferris | 0-60 | 40-60 | <0.06 | 0.15-0.18 | 7.9-8.4 | Very high | 0.32 | 4 | 4 | .5-2 |
| Heiden | 0-38 | 40-60 | <0.06 | 0.15-0.20 | 7.9-8.4 | Very high | 0.32 | 5 | 4 | 1-3 |
| | 38-72 | 40-60 | <0.06 | 0.12-0.20 | 7.9-8.4 | Very high | 0.32 | | | |
| 27 | 0-24 | 35-50 | 0.2-0.6 | 0.15-0.22 | 7.9-8.4 | Moderate | 0.32 | 5 | 4 | 1-4 |
| Frio | 24-80 | 35-50 | 0.2-0.6 | 0.11-0.22 | 7.9-8.4 | Moderate | 0.32 | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 27---------- | 0-35 | 35-50 | 0.2-0.6 | 0.15-0.22 | 7.9-8.4 | Moderate----- | 0.32 | 5 | 4 | 1-4 |
| Frio | 35-72 | 35-50 | 0.2-0.6 | 0.11-0.22 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| 28:* | | | | | | | | | | |
| Frio---------- | 0-24 | 35-50 | 0.2-0.6 | 0.15-0.22 | 7.9-8.4 | Moderate----- | 0.32 | 5 | 4 | 1-4 |
| | 24-80 | 35-50 | 0.2-0.6 | 0.11-0.22 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 29---------- | 0-10 | 8-20 | 2.0-6.0 | 0.11-0.15 | 6.1-7.8 | Low---------- | 0.24 | 5 | 3 | .5-1 |
| Gasil | 10-75 | 15-35 | 0.6-2.0 | 0.12-0.19 | 5.1-6.5 | Moderate----- | 0.32 | | | |
| 30---------- | 0-9 | 8-20 | 2.0-6.0 | 0.11-0.15 | 6.1-7.8 | Low---------- | 0.24 | 5 | 3 | .5-1 |
| Gasil | 9-80 | 15-35 | 0.6-2.0 | 0.12-0.19 | 5.1-6.5 | Moderate----- | 0.32 | | | |
| 31---------- | 0-60 | 18-35 | 0.6-2.0 | 0.12-0.19 | 5.1-6.5 | Moderate----- | 0.32 | 5 | 5 | 0-.5 |
| Gasil | | | | | | | | | | |
| 32:* | | | | | | | | | | |
| Gasil---------- | 0-10 | 8-20 | 2.0-6.0 | 0.11-0.15 | 6.1-7.8 | Low---------- | 0.24 | 5 | 3 | .5-1 |
| | 10-75 | 15-35 | 0.6-2.0 | 0.12-0.19 | 5.1-6.5 | Moderate----- | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 33---------- | 0-38 | 40-60 | <0.06 | 0.15-0.20 | 7.9-8.4 | Very high---- | 0.32 | 5 | 4 | 1-4 |
| Heiden | 38-72 | 40-60 | <0.06 | 0.12-0.20 | 7.9-8.4 | Very high---- | 0.32 | | | |
| 34---------- | 0-42 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | Very high---- | 0.32 | 5 | 4 | 1-4 |
| Houston Black | 42-80 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | Very high---- | 0.32 | | | |
| 35:* | | | | | | | | | | |
| Houston Black--- | 0-42 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | Very high---- | 0.32 | 5 | 4 | 1-4 |
| | 42-80 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | Very high---- | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 36---------- | 0-16 | 12-25 | 0.6-2.0 | 0.12-0.17 | 6.1-7.3 | Low---------- | 0.28 | 5 | 6 | <3 |
| Justin | 16-40 | 18-35 | 0.2-0.6 | 0.14-0.20 | 6.1-7.3 | Moderate----- | 0.28 | | | |
| | 40-70 | 27-45 | 0.2-0.6 | 0.14-0.17 | 6.1-8.4 | Moderate----- | 0.28 | | | |
| 37---------- | 0-9 | 8-20 | 2.0-6.0 | 0.11-0.15 | 6.1-7.8 | Low---------- | 0.24 | 5 | 3 | <1 |
| Konsil | 9-75 | 18-33 | 0.6-2.0 | 0.12-0.19 | 5.1-6.5 | Moderate----- | 0.32 | | | |
| 38---------- | 0-70 | 40-60 | <0.06 | 0.12-0.18 | 6.1-8.4 | High--------- | 0.32 | 5 | 4 | 1-3 |
| Leson | 70-80 | 35-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High--------- | 0.32 | | | |
| 39---------- | 0-5 | 25-35 | 0.2-0.6 | 0.12-0.20 | 6.1-8.4 | Low---------- | 0.32 | 2 | 6 | <2 |
| Lindale | 5-26 | 35-50 | 0.06-0.2 | 0.10-0.20 | 6.1-8.4 | Moderate----- | 0.32 | | | |
| | 26-48 | 35-50 | 0.06-0.2 | 0.02-0.10 | 7.9-8.4 | Moderate----- | 0.28 | | | |
| 40:* | | | | | | | | | | |
| Lindale---------- | 0-5 | 25-35 | 0.2-0.6 | 0.12-0.20 | 6.1-8.4 | Low---------- | 0.32 | 2 | 6 | <2 |
| | 5-26 | 35-50 | 0.06-0.2 | 0.10-0.20 | 6.1-8.4 | Moderate----- | 0.32 | | | |
| | 26-48 | 35-50 | 0.06-0.2 | 0.02-0.10 | 7.9-8.4 | Moderate----- | 0.28 | | | |
| Urban land. | | | | | | | | | | |
| 41---------- | 0-16 | 35-50 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | High--------- | 0.32 | 4 | 4 | 1-3 |
| Lott | 16-46 | 35-50 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| | 46-60 | 16-35 | 0.6-2.0 | 0.15-0.20 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| 42:* | | | | | | | | | | |
| Lott---------- | 0-16 | 35-50 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | High--------- | 0.32 | 4 | 4 | 1-3 |
| | 16-46 | 35-50 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| | 46-60 | 16-35 | 0.6-2.0 | 0.15-0.20 | 7.9-8.4 | Moderate----- | 0.32 | | | |
| Urban land. | | | | | | | | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 43---------- | 0-15 | 20-35 | 0.6-2.0 | 0.15-0.18 | 6.1-7.8 | Low---------- | 0.32 | 5 | 6 | 1-3 |
| Luckenbach | 15-48 | 35-55 | 0.2-0.6 | 0.13-0.18 | 7.4-8.4 | Moderate----- | 0.32 | | | |
| | 48-60 | 30-50 | 0.2-0.6 | 0.10-0.15 | 7.9-8.4 | Moderate----- | 0.28 | | | |
| 44:* | | | | | | | | | | |
| Luckenbach------ | 0-15 | 20-35 | 0.6-2.0 | 0.15-0.18 | 6.1-7.8 | Low---------- | 0.32 | 5 | 6 | 1-3 |
| | 15-48 | 35-55 | 0.2-0.6 | 0.13-0.18 | 7.4-8.4 | Moderate----- | 0.32 | | | |
| | 48-60 | 30-50 | 0.2-0.6 | 0.10-0.15 | 7.9-8.4 | Moderate----- | 0.28 | | | |
| Urban land. | | | | | | | | | | |
| 45---------- | 0-7 | 10-25 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low---------- | 0.43 | 5 | 3 | 1-2 |
