



United States
Department of
Agriculture

Soil
Conservation
Service

In Cooperation with
Texas
Agricultural
Experiment
Station

Soil Survey of Comal and Hays Counties Texas

Part 2



classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (7). 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. Table 17 shows the classification of the soils in the survey area. 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 Vertisol.

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 Ustert (*Ust*, meaning burnt, plus *ert*, from Vertisol).

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 Chromustert (*Chrom*, meaning color, plus *ustert*, the suborder of the Vertisols that have light colors).

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 *Udic* identifies the subgroup that receives more moisture than is typical of the great group. An example is Udic Chromusterts.

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, montmorillonitic, thermic Udic Chromusterts.

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 Heiden series.

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 (6). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (7). 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."

Altoga series

The Altoga series consists of deep, well drained, gently sloping to sloping clayey soils on uplands. The soils formed in calcareous clayey sediment. Slopes range from 2 to 8 percent.

Typical pedon of Altoga silty clay, 2 to 5 percent slopes, eroded; from the intersection of U.S. Interstate 35 and Farm Road 725 in New Braunfels, 1 mile south on Farm Road 725, 0.9 mile west on county line road, and 300 feet north of road, in a pasture:

- A1—0 to 7 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; extremely hard, very firm; many fine roots; many wormcasts; calcareous; moderately alkaline; abrupt wavy boundary.
- B2—7 to 13 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; very hard, very firm; common fine roots; many wormcasts; calcareous; moderately alkaline; gradual wavy boundary.
- B3ca—13 to 36 inches; light gray (2.5Y 7/2) silty clay, light brownish gray (2.5Y 6/2) moist; few fine faint yellow mottles; moderate fine subangular blocky structure; very hard, firm; few fine roots; many wormcasts; few soft masses and rounded concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.
- C—36 to 60 inches; white (2.5Y 8/2) silty clay, light gray (2.5Y 7/2) moist; about 15 percent yellow (2.5Y 7/6) partly weathered shaly marl; rock structure; very hard, very firm; calcareous, moderately alkaline.

The solum is 35 to 52 inches thick. The calcium carbonate equivalent in the 10- to 40-inch control section ranges from 40 to 70 percent. Silicate clay makes up 25 to 35 percent of the control section.

The A horizon is grayish brown, pale brown, light brownish gray, or light yellowish brown.

The B2 horizon and B3ca horizons are grayish brown, light brownish gray, pale brown, light gray, very pale brown, or pale yellow.

The C horizon is very pale brown, light gray, light yellowish brown, pale yellow, or white.

Anhalt series

The Anhalt series consists of moderately deep, well drained, nearly level to gently sloping clayey soils on uplands. The soils formed in clayey residual material that weathered from hard limestone. Slopes range from 0 to 3 percent.

Typical pedon of Anhalt clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 281 and Bulverde Road about 18 miles west of New Braunfels near Bulverde, 2.2 miles northwest on Bulverde Road, 6.3 miles northwest on Ammann Road, and 890 feet north, in cropland:

- Ap—0 to 7 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; weak coarse and medium blocky structure; very hard, very firm; common fine roots; few limestone fragments; neutral; gradual smooth boundary.
- A1—7 to 23 inches; dark reddish gray (5YR 4/2) clay, dark reddish brown (5YR 3/2) moist; moderate coarse blocky structure; very hard, very firm; common fine roots mostly on faces of peds; few

limestone fragments; few earthworm casts; few pressure faces; few intersecting slickensides; neutral; gradual smooth boundary.

- B—23 to 32 inches; dark reddish brown (2.5YR 3/4) clay, dusky red (2.5YR 3/2) moist; moderate medium blocky structure; very hard, very firm; few limestone and chert fragments; few intersecting slickensides; few dark reddish gray streaks in filled cracks; neutral; abrupt smooth boundary.
- R—32 to 35 inches; indurated fractured limestone.

The thickness of the solum and the depth to indurated limestone range from 20 to 40 inches. The soil is slightly acid to moderately alkaline throughout. Limestone and chert fragments cover 0 to 15 percent of the surface and make up as much as 15 percent of the volume. When dry, the soil has cracks 0.4 to 2 inches in width that extend from the surface to the R layer.

The A horizon is dark brown or dark reddish gray. The B horizon is reddish brown or dark reddish brown.

Austin series

The Austin series consists of moderately deep, well drained, gently sloping clayey soils on uplands of the Blackland Prairie. The soils formed in chalk or interbedded marl and chalk. Slopes range from 1 to 5 percent.

Typical pedon of Austin silty clay in an area of Austin-Castephen complex, 1 to 3 percent slopes; from intersection of Farm Road 150 and U.S. Interstate 35 in Kyle, 2.3 miles north on Farm Road 150, 1.1 miles north on Farm Road 2770, 0.6 mile east on county road, and 1,100 feet north of road, in rangeland:

- A1—0 to 11 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; friable, slightly hard; many fine roots; calcareous; moderately alkaline; clear smooth boundary.
- B21—11 to 18 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure; friable, slightly hard; many fine roots; few chalk fragments; calcareous; moderately alkaline; gradual smooth boundary.
- B22—18 to 24 inches; pale brown (10YR 6/3) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium and fine subangular blocky structure; friable, slightly hard; few fine roots; few fine pores; common concretions of calcium carbonate and chalk fragments; few vertical streaks of very dark grayish brown (10YR 3/2); calcareous; moderately alkaline; abrupt smooth boundary.
- Cr—24 to 34 inches; weakly cemented chalk with hardness of less than 3 by Mohs scale.

The thickness of the solum and the depth to chalk or interbedded marl and chalk range from 20 to 40 inches. The soil is silty clay or clay throughout. Clay content ranges from 35 to 55 percent. Some pedons have few chalk fragments on the surface and within the solum.

The A horizon is dark gray, very dark gray, dark grayish brown, or very dark grayish brown.

The B horizon is brown, dark yellowish brown, yellowish brown, or grayish brown. The calcium carbonate equivalent ranges from 40 to 70 percent. Silicate clay makes up 25 to about 35 percent of the volume.

Boerne series

The Boerne series consists of deep, well drained, gently sloping loamy soils on stream terraces. The soils formed in calcareous, loamy alluvial sediment. Slopes range from 1 to 3 percent.

Typical pedon of Boerne fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Interstate 35 and Texas 80 in San Marcos, 2.8 miles northeast on Interstate 35 and 600 feet west of access road, in a field:

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, friable; many fine roots; few snail shell fragments; calcareous; moderately alkaline; abrupt smooth boundary.

A1—5 to 17 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; common fine roots; few snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—17 to 26 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; few fine roots; common fine pores; common films and threads of calcium carbonate; few snail shell fragments; few rounded pebbles 0.1 to 1 inch across in thin discontinuous strata; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—26 to 41 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; few fine roots; common fine pores; many films and threads of calcium carbonate; few rounded pebbles 0.1 to 1 inch across in discontinuous strata; calcareous; moderately alkaline; gradual smooth boundary.

Cca—41 to 65 inches; very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; few fine roots; many films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum is 36 to about 80 inches thick. The calcium carbonate equivalent in the 10- to 40-inch control section ranges from 40 to 75 percent.

The A horizon is brown, grayish brown, or light brownish gray.

The B horizon is brown, pale brown, very pale brown, or light yellowish brown. It is fine sandy loam or loam. In some pedons, it has strata of very fine sandy loam or sandy clay loam. Silicate clay makes up about 10 to 18 percent of the volume. Water-worn limestone pebbles are concentrated in thin discontinuous strata and make up less than 15 percent of the volume.

Bolar series

The Bolar series consists of moderately deep, well drained, gently sloping loamy soils on uplands. These soils formed in loamy sediment over interbedded limestone and marl. Slopes commonly range from 1 to 3 percent.

Typical pedon of Bolar clay loam, 1 to 3 percent slopes; from the intersection of Ranch Road 12 and Ranch Road 2325 in Wimberly, 4 miles north on Ranch Road 12, 0.2 mile east on county road, and 250 feet south of road, in rangeland:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; common fine roots; many limestone fragments less than 0.1 inch across and few fragments 0.1 to 0.5 inch across; few earthworm casts; calcareous; moderately alkaline; clear smooth boundary.

A12—5 to 14 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky and granular; hard, firm; common fine roots; many limestone fragments less than 0.1 inch across and few fragments 0.1 to 0.5 inch across; few earthworm casts; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—14 to 28 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; many limestone fragments less than 0.1 inch across and few fragments 0.1 to 2 inches across; few small snail shell fragments; common weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

R—28 to 30 inches; indurated limestone that is fractured and interbedded with clayey marl.

The solum is 25 to 40 inches thick. The calcic horizon is at a depth of 12 to 24 inches. The calcium carbonate equivalent in the 10- to 40-inch control section ranges

from 40 to 60 percent. Silicate clay makes up 20 to 35 percent of the control section.

The A horizon is brown, dark brown, very dark brown, or dark grayish brown.

The B horizon is light brown, brown, or yellowish brown. Coarse fragments of limestone as much as 4 inches across make up 1 to 20 percent of the volume. Concretions of calcium carbonate range from few to common.

Brackett series

The Brackett series consists of shallow, well drained, undulating to steep loamy soils on uplands (fig. 13). The soils formed in interbedded soft limestone and marl. Slopes range from 1 to 30 percent.

Typical pedon of Brackett gravelly clay loam, in an area of Brackett-Rock outcrop-Real complex, steep; from the intersection of Ranch Road 32 and Ranch Road 12 about 10 miles west of San Marcos, 6 miles west on Ranch Road 32 and 1,000 feet north of the road, in rangeland:

- A1—0 to 6 inches; grayish brown (10YR 5/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; about 15 percent, by volume, weakly cemented limestone pebbles as much as 1 inch across; calcareous; moderately alkaline; clear smooth boundary.
- B2—6 to 14 inches; light gray (10YR 7/2) gravelly clay loam, light brownish gray (10YR 6/2) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; about 20 percent, by volume, weakly cemented limestone pebbles as much as 1 inch across; calcareous; moderately alkaline; clear wavy boundary.
- Cr—14 to 18 inches; weakly cemented limestone interbedded with thin strata of pale yellow and very pale brown calcareous shaly clay.

The solum is 11 to 20 inches thick. Coarse fragments make up as much as 35 percent of the volume. They are mostly pebbles, but as much as 10 percent is cobbles and stones. The calcium carbonate equivalent ranges from 40 to more than 80 percent.

The A horizon is grayish brown, pale brown, brown, very pale brown, and light gray. It is gravelly loam or gravelly clay loam.

The B horizon is pale brown, very pale brown, light yellowish brown, light brownish gray, or light gray. It is gravelly loam or gravelly clay loam.

The Cr horizon is pale yellow, very pale brown, or white. It is thinly interbedded marly earth, weakly cemented limestone, and calcareous shaly clay.

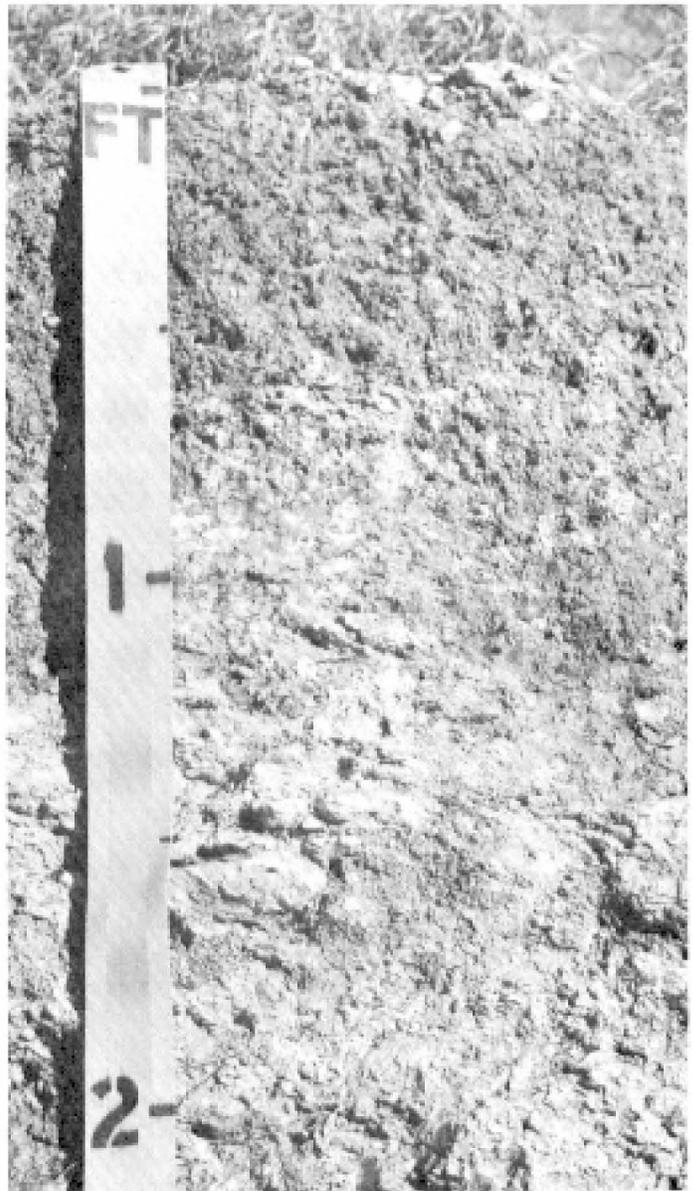


Figure 13.—Typical profile of Brackett gravelly clay loam. Interbedded soft limestone and marl are at a depth of about 14 inches.

Branyon series

The Branyon series consists of deep, moderately well drained, nearly level to gently sloping clayey soils on broad ancient stream terraces. The soils formed in calcareous clayey sediment. Slopes range from 0 to 3 percent.

Typical pedon of Branyon clay, 0 to 1 percent slopes; from the intersection of Texas 80 and Texas 21 in San

Marcos, 4.3 miles northeast on Texas 21, 1.1 mile northwest on county road, 0.7 mile northeast on county road, and 1,900 feet southeast, in cropland:

- Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and fine blocky structure; extremely hard, very firm; few fine roots; calcareous; moderately alkaline; clear smooth boundary.
- A11—6 to 32 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; common intersecting slickensides; calcareous; moderately alkaline; gradual smooth boundary.
- A12—32 to 44 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm; many intersecting slickensides; few concretions of calcium carbonate; few brownish yellow wormcasts; calcareous; moderately alkaline; gradual wavy boundary.
- AC1—44 to 54 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; extremely hard, very firm; common intersecting slickensides; common concretions of calcium carbonate; few brownish yellow wormcasts; few thin dark gray streaks from the upper horizons; calcareous; moderately alkaline; gradual wavy boundary.
- AC2—54 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium blocky structure; extremely hard, very firm; common intersecting slickensides; many concretions and soft masses of calcium carbonate; few brownish yellow wormcasts; few thin dark gray streaks from the upper horizons; calcareous; moderately alkaline; clear wavy boundary.
- C—60 to 80 inches; faintly mottled very pale brown (10YR 7/4) and pale yellow (2.5Y 8/4) clay; massive; extremely hard, very firm; many soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 50 to 70 inches thick in the microdepressions. Microdepressions make up 75 to 90 percent of each pedon. When the soil is dry, cracks 1 to 3 inches wide extend from the surface to a depth of 20 to 60 inches or more.

The A horizon is gray or dark gray. It is 15 to 50 inches thick in the microdepressions, which make up about 85 percent of the pedon. In more than half the pedons, the A horizon is more than 38 inches thick. It is 3 to 15 inches thick on the microknolls.

The AC horizon is brown, grayish brown, yellowish brown, light yellowish brown, or gray. In some pedons, the soil is noncalcareous to a depth of 18 inches in

microdepressions. In other pedons there is a IIC horizon of gravelly clay below a depth of 50 inches.

Castephen series

The Castephen series consists of shallow, well drained, gently sloping loamy and clayey soils on uplands. The soils formed in residuum of chalk and marl. Slopes range from 1 to 5 percent.

Typical pedon of Castephen clay loam, 3 to 5 percent slopes, eroded; from the intersection of Farm Road 150 and U.S. Interstate 35 in Kyle, 2.3 miles northwest on Farm Road 150, 0.4 mile southwest on county road, 0.3 mile west on private road, and 85 feet south of road, in rangeland:

- A11—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; few chalk fragments less than 0.1 inch across; calcareous; moderately alkaline; clear smooth boundary.
- A12—8 to 13 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; few chalk fragments less than 1 inch across; calcareous; moderately alkaline; clear wavy boundary.
- A13—13 to 16 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, friable; few fine roots; about 50 percent, by volume, weakly cemented chalk fragments as much as 2 inches across; calcareous; moderately alkaline; abrupt wavy boundary.
- Cr—16 to 20 inches; white weakly cemented platy chalk.

The solum is 8 to 20 inches thick. The calcium carbonate equivalent averages 40 to about 60 percent. Silicate clay makes up 25 to 35 percent of the volume.

The A horizon is brown, dark brown, dark gray, very dark gray, grayish brown, dark grayish brown, or very dark grayish brown. It is clay loam, silty clay loam, or silty clay. Chalk fragments less than 3 inches across make up 10 to 35 percent of the volume. The percentage increases with depth.

Comfort series

The Comfort series consists of shallow, well drained, undulating clayey soils on uplands. These soils formed in clay that weathered from dolomitic limestone. Slopes range from 1 to 8 percent.