| Mabank | 7-80 | 35-50 | <0.06 | 0.12-0.18 | 5.6-8.4 | High--------- | 0.32 | | | |
| 46:* | | | | | | | | | | |
| Maloterre------- | 0-7 | 30-45 | 0.2-0.6 | 0.13-0.16 | 7.9-8.4 | Low---------- | 0.15 | 1 | 8 | .5-2 |
| | 7-10 | --- | --- | --- | --- | ---------- | ---- | | | |
| Aledo----------- | 0-7 | 20-35 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate----- | 0.32 | 1 | 8 | 1-3 |
| | 7-16 | 20-35 | 0.6-2.0 | 0.05-0.12 | 7.9-8.4 | Low---------- | 0.10 | | | |
| | 16-20 | --- | --- | --- | --- | ---------- | ---- | | | |
| Brackett-------- | 0-14 | 15-35 | 0.2-0.6 | 0.10-0.20 | 7.9-8.4 | Low---------- | 0.32 | 2 | 4L | <1 |
| | 14-28 | --- | --- | --- | --- | ---------- | ---- | | | |
| 47---------- | 0-33 | 40-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High--------- | 0.32 | 4 | 4 | 5-2 |
| Medlin | 33-67 | 40-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High--------- | 0.32 | | | |
| 48---------- | 0-5 | 27-40 | 0.6-2.0 | 0.12-0.18 | 6.6-8.4 | Moderate----- | 0.37 | 2 | 4 | 1-3 |
| Mingo | 5-31 | 40-60 | <0.06 | 0.10-0.20 | 6.6-8.4 | High--------- | 0.32 | | | |
| | 31-37 | --- | --- | --- | --- | ---------- | ---- | | | |
| 49:* | | | | | | | | | | |
| Mingo----------- | 0-5 | 27-40 | 0.6-2.0 | 0.12-0.18 | 6.6-8.4 | Moderate----- | 0.37 | 2 | 4 | 1-3 |
| | 5-31 | 40-60 | <0.06 | 0.10-0.20 | 6.6-8.4 | High--------- | 0.32 | | | |
| | 1-37 | --- | --- | --- | --- | ---------- | ---- | | | |
| Urban land. | | | | | | | | | | |
| 50---------- | 0-12 | 25-35 | 0.06-0.2 | 0.15-0.20 | 5.6-7.3 | Moderate----- | 0.32 | 5 | 6 | <1 |
| Navo | 12-72 | 35-55 | <0.06 | 0.12-0.18 | 5.6-8.4 | High--------- | 0.32 | | | |
| 51:* | | | | | | | | | | |
| Navo------------ | 0-12 | 25-35 | 0.06-0.2 | 0.15-0.20 | 5.6-7.3 | Moderate----- | 0.32 | 5 | 6 | <1 |
| | 12-72 | 35-55 | <0.06 | 0.12-0.18 | 5.6-8.4 | High--------- | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 52---------- | 0-25 | 0-10 | 6.0-20 | 0.05-0.10 | 5.6-7.3 | Very low----- | 0.17 | 5 | 2 | <1 |
| Nimrod | 25-49 | 20-35 | 0.2-0.6 | 0.12-0.17 | 5.1-6.0 | Low---------- | 0.24 | | | |
| | 49-80 | 10-35 | 0.2-0.6 | 0.06-0.17 | 5.1-6.5 | Low---------- | 0.24 | | | |
| 53---------- | 0-72 | 40-60 | <0.06 | 0.15-0.20 | 7.9-8.4 | High--------- | 0.32 | 5 | 4 | 1-4 |
| Ovan | | | | | | | | | | |
| 54---------- | 0-66 | 40-60 | <0.06 | 0.15-0.20 | 7.9-8.4 | High--------- | 0.32 | 5 | 4 | 1-4 |
| Ovan | | | | | | | | | | |
| 55:* | | | | | | | | | | |
| Ovan------------ | 0-72 | 40-60 | <0.06 | 0.15-0.20 | 7.9-8.4 | High--------- | 0.32 | 5 | 4 | 1-4 |
| Urban land. | | | | | | | | | | |
| 56.* | | | | | | | | | | |
| Pits | | | | | | | | | | |
| 57---------- | 0-7 | 22-35 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate----- | 0.32 | 5 | 6 | 1-3 |
| Ponder | 7-53 | 35-50 | 0.06-0.2 | 0.12-0.18 | 5.6-8.4 | High--------- | 0.32 | | | |
| | 53-80 | 25-40 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | High--------- | 0.32 | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 58:* | | | | | | | | | | |
| Ponder | 0-7 | 22-35 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate | 0.32 | 5 | 6 | 1-3 |
| | 7-53 | 35-50 | 0.06-0.2 | 0.12-0.18 | 5.6-8.4 | High | 0.32 | | | |
| | 53-80 | 25-40 | 0.2-0.6 | 0.15-0.20 | 7.9-8.4 | High | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 59 | 0-10 | 10-20 | 2.0-6.0 | 0.11-0.15 | 5.6-8.4 | Low | 0.28 | 5 | 3 | <2 |
| Pulexas | 10-64 | 8-18 | 2.0-6.0 | 0.11-0.15 | 5.6-8.4 | Low | 0.28 | | | |
| 60:* | | | | | | | | | | |
| Pulexas | 0-10 | 10-20 | 2.0-6.0 | 0.11-0.15 | 5.6-8.4 | Low | 0.28 | 5 | 3 | <2 |
| | 10-64 | 8-18 | 2.0-6.0 | 0.11-0.15 | 5.6-8.4 | Low | 0.28 | | | |
| Urban land. | | | | | | | | | | |
| 61 | 0-15 | 35-55 | 0.2-0.6 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | 1 | 4 | 1-3 |
| Purves | 15-20 | --- | --- | --- | --- | --- | --- | | | |
| 62:* | | | | | | | | | | |
| Purves | 0-15 | 35-55 | 0.2-0.6 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | 1 | 4 | 1-3 |
| | 15-20 | --- | --- | --- | --- | --- | --- | | | |
| Urban land. | | | | | | | | | | |
| 63 | 0-18 | 5-20 | 2.0-6.0 | 0.10-0.15 | 5.6-6.5 | Low | 0.32 | 5 | 3 | .5-2 |
| Rader | 18-27 | 18-30 | 0.2-0.6 | 0.12-0.18 | 6.1-7.3 | Moderate | 0.32 | | | |
| | 27-63 | 35-50 | <0.06 | 0.12-0.18 | 4.5-7.3 | High | 0.32 | | | |
| | 63-69 | 30-45 | 0.06-0.2 | 0.12-0.18 | 5.1-8.4 | Moderate | 0.32 | | | |
| 64:* | | | | | | | | | | |
| Rader | 0-18 | 5-20 | 2.0-6.0 | 0.10-0.15 | 5.6-6.5 | Low | 0.32 | 5 | 3 | .5-2 |
| | 18-27 | 18-30 | 0.2-0.6 | 0.12-0.18 | 6.1-7.3 | Moderate | 0.32 | | | |
| | 27-63 | 35-50 | <0.06 | 0.12-0.18 | 4.5-7.3 | High | 0.32 | | | |
| | 63-69 | 30-45 | 0.06-0.2 | 0.12-0.18 | 5.1-8.4 | Moderate | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 65 | 0-20 | 40-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High | 0.32 | 5 | 4 | 1-3 |