Typical pedon of Comfort extremely stony clay, in an area of Comfort-Rock outcrop complex, undulating; from the intersection of Farm Road 306 and Farm Road 464 about 21 miles northwest of New Braunfels near Canyon

Lake, 9.3 miles west on Farm Road 306 and 50 feet north of road, in rangeland:

A1—0 to 6 inches; dark brown (7.5YR 3/2) extremely stony clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure parting to moderate fine blocky; very hard, very firm; many fine roots; about 45 percent, by volume, cobbles and stones as much as 4 feet across on the surface and in the soil; noncalcareous; mildly alkaline; clear smooth boundary.

B2t—6 to 13 inches; dark reddish brown (5YR 3/2) extremely stony clay, dark reddish brown (5YR 3/2) moist; moderate fine blocky structure parting to moderate very fine blocky; very hard, very firm; common fine roots; patchy clay films on ped faces; about 70 percent, by volume, stones as much as 4 feet across; noncalcareous; mildly alkaline; abrupt irregular boundary.

R—13 to 20 inches; indurated dolomitic limestone; soil material in the narrow fractures.

The solum is 9 to 20 inches thick. Soil reaction ranges from neutral to moderately alkaline. Stones, cobbles, and pebbles make up 35 to 60 percent of the volume. The cobbles and stones are dolomitic limestone, and the pebbles are dominantly chert.

The A horizon is dark brown or dark reddish brown. The fine-earth fraction is clay or clay loam.

The B2t horizon is dark reddish brown or red.

Denton series

The Denton series consists of moderately deep, well drained, gently sloping clayey soils on uplands. The soils formed in calcareous clays over indurated limestone. Slopes range from 1 to 5 percent.

Typical pedon of Denton silty clay, 1 to 3 percent slopes; from the intersection of Farm Road 150 and Farm Road 1826 near Driftwood, 0.6 mile south on Farm Road 1826, 0.2 mile west on county road, and 1,000 feet southeast of road, in pasture:

A11—0 to 14 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine granular and moderate medium subangular blocky structure; very hard, firm; many fine roots; calcareous; moderately alkaline; gradual smooth boundary.

A12—14 to 25 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate medium subangular blocky and blocky structure; very hard, firm; common fine roots; few concretions of calcium carbonate; few limestone pebbles less than 0.2 inch across; few small slickensides; dark grayish brown streaks in filled cracks; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—25 to 33 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; moderate medium blocky and subangular blocky structure; very hard, firm; few fine roots; common concretions of calcium carbonate; dark grayish brown streaks in filled cracks; calcareous; moderately alkaline; clear wavy boundary.

Cca—33 to 36 inches; coarsely mottled light brown (7.5YR 6/4) and reddish yellow (7.5YR 6/6) silty clay, brown (7.5YR 5/4) and strong brown (7.5YR 5/6) moist; structureless; very hard, very firm; few fine roots; many concretions and soft masses of calcium carbonate; many limestone pebbles 0.5 to 1 inch across; calcareous; moderately alkaline; abrupt smooth boundary.

R—36 to 40 inches; fractured limestone that cannot be cut with a spade interbedded with calcareous clayey marl.

The solum is 24 to 40 inches thick. The mollic epipedon is 18 to 30 inches thick. When dry these soils have cracks 1 cm or more wide in the upper part of the subsoil.

The A horizon is brown, dark brown, or dark grayish brown. Fragments of limestone smaller than 3 inches across make up 0 to 5 percent of the volume.

The B horizon is light brown, brown, dark brown, or yellowish brown. Fragments of limestone smaller than 3 inches across make up 0 to 20 percent of the volume.

The Cca horizon is brown, dark brown, or reddish yellow. Limestone fragments smaller than 6 inches across make up as much as 60 percent of the volume. Some pedons do not have a Cca horizon. The R horizon ranges from indurated fractured limestone to beds of limestone rubble with clayey marl filling the interstices.

Doss series

The Doss series consists of shallow, well drained, gently sloping to sloping loamy soils on uplands. The soils formed in interbedded marl and limestone. Slopes range from 1 to 8 percent.

Typical pedon of Doss silty clay, 1 to 5 percent slopes; from the intersection of Ranch Road 12 and Farm Road 2325 in Wimberley, 9 miles north on Ranch Road 12, 2.8 miles west on county road (Gatlin Road), and 120 feet south of road, in pasture:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, dark brown (10YR 3/2) moist; moderate medium subangular blocky and moderate fine granular structure; slightly hard, friable; common fine roots; few wormcasts; calcareous; moderately alkaline; clear smooth boundary.

B2ca—9 to 18 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky and moderate

fine granular structure; slightly hard, friable; common fine roots; few wormcasts; common concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Crca—18 to 24 inches; interbedded weakly cemented limestone and marl.

The solum is 11 to 20 inches thick. The calcium carbonate equivalent ranges from 40 to 60 percent.

The A horizon is dark grayish brown, dark brown, or brown. A few limestone pebbles and cobbles are on the surface and within the horizon in some pedons.

The B horizon is brown, yellowish brown, or light brown. Pebbles and cobbles of limestone make up 1 to 15 percent of the volume.

Eckrant series

The Eckrant series consists of very shallow to shallow, well drained, undulating to steep clayey soils on uplands (fig. 14). The soils formed over indurated fractured limestone. Slopes range from 1 to 30 percent.

Typical pedon of Eckrant extremely stony clay, in an area of Eckrant-Rock outcrop complex, steep; from the intersection of Loop 82 and U.S. Interstate 35 in San Marcos, 0.8 mile west on Loop 82, 0.3 mile northeast on Old Post Road, 2 miles northwest on Lime Kiln Road, 4.8 miles northwest on Hilyard Road, and 1,900 feet northeast of road, in rangeland:

A11—0 to 6 inches; very dark gray (10YR 3/1) extremely stony clay, black (10YR 2/1) moist; moderate fine subangular blocky and granular structure; hard, firm; common fine roots; about 35 percent limestone fragments 4 to 12 inches across on the surface and in the soil; noncalcareous; moderately alkaline; clear smooth boundary.

A12—6 to 10 inches; very dark gray (10YR 3/1) extremely stony clay, black (10YR 2/1) moist; moderate fine subangular blocky and granular structure; hard, firm; common fine roots; about 75 percent, by volume, limestone fragments 8 to 20 inches or more across; noncalcareous; moderately alkaline; abrupt irregular boundary.

R—10 to 20 inches; indurated, fractured limestone.

The solum is 4 to 20 inches thick. Reaction ranges from neutral to moderately alkaline. Stones, cobbles, and pebbles make up 35 to 70 percent of the pedon. Most of the fragments are limestone, although some pedons have coarse fragments of chert and dolomitic limestone.

The A horizon is black, very dark gray, dark brown, dark grayish brown, or very dark grayish brown.

Ferris series

The Ferris series consists of deep, well drained, sloping to moderately steep clayey soils on uplands. The



Figure 14.—Typical profile of Eckrant extremely stony clay.

soils formed in calcareous shaly clays and shale. Slopes range from 5 to 20 percent.

Typical pedon of Ferris clay, 5 to 20 percent slopes, severely eroded; from intersection of U.S. Interstate 35 and Texas 46 in New Braunfels, 5.9 miles north on Interstate 35, 0.8 mile southeast on East Watson Lane, and 700 feet south of lane, in pasture:

A1—0 to 12 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium and fine blocky structure; very hard, very firm; common

fine roots; calcareous; moderately alkaline; clear wavy boundary.

AC1—12 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine distinct mottles of pale olive (5Y 6/4) and many fine distinct mottles of light yellowish brown (2.5Y 6/4); weak coarse blocky structure; extremely hard, very firm; few fine roots; few soft masses of calcium carbonate; many intersecting slickensides; calcareous; moderately alkaline; clear smooth boundary.

AC2—24 to 35 inches; coarsely mottled light gray (10YR 6/1) and light yellowish brown (2.5Y 6/4) clay; weak coarse blocky structure; extremely hard, very firm; few fine roots; few soft masses of calcium carbonate; many intersecting slickensides; calcareous; moderately alkaline; gradual smooth boundary.

C1—35 to 41 inches; pale olive (5Y 6/3) shaly clay, olive (5Y 5/3) moist; common fine faint mottles of light yellowish brown (2.5Y 6/4) and few coarse prominent mottles of light gray (10YR 6/1); weak coarse blocky structure; extremely hard, very firm; few small masses of unweathered shale; common gypsum crystals; calcareous; moderately alkaline; clear smooth boundary.

C2—41 to 60 inches; pale yellow (2.5Y 7/4) shale, light yellowish brown (2.5Y 6/4) moist; weak coarse blocky and platy rock structure; extremely hard, very firm; calcareous; moderately alkaline.

The solum is 30 to 55 inches thick. Clay content ranges from 40 to 60 percent. Cracks more than 1 cm wide extend to a depth of more than 20 inches when the soil is dry.

The A horizon is dark grayish brown, olive gray, grayish brown, olive, light brownish gray, or pale olive. Where the moist soil has value of less than 3.5, the horizon is less than 12 inches thick.

The AC horizon is olive gray, light gray, grayish brown, light yellowish brown, pale olive, or olive yellow. Some pedons have grayish, yellowish, brownish, and olive mottles. There are gypsum crystals and soft masses of calcium carbonate in some pedons.

The C horizon is light brownish gray, pale olive, light yellowish brown, light gray, pale yellow, or yellow. It is strongly weathered shaly clay or calcareous shale.

Gruene series

The Gruene series consists of very shallow to shallow, well drained, gently sloping clayey soils on uplands. These soils formed in clayey sediment over gravel. Slopes range from 1 to 5 percent.

Typical pedon of Gruene clay, 1 to 5 percent slopes; from the intersection of U.S. Interstate 35 and Texas 80 in San Marcos, 4.9 miles north on Interstate 35 and 550 feet east of access road at exit number 210, in pasture:

A1—0 to 13 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong coarse blocky structure breaking to moderate fine blocky; very hard, very firm; common fine roots; few chert pebbles and few limestone and chert cobbles on the surface and within the horizon; very gravelly clay layer about 2 inches thick in lower part; noncalcareous; mildly alkaline; clear wavy boundary.

Ccam—13 to 22 inches; strongly cemented, massive caliche containing embedded rounded siliceous and limestone pebbles; abrupt wavy boundary.

IIC—22 to 80 inches; stratified very pale brown (10YR 7/4) very gravelly loam becoming sandier with depth; some strata have rounded rock fragments as much as 6 inches across.

The thickness of the solum and the depth to the petrocalcic horizon is 7 to 16 inches.

The A horizon is brown, dark brown, very dark gray, or very dark grayish brown. It is 0 to 15 percent, by volume, siliceous and limestone pebbles. Its structure is blocky or subangular blocky. Reaction ranges from neutral to mildly alkaline. In some pedons the A horizon has thin, calcareous, very gravelly strata in the lower part.

The Ccam horizon is massive, strongly cemented or indurated caliche that is about 30 to 70 percent, by volume, chert and limestone. The IIC horizon is stratified very gravelly loam and sand. In some pedons it has strata of weakly cemented, nongravelly caliche.

Heiden series

The Heiden series consists of deep, well drained, gently sloping to sloping clayey soils on uplands. The soils formed in calcareous clay and shaly clay. Slopes range from 1 to 8 percent.

Typical pedon of Heiden clay, 3 to 5 percent slopes, eroded; from the intersection of U.S. Interstate 35 and Farm Road 2001 near Buda, 1.6 miles south on Interstate 35 east access road, 0.3 mile east on county road, 0.3 mile south on county road, and 40 feet west of road, in pasture:

A1—0 to 13 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular and blocky structure; very hard, very firm; common fine roots; common earthworm casts; calcareous; moderately alkaline; gradual wavy boundary.

AC1—13 to 22 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common dark grayish brown filled cracks; moderate medium blocky structure; very hard, very firm; common fine roots; few slickensides in lower part; calcareous; moderately alkaline; diffuse wavy boundary.

AC2—22 to 58 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common

medium faint mottles of light olive brown (2.5Y 5/4); common cracks filled with dark grayish brown material; weak coarse blocky structure; very hard, very firm; few fine roots; common concretions and weakly cemented masses of calcium carbonate; many intersecting slickensides; calcareous; moderately alkaline; diffuse wavy boundary.

C—58 to 80 inches; pale yellow (2.5Y 7/4) shaly clay, light yellowish brown (2.5Y 6/4) moist; few fine distinct mottles of brownish yellow and common fine faint mottles of olive yellow; massive; very hard, very firm; many weakly cemented masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. Cracks more than 1 cm wide extend to a depth of more than 20 inches when the soil is dry.

The A horizon is grayish brown, dark grayish brown, or dark gray. It is clay or gravelly clay. It is less than 12 inches thick in pedons that are dark gray. Few to common chert pebbles are on the surface and in the soil in some pedons.

The AC horizon is grayish brown, yellowish brown, or olive. Mottles of yellow and olive are in most pedons. Gypsum crystals are few to common in some pedons.

The C horizon is light gray, light brownish gray, pale yellow, yellow, or pale olive. It is clay, shaly clay, or weathered calcareous shale.

Houston Black series

The Houston Black series consists of deep, moderately well drained, gently sloping to sloping clayey soils on uplands. The soils formed in calcareous clay and shale. Slopes range from 1 to 8 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes, in a microdepression; from the intersection of Farm Road 150 and U.S. Interstate 35 in Kyle, 1.6 miles north on access road, 0.4 mile southeast on county road, and 150 feet west of road, in field:

Ap—0 to 5 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine granular structure; very hard, very firm; common fine grass roots; calcareous; moderately alkaline; gradual smooth boundary.

A11—5 to 25 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; very hard, very firm; common fine roots; few snail shell fragments; calcareous; moderately alkaline; diffuse wavy boundary.

A12—25 to 50 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium blocky structure; very hard, very firm; few snail shell fragments, few concretions of calcium carbonate; common intersecting slickensides; few limestone pebbles as much as 1 inch across; calcareous; moderately alkaline; gradual smooth boundary.

AC1—50 to 62 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; very hard, very firm; few concretions of calcium carbonate; common intersecting slickensides; dark gray streaks in filled cracks; calcareous; moderately alkaline; gradual smooth boundary.

AC2—62 to 77 inches; grayish brown (2.5Y 5/2) and gray (10YR 5/1) clay, dark grayish brown (2.5Y 4/2) and dark gray (10YR 4/1) moist; moderate medium blocky structure; very hard, very firm; few concretions of calcium carbonate; common intersecting slickensides; dark gray streaks in filled cracks; calcareous; moderately alkaline; gradual smooth boundary.

C—77 to 90 inches; yellow (10YR 7/6) marly clay, brownish yellow (10YR 6/6) moist; massive; very hard, very firm; common soft masses of calcium carbonate; calcareous; moderately alkaline.

Combined thickness of the A and AC horizons is 60 to more than 80 inches. Cracks 0.4 inch to 4 inches wide extend to a depth of more than 20 inches when the soil is dry. Intersecting slickensides begin at a depth of about 16 to 24 inches. Clay content in the 10- to 40-inch control section ranges from 50 to 60 percent. Grayish colors that have chroma of less than 1.5 are at a depth of 30 to 60 inches in microdepressions and at a depth of 10 to 18 inches in microknolls. Cycles of microdepressions and microknolls are repeated at intervals of 10 to 24 feet. Siliceous pebbles cover as much as 60 percent of the surface in some pedons and make up as much as about 25 percent, by volume, of the upper 12 inches.

The A horizon is black, very dark gray, or dark gray in the upper part, and very dark gray, dark gray, or gray in the lower part. Brownish or olivish mottles or matrix colors are at a depth of 30 to 60 inches in microdepressions and at a depth of 10 to 18 inches in microknolls. The A horizon is moderately alkaline and calcareous except in some gravelly pedons where it is noncalcareous in the upper part.

The AC horizon is dark grayish brown, grayish brown, light grayish brown, yellowish brown, olive, or olive gray. Most pedons have gray, brown, olive, and yellow mottles. Siliceous pebbles make up 0 to about 5 percent of the volume.

Krum series

The Krum series consists of deep, well drained, nearly level to gently sloping clayey soils on uplands. The soils formed in calcareous clayey sediment. Slopes range from 0 to 5 percent.

Typical pedon of Krum clay, 1 to 3 percent slopes; from the intersection of Farm Road 2439 and Ranch Road 12 in San Marcos, 5.2 miles southwest on Farm

Road 2439, 0.6 mile northwest on county road, and 400 feet southwest of road, in cropland:

- Ap—0 to 4 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky and moderate fine granular structure; hard, firm; many fine roots; calcareous; moderately alkaline; clear smooth boundary.
- A1—4 to 16 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and fine subangular blocky structure; hard, firm; common fine roots; calcareous; moderately alkaline; gradual smooth boundary.
- B21—16 to 58 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; very hard, very firm; very dark gray streaks in filled cracks; few fine roots; few concretions of calcium carbonate; few wormcasts; calcareous; moderately alkaline; diffuse smooth boundary.
- B22—58 to 66 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; very hard, very firm; few concretions of calcium carbonate; few threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
- C—66 to 80 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; structureless; very hard, very firm; few concretions of calcium carbonate; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 70 inches thick. When the soil is dry, cracks 0.4 inch to 1.2 inches wide extend to a depth of about 24 to 48 inches. The 10- to 40-inch control section is clay or silty clay. The clay content is 40 to 60 percent.

The A horizon is dark gray, dark grayish brown, or dark brown. Where the A horizon, when moist, has value and chroma of less than 3.5, it is 14 to 36 inches thick. The upper 10 inches is noncalcareous in some pedons.

The B horizon is grayish brown, brown, or yellowish brown. Content of visible concretions and powdery bodies of calcium carbonate ranges from less than 1 percent to about 10 percent, but is more than 5 percent below a depth of 40 inches.

The C horizon is light yellowish brown, pale brown, brownish yellow, or light brown. Calcium carbonate concretions make up 2 to 20 percent of the volume.

Lewisville series

The Lewisville series consists of deep, well drained, nearly level to gently sloping clayey soils on stream terraces. The soils formed in calcareous clayey and loamy sediment. Slopes range from 0 to 3 percent.

Typical pedon of Lewisville silty clay, 0 to 1 percent slopes; from the intersection of Texas 80 and Texas 21

near San Marcos, 1.9 miles northeast on Texas 21, 0.7 mile northwest on county road, and 100 feet northeast of county road, in cropland:

- Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky and granular structure; hard, friable; many fine roots; calcareous; moderately alkaline; abrupt smooth boundary.
- A1—7 to 17 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky and moderate fine and very fine blocky structure; hard, friable; many fine roots; calcareous; moderately alkaline; gradual smooth boundary.
- B21ca—17 to 36 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate fine subangular blocky and moderate fine blocky structure; hard, friable; few fine threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
- B22ca—36 to 54 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; weak medium and fine subangular blocky structure; hard, firm; common soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
- Cca—54 to 61 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; common medium distinct mottles of reddish yellow (7.5YR 7/6) and pinkish white (7.5YR 8/2); massive; very hard, firm; many moderately and strongly cemented concretions of calcium carbonate 0.3 to 1 inch in diameter; calcareous; moderately alkaline.

The solum is 42 to about 63 inches thick. A calcic horizon is at a depth of 24 to 40 inches.

The A horizon is brown, dark grayish brown, or very dark grayish brown.

The B21ca horizon is brown, dark grayish brown, dark brown, or yellowish brown. The B22ca horizon is brown, light brown, reddish yellow, or yellowish brown. It is clay, silty clay, or silty clay loam and is 5 to 15 percent, by volume, visible secondary carbonates. Some pedons are underlain at a depth of 3 to 6 feet by sediment that is 15 to 50 percent gravel by volume.

Medlin series

The Medlin series consists of deep, well drained, undulating to hilly clayey soils on uplands. The soils formed in calcareous clay and shale. Slopes range from 1 to 30 percent.

Typical pedon of Medlin stony clay, in an area of Medlin-Eckrant association, hilly; from the intersection of Farm Road 306 and U.S. Interstate 35 near New

Braunfels, 2.5 miles northwest on Farm Road 306, 1 mile west on county road, and 180 feet south of road, in rangeland:

- A11—0 to 6 inches; grayish brown (2.5Y 5/2) stony clay, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots; few wormcasts; few concretions of calcium carbonate; few limestone pebbles; stones on about 2 percent of the surface; calcareous; moderately alkaline; gradual smooth boundary.
- A12—6 to 11 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots; few wormcasts; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.
- AC1—11 to 32 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; few fine faint mottles of yellowish brown; moderate medium and coarse blocky structure; extremely hard, very firm; few fine roots; few grayish brown streaks in filled cracks; few concretions of calcium carbonate; few small slickensides in lower part; few small fossilized oyster shells; calcareous; moderately alkaline; gradual wavy boundary.
- AC2—32 to 50 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; common medium faint mottles of light yellowish brown (2.5Y 6/4) and olive yellow (2.5Y 6/6); moderate medium and coarse blocky structure; extremely hard, very firm; few grayish brown streaks in filled cracks; common soft masses of calcium carbonate; common masses of gypsum crystals; few small slickensides; few small fossilized oyster shells; calcareous; moderately alkaline; gradual wavy boundary.
- C—50 to 80 inches; light gray (2.5Y 7/2) shaly clay, light brownish gray (2.5Y 6/2) moist; common medium distinct mottles of olive yellow (2.5Y 6/6) and yellow (2.5Y 7/8); platy rock structure; extremely hard, very firm; few small fossilized oyster shells; common masses of gypsum crystals; calcareous; moderately alkaline.

The solum is 35 to 50 inches thick. Slickensides are below a depth of 15 to 24 inches. When the soil is dry, cracks 1 to 3 inches in width extend to a depth of more than 20 inches. Limestone pebbles and cobbles cover 0 to 40 percent of the surface, and stones cover 0 to 5 percent.

The A horizon is grayish brown or dark grayish brown.

The AC horizon is light yellowish brown, light olive brown, olive brown, olive yellow, or olive. Mottles in shades of gray, brown, and yellow are few to many. Concretions and soft masses of calcium carbonate make up 2 to 20 percent of the volume.

The C horizon is light gray, light brownish gray, light yellowish brown, yellow, pale yellow, olive yellow, or olive gray. Mottles in shades of gray, brown, or yellow are common to many.

Oakalla series

The Oakalla series consists of deep, well drained, nearly level loamy soils on flood plains. The soils formed in calcareous loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Oakalla silty clay loam, rarely flooded; from the intersection of Texas 80 and Interstate 35 in San Marcos, 0.5 mile east on Texas 80, 0.7 mile southwest on River Road, 0.2 mile southeast on Old Martindale Road, 0.2 mile southeast on Thompson Road, and 50 feet southwest of road, in cropland:

- Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; very hard, firm; few fine roots; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.
- A1—6 to 31 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, firm; few fine roots; about 44 percent calcium carbonate equivalent; calcareous; moderately alkaline; diffuse smooth boundary.
- B21—31 to 42 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; very hard, firm; few films and threads of calcium carbonate; about 42 percent calcium carbonate equivalent; few snail shell fragments; few wormcasts; calcareous; moderately alkaline; diffuse smooth boundary.
- B22—42 to 62 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; very hard, firm; few films, threads, and concretions of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.
- C—62 to 80 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; massive; very hard, firm; few films and threads of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline.

The calcium carbonate equivalent in the 10- to 40-inch control section ranges from 40 to 55 percent. The mollic epipedon is 20 to 34 inches thick. The soil throughout is silty clay, silty clay loam, loam, or clay loam. Rounded limestone pebbles make up 0 to 10 percent of the volume.

The A horizon is brown, grayish brown, dark brown, or dark grayish brown.

The B horizon is grayish brown, brown, dark brown, or light yellowish brown. Some pedons do not have a B horizon.

The C horizon is brown, yellowish brown, or light yellowish brown.

Orif series

The Orif series consists of deep, well drained, nearly level to gently sloping loamy soils on flood plains. The soils formed in recently deposited gravelly alluvium. Slopes range from 0 to 3 percent.

Typical pedon of Orif soils, frequently flooded; from the intersection of U.S. Interstate 35 and Texas 80 in San Marcos, 1.2 miles north on U.S. Interstate access road, 0.5 mile east on county road (Uhland Road), and 500 feet south of road and 100 feet west of Blanco River channel, in rangeland:

A1—0 to 20 inches; grayish brown (10YR 5/2) very gravelly loamy sand, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; few fine roots; about 50 percent, by volume, rounded limestone pebbles and cobbles mostly in horizontal strata; calcareous; moderately alkaline; clear wavy boundary.

IIC—20 to 60 inches; brown (10YR 5/3) very gravelly loamy sand, dark brown (10YR 4/3) moist; many strata of very gravelly sand, very gravelly sandy loam, and very dark grayish brown loam; single grained; slightly hard, very friable; about 75 percent, by volume, rounded pebbles and cobbles; calcareous; moderately alkaline.

The solum is 60 to 100 inches or more thick. Pebbles cover about 20 to 60 percent of the surface. A few cobbles and stones are on the surface in most places. Coarse fragments make up 35 to 80 percent of the 10- to 40-inch control section.

The A horizon is grayish brown, light brownish gray, or brown. It is gravelly loamy sand, gravelly loam, or gravelly sandy loam or their very gravelly analogs. Pebbles make up 20 to 60 percent of the volume, and in most pedons the horizon has a few cobbles and stones.

The C horizon is brown, pale brown, or very pale brown. It is very gravelly loamy sand or very gravelly sand. Below a depth of 20 inches there are thin, discontinuous strata of various textures ranging from loam to sand and including the gravelly, very gravelly, or extremely gravelly analogs. Some pedons have a IIAb horizon below a depth of 24 inches.

Pedernales series

The Pedernales series consists of deep, well drained, gently sloping loamy soils on uplands. The soils formed in ancient loamy and clayey alluvium. Slopes range from 1 to 5 percent.

Typical pedon of Pedernales fine sandy loam, 1 to 5 percent slopes; from the intersection of U.S. 290 and Ranch Road 12 in Dripping Springs, 7.6 miles northwest on Ranch Road 12 to intersection with county road in Travis County, 7.3 miles northwest on county road, 0.4 mile west on private road, and 150 feet south of road, in rangeland:

A1—0 to 12 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, friable; many fine roots; few chert pebbles 0.2 to 0.5 inch across; neutral; clear smooth boundary.

B21t—12 to 16 inches; reddish brown (2.5YR 4/4) sandy clay, dark reddish brown (2.5YR 3/4) moist; moderate fine subangular blocky structure; neutral; abrupt smooth boundary.

B22t—16 to 25 inches; finely mottled dark red (2.5YR 3/6) and red (2.5YR 4/6) sandy clay, dry and moist; moderate fine subangular blocky structure; very hard, very firm; few fine roots; about 15 percent, by volume, rounded and angular chert pebbles; slightly acid; clear smooth boundary.

B23t—25 to 40 inches; finely mottled dark red (2.5YR 3/6) and red (2.5YR 4/6) sandy clay, dry and moist; moderate fine subangular blocky structure; very hard, very firm; 5 to 10 percent chert pebbles 0.5 inch to 2 inches across; slightly acid; abrupt smooth boundary.

C—40 to 60 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; interbedded with weakly cemented limestone.

The solum is 35 to 45 inches thick. Reaction ranges from slightly acid to mildly alkaline.

The A horizon is reddish brown or brown.

The B horizon is reddish brown, brown, red, dark red, or dark brown. It is sandy clay or clay.

Purves series

The Purves series consists of shallow, well drained, gently sloping clayey soils on uplands. The soils formed in residual material that weathered from indurated limestone. Slopes range from 1 to 5 percent.

Typical pedon of Purves clay, 1 to 5 percent slopes; from the intersection of Farm Road 150 and Farm Road 3237 about 8 miles northwest of Kyle, 0.4 mile north on Farm Road 150 and 120 feet west of road, in rangeland:

A11—0 to 10 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; few concretions of calcium carbonate; few limestone pebbles less than 0.1 inch across; calcareous; moderately alkaline; clear smooth boundary.

A12ca—10 to 16 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium and fine subangular blocky structure; very hard, very firm; few fine roots; few concretions of calcium carbonate; few limestone pebbles 0.1 to 0.2 inch across; calcareous; moderately alkaline; clear smooth boundary.

A13ca—16 to 19 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; few fine roots; common concretions of calcium carbonate; about 10 percent, by volume, strongly cemented limestone fragments 3 to 6 inches across; calcareous; moderately alkaline; abrupt smooth boundary.

R—19 to 22 inches; indurated fractured limestone.

The thickness of the solum and the depth to indurated limestone range from 8 to 20 inches. The soil is very dark gray, dark gray, very dark grayish brown, dark brown, dark grayish brown, and brown. Coarse fragments make up 0 to 35 percent of the volume. Concretions and coatings and pendants on fragments are secondary carbonates.

Real series

The Real series consists of shallow, well drained, undulating to steep loamy soils on uplands. These soils formed over interbedded marl and limestone. Slopes range from 1 to 30 percent.

Typical pedon of Real gravelly loam, 1 to 8 percent slopes; from the intersection of U.S. Interstate 35 and Farm Road 150 in Kyle, 2.3 miles northwest on Farm Road 150, 0.4 mile southwest on county road, 0.5 mile west on private road, and 66 feet south of road, in rangeland:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; few snail shell fragments; few angular pebbles of soft limestone; calcareous; moderately alkaline; clear wavy boundary.

A12ca—4 to 9 inches; dark grayish brown (10YR 4/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; common fine roots; few snail shell fragments; about 40 percent, by volume, chalk fragments 1 to 10 inches across; calcareous; moderately alkaline; clear smooth boundary.

A13ca—9 to 14 inches; dark grayish brown (10YR 4/2) extremely stony loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; few fine roots; about 80 percent, by volume, chalk fragments 3 to 12 inches across with soil in spaces between fragments; coatings and pendants

of secondary calcium carbonate on fragments; calcareous; moderately alkaline; abrupt wavy boundary.

Crca—14 to 17 inches; strongly cemented platy chalk.

The solum is 8 to 16 inches thick. Coarse fragments of chalk make up 35 to 60 percent of the solum. The fragments are mostly 0.2 inch to 3 inches in diameter in the upper part and 3 to 12 inches in the lower part. The calcium carbonate equivalent ranges from 40 to 70 percent.

The A horizon is dark grayish brown or very dark grayish brown.

The Crca horizon is weakly cemented to strongly cemented chalk.

Rumple series

The Rumple series consists of moderately deep, well drained, undulating clayey and cherty soils on uplands. The soils formed over indurated fractured limestone. Slopes are 1 to 8 percent.

Typical pedon of Rumple very cherty clay loam, in an area of Rumple-Comfort association, undulating; from the intersection of U.S. Interstate 35 and Farm Road 306 near New Braunfels, 5.5 miles northwest on Farm Road 306 and 50 feet east of road, in rangeland:

A1—0 to 10 inches; dark reddish brown (5YR 3/3) very cherty clay loam, dark reddish brown (5YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; about 35 percent, by volume, angular chert fragments mostly 0.5 to 1 inch across; noncalcareous; mildly alkaline; clear smooth boundary.

B21t—10 to 14 inches; dark reddish brown (2.5YR 3/4) very cherty clay, dark reddish brown (2.5YR 2/4) moist; moderate very fine subangular blocky structure; hard, friable; common fine roots; patchy clay films on peds; about 35 percent, by volume, angular chert fragments mostly 0.5 inch to 2 inches across; noncalcareous; mildly alkaline; abrupt irregular boundary.

B22t—14 to 28 inches; dark reddish brown (2.5YR 3/4) extremely stony clay, dark reddish brown (2.5YR 2/4) moist; few fine roots; about 25 percent, by volume, clayey soil material in vertical and horizontal fractures and solution cavities; 75 percent limestone cobbles and stones and chert pebbles and cobbles; noncalcareous; mildly alkaline; abrupt wavy boundary.

R—28 to 36 inches; coarsely fractured indurated limestone with dark reddish brown clay in crevices.

The thickness of the solum and the depth to indurated limestone range from 20 to 40 inches. Coarse fragments

cover 10 to 25 percent of the surface and are mostly chert, although some are limestone.

The A horizon is dark brown, dark reddish gray, or dark reddish brown. It is cherty clay loam, very cherty clay loam, or cherty clay. Coarse fragments make up 15 to 60 percent of the volume. This horizon is slightly acid or neutral.

The B2t horizon is dark reddish brown, reddish brown, or red. The clay content of the fine-earth fraction ranges from 60 to 75 percent. Coarse fragments make up 35 to 85 percent of the volume. This horizon is slightly acid to mildly alkaline.

Seawillow series

The Seawillow series consists of deep, well drained, gently sloping to sloping loamy soils on stream terraces. The soils formed in calcareous, loamy alluvial sediment. Slopes range from 1 to 8 percent.

Typical pedon of Seawillow clay loam, 1 to 3 percent slopes; from the intersection of U.S. Interstate 35 and Farm Road 150 in Kyle, 0.6 mile west on Farm Road 150, 0.5 mile west on county road, 2.1 miles south on county road, and 0.5 mile west, in a pasture:

- Ap—0 to 4 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; common earthworm casts; common snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.
- A1—4 to 11 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable; common fine roots; common earthworm casts; common snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.
- B2ca—11 to 26 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable; few fine roots; common earthworm casts; common snail shell fragments; common films and threads of calcium carbonate; few rounded limestone pebbles in lower part; calcareous; moderately alkaline; gradual smooth boundary.
- Cca—26 to 60 inches; very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; common snail shell fragments; common films and threads of calcium carbonate; common rounded limestone pebbles becoming more common with depth; calcareous; moderately alkaline.

The solum is 18 to 40 inches thick. The calcium carbonate equivalent ranges from 40 to 70 percent.

Coarse fragments of rounded limestone make up 0 to 15 percent of the volume.

The A horizon is brown or grayish brown.

The B and C horizons are light yellowish brown, brownish yellow, or very pale brown. They are clay loam, silty clay loam, or loam.

Sunev series

The Sunev series consists of deep, well drained, gently sloping loamy soils on uplands. The soils formed in loamy and clayey material that weathered from limestone. Slopes range from 1 to 5 percent.

Typical pedon of Sunev clay loam, 1 to 3 percent slopes; from the intersection of Ranch Road 32 and Ranch Road 12, about 9 miles west of San Marcos, 7.4 miles west on Ranch Road 32, 1.1 miles north on county road, 1 mile east on private road, 0.1 mile south on private road, and 300 feet east, in cropland:

- Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; common fine roots; common fragments of limestone and snail shells less than 0.1 inch across; calcareous; moderately alkaline; clear smooth boundary.
- A11—6 to 11 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, firm; few fine roots; common fragments of limestone and snail shell fragments less than 0.1 inch across; calcareous; moderately alkaline; clear smooth boundary.
- B21—11 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate fine granular and subangular blocky structure; hard, firm; few fine roots; few concretions of calcium carbonate; common fragments of limestone and snail shells less than 0.1 inch across; calcareous; moderately alkaline; clear smooth boundary.
- B22ca—17 to 35 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; very hard, very firm; few fine roots; common concretions of calcium carbonate; few threads and weakly cemented masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.
- B23ca—35 to 45 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; weak fine subangular blocky structure; very hard, very firm; few fine roots; about 15 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.
- Cca—45 to 60 inches; yellow (10YR 7/6) gravelly clay loam, brownish yellow (10YR 6/6) moist; structureless; hard, firm; about 20 percent, by volume, soft masses and concretions of calcium

carbonate; about 5 percent, by volume, limestone gravel; calcareous; moderately alkaline.