| Sanger | 20-49 | 40-60 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | | | |
| | 49-80 | 40-60 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | | | |
| 66 | 0-16 | <0-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High | 0.32 | 5 | 4 | 1-3 |
| Sanger | 16-46 | 40-60 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | | | |
| | 46-63 | 40-60 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | | | |
| 67:* | | | | | | | | | | |
| Sanger | 0-20 | 40-60 | <0.06 | 0.12-0.18 | 7.4-8.4 | High | 0.32 | 5 | 4 | 1-3 |
| | 20-49 | 40-60 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | | | |
| | 49-80 | 40-60 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | 0.32 | | | |
| Urban land. | | | | | | | | | | |
| 68 | 0-30 | 45-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | Very high | 0.32 | 2 | 4 | 1-4 |
| San Saba | 30-36 | --- | --- | --- | --- | --- | --- | | | |
| 69 | 0-14 | 3-15 | 2.0-6.0 | 0.05-0.09 | 5.6-7.3 | Very low | 0.17 | 5 | 2 | <1 |
| Selden | 14-65 | 20-35 | 0.2-0.6 | 0.12-0.17 | 5.1-6.5 | Low | 0.24 | | | |
| 70 | 0-6 | 10-20 | 2.0-6.0 | 0.10-0.15 | 5.1-6.5 | Low | 0.24 | 5 | 3 | .5-2 |
| Silawa | 6-46 | 18-35 | 0.6-2.0 | 0.12-0.17 | 4.5-6.0 | Low | 0.32 | | | |
| | 46-60 | 12-30 | 2.0-6.0 | 0.08-0.15 | 4.5-6.0 | Low | 0.32 | | | |
| 71 | 0-27 | 3-12 | 6.0-20 | 0.05-0.10 | 5.6-7.0 | Low | 0.17 | 5 | 2 | <1 |
| Silstid | 27-67 | 18-32 | 0.6-2.0 | 0.12-0.17 | 5.1-6.5 | Low | 0.24 | | | |
| | 67-74 | 18-32 | 0.6-2.0 | 0.10-0.16 | 5.1-6.5 | Low | 0.24 | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 72:* | | | | | | | | | | |
| Silstid | 0-27 | 3-12 | 6.0-20 | 0.05-0.10 | 5.6-7.0 | Low | 0.17 | 5 | 2 | <1 |
| | 27-67 | 18-32 | 0.6-2.0 | 0.12-0.17 | 5.1-6.5 | Low | 0.24 | | | |
| | 67-74 | 18-32 | 0.6-2.0 | 0.10-0.16 | 5.1-6.5 | Low | 0.24 | | | |
| Urban land. | | | | | | | | | | |
| 73 | 0-27 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | High | 0.32 | 5 | 4 | 1-4 |
| Slidell | 27-60 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | High | 0.32 | | | |
| 74 | 0-22 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | High | 0.32 | 5 | 4 | 1-4 |
| Slidell | 22-80 | 40-60 | <0.06 | 0.15-0.20 | 7.4-8.4 | High | 0.32 | | | |
| 75 | 0-7 | 27-40 | 0.2-0.6 | 0.15-0.20 | 6.1-7.8 | Moderate | 0.32 | 1 | 6 | 1-3 |
| Speck | 7-15 | 35-60 | 0.06-0.2 | 0.12-0.18 | 6.1-7.8 | High | 0.32 | | | |
| | 15-29 | --- | --- | --- | --- | --- | --- | | | |
| 76 | 0-11 | 10-20 | 2.0-6.0 | 0.11-0.15 | 5.1-7.3 | Low | 0.24 | 3 | 3 | <1 |
| Stephenville | 11-32 | 18-35 | 0.6-2.0 | 0.11-0.17 | 5.1-6.5 | Low | 0.32 | | | |
| | 32-50 | --- | --- | --- | --- | --- | --- | | | |
| 77 | 0-19 | 20-40 | 0.6-2.0 | 0.11-0.16 | 7.9-8.4 | Low | 0.28 | 5 | 4L | 1-3 |
| Sunev | 19-72 | 20-40 | 0.6-2.0 | 0.11-0.16 | 7.9-8.4 | Low | 0.28 | | | |
| 78 | 0-15 | 20-40 | 0.6-2.0 | 0.11-0.16 | 7.9-8.4 | Low | 0.28 | 5 | 4L | 1-3 |
| Sunev | 15-63 | 20-40 | 0.6-2.0 | 0.11-0.16 | 7.9-8.4 | Low | 0.28 | | | |
| 79:* | | | | | | | | | | |
| Sunev | 0-15 | 20-40 | 0.6-2.0 | 0.11-0.16 | 7.9-8.4 | Low | 0.28 | 5 | 4L | 1-3 |
| | 15-63 | 20-40 | 0.6-2.0 | 0.11-0.16 | 7.9-8.4 | Low | 0.28 | | | |
| Urban land. | | | | | | | | | | |
| 80 | 0-63 | 60-80 | <0.06 | 0.15-0.20 | 7.4-8.4 | Very high | 0.32 | 5 | 4 | 1-4 |
| Trinity | | | | | | | | | | |
| 81.* | | | | | | | | | | |
| Urban land | | | | | | | | | | |
| 82 | 0-6 | 8-20 | 2.0-6.0 | 0.11-0.15 | 5.1-7.3 | Low | 0.43 | 3 | 3 | <2 |
| Weatherford | 6-23 | 20-35 | 0.6-2.0 | 0.12-0.19 | 5.1-6.0 | Low | 0.49 | | | |
| | 23-51 | 18-35 | 0.6-2.0 | 0.10-0.15 | 5.1-6.0 | Low | 0.49 | | | |
| | 51-60 | --- | --- | --- | --- | --- | --- | | | |
| 83 | 0-6 | 22-35 | 0.6-2.0 | 0.15-0.20 | 6.1-7.8 | Moderate | 0.28 | 5 | 6 | 1-2 |
| Whitesboro | 6-80 | 22-35 | 0.6-2.0 | 0.15-0.20 | 6.1-8.4 | Moderate | 0.28 | | | |
| 84 | 0-6 | 27-40 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Low | 0.43 | 5 | 6 | .5-2 |
| Wilson | 6-42 | 35-50 | <0.06 | 0.14-0.20 | 5.6-8.4 | High | 0.37 | | | |
| | 42-75 | 35-50 | <0.06 | 0.12-0.15 | 6.6-8.4 | High | 0.37 | | | |
| 85:* | | | | | | | | | | |
| Wilson | 0-6 | 27-40 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Low | 0.43 | 5 | 6 | .5-2 |
| | 6-42 | 35-50 | <0.06 | 0.14-0.20 | 5.6-8.4 | High | 0.37 | | | |
| | 42-75 | 35-50 | <0.06 | 0.12-0.15 | 6.6-8.4 | High | 0.37 | | | |
| Urban land. | | | | | | | | | | |
| 86 | 0-7 | 5-18 | 0.6-2.0 | 0.12-0.17 | 5.6-7.3 | Low | 0.49 | 5 | 3 | <1 |
| Windthorst | 7-41 | 35-50 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate | 0.37 | | | |
| | 41-57 | 15-45 | 0.2-0.6 | 0.12-0.20 | 5.6-8.4 | Moderate | 0.37 | | | |
| | 57-67 | --- | --- | --- | --- | --- | --- | | | |
| 87 | 0-7 | 5-18 | 0.6-2.0 | 0.12-0.17 | 5.6-7.3 | Low | 0.49 | 5 | 3 | <1 |
| Windthorst | 7-56 | 35-50 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate | 0.37 | | | |
| | 56-80 | 15-45 | 0.2-0.6 | 0.12-0.20 | 5.6-8.4 | Moderate | 0.37 | | | |

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

| Map symbol and soil name | Depth | Clay <2mm | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Erosion factors | | Wind erodibility group | Organic matter |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | K | T | | |
| | In | Pct | In/hr | In/in | pH | | | | | Pct |
| 88---------- | 0-3 | 5-18 | 0.6-2.0 | 0.12-0.17 | 5.6-7.3 | Low---------- | 0.49 | 5 | 3 | <1 |
| Windthorst | 3-31 | 35-50 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate----- | 0.37 | | | |
| | 31-38 | 15-45 | 0.2-0.6 | 0.12-0.20 | 5.6-8.4 | Moderate----- | 0.37 | | | |
| | 38-60 | --- | --- | --- | --- | ---------- | ---- | | | |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

| Map symbol and soil name | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | |
| 1---- Aledo | C | None---- | --- | --- | >6.0 | --- | --- | 8-20 | Soft | Moderate | Low. |
| 2:* | | | | | | | | | | | |
| Aledo---- | C | None---- | --- | --- | >6.0 | --- | --- | 8-20 | Soft | Moderate | Low. |
| Bolar---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Low. |
| 3:* | | | | | | | | | | | |
| Aledo---- | C | None---- | --- | --- | >6.0 | --- | --- | 8-20 | Soft | Moderate | Low. |
| Bolar---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Low. |
| Urban land. | | | | | | | | | | | |
| 4:* | | | | | | | | | | | |
| Aledo---- | C | None---- | --- | --- | >6.0 | --- | --- | 8-20 | Soft | Moderate | Low. |
| Urban land. | | | | | | | | | | | |
| 5---- Altoga | C | None---- | --- | --- | >6.0 | --- | --- | >60 | --- | High---- | Low. |
| 6---- Aquilla | A | None---- | --- | --- | 4.0-5.0 | Perched | Dec-Mar | >60 | --- | Low---- | Low. |
| 7,* 8.* Arents | | | | | | | | | | | |
| 9---- Bastsil | B | None---- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| 10:* | | | | | | | | | | | |
| Bastsil---- | B | None---- | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| Urban land. | | | | | | | | | | | |
| 11---- Birome | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Moderate. |
| 12:* | | | | | | | | | | | |
| Birome---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Moderate. |
| Aubrey---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | High. |
| Rayex---- | D | None---- | --- | --- | >6.0 | --- | --- | 10-20 | Soft | High---- | Moderate. |
| 13:* | | | | | | | | | | | |
| Birome---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Moderate. |
| Aubrey---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | High. |
| Urban land. | | | | | | | | | | | |
| 14, 15---- Bolar | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Low. |
| 16:* | | | | | | | | | | | |
| Bolar---- | C | None---- | --- | --- | >6.0 | --- | --- | 20-40 | Soft | High---- | Low. |
| Urban land. | | | | | | | | | | | |
| 17---- Brackett | C | None---- | --- | --- | >6.0 | --- | --- | 10-20 | Soft | High---- | Low. |