The solum is 40 to 70 inches thick. Calcium carbonate makes up 40 to 60 percent of the 10- to 40-inch control section.

The A horizon is dark grayish brown, dark brown, or brown.

The B horizon is light brown, brown, dark yellowish brown, reddish yellow, or strong brown. It is clay or clay loam. Segregated carbonates make up an estimated 5 to 50 percent of the volume. Gravel content ranges from 5 to 35 percent below a depth of 30 inches.

Map unit SuA is more silty than is typical for the Sunev series and is considered a taxadjunct to the series. The difference, however, does not affect the use and management of the soil.

Tarpley series

The Tarpley series consists of shallow, well drained, gently sloping clayey soils on uplands. The soils formed in material that weathered from indurated limestone. Slopes range from 1 to 3 percent.

Typical pedon of Tarpley clay, 1 to 3 percent slopes; from the intersection of Ranch Road 150 and Ranch Road 1826 about 14 miles northwest of Kyle near Driftwood, 0.8 mile south on Ranch Road 150 and 600 feet east of road, in pasture:

A1—0 to 6 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 3/2) moist; moderate medium and fine blocky structure; very hard, very firm; many fine roots; noncalcareous; neutral; clear smooth boundary.

B2t—6 to 17 inches; dark reddish brown (5YR 3/2) clay, dark reddish brown (5YR 3/2) moist; strong fine blocky structure; very firm, very hard; common fine roots; thin clay films on ped faces; few pressure faces; few filled cracks of dark brown clay; noncalcareous; neutral; abrupt smooth boundary.

R—17 to 21 inches; indurated fractured limestone.

The thickness of the solum and the depth to indurated limestone range from 13 to 20 inches. The soil is slightly acid to mildly alkaline. Limestone and chert fragments cover 0 to 30 percent of the surface and make up 0 to 30 percent of the volume. Cracks more than 1 cm wide extend to a depth of more than 20 inches when the soil is dry. COLE is 0.09 to 0.20.

The A horizon is dark brown, dark reddish brown, or dark reddish gray.

The B horizon is reddish brown and dark reddish brown. The clay content of the fine-earth fraction ranges from 60 to 80 percent.

Tinn series

The Tinn series consists of deep, somewhat poorly drained, nearly level clayey soils on flood plains. The soils formed in calcareous clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Tinn clay, frequently flooded; from the intersection of Texas 21 and Texas 80 in San Marcos, 8.7 miles north on Texas 21, 3.2 miles northwest on paved county road, and 0.4 mile south of road, in pasture:

A11—0 to 19 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky and subangular blocky structure; very hard, very firm; common fine roots; common fine snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.

A12—19 to 25 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium blocky structure; extremely hard, extremely firm; few fine grass roots; few fine snail shell fragments; calcareous; moderately alkaline; gradual smooth boundary.

A13—25 to 32 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; extremely hard, extremely firm; few faint brown mottles; few pressure faces; few fine snail shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B2—32 to 53 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium blocky structure; extremely hard, extremely firm; few faint brownish and olive mottles; few fine roots; common siliceous pebbles; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—53 to 80 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; structureless; extremely hard, extremely firm; common siliceous pebbles; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is very dark gray or dark gray in the upper part and dark grayish brown and grayish brown in the lower part. There are brown mottles in the lower part. Some pedons have bedding planes. When the soil is dry, cracks 0.5 inch to 2 inches in width extend to a depth of 30 inches or more.

The B horizon has value about 1 unit higher than that of the A horizon. Most pedons have brownish, yellowish, and olive mottles. Some pedons do not have a B horizon.

The C horizon has mottles of gray, brown, and olive. In some pedons gravel makes up 15 to 50 percent of the volume below a depth of 40 inches.

formation of the soils

In this section, the factors of soil formation are described and related to the soils in the survey area. The development of soil horizons is discussed, and the geology of the area is described.

factors of soil formation

Soil is the product of the interaction of five major soil-forming factors. These factors are climate, living organisms, parent material, relief, and time. Climate and living organisms are the active forces of soil formation. They act on the parent material over a period of time. The effects of climate and organisms are modified by relief, or lay of the land.

The interrelationship among these factors is complex. The influence of each factor on soil formation varies from one place to another, and the effect of any one factor is difficult to isolate.

climate

The climate in Comal and Hays Counties is humid subtropical and is characterized by hot summers and relatively mild winters. Temperature and rainfall are the climatic factors that have the greatest influence on soil formation. In general, the higher the temperature and the amount of rainfall, the more active the physical and chemical processes that promote weathering of parent rock and development of the soil profile.

Rainfall has influenced soil development through the downward movement of carbonates and clay within the soil. The leaching of carbonates has occurred in all soils in varying degrees. The amount of carbonates presently in a soil depends on the amount in the parent material and the amount of water that has moved through the soil. In some of the soils, for example, Bolar, Denton, Doss, Lewisville, and Sunev soils, carbonates have accumulated in the subsoil. In other soils, for example, Anhalt, Comfort, Rumble, and Tarpley soils, carbonates have been completely leached, and the soil is noncalcareous throughout.

The movement of clay particles in soils is much slower than the movement of carbonates. However, Comfort, Rumble, and Tarpley soils have had significant amounts of clay translocated from the surface horizon to the subsoil.

The pattern of rainfall consists of interspersed wet and dry periods, causing certain clays to undergo a

continuous shrink-swell cycle. Cracking of these clays during dry periods allows surface soil to fall or wash into the cracks. This continual mixing of surface soil and subsoil prevents the formation of distinct horizons. Anhalt, Houston Black, Branyon, and Heiden soils undergo this shrink-swell cycle.

parent material

Parent material is the unconsolidated or consolidated mass in which a soil forms. It determines the dominant chemical and mineralogical composition of the soil and influences the rate of soil development. Unconsolidated, or soft, materials weather faster; thus soils form more rapidly in unconsolidated materials than in consolidated, or hard, materials. In Comal and Hays Counties, the parent material of the soils on uplands ranges from strongly indurated limestone to marl, chalk, and shale. On stream terraces, the parent material is unconsolidated, calcareous, alluvial sediment consisting of clay, silt, and gravel. On flood plains, the parent material is unconsolidated, calcareous, recent alluvium consisting of sand, silt, and clay. More detailed information on the different parent materials in the survey area is given in the "Geology" section.

living organisms

Vegetation, micro-organisms, insects, earthworms, fungi, and all forms of life on and in the soil contribute to soil formation. Organic matter accumulation, gains and losses of plant nutrients, soil mixing, structural stability, and porosity are affected by organisms. Decaying plant roots as well as burrowing animals and insects leave a network of channels and pores that increase the passage of air and water. Trees remove soil minerals from deep in the soil and return them to the soil surface through decaying leaves. Grasses, because of their fibrous root systems, add more organic matter to the soil, especially the subsoil, than do trees. Soils that formed under grasses are generally darker in color than soils that developed under forest vegetation. Soils that formed under coniferous trees tend to be more acid than those that formed under deciduous trees, because conifers are lower in base elements, including calcium, magnesium, and potassium.

The soils in the survey area developed mainly under grassland vegetation. Generally the surface layer is dark

and has the good structure that is associated with soils that formed under grassland vegetation.

relief

Relief influences the formation of soils in Comal and Hays Counties by its effect on runoff, erosion, and drainage. More water enters soils that are nearly level or gently sloping because runoff is slower. Consequently, leaching and profile development are increased. Runoff is more rapid on soils that are strongly sloping or steep. Steeper soils are more likely to erode and thus are less likely to be deep. Generally, the profile is less well developed. Steeper soils tend to be more droughty because less water enters the soil. Droughtiness affects vegetation and crops.

time

The length of time in which climate, living organisms, and topography have acted on parent material affects soil characteristics. Soils that have been weathered for a short period resemble the parent material more than those weathered for a longer period. Soils that formed in recent alluvium on bottom lands and stream terraces are younger than soils that formed on uplands. Boerne soils, for example, formed in loamy alluvium and are young, sandy loam soils, whereas Comfort soils formed in limestone residuum on uplands and are older, clayey soils.

soil horizon development

The soil profile records the activities of the soil-forming factors. A succession of layers, or horizons, is formed, extending from the surface down to the parent material. The horizons differ in one or more properties, for example, thickness, color, texture, structure, consistence, porosity, and reaction.

Most profiles consist of three major horizons, designated the A, B, and C horizons. In some young soils, a B horizon has not developed. In other soils, a Ccam horizon, which is an indurated calcium carbonate horizon, is present. Several processes are involved in the formation of horizons. In Comal and Hays Counties, the main processes are accumulation of organic matter, leaching and accumulation of calcium carbonate and bases, and formation and translocation of silicate clay minerals. In most soils, several processes have been active.

The A horizon is the surface layer. It is either a horizon of maximum accumulation of organic matter, called the A1 horizon, or a horizon of maximum leaching of materials, called the A2 horizon. None of the soils in the survey area has an A2 horizon, mainly because rainfall is not sufficient for maximum leaching. If a soil is plowed, the upper part of the A horizon is disturbed. This disturbed layer is called the Ap horizon.

The B horizon lies directly below the A horizon. It is the horizon of maximum accumulation of dissolved or suspended materials, for example, iron or clay, or it is an altered horizon whose structure is distinct from that of the A horizon but shows little evidence of clay translocation or accumulation. A B horizon that has a significant amount of clay accumulation is called a Bt horizon. A Bt horizon generally is firmer than the horizons directly above and below and generally has blocky structure. The Pedernales soil has a distinct Bt horizon. Rumble and Tarpley soils have a Bt horizon that is not distinct because of the high content of clay. A subsurface layer that has distinct structure but little evidence of clay accumulation is called a B horizon, without the "t." Austin, Bolar, and Lewisville soils have a B horizon.

The C horizon is relatively unchanged by the soil-forming processes; however, it has been somewhat modified by weathering. Lewisville, Krum, and Seawillow soils have a C horizon. If the C horizon is weathered bedrock, for example, partly consolidated soft limestone, caliche, chalk, or shale, it is called a Cr horizon.

The Ccam horizon is an underlying indurated layer of cemented caliche that has imbedded gravel. Gruene soils have a Ccam horizon.

A soil horizon that has a significant accumulation of calcium carbonate is designated by the addition of "ca." Generally this designation is applied to a B horizon, although it can be an A or a C horizon. Real soils have an A1ca horizon, and Sunev soils have a Bca horizon and a Cca horizon.

The soils in the survey area that have a high shrink-swell potential have an AC horizon. These soils are clayey and have a large amount of montmorillonite. When these soils dry, they shrink, and cracks form. The cracks extend into the C horizon. Soil material from the A horizon falls into the cracks or is washed into the cracks by rain. As the soil soaks up the water, it swells. Because of the small space for expansion, the soil material is pushed up forming a gilgai microrelief of low knolls and depressions. In this manner, the A and C horizons are continually mixed, and a B horizon does not form. Branyon, Heiden, and Houston Black soils have an AC horizon.

An R layer underlies many of the soils in the survey area and is generally indurated limestone bedrock. In some places, it is dolomitic limestone. Chert nodules imbedded in the limestone bedrock are the source of the chert gravel and cobbles in Rumble soils. The chert remained in the soil after the more soluble limestone dissolved. Other soils that have an underlying R layer are Denton, Eckrant, and Comfort soils.

geology

Max D. Bircket, geologist, Soil Conservation Service, prepared this section.

Comal and Hays Counties lie within two physiographic areas, the Edwards Plateau and the Black Prairie. These physiographic areas are essentially equivalent to the similarly named Edwards Plateau and Texas Blackland Prairie major land resource areas. Approximately four-fifths of the survey area is in the Edwards Plateau. The topography is undulating to hilly. The underlying material is erosion-resistant limestone and limestone interbedded with clay and marl. Drainage is generally immature, particularly where stream courses traverse massive crystalline limestone. The southeastern one-fifth of Comal and Hays Counties is in the Black Prairie. The topography is gently undulating to gently rolling, and relief is low. The underlying material is relatively erodible chalk and clay-shale. Drainage is well developed.

The Balcones fault zone is the dominant geological structure in the survey area. It extends through Comal and Hays Counties in a northeast-southwest direction. Its principal topographic expression, the Balcones Escarpment, forms an abrupt boundary between the Edwards Plateau and the Black Prairie. All displacement is the result of gravity or normal faulting with the footwall generally being upthrown to the northwest. In a few areas, however, the footwall is upthrown to the southeast. This faulting, which has exposed clay-shale beds between hard, erosion-resistant limestone, has had a significant impact on the soils and their location. Faulting has to some extent controlled or strongly influenced stream courses and patterns.

The parent material of the soils in Comal and Hays Counties derived from sedimentary deposits and rocks of Recent, Pleistocene, and Cretaceous age. Cretaceous rocks are the oldest and range from the relatively insignificant Sycamore Sand and Hensell Sand to the dominant interbedded limestone-marl, limestone, chalk, and chalk-marl of the Glen Rose, Edwards Limestone, Austin Chalk, and Pecan Gap Chalk Formations, respectively. Pleistocene deposits are mostly fluvial terraces of clay, silt, sand, and gravel. Recent deposits are clay, silt, sand, gravel, and cobbles derived from older Pleistocene and Cretaceous strata and are in the flood-prone areas.

The oldest rocks cropping out in Comal and Hays Counties are in the Travis Peak Formation. The Sycamore Sand, Cow Creek Limestone, and Hensell Sand members of this formation are at the surface in the northernmost part of Hays County near the Pedernales River. The Cow Creek Limestone and Hensell Sand crop out in northwestern Comal County, west of Canyon Lake and in the valley and periphery of the Guadalupe River and Rebecca Creek. The Travis Peak Formation is relatively insignificant as a source of parent material because the area of outcrop is very small.

The Glen Rose Formation overlies the Travis Peak Formation. It crops out mainly in the northwestern half of the survey area and is the dominant geological unit in surface area. The Glen Rose Formation consists of interbedded limestone and marl or clay. Because the limestone is much more resistant to erosion than the marl and clay, the topography consists of hill slopes having a benched appearance. Brackett, Comfort, Bolar, and associated soils developed over the Glen Rose Formation.

In ascending order, the Walnut Formation, the Comanche Peak Limestone, and the Edwards Limestone overlie the Glen Rose Formation. These formations crop out southeast of the Glen Rose Formation within a northeast-southwest trending band averaging about 7 miles in width. Comfort, Rumble, Eckrant, and associated soils developed over the Walnut Formation, the Comanche Peak Limestone, and the Edwards Limestone.

The Walnut Formation crops out in the central part of the survey area near the Comal-Hays county line. It ranges in thickness from a few inches to about 5 feet in Comal County and from 5 to 15 feet in Hays County (2, 3). It is relatively insignificant as a source of parent material because the area of outcrop is small. The Comanche Peak Limestone is mostly hard, massive, and in some locations, dolomitic limestone that resembles the overlying Edwards Limestone. In some areas, the lower part of the formation is marl and clay somewhat similar to the underlying Walnut Formation. The Edwards Limestone has the second most extensive outcrop in the survey area. It is mostly hard, massive, crystalline, and, in some areas, dolomitic limestone. A distinguishing lithologic characteristic of this formation is the presence of chert nodules, many of which have weathered out and are now part of the solum. The Edwards Limestone has been subjected to considerable solution, as indicated by scattered sinks on the surface and a generally honeycombed appearance.

Because of its fractured, vuggy, and cavernous character, the Edwards Limestone is an extremely important ground-water recharge area and aquifer. It furnishes large quantities of water of high quality for industrial, municipal, recreational, and domestic uses. It is imperative that prudent judgment be used in managing this important resource. The nature of the soils in the area is a principal factor in determining land use and management and the resulting effects on the aquifer.

The Edwards Limestone is overlain, in ascending order, by the Georgetown Formation, Del Rio Clay (Grayson Marl), and Buda Limestone. Outcrops of these formations occur where crustal movement has been intense in the fault zone. In the survey area, the Georgetown Formation ranges from a few feet to 32 feet in thickness, the Del Rio Clay is about 44 feet thick, and the Buda Limestone is about 30 to 60 feet thick. Although the thickness of these formations is relatively

limited, their lithology, stratigraphy, and geologic structure have controlled or substantially influenced location, extent, and type of soil. Krum, Medlin, Eckrant, and associated soils developed over these formations. The Buda Limestone generally occurs as a resistant cap on small hills and narrow ridges where shallow Eckrant soils have formed. In many areas, faulting has tilted and exposed the Del Rio Clay on hill slopes where the deep Medlin soils have formed. Erosion of these slopes has caused deposition of clay material on foot slopes where Drum soils have developed.

The Eagle Ford Group overlies the Buda Limestone and crops out in Comal and Hays Counties in the Balcones fault zone. It consists of calcareous shale and sandy limestone strata about 30 feet thick and is located generally on top of hills and ridges. The Eagle Ford is not considered to be a significant source of soil parent material in the survey area because it crops out in only a few small areas.

Austin Chalk overlies the Eagle Ford Group. This formation has been significant in the development of the soils on the southeastern part of the Balcones Escarpment. In most places, it is in fault contact at the surface with the overlying Pecan Gap Chalk or with the Ozan Formation, which consists of clay and marl strata.