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Map symbol and soil name | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | |
| 18---- Branyon | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 19---- Burleson | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 20---- Chatt | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 21, 22---- Crosstell | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Moderate. |
| 23:* Crosstell---- Urban land. | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Moderate. |
| 24---- Ferris | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 25:* Ferris---- | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| Heiden---- | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 26---- Frio | B | Occasional | Very brief | Oct-May | >6.0 | --- | --- | >60 | --- | High | Low. |
| 27---- Frio | B | Frequent | Very brief | Oct-May | >6.0 | --- | --- | >60 | --- | High | Low. |
| 28:* Frio---- Urban land. | B | Occasional | Very brief | Oct-May | >6.0 | --- | --- | >60 | --- | High | Low. |
| 29, 30, 31---- Gasil | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Low | Moderate. |
| 32:* Gasil---- Urban land. | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Low | Moderate. |
| 33---- Heiden | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 34---- Houston Black | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 35:* Houston Black---- Urban land. | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 36---- Justin | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| 37---- Konsil | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Low | Moderate. |
| 38---- Leson | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 39---- Lindale | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 40:* Lindale---- Urban land. | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Map symbol and soil name | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | |
| 41--Lott | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 42:* Lott | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| Urban land. | | | | | | | | | | | |
| 43--Luckenbach | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| 44:* Luckenbach | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| Urban land. | | | | | | | | | | | |
| 45--Mabank | D | None | --- | --- | 0.6-1.0 | Perched | Dec-Mar | >60 | --- | High | Moderate. |
| 46:* Maloterre | D | None | --- | --- | >6.0 | --- | --- | 3-10 | Hard | High | Low. |
| Aledo | C | None | --- | --- | >6.0 | --- | --- | 8-20 | Soft | Moderate | Low. |
| Brackett | C | None | --- | --- | >6.0 | --- | --- | 10-20 | Soft | High | Low. |
| 47--Medlin | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 48--Mingo | C | None | --- | --- | >6.0 | --- | --- | 22-40 | Hard | High | Low. |
| 49:* Mingo | C | None | --- | --- | >6.0 | --- | --- | 22-40 | Hard | High | Low. |
| Urban land. | | | | | | | | | | | |
| 50--Navo | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 51:* Navo | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| Urban land. | | | | | | | | | | | |
| 52--Nimrod | C | None | --- | --- | 1.5-3.5 | Perched | May-Oct | >60 | --- | High | Moderate. |
| 53--Ovan | D | Occasional | Very brief | Mar-Jun | >6.0 | --- | --- | >60 | --- | High | Low. |
| 54--Ovan | D | Frequent | Very brief | Mar-Jun | >6.0 | --- | --- | >60 | --- | High | Low. |
| 55:* Ovan | D | Occasional | Very brief | Mar-Jun | >6.0 | --- | --- | >60 | --- | High | Low. |
| Urban land. | | | | | | | | | | | |
| 56.* Pits | | | | | | | | | | | |
| 57--Ponder | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 58:* Ponder | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| Urban land. | | | | | | | | | | | |

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Map symbol and soil name | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | |
| 59--Pulexas | B | Frequent | Brief | Oct-May | >6.0 | --- | --- | >60 | --- | Low | Low. |
| 60:* Pulexas | B | Occasional | Very brief | Oct-May | >6.0 | --- | --- | >60 | --- | Low | Low. |
| Urban land. | | | | | | | | | | | |
| 61--Purves | D | None | --- | --- | >6.0 | --- | --- | 8-20 | Soft | High | Low. |
| 62:* Purves | D | None | --- | --- | >6.0 | --- | --- | 8-20 | Soft | High | Low. |
| Urban land. | | | | | | | | | | | |
| 63--Rader | D | None | --- | --- | 1.5-5.0 | Perched | Dec-Mar | >60 | --- | High | Moderate. |
| 64:* Rader | D | None | --- | --- | 1.5-5.0 | Perched | Dec-Mar | >60 | --- | High | Moderate. |
| Urban land. | | | | | | | | | | | |
| 65, 66--Sanger | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 67:* Sanger | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| Urban land. | | | | | | | | | | | |
| 68--San Saba | D | None | --- | --- | >6.0 | --- | --- | 24-40 | Hard | High | Low. |
| 69--Selden | C | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Moderate. |
| 70--Silawa | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Moderate. |
| 71--Silstid | A | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Moderate. |
| 72:* Silstid | A | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Moderate. |
| Urban land. | | | | | | | | | | | |
| 73, 74--Slidell | D | None | --- | --- | >6.0 | --- | --- | >60 | --- | High | Low. |
| 75--Speck | D | None | --- | --- | >6.0 | --- | --- | 14-20 | Hard | High | Low. |
| 76--Stephenville | B | None | --- | --- | >6.0 | --- | --- | 20-40 | Soft | Moderate | Moderate. |
| 77, 78--Sunev | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| 79:* Sunev | B | None | --- | --- | >6.0 | --- | --- | >60 | --- | Moderate | Low. |
| Urban land. | | | | | | | | | | | |
| 80--Trinity | D | Frequent | Very brief to brief. | Feb-May | 0-3.0 | Apparent | Nov-Feb | >60 | --- | High | Low. |

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

| Map symbol and soil name | Hydrologic group | Flooding | | | High water table | | | Bedrock | | Risk of corrosion | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness | Uncoated steel | Concrete |
| | | | | | Ft | | | In | | | |
| 81.* Urban land | | | | | | | | | | | |
| 82---------- Weatherford | B | None-------- | --- | --- | >6.0 | --- | --- | 40-60 | Soft | Low------ | Moderate. |
| 83---------- Whitesboro | C | Frequent---- | Very brief | Sep-May | 2.0-4.0 | Apparent | Oct-May | >60 | --- | High----- | Low. |
| 84---------- Wilson | D | None-------- | --- | --- | 0-1.0 | Perched | Nov-Mar | >60 | --- | High----- | High. |
| 85:* Wilson---------- Urban land. | D | None-------- | --- | --- | 0-1.0 | Perched | Nov-Mar | >60 | --- | High----- | High. |
| 86, 87, 88-------- Windthorst | C | None-------- | --- | --- | >6.0 | --- | --- | >60 | --- | High----- | Low. |