The Marlbrook Marl, youngest of the Cretaceous strata that crop out in the survey area, is exposed at the surface in eastern Hays County. Stephen, Austin, Houston Black, and associated soils developed over the Austin Chalk and the Pecan Gap Chalk. Heiden, Houston Black, and associated soils developed over the clay and marl of the Ozan Formation, the Pecan Gap Chalk, and the Marlbrook Marl.

Pleistocene fluvial terrace deposits are located in both counties southeast of the Balcones Escarpment. The oldest deposits are in topographically high areas that have a northwest-southeast trend roughly parallel to the regional drainage. The Leona Formation extends from southwest of Kyle into Caldwell County and is an example of a topographically high, nearly level to sloping stream terrace. Branyon, Krum, and associated soils developed on these high terraces. The somewhat younger, gravelly to clayey, fluvial terrace deposits are along major streams in the Edwards Plateau and Blackland Prairie. They are at a lower elevation than the adjacent Pleistocene deposits. Lewisville, Gruene, Krum, and associated soils developed on these low terraces. Recent deposits of gravel, sand, silt, and clay are on modern flood plains. Boerne, Oakalla, Orif, and Tinn soils developed on these flood plains.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon.

Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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—

	<i>Inches</i>
Very low.....	0 to 3
Low.....	3 to 6
Moderate.....	6 to 9
High.....	9 to 12
Very high.....	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

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.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

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.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Cemented pan. A strongly cemented or indurated layer of caliche.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. 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.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

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.

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.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of

regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from

seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Droughty. The soil holds little water, or rainfall is so low that nonirrigated farming is not feasible.

Dusty. Soil particles easily detached, forming dust.

Electrical conductivity (EC). The reciprocal of the electrical resistivity. The resistivity is the resistance, in ohms, of a conductor which is 1 cm long and has a cross sectional area of 1 cm². Hence, electrical conductivity is expressed in reciprocal ohms per centimeter, or mhos per centimeter. It is a measure of the soluble salts in soil or water.

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.

Escarpment. A steep slope or cliff separating two comparatively level or more gently sloping surfaces.

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.

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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

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.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is

cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A

soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasesers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasesers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2.....	very low
0.2 to 0.4.....	low
0.4 to 0.75.....	moderately low
0.75 to 1.25.....	moderate
1.25 to 1.75.....	moderately high
1.75 to 2.5.....	high
More than 2.5.....	very high

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

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.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow.....	less than 0.06 inch
Slow.....	0.06 to 0.20 inch
Moderately slow.....	0.2 to 0.6 inch
Moderate.....	0.6 inch to 2.0 inches
Moderately rapid.....	2.0 to 6.0 inches
Rapid.....	6.0 to 20 inches
Very rapid.....	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, 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.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the

product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	<i>pH</i>
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.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called 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.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

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:

	<i>Millimeters</i>
Very coarse sand.....	2.0 to 1.0
Coarse sand.....	1.0 to 0.5
Medium sand.....	0.5 to 0.25
Fine sand.....	0.25 to 0.10
Very fine sand.....	0.10 to 0.05

Silt.....0.05 to 0.002
 Clay.....less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

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."

Too clayey. Soil that is slippery and sticky when wet and dries slowly.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION
 [Recorded in the period 1951-78 at New Braunfels, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have--		Average number of growing degree days ¹	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
^o F	^o F	^o F	^o F	^o F	Units	In	In	In		In	
January----	61.9	37.8	49.9	85	17	152	1.77	.49	2.80	4	.1
February---	66.9	41.7	54.3	88	22	204	2.36	.78	3.65	5	.3
March-----	74.8	48.3	61.6	93	28	377	1.56	.52	2.41	4	.0
April-----	81.4	57.6	69.5	95	37	585	3.17	1.15	4.85	5	.0
May-----	86.7	64.2	75.5	98	46	791	4.59	1.48	7.12	5	.0
June-----	93.3	70.8	82.0	101	59	960	3.07	1.08	4.75	4	.0
July-----	96.6	72.8	84.7	105	66	1,076	1.44	.25	2.35	3	.0
August-----	96.7	72.2	84.5	104	63	1,070	2.85	.56	4.61	4	.0
September--	90.8	68.1	79.4	102	52	882	4.22	1.32	6.58	5	.0
October----	82.5	57.7	70.2	95	40	626	3.64	.95	5.79	5	.0
November---	71.8	47.3	59.6	87	27	302	2.81	.77	4.46	4	.0
December---	64.9	40.1	52.5	84	22	156	1.98	.67	3.06	4	.0
Yearly:											
Average--	80.7	56.6	68.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	17	---	---	---	---	---	---
Total----	---	---	---	---	---	7,181	33.46	23.98	42.37	52	.4

¹A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature (50° F) below which growth is minimal for the principal crops in the area.

TABLE 2.--FREEZE DATES IN SPRING AND FALL
 [Recorded in the period 1951-78 at New Braunfels, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	February 18	March 17	March 26
2 years in 10 later than--	February 9	March 8	March 20
5 years in 10 later than--	January 24	February 20	March 10
First freezing temperature in fall:			
1 year in 10 earlier than--	November 29	November 18	November 11
2 years in 10 earlier than--	December 11	November 27	November 18
5 years in 10 earlier than--	January 3	December 12	November 30

TABLE 3.--GROWING SEASON
 [Recorded in the period 1951-78 at
 New Braunfels, Texas]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
9 years in 10	301	267	238
8 years in 10	312	277	247
5 years in 10	335	295	264
2 years in 10	>365	313	281
1 year in 10	>365	322	290

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Comal County Acres	Hays County Acres	Total--	
				Area Acres	Extent Pct
AgC3	Altoga silty clay, 2 to 5 percent slopes, eroded-----	1,280	1,610	2,890	0.4
AgD3	Altoga silty clay, 5 to 8 percent slopes, eroded-----	160	1,150	1,310	0.2
AnA	Anhalt clay, 0 to 1 percent slopes-----	740	400	1,140	0.1
AnB	Anhalt clay, 1 to 3 percent slopes-----	2,230	2,200	4,430	0.6
AuB	Austin-Castephen complex, 1 to 3 percent slopes-----	170	2,050	2,220	0.3
AuC3	Austin-Castephen complex, 2 to 5 percent slopes, eroded----	210	520	730	0.1
BoB	Boerne fine sandy loam, 1 to 3 percent slopes-----	2,150	660	2,810	0.3
RrB	Bolar clay loam, 1 to 3 percent slopes-----	7,280	9,130	16,410	2.1
BtD	Brackett-Rock outcrop-Comfort complex, undulating-----	43,430	67,950	111,380	14.1
BtG	Brackett-Rock outcrop-Real complex, steep-----	54,400	49,720	104,120	13.1
ByA	Branyon clay, 0 to 1 percent slopes-----	5,770	7,520	13,290	1.7
ByB	Branyon clay, 1 to 3 percent slopes-----	2,400	2,490	4,890	0.6
CaC3	Castephen clay loam, 3 to 5 percent slopes, eroded-----	130	690	820	0.1
CrD	Comfort-Rock outcrop complex, undulating-----	84,270	64,962	149,232	18.8
DeB	Denton silty clay, 1 to 3 percent slopes-----	4,850	3,980	8,830	1.1
DeC3	Denton silty clay, 1 to 5 percent slopes, eroded-----	570	540	1,110	0.1
DoC	Doss silty clay, 1 to 5 percent slopes-----	2,660	12,970	15,630	2.0
ErG	Eckrant-Rock outcrop complex, steep-----	23,070	8,250	31,320	4.0
FeF4	Ferris clay, 5 to 20 percent slopes, severely eroded-----	760	1,870	2,630	0.3
GrC	Gruene clay, 1 to 5 percent slopes-----	1,490	4,610	6,100	0.8
HeB	Heiden clay, 1 to 3 percent slopes-----	3,000	4,820	7,820	1.0
HeC3	Heiden clay, 3 to 5 percent slopes, eroded-----	4,510	11,440	15,950	2.0
HeD3	Heiden clay, 5 to 8 percent slopes, eroded-----	670	3,790	4,460	0.6
HgD	Heiden gravelly clay, 3 to 8 percent slopes-----	920	1,620	2,540	0.3
HoB	Houston Black clay, 1 to 3 percent slopes-----	4,320	15,990	20,310	2.6
HvB	Houston Black gravelly clay, 1 to 3 percent slopes-----	1,520	2,450	3,970	0.5
HvD	Houston Black gravelly clay, 3 to 8 percent slopes-----	1,280	3,240	4,520	0.6
KrA	Krum clay, 0 to 1 percent slopes-----	2,250	2,080	4,330	0.5
KrB	Krum clay, 1 to 3 percent slopes-----	4,410	8,160	12,570	1.6
KrC	Krum clay, 3 to 5 percent slopes-----	340	630	970	0.1
LeA	Lewisville silty clay, 0 to 1 percent slopes-----	1,700	2,440	4,140	0.5
LeB	Lewisville silty clay, 1 to 3 percent slopes-----	4,740	4,340	9,080	1.2
MEC	Medlin-Eckrant association, undulating-----	2,780	870	3,650	0.5
MED	Medlin-Eckrant association, hilly-----	1,120	1,620	2,740	0.3
Oa	Oakalla silty clay loam, rarely flooded-----	650	1,230	1,880	0.2
Ok	Oakalla soils, frequently flooded-----	970	760	1,730	0.2
Or	Orif soils, frequently flooded-----	1,090	2,110	3,200	0.4
PdB	Pedernales fine sandy loam, 1 to 5 percent slopes-----	0	280	280	*
Pt	Pits-----	1,460	1,220	2,680	0.3
PuC	Purves clay, 1 to 5 percent slopes-----	4,680	3,220	7,900	1.0
RaD	Real gravelly loam, 1 to 8 percent slopes-----	3,710	4,880	8,590	1.1
RcD	Real-Comfort-Doss complex, undulating-----	13,390	29,550	42,940	5.5
RUD	Rumple-Comfort association, undulating-----	46,500	60,810	107,310	13.5
SeB	Seawillow clay loam, 1 to 3 percent slopes-----	880	850	1,730	0.2
SeD	Seawillow clay loam, 3 to 8 percent slopes-----	690	950	1,640	0.2
SuA	Sunev silty clay loam, 0 to 1 percent slopes-----	1,790	810	2,600	0.3
SuB	Sunev clay loam, 1 to 3 percent slopes-----	3,120	6,880	10,000	1.3
TaB	Tarpley clay, 1 to 3 percent slopes-----	2,480	3,310	5,790	0.7
Tn	Tinn clay, frequently flooded-----	1,650	5,020	6,670	0.9
	Water-----	8,240	158	8,398	1.1
	Total-----	362,880	428,800	791,680	100.0

* Less than 0.1 percent.

TABLE 5.--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	Cotton lint	Grain sorghum	Corn	Wheat	Oats	Pasture
	<u>Lb</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>
AgC3----- Altoga	225	35	25	---	35	6.0
AgD3----- Altoga	---	---	---	---	---	5.0
AnA----- Anhalt	---	45	---	---	50	8.0
AnB----- Anhalt	---	45	---	---	50	8.0
AuB----- Austin-Castephen	---	65	---	---	62	5.0
AuC3----- Austin-Castephen	---	52	---	---	42	4.5
BoB----- Boerne	---	35	---	15	40	4.0
BrB----- Bolar	---	35	---	---	35	5.0
BtD----- Brackett-Rock outcrop- Comfort	---	---	---	---	---	---
BtG----- Brackett-Rock outcrop- Real	---	---	---	---	---	---
ByA----- Branyon	550	90	---	35	---	8.0
ByB----- Branyon	550	85	---	---	---	8.0
CaC3----- Castephen	---	35	---	---	35	3.0
CrD----- Comfort-Rock outcrop	---	---	---	---	---	---
DeB----- Denton	350	65	40	35	60	6.0
DeC3----- Denton	250	50	---	25	45	5.0
DoC----- Doss	---	---	---	20	60	4.0
ErG----- Eckrant-Rock outcrop	---	---	---	---	---	---
FeF4----- Ferris	---	---	---	---	---	3.5
GrC----- Gruene	---	30	---	20	30	2.5
HeB----- Heiden	400	80	60	35	---	8.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Grain sorghum	Corn	Wheat	Oats	Pasture
	<u>Lb</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>
HeC3----- Heiden	350	45	45	---	---	6.0
HeD3----- Heiden	---	30	---	---	---	3.5
HgD----- Heiden	350	50	40	---	---	4.5
HoB, HvB----- Houston Black	550	85	55	35	90	9.5
HvD----- Houston Black	400	80	50	25	65	7.5
KrA----- Krum	450	75	---	---	70	8.0
KrB----- Krum	400	70	---	---	70	8.0
KrC----- Krum	350	65	---	---	50	6.0
LeA----- Lewisville	500	85	---	---	70	7.5
LeB----- Lewisville	500	80	---	---	70	7.5
MEC: Medlin-----	250	45	---	35	---	5.0
Eckrant-----	---	---	---	---	---	---
MED: Medlin-----	---	---	---	---	---	---
Eckrant-----	---	---	---	---	---	---
Oa----- Oakalla	---	65	---	25	60	6.5
Ok----- Oakalla	---	---	---	---	---	6.5
Or----- Orif	---	---	---	---	---	---
PdB----- Pedernales	---	35	---	20	45	4.0
Pt. Pits	---	---	---	---	---	---
PuC----- Purves	---	25	---	20	40	3.5
RaD----- Real	---	---	---	---	---	---
RcD----- Real-Comfort-Doss	---	---	---	---	---	---
RUD: Rumple-----	---	---	---	---	---	---
Comfort-----	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Grain sorghum	Corn	Wheat	Oats	Pasture
	<u>Lb</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>AUM*</u>
SeB----- Seawillow	250	45	---	---	45	5.0
SeD----- Seawillow	---	35	---	---	30	4.5
SuA----- Sunev	300	70	40	---	60	6.5
SuB----- Sunev	200	35	30	---	50	5.5
TaB----- Tarpley	---	25	---	---	30	2.5
Tn----- Tinn	---	---	---	---	---	8.0

* 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.

TABLE 6.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
AgC3, AgD3----- Altoga	Clay Loam-----	6,500	5,000	3,800
AnA, AnB----- Anhalt	Deep Redland-----	6,000	5,000	3,000
AuB,* AuC3:* Austin-----	Clay Loam-----	6,500	5,000	3,000
Castephen-----	Chalky Ridge-----	4,250	3,250	1,900
BoB----- Boerne	Loamy Bottomland-----	4,500	3,700	2,000
BrB----- Bolar	Clay Loam-----	6,000	5,000	3,000
BtD:* Brackett-----	Adobe-----	4,000	3,200	1,800
Rock outcrop.				
Comfort-----	Low Stony Hills-----	3,000	2,500	1,500
BtG:* Brackett-----	Steep Adobe-----	3,000	2,200	1,500
Rock outcrop.				
Real-----	Steep Adobe-----	3,500	2,500	1,500
ByA, ByB----- Branyon	Blackland-----	7,000	5,500	3,500
CaC3----- Castephen	Chalky Ridge-----	4,250	3,250	1,900
CrD:* Comfort-----	Low Stony Hills-----	3,000	2,500	1,500
Rock outcrop.				
DeB, DeC3----- Denton	Clay Loam-----	6,500	5,000	3,000
DoC----- Doss	Shallow-----	3,000	2,500	1,800
ErG:* Eckrant-----	Steep Rocky-----	1,800	1,400	800
Rock outcrop.				
FeF4----- Ferris	Eroded Blackland-----	7,000	5,500	4,000
GrC----- Gruene	Shallow-----	4,000	2,800	1,800
HeB, HeC3, HeD3, HgD----- Heiden	Blackland-----	7,000	6,000	3,500
HoB, HvB, HvD----- Houston Black	Blackland-----	7,000	6,000	3,500

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
KrA, KrB, KrC----- Krum	Clay Loam-----	6,500	6,000	4,000
LeA, LeB----- Lewisville	Clay Loam-----	6,500	5,500	3,500
MEC:* Medlin-----	Blackland-----	6,000	5,000	3,000
Eckrant-----	Low Stony Hills-----	3,000	2,500	1,500
MED:* Medlin-----	Blackland-----	6,000	5,000	3,000
Eckrant-----	Steep Rocky-----	1,800	1,400	800
Oa, Ok*----- Oakalla	Loamy Bottomland-----	5,500	4,500	2,500
Or*----- Orif	Loamy Bottomland-----	3,800	3,500	2,000
PdB----- Pedernales	Tight Sandy Loam-----	3,500	3,000	1,500
PuC----- Purves	Shallow-----	3,000	2,500	1,800
RaD----- Real	Adobe-----	3,500	2,500	1,500
RcD:* Real-----	Adobe-----	3,500	2,500	1,500
Comfort-----	Low Stony Hills-----	3,000	2,500	1,500
Doss-----	Shallow-----	3,000	2,500	1,800
RUD:* Rumple-----	Gravelly Redland-----	3,500	3,000	2,000
Comfort-----	Low Stony Hills-----	3,000	2,500	1,500
SeB, SeD----- Seawillow	Blackland-----	5,000	4,500	2,500
SuA, SuB----- Sunev	Clay Loam-----	7,000	5,500	3,500
TaB----- Tarpley	Redland-----	5,500	4,500	3,500
Tn----- Tinn	Clayey Bottomland-----	7,000	6,000	4,000