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

| Soil name, report number, horizon, and depth in inches | Classification | | Grain size distribution[1] | | | | | | | | | Liquid limit[2] | Plasticity index[2] | Specific gravity | Shrinkage | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Percentage passing sieve-- | | | | | | | Percentage smaller than-- | | | | | | | |
| | AASHTO | Unified | 7/4 inch | 5/8 inch | 3/8 inch | No. 4 | No. 10 | No. 40 | No. 200 | .05 mm | .005 mm | .002 mm | | | | Limit | Linear | Ratio |
| | | | | | | | | | | | | | Pct | | G/cm$^3$ | Pct | Pct | Pct |
| Aubrey fine sandy loam:[3] (S76TX-439-012) | | | | | | | | | | | | | | | | | | |
| A1--------0 to 5 | A-2-4(00) | SM-SC | 100 | 100 | 99 | 96 | 93 | 90 | 22 | 17 | 7 | 5 | 25 | 4 | -- | 21.0 | 2.1 | 1.6 |
| B21t------5 to 17 | A-7-6(33) | CH | 100 | 100 | 100 | 99 | 97 | 96 | 82 | 76 | 66 | 63 | 60 | 38 | -- | 15.0 | 18.2 | 1.8 |
| Cr--------30 to 56 | A-7-6(19) | CL | 100 | 100 | 100 | 100 | 99 | 97 | 75 | 64 | 47 | 43 | 43 | 27 | -- | 15.0 | 12.8 | 1.8 |
| Birome gravelly fine sandy loam:[4] (S76TX-439-010) | | | | | | | | | | | | | | | | | | |
| A2--------3 to 9 | A-4 (00) | SM-SC | 100 | 96 | 91 | 84 | 77 | 74 | 39 | 28 | 7 | 4 | 23 | 4 | 2.64 | 21.0 | 1.3 | 1.6 |
| B21t------9 to 15 | A-7-6(21) | CL | 100 | 100 | 100 | 100 | 100 | 100 | 81 | 70 | 50 | 46 | 44 | 26 | 2.70 | 15.0 | 13.0 | 1.8 |
| B23t-----25 to 35 | A-6 (17) | CL | 100 | 100 | 100 | 100 | 100 | 100 | 83 | 70 | 38 | 35 | 38 | 22 | 2.70 | 18.0 | 9.7 | 1.8 |
| Crosstell fine sandy loam:[5] (S75TX-439-007) | | | | | | | | | | | | | | | | | | |
| Ap--------0 to 6 | A-4 (05) | CL | 100 | 100 | 100 | 97 | 94 | 92 | 77 | 57 | 18 | 16 | 30 | 8 | 2.70 | 22.0 | 4.4 | 1.6 |
| B21t------6 to 12 | A-7-6(23) | CH | 100 | 100 | 100 | 99 | 98 | 96 | 68 | 66 | 49 | 48 | 55 | 37 | 2.73 | 12.0 | 18.8 | 2.0 |
| B3--------32 to 46 | A-7-6(34) | CH | 100 | 100 | 100 | 98 | 95 | 92 | 85 | 81 | 57 | 51 | 56 | 39 | 2.74 | 11.0 | 19.6 | 2.0 |
| C--------46 to 65 | A-7-6(11) | CL | 100 | 100 | 100 | 100 | 98 | 96 | 53 | 51 | 41 | 39 | 43 | 28 | 2.68 | 14.0 | 13.8 | 1.9 |
| Heiden clay:[6] (S75TX-439-004) | | | | | | | | | | | | | | | | | | |
| A11-------0 to 10 | A-7-6(29) | CH | 100 | 100 | 100 | 100 | 100 | 98 | 79 | 75 | 48 | 43 | 55 | 37 | 2.65 | 12.0 | 18.4 | 1.9 |
| A12------10 to 27 | A-7-6(28) | CH | 100 | 100 | 100 | 100 | 100 | 99 | 83 | 79 | 54 | 47 | 51 | 33 | 2.68 | 10.0 | 18.4 | 2.0 |
| AC1------27 to 50 | A-7-6(29) | CL-CH | 100 | 100 | 100 | 100 | 98 | 96 | 84 | 80 | 56 | 48 | 50 | 34 | 2.70 | 11.0 | 18.2 | 2.0 |
| AC2------50 to 64 | A-7-6(32) | CL-CH | 100 | 100 | 100 | 100 | 99 | 98 | 94 | 92 | 75 | 59 | 50 | 32 | 2.73 | 14.0 | 16.3 | 1.9 |
| Houston Black clay:[7] (S75TX-439-003) | | | | | | | | | | | | | | | | | | |
| A12-------8 to 17 | A-7-6(37) | CH | 100 | 100 | 100 | 100 | 99 | 98 | 88 | 84 | 60 | 52 | 58 | 39 | 2.68 | 9.0 | 20.6 | 2.0 |
| AC1------42 to 61 | A-7-6(45) | CH | 100 | 100 | 100 | 100 | 100 | 98 | 91 | 86 | 64 | 56 | 64 | 45 | 2.71 | 9.0 | 22.8 | 2.1 |
| AC3------74 to 85 | A-7-6(35) | CH | 100 | 100 | 100 | 100 | 99 | 98 | 92 | 89 | 72 | 59 | 51 | 36 | 2.73 | 10.0 | 19.0 | 2.1 |