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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	Golf fairways
AgC3----- Altoga	Slight-----	Slight-----	Moderate: slope.	Slight-----	Moderate: excess lime.
AgD3----- Altoga	Slight-----	Slight-----	Severe: slope.	Slight-----	Moderate: excess lime.
AnA----- Anhalt	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
AnB----- Anhalt	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
AuB,* AuC3:* Austin-----	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
Castephen-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Severe: thin layer.
BoB----- Boerne	Severe: flooding.	Slight-----	Slight-----	Slight-----	Moderate: excess lime.
BrB----- Bolar	Slight-----	Slight-----	Moderate: small stones, slope.	Slight-----	Moderate: thin layer.
BtD:* Brackett-----	Severe: depth to rock.	Severe: depth to rock.	Severe: small stones, depth to rock.	Slight-----	Severe: thin layer.
Rock outcrop. Comfort-----	Severe: large stones, small stones, depth to rock.	Severe: large stones, small stones, depth to rock.	Severe: small stones, depth to rock.	Moderate: large stones.	Severe: large stones, thin layer, too clayey.
BtG:* Brackett-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
Rock outcrop. Real-----	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: small stones.	Severe: small stones, slope, thin layer.
ByA----- Branyon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
ByB----- Branyon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CaC3----- Castephen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Severe: thin layer.
CrD:* Comfort----- Rock outcrop.	Severe: large stones, small stones, depth to rock.	Severe: large stones, small stones, depth to rock.	Severe: small stones, depth to rock.	Moderate: large stones.	Severe: large stones, thin layer, too clayey.
DeB, DeC3----- Denton	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
DoC----- Doss	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.	Severe: thin layer.
ErG:* Eckrant----- Rock outcrop.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, slope, thin layer.
FeF4----- Ferris	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
GrC----- Gruene	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Moderate: too clayey.	Severe: thin layer, too clayey.
HeB, HeC3----- Heiden	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
HeD3----- Heiden	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
HgD----- Heiden	Moderate: percs slowly, too clayey.	Moderate: percs slowly, too clayey.	Moderate: small stones, too clayey, percs slowly.	Moderate: too clayey.	Severe: small stones, too clayey.
HoB----- Houston Black	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
HvB, HvD----- Houston Black	Moderate: small stones, percs slowly, too clayey.	Moderate: too clayey, small stones, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
KrA----- Krum	Moderate: too clayey.	Moderate: too clayey.	Moderate: small stones.	Moderate: too clayey.	Severe: too clayey.
KrB, KrC----- Krum	Moderate: too clayey.	Moderate: too clayey.	Moderate: small stones, slope.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
LeA----- Lewisville	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
LeB----- Lewisville	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
MEC:* Medlin-----	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
Eckrant-----	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones.	Severe: large stones, thin layer.
MED:* Medlin-----	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
Eckrant-----	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, slope, thin layer.
Oa----- Oakalla	Severe: flooding.	Moderate: too clayey.	Moderate: dusty.	Moderate: dusty.	Moderate: excess lime.
Ok*----- Oakalla	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding, dusty.	Severe: flooding.
Or*----- Orif	Severe: flooding, small stones.	Severe: small stones.	Severe: small stones, flooding.	Moderate: flooding.	Severe: small stones, droughty, flooding.
PdB----- Pedernales	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Pt. Pits					
PuC----- Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.	Severe: thin layer, too clayey.
RaD----- Real	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: small stones.	Severe: small stones, thin layer.
RcD:* Real-----	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: small stones.	Severe: small stones, thin layer.
Comfort-----	Severe: large stones, small stones, depth to rock.	Severe: large stones, small stones, depth to rock.	Severe: small stones, depth to rock.	Moderate: large stones.	Severe: large stones, thin layer, too clayey.
Doss-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Severe: thin layer.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RUD:*					
Rumple-----	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight-----	Severe: small stones.
Comfort-----	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Moderate: large stones.	Severe: large stones, thin layer, too clayey.
SeB, SeD----- Seawillow	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
SuA----- Sunev	Slight-----	Slight-----	Moderate: small stones.	Slight-----	Moderate: excess lime.
SuB----- Sunev	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: excess lime.
TaB----- Tarpley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----	Severe: thin layer, too clayey.
Tn----- Tinn	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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 herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AgC3, AgD3----- Altoga	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
AnA, AnB----- Anhalt	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
AuB,* AuC3:* Austin----- Castephen-----	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
BoB----- Boerne	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
BrB----- Bolar	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
BtD:* Brackett----- Rock outcrop.	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Comfort-----	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
BtG:* Brackett----- Rock outcrop.	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
Real-----	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
ByA, ByB----- Branyon	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
CaC3----- Castephen	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
CrD:* Comfort----- Rock outcrop.	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
DeB----- Denton	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
DeC3----- Denton	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
DoC----- Doss	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
ErG:* Eckrant----- Rock outcrop.	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
FeF4----- Ferris	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
GrC----- Gruene	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
HeB----- Heiden	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
HeC3----- Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
HeD3----- Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
HgD----- Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
HoB, HvB----- Houston Black	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
HvD----- Houston Black	Fair	Good	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair.
KrA, KrB----- Krum	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
KrC----- Krum	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
LeA, LeB----- Lewisville	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
MEC:* Medlin-----	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
Eckrant-----	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
MED:* Medlin-----	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Eckrant-----	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Oa----- Oakalla	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Ok*----- Oakalla	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
Or*----- Orif	Poor	Poor	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
PdB----- Pedernales	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Pt. Pits									
PuC----- Purves	Fair	Good	Poor	Fair	Poor	Very poor	Fair	Very poor	Poor.
RaD----- Real	Very poor	Poor	Poor	Fair	Poor	Very poor	Poor	Very poor	Poor.
RcD:* Real-----	Very poor	Poor	Poor	Fair	Poor	Very poor	Poor	Very poor	Poor.
Comfort-----	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
Doss-----	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
RUD:* Rumple-----	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Comfort-----	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
SeB----- Seawillow	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
SeD----- Seawillow	Fair	Good	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
SuA----- Sunev	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
SuB----- Sunev	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
TaB----- Tarpley	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Tn----- Tinn	Poor	Fair	Fair	---	Poor	Fair	Fair	Poor	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AgC3, AgD3----- Altoga	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: excess lime.
AnA, AnB----- Anhalt	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.
AuB,* AuC3:* Austin-----	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Severe: too clayey.
Castephen-----	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.
BoB----- Boerne	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: excess lime.
BrB----- 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.
BtD:* Brackett-----	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: low strength.	Severe: thin layer.
Rock outcrop.						
Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer, too clayey.
BtG:* Brackett-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope, thin layer.
Rock outcrop.						
Real-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope, thin layer.
ByA, ByB----- Branyon	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
CaC3----- Castephen	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
CrD:* Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer, too clayey.
Rock outcrop.						

See footnote at end of table.

TABLE 9.--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
DeB, DeC3----- Denton	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
DoC----- Doss	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Severe: thin layer.
ErG:* Eckrant----- Rock outcrop.	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
FeF4----- Ferris	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
GrC----- Gruene	Severe: cemented pan.	Moderate: shrink-swell, cemented pan.	Severe: cemented pan.	Moderate: shrink-swell, cemented pan.	Moderate: cemented pan, shrink-swell.	Severe: thin layer, too clayey.
HeB, HeC3, HeD3--- Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
HgD----- Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: small stones, too clayey.
HoB, HvB, HvD----- Houston Black	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
KrA, KrB, KrC----- Krum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
LeA, LeB----- Lewisville	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
MEC:* Medlin----- Eckrant-----	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
	Severe: depth to rock, large stones.	Severe: large stones, thin layer.				
MED:* Medlin----- Eckrant-----	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Oa----- Oakalla	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Moderate: excess lime.
Ok*----- Oakalla	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.

See footnote at end of table.

TABLE 9.--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
Or*----- Orif	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: small stones, droughty, flooding.
PdB----- Pedernales	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Pt. Pits						
PuC----- Purves	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, too clayey.
RaD----- Real	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: small stones, thin layer.
RcD:* Real-----	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.	Severe: small stones, thin layer.
Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer, too clayey.
Doss-----	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Severe: thin layer.
RUD:* Rumple-----	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: small stones.
Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer, too clayey.
SeB----- Seawillow	Slight-----	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell.	Severe: low strength.	Moderate: excess lime.
SeD----- Seawillow	Slight-----	Moderate: shrink-swell.	Slight-----	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: excess lime.
SuA, SuB----- Sunev	Slight-----	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: excess lime.
TaB----- Tarpley	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, too clayey.
Tn----- Tinn	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AgC3, AgD3----- Altoga	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey, excess lime.
AnA, AnB----- Anhalt	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.
AuB,* AuC3:* Austin-----	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.
Castephen-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
BoB----- Boerne	Moderate: flooding.	Severe: seepage, flooding.	Severe: seepage.	Severe: seepage.	Fair: excess lime.
BrB----- Bolar	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
BtD:* Brackett-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Rock outcrop. Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: too clayey, large stones, thin layer.
BtG:* Brackett-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop. Real-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
ByA----- Branyon	Severe: percs slowly.	Slight-----	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
ByB----- Branyon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
CaC3----- Castephen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 10.--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
CrD:* Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: too clayey, large stones, thin layer.
Rock outcrop.					
DeB, DeC3----- Denton	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.
DoC----- Doss	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.
ErG:* Eckrant-----	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
Rock outcrop.					
FeF4----- Ferris	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
GrC----- Gruene	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: area reclaim, thin layer.
HeB, HeC3, HeD3----- Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
HgD----- Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey.
HoB, HvB, HvD----- Houston Black	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
KrA----- Krum	Severe: percs slowly.	Slight-----	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
KrB, KrC----- Krum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
LeA----- Lewisville	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
LeB----- Lewisville	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
MFC:* Medlin-----	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--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
MEC:* Eckrant-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, large stones, thin layer.
MED:* Medlin-----	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Eckrant-----	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
Oa----- Oakalla	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey, excess lime.
Ok*----- Oakalla	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey, excess lime.
Or*----- Orif	Severe: flooding, poor filter.	Severe: seepage, flooding, too sandy.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
PdB----- Pedernales	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
Pt. Pits					
PuC----- 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.
RaD----- Real	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
RcD:* Real-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: too clayey, large stones, thin layer.
Doss-----	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.
RUD:* Rumple-----	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, small stones, thin layer.

See footnote at end of table.

TABLE 10.--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
RUD:* Comfort-----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: too clayey, large stones, thin layer.
SeB, SeD----- Seawillow	Slight-----	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey, excess lime.
SuA----- Sunev	Slight-----	Moderate: seepage.	Moderate: too clayey.	Slight-----	Fair: too clayey, excess lime.
SuB----- Sunev	Slight-----	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey, excess lime.
TaB----- Tarpley	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey, thin layer.
Tn----- Tinn	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AgC3, AgD3----- Altoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
AnA, AnB----- Anhalt	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
AuB,* AuC3:* Austin-----	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Castephen-----	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
BoB----- Roerne	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: excess lime.
BrB----- Bolar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
BtD:* Brackett-----	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Rock outcrop.				
Comfort-----	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too clayey, large stones, thin layer.
BtG:* Brackett-----	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
Real-----	Poor: area reclaim, thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, small stones, thin layer.
ByA, ByB----- Branyon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CaC3----- Castephen	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
CrD:* Comfort-----	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too clayey, large stones, thin layer.
Rock outcrop.				
DeB, DeC3----- Denton	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
DoC----- Doss	Poor: area reclaim, low strength.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer, excess lime.
ErG:* Eckrant-----	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
FeF4----- Ferris	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GrC----- Gruene	Poor: area reclaim, thin layer.	Improbable: excess fines, thin layer.	Probable-----	Poor: area reclaim, too clayey, thin layer.
HeB, HeC3, HeD3----- Heiden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
HgD----- Heiden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
HoB----- Houston Black	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
HvB, HvD----- Houston Black	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
KrA, KrB, KrC----- Krum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LeA, LeB----- Lewisville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MEC,* MED:* Medlin-----	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Eckrant-----	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Poor: area reclaim, large stones, thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Oa, Ok*----- Oakalla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
Or*----- Orif	Good-----	Improbable: small stones, excess fines.	Probable-----	Poor: small stones, area reclaim, excess lime.
PdB----- Pedernales	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Pt. Pits				
PuC----- Purves	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
RaD----- Real	Poor: area reclaim, thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, small stones, thin layer.
RcD:* Real-----	Poor: area reclaim, thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, small stones, thin layer.
Comfort-----	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too clayey, large stones, thin layer.
Doss-----	Poor: area reclaim, low strength.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer, excess lime.
RUD:* Rumple-----	Poor: area reclaim, thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, too clayey, small stones.
Comfort-----	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too clayey, large stones, thin layer.
SeB, SeD----- Seawillow	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: excess lime.
SuA, SuB----- Sunev	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, excess lime.
TaB----- Tarpley	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer, too clayey.
Tn----- Tinn	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AgC3, AgD3----- Altoga	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Slope, excess lime.	Favorable-----	Excess lime.
AnA, AnB----- Anhalt	Moderate: 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.
AuB:* Austin-----	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, depth to rock.	Depth to rock	Depth to rock.
Castephen-----	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock, excess lime.
AuC3:* Austin-----	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, depth to rock, slope.	Depth to rock	Depth to rock.
Castephen-----	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock, excess lime.
BoB----- Boerne	Severe: seepage.	Severe: piping.	Deep to water	Excess lime---	Favorable-----	Favorable.
BrB----- Bolar	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
BtD:* 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.
Rock outcrop.						
Comfort-----	Severe: depth to rock.	Severe: thin layer, hard to pack, large stones.	Deep to water	Large stones, slow intake, depth to rock.	Large stones, depth to rock, percs slowly.	Large stones, depth to rock, percs slowly.
BtG:* 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.
Rock outcrop.						
Real-----	Severe: depth to rock, slope, seepage.	Severe: thin layer, seepage.	Deep to water	Droughty, depth to rock, excess lime.	Slope, depth to rock.	Slope, depth to rock.
ByA, ByB----- Branyon	Slight-----	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
CaC3----- Castephen	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock, excess lime.

See footnote at end of table.

TABLE 12.--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
GrD:* Comfort-----	Severe: depth to rock.	Severe: thin layer, hard to pack, large stones.	Deep to water	Large stones, slow intake, depth to rock.	Large stones, depth to rock, percs slowly.	Large stones, depth to rock, percs slowly.
Rock outcrop.						
DeB----- Denton	Moderate: 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.
DeC3----- Denton	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
DoC----- Doss	Severe: depth to rock, seepage.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
FrG:* Eckrant-----	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.						
FeF4----- Ferris	Severe: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
GrC----- Gruene	Severe: seepage, cemented pan.	Severe: thin layer.	Deep to water	Slow intake, cemented pan, slope.	Cemented pan---	Cemented pan.
HeB----- Heiden	Slight-----	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
HeC3, HeD3----- Heiden	Slight-----	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly---	Percs slowly.
HgD----- Heiden	Slight-----	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
HoB, HvB----- Houston Black	Slight-----	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
HvD----- Houston Black	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly---	Percs slowly.
KrA, KrB----- Krum	Slight-----	Severe: hard to pack.	Deep to water	Slow intake---	Favorable-----	Favorable.
KrC----- Krum	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, slope.	Favorable-----	Favorable.
LeA, LeB----- Lewisville	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Slow intake---	Erodes easily	Erodes easily.
MEC:* Medlin-----	Slight-----	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly---	Percs slowly.

See footnote at end of table.

TABLE 12.--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
MEC:* Eckrant-----	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Deep to water	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
MED:* Medlin-----	Slight-----	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Eckrant-----	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Oa----- Oakalla	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Excess lime----	Favorable-----	Excess lime.
Ok*----- Oakalla	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Flooding, excess lime.	Flooding-----	Excess lime.
Or*----- Orif	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake, flooding.	Small stones---	Droughty.
PdB----- Pedernales	Slight-----	Moderate: hard to pack.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
Pt. Pits						
PuC----- Purves	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slow intake, depth to rock, slope.	Depth to rock	Depth to rock.
RaD----- Real	Severe: depth to rock, seepage.	Severe: thin layer, seepage.	Deep to water	Droughty, depth to rock, excess lime.	Depth to rock	Depth to rock.
RcD:* Real-----	Severe: depth to rock, seepage.	Severe: thin layer, seepage.	Deep to water	Droughty, depth to rock, excess lime.	Depth to rock	Depth to rock.
Comfort-----	Severe: depth to rock.	Severe: thin layer, hard to pack, large stones.	Deep to water	Large stones, slow intake, depth to rock.	Large stones, depth to rock, percs slowly.	Large stones, depth to rock, percs slowly.
Doss-----	Severe: depth to rock, seepage.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
RUD:* Rumple-----	Moderate: depth to rock, seepage.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock	Depth to rock.
Comfort-----	Severe: depth to rock.	Severe: thin layer, hard to pack, large stones.	Deep to water	Large stones, slow intake, depth to rock.	Large stones, depth to rock, percs slowly.	Large stones, depth to rock, percs slowly.
SeB----- Seawillow	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable-----	Favorable-----	Excess lime.
SeD----- Seawillow	Moderate: seepage.	Moderate: piping.	Deep to water	Slope-----	Favorable-----	Excess lime.

See footnote at end of table.

TABLE 12.--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
SuA----- Sunev	Moderate: seepage.	Moderate: piping.	Deep to water	Excess lime----	Favorable-----	Excess lime.
SuB----- Sunev	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, excess lime.	Favorable-----	Excess lime.
TaB----- Tarpley	Severe: depth to rock, seepage.	Severe: thin layer, hard to pack.	Deep to water	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
Tn----- Tinn	Slight-----	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--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	
AgC3, AgD3----- Altoga	0-13	Silty clay-----	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	70-99	33-52	17-33
	13-60	Silty clay, silty clay loam, clay loam.	CL	A-6, A-7-6	0	95-100	95-100	90-100	58-99	34-48	18-33
AnA, AnB----- Anhalt	0-18	Clay-----	CH	A-7-6	0-10	85-100	85-100	85-100	80-100	51-70	35-53
	18-28	Clay-----	CH	A-7-6	0-10	85-100	85-100	85-100	80-95	68-88	45-62
	28-35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
AuB,* AuC3:* Austin-----	0-11	Silty clay-----	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-96	45-69	25-44
	11-24	Silty clay, clay, silty clay loam.	CH, CL	A-7-6, A-6	0-5	95-100	90-100	80-100	75-96	35-65	16-40
	24-34	Weathered bedrock	---	---	---	---	---	---	---	---	---
Castephen-----	0-15	Clay loam-----	CL, CH	A-6, A-7-6	0-2	80-95	60-95	55-92	51-85	30-55	15-38
	15-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
BoB----- Boerne	0-65	Fine sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-100	75-100	70-95	38-75	22-35	4-15
BrB----- Bolar	0-14	Clay loam-----	CL, SC, CH	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-57	9-34
	14-28	Clay loam, loam, silty clay loam.	CL, SC, CH	A-6, A-7	0-10	75-98	75-95	70-90	40-80	25-60	11-38
	28-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
BtD:* Brackett-----	0-17	Gravelly 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
	17-18	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Comfort-----	0-4	Extremely stony clay.	CH, GC, SC, CL	A-2-7, A-7-6	20-70	45-98	40-98	35-95	30-90	41-65	25-45
	4-11	Stony clay, very stony clay, extremely stony clay.	CH, GC, SC	A-7-6, A-2-7	30-70	45-98	40-98	35-97	30-95	60-90	45-65
	11-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
BtG:* Brackett-----	0-14	Gravelly 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
	14-18	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Real-----	0-12	Gravelly clay loam.	GC, SC, GP-GC, SP-SC	A-2-6, A-2-4	1-10	25-75	10-50	10-45	10-35	25-35	8-15
	12-36	Variable, weathered bedrock.	---	---	---	---	---	---	---	---	---
ByA, ByB----- Branyon	0-60	Clay-----	CH	A-7-6	0	95-100	85-100	80-100	75-100	54-80	35-55
	60-80	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

See footnote at end of table.

TABLE 13.--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	
CaC3----- Castephen	0-16	Clay loam-----	CL, CH	A-6, A-7-6	0-2	80-95	60-95	55-92	51-85	30-55	15-38
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CrD:* Comfort-----	0-6	Extremely stony clay.	CH, GC, SC, CL	A-2-7, A-7-6	20-70	45-98	40-98	35-95	30-90	41-65	25-45
	6-13	Stony clay, very stony clay, extremely stony clay.	CH, GC, SC	A-7-6, A-2-7	30-70	45-98	40-98	35-97	30-95	60-90	45-65
	13-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
DeB, DeC3----- Denton	0-25	Silty clay-----	CH, CL	A-7-6	0-10	80-100	80-100	80-100	75-95	49-70	26-45
	25-36	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-20	80-100	80-100	80-100	70-95	41-60	21-40
	36-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
DoC----- Doss	0-18	Silty clay, clay loam.	CL, CH	A-7-6	0-20	84-100	81-100	75-100	61-95	41-61	20-39
	18-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ErG:* Eckrant-----	0-10	Extremely stony clay.	GC, SC, CH	A-7-6, A-2-7	25-75	45-98	40-98	35-97	30-94	51-76	31-54
	10-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
FeF4----- Ferris	0-60	Clay-----	CH	A-7-6	0	95-100	95-100	75-100	75-100	51-76	35-55
GrC----- Gruene	0-13	Clay-----	CH, CL	A-7-6, A-6	0-5	75-98	75-95	60-90	51-80	36-55	15-31
	13-22	Cemented-----	---	---	---	---	---	---	---	---	---
	22-80	Variable-----	---	---	---	---	---	---	---	---	---
HeB, HeC3, HeD3-- Heiden	0-16	Clay-----	CH	A-7-6	0	95-100	90-100	80-100	75-99	51-80	32-55
	16-80	Clay, shaly clay	CH, CL	A-7-6	0	90-100	90-100	75-100	70-99	50-80	32-55
HgD----- Heiden	0-22	Gravelly clay----	CH, GC	A-7-6, A-2-7	0-10	40-80	34-75	30-75	25-75	55-80	35-55
	22-80	Clay, silty clay	CH, CL	A-7-6	0	83-100	81-100	75-100	70-99	45-80	31-60
HoB----- Houston Black	0-25	Clay-----	CH	A-7-6	0	94-100	94-100	94-100	85-100	58-98	34-72
	25-77	Clay, silty clay	CH	A-7-6	0	94-100	93-100	92-100	85-100	58-100	34-75
HvB, HvD----- Houston Black	0-36	Gravelly clay----	CH, GC	A-7-6	0-5	55-80	50-75	50-75	45-75	58-90	34-65
	36-60	Clay, shaly clay	CH	A-7-6	0	94-100	93-100	92-100	85-100	58-100	34-75
KrA, KrB, KrC---- Krum	0-16	Clay-----	CH, CL	A-7-6	0	95-100	85-100	85-100	85-95	47-65	25-42
	16-66	Silty clay, clay	CH	A-7-6	0	95-100	85-100	80-100	65-95	51-74	28-50
	66-80	Silty clay loam, silty clay, clay.	CH, CL	A-7-6, A-6	0	85-100	75-100	70-99	65-95	36-60	20-39
LeA, LeB----- Lewisville	0-17	Silty clay-----	CL, CH	A-7	0	95-100	95-100	82-99	80-95	41-61	20-37
	17-36	Silty clay, clay loam, silty clay loam.	CL, CH	A-7	0	95-100	95-100	73-99	72-95	40-60	24-36
	36-61	Silty clay, clay loam, silty clay loam.	CL, CH, SC	A-6, A-7	0	80-100	65-99	56-98	41-95	30-57	12-36

See footnote at end of table.

TABLE 13.--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	
MEC:*											
Medlin-----	0-24	Clay-----	CH, CL	A-7-6	0	90-100	85-100	85-100	80-95	48-70	25-45
	24-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	90-100	85-100	75-100	70-95	35-55	15-44
Eckrant-----	0-17	Extremely stony clay.	GC, SC, CH	A-7-6, A-2-7	25-75	45-98	40-98	35-97	30-94	51-76	31-54
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MED:*											
Medlin-----	0-6	Stony clay	CH, CL	A-7-6	2-15	90-100	85-100	85-100	75-95	48-70	25-45
	6-80	Clay, silty clay	CL, CH	A-7-6, A-6	0	90-100	85-100	75-100	70-95	35-55	15-44
Eckrant-----	0-16	Extremely stony clay.	GC, SC	A-7-6	25-75	45-98	40-98	35-97	80-94	51-76	31-54
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Oa-----	0-72	Silty clay loam	CL, CH	A-6, A-7-6	0-2	85-100	80-100	70-100	64-95	25-54	14-36
Oakalla											
Ok*-----	0-80	Clay loam-----	CL, CH	A-6, A-7-6	0-2	85-100	80-100	70-100	64-95	25-54	14-36
Oakalla											
Or*-----	0-20	Gravelly loamy sand.	GM, GM-GC, SM, SM-SC	A-1-B, A-2-4	0-10	55-80	50-75	35-55	10-30	<20	NP-7
Orif											
	20-60	Stratified very gravelly sand to very gravelly loamy sand.	GW-GM, GM, SW-SM, SM	A-1-A, A-1-B	0-10	11-60	5-50	5-35	5-20	<20	NP-4
PdB-----	0-12	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0	95-100	90-100	75-100	33-55	<25	NP-7
Pedernales											
	12-40	Sandy clay, clay	CH, CL, SC	A-7, A-6	0	90-100	90-100	80-100	45-75	38-60	20-36
	40-45	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-6, A-7	0-5	90-100	90-100	80-100	36-75	32-55	13-30
Pt. Pits											
PuC-----	0-10	Clay-----	CH	A-7-6	0-5	90-100	80-100	80-95	70-95	51-65	30-40
Purves											
	10-19	Gravelly clay, very gravelly clay, gravelly clay loam.	CH, SC, GC	A-7-6	0-35	60-100	60-100	55-95	45-90	51-65	30-40
	19-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RaD-----	0-9	Gravelly loam----	GC, SC, GP-GC, SP-SC	A-2-6, A-2-4	1-10	25-75	10-50	10-45	10-35	25-35	8-15
Real											
	9-14	Variable, weathered bedrock.	---	---	---	---	---	---	---	---	---
RcD:*											
Real-----	0-8	Gravelly loam.	GC, SC, GP-GC, SP-SC	A-2-6, A-2-4	1-10	25-75	10-50	10-45	10-35	25-35	8-15
	8-15	Variable, weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--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	
RcD:*											
Comfort-----	0-6	Extremely stony clay, very stony clay.	CH, GC, SC, CL	A-2-7, A-7-6	20-70	45-98	40-98	35-95	30-90	41-65	25-45
	6-13	Stony clay, very stony clay, extremely stony clay.	CH, GC, SC	A-7-6, A-2-7	30-70	45-98	40-98	35-97	30-95	60-90	45-65
	13-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Doss-----	0-12	Clay loam-----	CL, CH	A-7-6	0-20	84-100	81-100	75-100	61-95	41-61	20-39
	12-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RUD:*											
Rumple-----	0-10	Very cherty clay loam.	GC, CL, SC	A-2-6, A-6	0-10	40-90	35-90	35-80	25-75	30-40	13-22
	10-28	Very cherty clay, extremely stony clay.	GC, SC	A-2-7	0-10	20-75	13-50	13-40	13-35	41-86	20-60
	28-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Comfort-----	0-7	Extremely stony clay.	CH, GC, SC, CL	A-2-7, A-7-6	20-70	45-98	40-98	35-95	30-90	41-65	25-45
	7-12	Stony clay, very stony clay, extremely stony clay.	CH, GC, SC	A-7-6, A-2-7	30-70	45-98	40-98	35-97	30-95	60-90	45-65
	12-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SeB, SeD-----											
Seawillow-----	0-26	Clay loam-----	CL	A-7-6, A-6	0-5	80-100	75-100	75-100	51-90	29-46	14-30
	26-48	Clay loam, silty clay loam.	CL, ML	A-4, A-6	0-5	75-100	65-100	60-100	51-75	27-41	10-25
SuA-----											
Sunev-----	0-15	Silty clay loam	CL, SC, CH	A-6, A-7-6	0	90-100	80-100	80-100	60-80	30-51	12-32
	15-33	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	85-100	80-100	70-100	51-85	28-40	8-20
	33-65	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	80-100	70-100	65-100	51-61	25-40	8-20
SuB-----											
Sunev-----	0-11	Clay loam-----	CL, SC, CH	A-6, A-7-6	0	90-100	80-100	80-100	60-80	30-51	12-32
	11-35	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	85-100	80-100	70-100	51-85	28-40	8-20
	35-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	80-100	70-100	65-100	51-61	25-40	8-20
TaB-----											
Tarpley-----	0-6	Clay-----	CL, CH	A-7	0-3	90-100	90-100	80-95	70-90	41-60	20-38
	6-17	Clay-----	CH	A-7	0	90-100	90-100	90-100	65-98	51-80	30-55
	17-21	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Tn-----											
Tinn-----	0-25	Clay-----	CH, CL	A-7	0	95-100	95-100	85-100	80-100	45-75	25-54
	25-80	Clay, silty clay	CH	A-7	0	95-100	90-100	80-100	80-100	55-75	35-54

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "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	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
AgC3, AgD3----- Altoga	0-13 13-60	35-50 35-50	0.6-2.0 0.6-2.0	0.15-0.18 0.15-0.18	7.9-8.4 7.9-8.4	High----- Moderate-----	0.32 0.32	5	<2
AnA, AnB----- Anhalt	0-18 18-28 28-35	--- --- ---	<0.06 <0.06 ---	0.15-0.18 0.15-0.18 ---	6.1-8.4 6.1-8.4 ---	High----- Very high----- -----	0.32 0.32 ---	2	---
AuB,* AuC3:* Austin-----	0-11 11-24 24-34	35-55 35-55 ---	0.2-0.6 0.2-0.6 ---	0.15-0.20 0.15-0.20 ---	7.9-8.4 7.9-8.4 ---	High----- Moderate----- -----	0.32 0.32 ---	2	1-4
Castephen-----	0-15 15-18	24-43 ---	0.6-2.0 ---	0.08-0.14 ---	7.9-8.4 ---	Moderate----- -----	0.32 ---	1	1-3
BoB----- Boerne	0-65	12-23	2.0-6.0	0.10-0.15	7.9-8.4	Low-----	0.28	5	.5-1
BrB----- Bolar	0-14 14-28 28-30	25-40 25-40 ---	0.6-2.0 0.6-2.0 ---	0.11-0.20 0.11-0.20 ---	7.9-8.4 7.9-8.4 ---	Moderate----- Moderate----- -----	0.32 0.17 ---	2	1-3
BtD:* Brackett-----	0-17 17-18	15-35 ---	0.2-0.6 ---	0.10-0.20 ---	7.9-8.4 ---	Low-----	0.17	2	<1
Rock outcrop.									
Comfort-----	0-4 4-11 11-20	35-50 55-75 ---	0.06-0.2 0.06-0.2 ---	0.07-0.15 0.07-0.15 ---	6.6-8.4 6.6-8.4 ---	Low----- Moderate----- -----	0.10 0.10 ---	1	1-4
BtG:* Brackett-----	0-14 14-18	15-35 ---	0.2-0.6 ---	0.10-0.20 ---	7.9-8.4 ---	Low-----	0.17	2	<1
Rock outcrop.									
Real-----	0-12 12-36	22-40 ---	0.6-2.0 ---	0.05-0.10 ---	7.9-8.4 ---	Low-----	0.10	1	1-4
ByA, ByB----- Branyon	0-60 60-80	45-60 30-60	<0.06 <2.0	0.15-0.18 0.11-0.18	7.9-8.4 7.9-8.4	Very high----- Very high-----	0.32 0.32	5	2-4
CaC3----- Castephen	0-16 16-20	24-43 ---	0.6-2.0 ---	0.08-0.14 ---	7.9-8.4 ---	Moderate----- -----	0.32 ---	1	1-3
CrD:* Comfort-----	0-6 6-13 13-20	35-50 55-75 ---	0.06-0.2 0.06-0.2 ---	0.07-0.15 0.07-0.15 ---	6.6-8.4 6.6-8.4 ---	Low----- Moderate----- -----	0.10 0.10 ---	1	1-4
Rock outcrop.									
DeB, DeC3----- Denton	0-25 25-36 36-40	35-60 35-60 ---	0.06-0.2 0.06-0.2 ---	0.15-0.20 0.15-0.20 ---	7.9-8.4 7.9-8.4 ---	High----- High----- -----	0.32 0.32 ---	2	1-4
DoC----- Doss	0-18 18-24	32-48 ---	0.2-0.6 ---	0.15-0.20 ---	7.9-8.4 ---	Moderate----- -----	0.24 ---	1	1-3

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
ErG:* Eckrant-----	0-10 10-20	35-60 ---	0.2-0.6 ---	0.05-0.12 ---	6.6-8.4 ---	Moderate-----	0.10	1	---
Rock outcrop.									
FeF4----- Ferris	0-60	40-60	<0.06	0.15-0.18	7.9-8.4	Very high-----	0.32	4	.5-2
GrC----- Gruene	0-13 13-22 22-80	35-50 ---	0.2-0.6 ---	0.12-0.18 ---	6.6-8.4 ---	Moderate-----	0.28	1	1-3
HeB, HeC3, HeD3-- Heiden	0-22 22-80	40-60 40-60	<0.06 <0.06	0.15-0.20 0.12-0.20	7.9-8.4 7.9-8.4	Very high----- Very high-----	0.32 0.32	5	1-4
HgD----- Heiden	0-16 16-80	40-60 40-60	<0.06 <0.06	0.09-0.18 0.12-0.20	7.9-8.4 7.9-8.4	Very high----- Very high-----	0.20 0.32	5	1-3
HoB----- Houston Black	0-25 25-77	40-60 40-60	<0.06 <0.06	0.15-0.20 0.15-0.20	7.4-8.4 7.4-8.4	Very high----- Very high-----	0.32 0.32	5	1-4
HvB, HvD----- Houston Black	0-36 36-60	40-60 40-60	<0.06 <0.06	0.11-0.18 0.15-0.20	7.4-8.4 7.4-8.4	High----- Very high-----	0.20 0.32	5	1-4
KrA, KrB, KrC---- Krum	0-16 16-66 66-80	35-55 40-60 35-60	0.2-0.6 0.2-0.6 0.2-0.6	0.15-0.20 0.14-0.20 0.14-0.20	7.4-8.4 7.9-8.4 7.9-8.4	High----- High----- High-----	0.32 0.32 0.32	5	1-3
LeA, LeB----- Lewisville	0-17 17-36 36-61	28-45 30-45 30-50	0.6-2.0 0.6-2.0 0.6-2.0	0.16-0.20 0.14-0.18 0.14-0.18	7.9-8.4 7.9-8.4 7.9-8.4	High----- High----- High-----	0.32 0.37 0.37	5	1-3
MEC:* Medlin-----	0-24 24-80	40-60 40-60	<0.06 <0.06	0.12-0.18 0.12-0.18	7.4-8.4 7.4-8.4	High----- High-----	0.32 0.32	4	.5-2
Eckrant-----	0-17 17-20	35-60 ---	0.2-0.6 ---	0.05-0.12 ---	6.6-8.4 ---	Moderate-----	0.10	1	---
MED:* Medlin-----	0-6 6-80	40-60 40-60	<0.06 <0.06	0.10-0.18 0.12-0.18	7.4-8.4 7.4-8.4	High----- High-----	0.20 0.32	4	.5-2
Eckrant-----	0-16 16-20	35-60 ---	0.2-0.6 ---	0.05-0.12 ---	6.6-8.4 ---	Moderate-----	0.10	1	---
Oa, Ok*----- Oakalla	0-80	25-43	0.6-2.0	0.12-0.19	7.9-8.4	Moderate-----	0.32	5	1-3
Or*----- Orif	0-20 20-60	---	6.0-20 6.0-20	0.03-0.08 0.03-0.08	7.9-8.4 7.9-8.4	Low----- Low-----	0.10 0.10	5	---
PdB----- Pedernales	0-12 12-40 40-45	5-20 35-55 20-50	0.6-2.0 0.2-0.6 0.2-0.6	0.12-0.17 0.15-0.20 0.15-0.20	6.1-7.8 6.1-7.8 7.9-8.4	Low----- Moderate----- Moderate-----	0.32 0.28 0.28	5	<1
Pt. Pits									
PuC----- Purves	0-10 10-19 19-20	35-55 35-55 ---	0.2-0.6 0.2-0.6 ---	0.12-0.18 0.08-0.18 ---	7.9-8.4 7.9-8.4 ---	High----- High----- ---	0.32 0.32 ---	1	1-3
RaD----- Real	0-9 9-14	22-40 ---	0.6-2.0 ---	0.05-0.10 ---	7.9-8.4 ---	Low----- ---	0.10 ---	1	1-4