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

| Soil name, report number, horizon, and depth in inches | Classification | | Grain size distribution[1] | | | | | | | | | | Liquid limit[2] | Plasticity index[2] | Specific gravity | Shrinkage | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Percentage passing sieve-- | | | | | | | Percentage smaller than-- | | | | | | | | |
| | AASHTO | Unified | 7/4 inch | 5/8 inch | 3/8 inch | No. 4 | No. 10 | No. 40 | No. 200 | .05 mm | .005 mm | .002 mm | | | | Limit | Linear | Ratio |
| | | | | | | | | | | | | | Pct | | G/cm$^3$ | Pct | Pct | Pct |
| Lindale loam:[8] (S76TX-439-009) | | | | | | | | | | | | | | | | | | |
| Ap--------0 to 4 | A-6 (05) | CL | 100 | 100 | 100 | 99 | 98 | 95 | 59 | 52 | 22 | 18 | 28 | 14 | 2.63 | 15.0 | 7.2 | 1.8 |
| B22t------7 to 29 | A-7-6(24) | CH | 100 | 100 | 100 | 98 | 95 | 91 | 73 | 71 | 52 | 49 | 56 | 33 | 2.72 | 13.0 | 18.7 | 1.9 |
| B23t-----29 to 36 | A-7-6(26) | CH | 100 | 100 | 100 | 98 | 95 | 92 | 75 | 71 | 52 | 49 | 56 | 34 | 2.73 | 13.0 | 18.5 | 1.9 |
| C&B3ca---36 to 44 | A-7-6(06) | GC | 100 | 88 | 74 | 59 | 49 | 44 | 36 | 34 | 26 | 25 | 61 | 39 | 2.76 | 12.0 | 20.2 | 1.9 |
| Lott silty clay:[9] (S76TX-439-014) | | | | | | | | | | | | | | | | | | |
| A12-------6 to 14 | A-7-6(29) | CH | 100 | 100 | 100 | 99 | 99 | 96 | 85 | 80 | 53 | 42 | 53 | 33 | 2.67 | 10.0 | 19.0 | 2.0 |
| B22ca----28 to 46 | A-6 (15) | CL | 100 | 100 | 100 | 99 | 97 | 95 | 90 | 88 | 56 | 35 | 33 | 18 | 2.71 | 13.0 | 10.4 | 1.9 |
| Cca------46 to 60 | A-6 (19) | CL | 100 | 100 | 100 | 100 | 99 | 98 | 93 | 91 | 60 | 40 | 36 | 21 | 2.74 | 14.0 | 11.4 | 1.9 |
| Mingo clay loam:[10] (S75TX-439-006) | | | | | | | | | | | | | | | | | | |
| A1--------0 to 5 | A-7-6(33) | CH | 100 | 100 | 100 | 100 | 99 | 99 | 94 | 89 | 51 | 44 | 54 | 32 | 2.63 | 13.0 | 17.6 | 1.9 |
| B22t-----13 to 25 | A-7-6(41) | CH | 100 | 100 | 100 | 100 | 100 | 99 | 95 | 91 | 63 | 55 | 61 | 38 | 2.80 | 11.0 | 20.7 | 2.0 |
| Ponder loam:[11] (S75TX-439-008) | | | | | | | | | | | | | | | | | | |
| Ap--------0 to 7 | A-6 (17) | CL | 100 | 100 | 100 | 100 | 100 | 99 | 82 | 79 | 38 | 33 | 38 | 22 | 2.63 | 13.0 | 12.7 | 1.9 |
| B21t------7 to 17 | A-7-6(30) | CH | 100 | 100 | 100 | 100 | 99 | 99 | 85 | 81 | 51 | 46 | 52 | 34 | 2.67 | 10.0 | 18.7 | 2.0 |
| B23t-----47 to 52 | A-7-6(34) | CH | 100 | 100 | 100 | 98 | 96 | 95 | 83 | 79 | 48 | 44 | 58 | 40 | 2.71 | 10.0 | 20.6 | 2.0 |
| Rayex gravelly fine sandy loam:[12] (S76TX-439-011) | | | | | | | | | | | | | | | | | | |
| A1--------0 to 5 | A-2-4(00) | GM-GC | 100 | 65 | 62 | 58 | 53 | 50 | 34 | 28 | 6 | 5 | 22 | 4 | 2.64 | 19.0 | 2.1 | 1.7 |
| B21t------5 to 16 | A-7-6(25) | CL | 100 | 100 | 100 | 100 | 99 | 97 | 88 | 78 | 48 | 44 | 44 | 28 | 2.69 | 14.0 | 14.4 | 1.9 |

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

| Soil name, report number, horizon, and depth in inches | Classification | | Grain size distribution[1] | | | | | | | | | | Liquid limit[2] | Plasticity index[2] | Specific gravity | Shrinkage | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Percentage passing sieve-- | | | | | | | Percentage smaller than-- | | | | | | | | |
| | AASHTO | Unified | 7/4 inch | 5/8 inch | 3/8 inch | No. 4 | No. 10 | No. 40 | No. 200 | .05 mm | .005 mm | .002 mm | | | | Limit | Linear | Ratio |
| | | | | | | | | | | | | | Pct | | G/cm$^3$ | Pct | Pct | Pct |
| Sanger clay:[13] (S75TX-439-001) | | | | | | | | | | | | | | | | | | |
| A11--------4 to 10 | A-7-6(31) | CL-CH | 100 | 100 | 100 | 100 | 100 | 98 | 94 | 88 | 50 | 40 | 50 | 30 | 2.63 | 11.0 | 17.6 | 1.9 |
| A12--------10 to 20 | A-7-6(29) | CL | 100 | 100 | 100 | 100 | 99 | 96 | 92 | 89 | 56 | 45 | 47 | 30 | 2.68 | 10.0 | 17.1 | 2.0 |
| AC2--------31 to 49 | A-7-6(27) | CL | 100 | 100 | 100 | 98 | 94 | 90 | 86 | 82 | 53 | 42 | 48 | 31 | 2.71 | 11.0 | 17.0 | 2.0 |
| C2---------59 to 90 | A-6 (17) | CL | 100 | 100 | 100 | 98 | 94 | 87 | 76 | 71 | 37 | 28 | 39 | 25 | 2.71 | 14.0 | 12.3 | 1.9 |
| Slidell clay:[14] (S75TX-439-002) | | | | | | | | | | | | | | | | | | |
| A12--------4 to 22 | A-7-6(41) | CH | 100 | 100 | 100 | 100 | 99 | 99 | 94 | 94 | 57 | 51 | 62 | 39 | 2.67 | 12.0 | 20.7 | 2.0 |
| AC1--------32 to 58 | A-7-6(38) | CH | 100 | 100 | 100 | 100 | 98 | 96 | 91 | 88 | 60 | 50 | 58 | 39 | 2.69 | 11.0 | 20.3 | 2.0 |
| C---------70 to 90 | A-7-6(18) | CL | 100 | 100 | 99 | 97 | 93 | 86 | 73 | 70 | 45 | 33 | 42 | 28 | 2.71 | 13.0 | 14.3 | 1.9 |

[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 plastic index values were based on AASHTO-89 and AASHTO-90 methods respectively, except that soil was added to water.

[3]Aubrey fine sandy loam:
From junction of Main Street and Davis Boulevard (Farm Road 1938) in Smithfield; 0.2 mile north on Davis Boulevard and 0.2 mile northeast.

[4]Birome gravelly fine sandy loam:
East 6.1 miles on Farm Road 1187 from junction with Interstate 35 w; 40 feet north of Farm Road 1187.

[5]Crosstell fine sandy loam:
From junction of Farm Road 157 and Interstate 20 south of Arlington, 3.4 miles south to T.O. Harris Road, 0.7 mile west and 50 feet north.

[6]Heiden clay:
From junction of U.S. Highway 287 and Broad Street in Mansfield, 3 miles east on Broad Street, 0.5 mile south on Seton Road and 0.4 mile east.

[7]Houston Black clay:
From junction of U.S. Highway 287 and Broad Street in Mansfield, 3 miles east on Broad Street, 0.3 mile south and 100 feet east.

[8]Lindale loam:
From junction of Farm Roads 731 and 1187 in Crowley, 0.8 mile north, 600 feet west on Industrial Boulevard and 100 feet north.

[9]Lott silty clay:
From junction of Interstate 35 w and South Loop 820, 2.94 miles south on Interstate 35 w and 0.65 mile west.

[10]Mingo clay loam:
From junction of North Loop 820 and Mark IV Parkway in Forth Worth, 0.5 mile west on North Loop 820, 0.5 mile south on Mark IV Parkway, 0.3 mile west and 50 feet south.

[11]Ponder loam:
Junction South Loop 820 and Old Granbury Road, 3.8 miles south on Old Granbury Road, 0.9 mile east on West Cleburne Road and 300 feet north.

[12]Rayex gravelly fine sandy loam:
At North Loop 820 and Business Highway 121; 1 mile northeast; 1.6 miles east on Harmon Road; 2.75 miles north on Hurstview Road and 75 feet east.

[13]Sanger clay:
From junction of U.S. Highway 377 and Lakeway Drive in Benbrook, 0.7 mile south on U.S. Highway 377 and 110 feet east of highway.

[14]Slidell clay:
From junction of Southwest Loop 820 and Old Granbury Road, 3.9 miles south on Old Granbury Road, 0.5 mile west, 0.2 mile south and 220 feet west.

TABLE 20.--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 |
|---|---|
| Aledo | Loamy-skeletal, carbonatic, thermic Lithic Haplustolls |
| Altoga | Fine-silty, carbonatic, thermic Typic Ustochrepts |
| Aquilla | Sandy, siliceous, thermic Psammentic Paleustalfs |
| Aubrey | Clayey, mixed, thermic Typic Haplustults |
| Bastsil | Fine-loamy, siliceous, thermic Udic Paleustalfs |
| Birome | Fine, mixed, thermic Ultic Paleustalfs |
| Bolar | Fine-loamy, carbonatic, thermic Typic Calciustolls |
| Brackett | Loamy, carbonatic, thermic, shallow Typic Ustochrepts |
| Branyon | Fine, montmorillonitic, thermic Udic Pellusterts |
| Burleson | Fine, montmorillonitic, thermic Udic Pellusterts |
| Chatt | Fine, mixed, thermic Vertic Calciustolls |
| Crosstell | Fine, montmorillonitic, thermic Udertic Paleustalfs |
| Ferris | Fine, montmorillonitic, thermic Udorthentic Chromusterts |
| Frio | Fine, mixed, thermic Cumulic Haplustolls |
| Gasil | Fine-loamy, siliceous, thermic Ultic Paleustalfs |
| Heiden | Fine, montmorillonitic, thermic Udic Chromusterts |
| Houston Black | Fine, montmorillonitic, thermic Udic Pellusterts |
| Justin | Fine-loamy, mixed, thermic Udic Paleustolls |
| Konsil | Fine-loamy, siliceous, thermic Ultic Paleustalfs |
| Leson | Fine, montmorillonitic, thermic Udic Pellusterts |
| Lindale | Fine, mixed, thermic Typic Haplustalfs |
| Lott | Fine-silty, carbonatic, thermic Entic Haplustolls |
| Luckenbach | Fine, mixed, thermic Typic Argiustolls |
| Mabank | Fine, montmorillonitic, thermic Vertic Albaqualfs |
| Maloterre | Loamy, carbonatic, thermic Lithic Ustorthents |
| Medlin | Fine, montmorillonitic, thermic Udorthentic Chromusterts |
| Mingo | Fine, mixed, thermic Pachic Argiustolls |
| Navo | Fine, montmorillonitic, thermic Udertic Paleustalfs |
| Nimrod | Loamy, siliceous, thermic Aquic Arenic Paleustalfs |
| Ovan | Fine, montmorillonitic, thermic Udic Chromusterts |
| Ponder | Fine, montmorillonitic, thermic Vertic Haplustalfs |
| Pulexas | Coarse-loamy, mixed, nonacid, thermic Typic Ustifluvents |
| *Purves | Clayey, montmorillonitic, thermic Lithic Calciustolls |
| *Rader | Fine-loamy, mixed, thermic Aquic Paleustalfs |
| Rayex | Clayey, mixed, thermic, shallow Ultic Haplustalfs |
| Sanger | Fine, montmorillonitic, thermic Udic Chromusterts |
| San Saba | Fine, montmorillonitic, thermic Udic Pellusterts |
| Selden | Fine-loamy, siliceous, thermic Aquic Paleustalfs |
| Silawa | Fine-loamy, siliceous, thermic Ultic Haplustalfs |
| Silstid | Loamy, siliceous, thermic Arenic Paleustalfs |
| Slidell | Fine, montmorillonitic, thermic Udic Pellusterts |
| Speck | Clayey, mixed, thermic Lithic Argiustolls |
| *Stephenville | Fine-loamy, siliceous, thermic Ultic Haplustalfs |
| Sunev | Fine-loamy, carbonatic, thermic Typic Calciustolls |
| Trinity | Very-fine, montmorillonitic, thermic Typic Pelluderts |
| Weatherford | Fine-loamy, siliceous, thermic Ultic Haplustalfs |
| Whitesboro | Fine-loamy, mixed, thermic Cumulic Haplustolls |
| Wilson | Fine, montmorillonitic, thermic Vertic Ochraqualfs |
| Windthorst | Fine, mixed, thermic Udic Paleustalfs |

☆U.S. GOVERNMENT PRINTING OFFICE: 1981—334-350/104

# NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.