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
RcD:*									
Real-----	0-8 8-15	22-40 ---	0.6-2.0 ---	0.05-0.10 ---	7.9-8.4 ---	Low----- -----	0.10 ---	1	1-4
Comfort-----	0-6 6-13 13-20	35-50 55-75 ---	0.06-0.2 0.06-0.2 ---	0.07-0.15 0.07-0.15 ---	6.6-8.4 6.6-8.4 ---	Low----- Moderate----- -----	0.10 0.10 ---	1	1-4
Doss-----	0-12 12-24	32-48 ---	0.2-0.6 ---	0.15-0.20 ---	7.9-8.4 ---	Moderate----- -----	0.24 ---	1	1-3
RUD:*									
Rumple-----	0-10 10-28 28-36	20-40 40-80 ---	0.2-0.6 0.2-0.6 ---	0.08-0.16 0.05-0.15 ---	6.1-7.8 6.1-8.4 ---	Low----- Moderate----- -----	0.17 0.10 ---	2	1-3
Comfort-----	0-7 7-12 12-20	35-50 55-75 ---	0.06-0.2 0.06-0.2 ---	0.07-0.15 0.07-0.15 ---	6.6-8.4 6.6-8.4 ---	Low----- Moderate----- -----	0.10 0.10 ---	1	1-4
SeB, SeD-----	0-26 26-48	27-40 ---	0.6-2.0 0.6-2.0	0.12-0.20 0.12-0.18	7.9-8.4 7.9-8.4	Moderate----- Low-----	0.32 0.32	5	<1
SuA, SuB-----	0-15 15-33 33-65	20-40 20-40 20-40	0.6-2.0 0.6-2.0 0.6-2.0	0.11-0.16 0.11-0.16 0.11-0.16	7.9-8.4 7.9-8.4 7.9-8.4	Low----- Low----- Low-----	0.28 0.28 0.28	5	1-3
TaB-----	0-6 6-17 17-21	30-50 60-80 ---	0.2-0.6 0.06-0.2 ---	0.15-0.20 0.12-0.18 ---	6.1-7.8 6.1-7.8 ---	High----- Very high----- -----	0.32 0.32 ---	1	1-4
Tn-----	0-25 25-80	35-60 40-60	0.06-0.2 <0.06	0.15-0.20 0.15-0.20	7.4-8.4 7.4-8.4	High----- High-----	0.32 0.32	5	1-4

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and terms such as "rare," "brief," and "frequent" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydro-logic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
AgC3, AgD3----- Altoga	C	None-----	---	---	In >60	---	In ---	---	High-----	Low.
AnA, AnB----- Anhalt	D	None-----	---	---	20-40	Hard	---	---	High-----	Low.
AuB,* AuC3:* Austin-----	C	None-----	---	---	20-40	Soft	---	---	High-----	Low.
Castephen-----	C	None-----	---	---	8-20	Soft	---	---	High-----	Low.
BoB----- Boerne	B	Rare-----	---	---	>60	---	---	---	Moderate	Low.
BrB----- Bolar	C	None-----	---	---	25-40	Soft	---	---	High-----	Low.
BtD:* Brackett----- Rock outcrop.	C	None-----	---	---	11-20	Soft	---	---	High-----	Low.
Comfort-----	D	None-----	---	---	9-20	Hard	---	---	High-----	Low.
BtG:* Brackett----- Rock outcrop.	C	None-----	---	---	11-20	Soft	---	---	High-----	Low.
Real-----	D	None-----	---	---	8-16	Soft	---	---	High-----	Low.
ByA, ByB----- Branyon	D	None-----	---	---	>60	---	---	---	High-----	Low.
CaC3----- Castephen	C	None-----	---	---	8-20	Soft	---	---	High-----	Low.
CrD:* Comfort----- Rock outcrop.	D	None-----	---	---	9-20	Hard	---	---	High-----	Low.
DeB, DeC3----- Denton	D	None-----	---	---	24-40	Soft	---	---	High-----	Low.
DoC----- Doss	C	None-----	---	---	11-20	Soft	---	---	High-----	Low.
ErG:* Eckrant----- Rock outcrop.	D	None-----	---	---	4-20	Hard	---	---	High-----	Low.
FeF4----- Ferris	D	None-----	---	---	>60	---	---	---	High-----	Low.
GrC----- Gruene	D	None-----	---	---	>60	---	7-16	Thin	High-----	Low.
HeB, HeC3, HeD3, HgD----- Heiden	D	None-----	---	---	>60	---	---	---	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydro-logic group	Flooding			Bedrock		Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness	Depth	Hardness	Uncoated steel	Concrete
HoB, HvB, HvD----- Houston Black	D	None-----	---	---	<u>In</u> >60	---	<u>In</u> ---	---	High-----	Low.
KrA, KrB, KrC----- Krum	D	None-----	---	---	>60	---	---	---	High-----	Low.
LeA, LeB----- Lewisville	B	None-----	---	---	>60	---	---	---	High-----	Low.
MEC,* MED:* Medlin-----	D	None-----	---	---	>60	---	---	---	High-----	Low.
Eckrant-----	D	None-----	---	---	4-20	Hard	---	---	High-----	Low.
Oa----- Oakalla	B	Rare-----	---	---	>60	---	---	---	Moderate	Low.
Ok*----- Oakalla	B	Frequent---	Very brief	May-Sep	>60	---	---	---	Moderate	Low.
Or*----- Orif	A	Frequent---	Very brief	Sep-Jun	>60	---	---	---	Low-----	Low.
PdB----- Pedernales	C	None-----	---	---	>60	---	---	---	High-----	Low.
Pt. Pits										
PuC----- Purves	D	None-----	---	---	8-20	Hard	---	---	High-----	Low.
RaD----- Real	D	None-----	---	---	8-16	Soft	---	---	High-----	Low.
RcD:* Real-----	D	None-----	---	---	8-16	Soft	---	---	High-----	Low.
Comfort-----	D	None-----	---	---	9-20	Hard	---	---	High-----	Low.
Doss-----	C	None-----	---	---	11-20	Soft	---	---	High-----	Low.
RUD:* Rumple-----	C	None-----	---	---	20-40	Hard	---	---	High-----	Low.
Comfort-----	D	None-----	---	---	9-20	Hard	---	---	High-----	Low.
SeB, SeD----- Seawillow	B	None-----	---	---	>60	---	---	---	Moderate	Low.
SuA, SuB----- Sunev	B	None-----	---	---	>60	---	---	---	Moderate	Low.
TaB----- Tarpley	D	None-----	---	---	13-20	Hard	---	---	High-----	Low.
Tn----- Tinn	D	Frequent---	Brief-----	Feb-May	>60	---	---	---	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution									Liquid limit ²	Plasticity index ²	Specific gravity	Shrinkage			
			Percentage passing sieve ¹ --				Percentage smaller than--								Limit	Linear	Ratio	
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm							Pct
Altoga silty clay: ³ (S72TX-105-002)																		
A1----- 0 to 6	A-6 (12)	CL	--	100	99	99	97	78	66	37	26	33	17	2.66	15.0	8.9	1.85	
B2----- 6 to 38	A-6 (20)	CL	--	100	100	100	99	90	85	55	38	40	22	2.66	17.0	11.0	1.82	
C----- 38 to 55	A-6 (21)	CL	--	100	100	99	98	87	79	52	36	40	25	2.67	15.0	12.0	1.82	
Boerne fine sandy loam: ⁴ (S79TX-209-002)																		
A----- 5 to 17	A-4 (00)	SM-SC	--	100	100	100	94	38	27	15	9	25	6	2.66	17.0	4.6	1.81	
B22ca---- 26 to 41	A-4 (01)	SC	--	100	100	100	93	43	33	18	14	26	8	2.70	18.0	4.3	1.82	
Cca----- 41 to 65	A-6 (02)	SC	--	100	100	100	92	49	39	19	11	28	11	2.71	17.0	6.2	1.85	
Rolar clay loam: ⁵ (S79TX-209-003)																		
A12----- 5 to 14	A-7-6(27)	CH	100	99	98	94	84	77	57	35	23	57	34	2.70	14.0	17.8	1.87	
B2ca----- 14 to 28	A-7-6(32)	CH	100	99	97	95	84	79	55	37	23	59	38	2.70	14.0	18.4	1.87	
Branyon clay: ⁶ (S72TX-105-005)																		
A11----- 0 to 24	A-7-6(50)	CH	100	100	100	100	98	96	92	63	50	68	46	2.69	12.0	22.3	2.01	
A12----- 24 to 30	A-7-6(52)	CH	100	100	100	99	98	97	95	71	57	68	48	2.74	12.0	22.3	2.01	
AC----- 30 to 75	A-7-6(53)	CH	100	100	100	99	97	96	93	67	53	70	49	2.76	13.0	22.4	2.00	
Ferris clay: ⁷ (S78TX-091-001)																		
A1----- 0 to 12	A-7-6(51)	CH	100	100	100	100	100	100	98	76	62	65	45	2.71	12.0	21.4	1.99	
AC1----- 12 to 24	A-7-6(51)	CH	100	100	100	99	95	94	92	73	61	68	48	2.77	12.0	22.2	2.01	
C2----- 41 to 60	A-7-6(54)	CH	100	100	100	100	99	99	97	75	63	67	48	2.74	14.0	20.9	1.93	
Krum clay: ⁸ (S72TX-105-002)																		
A1----- 0 to 24	A-7-6(42)	CH	100	100	99	97	96	94	89	58	48	61	40	2.68	14.0	19.8	1.97	
B2----- 24 to 54	A-7-6(36)	CH	100	99	96	92	90	87	83	60	50	59	39	2.72	13.0	19.6	2.00	
Lewisville silty clay: ⁹ (S78TX-209-001)																		
A11----- 5 to 18	A-7-6(37)	CH	100	100	100	100	99	93	89	54	38	59	34	2.65	17.0	17.8	1.85	
B21ca---- 28 to 38	A-6 (19)	CL	100	100	99	98	96	80	79	49	36	40	24	2.68	15.0	11.9	1.89	
Lewisville silty clay: ¹⁰ (S79TX-209-004)																		
A1----- 7 to 17	A-7-6(36)	CH	100	100	100	100	99	94	86	52	37	57	33	2.64	15.0	17.7	1.89	
B21ca---- 17 to 36	A-7-6(36)	CH	100	100	100	100	99	93	87	58	46	56	35	2.64	13.0	18.8	1.99	
B22ca---- 36 to 54	A-7-6(36)	CH	100	100	99	97	96	90	83	58	47	57	36	2.62	13.0	19.0	2.01	
Cca----- 54 to 61	A-7-6(19)	CH	98	89	80	75	72	64	42	29	8	51	32	2.66	14.0	16.8	1.96	
Medlin stony clay: ¹¹ (S78TX-091-002)																		
A1----- 0 to 8	A-7-6(22)	CL	100	99	97	93	87	82	77	50	37	48	26	2.63	12.0	16.0	1.94	
AC1----- 8 to 30	A-7-6(29)	CL	100	100	98	96	94	92	91	68	53	45	29	2.71	11.0	16.0	2.03	
C2----- 38 to 50	A-7-6(32)	CH	100	100	97	91	77	72	71	56	48	65	44	2.80	16.0	19.3	1.86	
Medlin clay: ¹² (S72TX-105-003)																		
A----- 0 to 4	A-7-6(31)	CH	97	95	92	89	85	81	80	58	48	57	37	2.73	16.0	16.8	1.84	
AC----- 4 to 60	A-7-6(24)	CH	100	99	97	91	80	72	70	50	43	55	35	2.77	16.0	16.5	1.88	

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution									Liquid limit ²	Plasticity index ²	Specific gravity	Shrinkage		
			Percentage passing sieve ¹⁻⁻						Percentage smaller than--						Limit	Linear	Ratio
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm						
Oakalla silty clay loam: ¹³ (S72TX-105-007)												Pct		G/cc	Pct	Pct	Pct
A1----- 0 to 20	A-7-6(30)	CH	100	100	100	99	98	86	76	34	23	54	32	2.66	16.0	16.0	1.84
A12-----20 to 34	A-7-6(24)	CH	100	100	100	99	94	75	66	23	14	53	31	2.64	18.0	14.8	1.78
C1-----34 to 74	A-7-6(18)	CL	100	100	99	97	83	64	69	37	30	49	32	2.69	15.0	14.8	1.86
Sunev silty clay loam: ¹⁴ (S78TX-209-002)																	
A11----- 5 to 15	A-6 (14)	CL	100	100	99	99	97	79	69	35	26	35	19	2.68	15.0	10.0	1.86
B21ca----15 to 33	A-6 (15)	CL	100	100	100	99	99	84	76	41	30	36	19	2.70	17.0	9.4	1.83
Tarpley clay: ¹⁵ (S72TX-105-008)																	
A1----- 0 to 6	A-7-6(25)	CL	96	95	94	93	91	87	83	53	45	46	26	2.67	14.0	14.5	1.88
B2t----- 6 to 14	A-7-6(32)	CH	99	99	98	97	95	93	90	71	64	55	30	2.68	16.0	16.4	1.85
Tinn clay: ¹⁶ (S72TX-105-006)																	
A11----- 0 to 27	A-7-6(45)	CH	100	100	100	99	97	95	91	59	49	64	42	2.71	12.0	20.8	1.98
A12-----27 to 52	A-7-6(43)	CH	100	100	99	97	94	92	91	62	52	63	43	2.70	14.0	20.3	1.97
C-----52 to 75	A-7-6(40)	CH	100	100	99	97	93	91	87	62	50	60	40	2.70	12.0	20.3	2.05
Tinn clay: ¹⁷ (S72TX-105-009)																	
A1----- 0 to 46	A-7-6(52)	CH	100	100	100	95	93	90	87	63	52	74	53	2.72	11.0	24.2	2.06
B2-----46 to 88	A-7-6(47)	CH	97	97	96	99	94	90	87	58	48	68	46	2.71	10.0	23.0	2.05
C-----88 to 96	A-7-6(42)	CH	100	100	100	91	84	80	79	55	44	72	49	2.72	11.0	23.8	2.06

¹For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves. This difference does not seriously affect the data.

²Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

³Altoga silty clay: 1.8 miles east of junction of Farm Road 621 and Texas 123 along Farm Road 621; 50 feet south.

⁴Boerne fine sandy loam: From I-35 and Texas 80 in San Marcos, 2.8 miles northeast on I-35 and 600 feet west.

⁵Bolar clay loam: 1,800 feet southwest of Owen Goodnight Junior High School and 100 feet east of I-35; in San Marcos.

⁶Branyon clay: 1,800 feet southwest of Owen Goodnight Junior High School and 100 feet east of I-35; in San Marcos.

⁷Ferris clay: From intersection of I-35 and Farm Road 725 in New Braunfels, 6 miles north on I-35, 0.7 mile southeast on Watson Lane, and 700 feet south.

⁸Krum clay: 300 feet west of Travis Elementary School on Lime Kiln Road and 50 feet south; in San Marcos.

⁹Lewisville silty clay: From intersection of I-35 and Center Street in Kyle, 1.2 miles west on Center Street, 2.4 miles south on county road, and 120 feet northwest.

¹⁰Lewisville silty clay: From intersection of Texas 21 and Texas 80 in San Marcos, 1.9 miles northeast on Texas 21, 0.7 mile northwest on county road, and 100 feet northeast.

¹¹Medlin stony clay: From intersection of I-35 and Farm Road 306 in New Braunfels, 2.5 miles northwest on Farm Road 306, 1.1 miles west on county road, and 186 feet south.

¹²Medlin clay: From Travis Elementary School in San Marcos, 1.7 miles northwest on Lime Kiln Road, 0.4 mile north on private road, and 300 feet west, in a pasture.

¹³Oakalla silty clay loam: 500 feet south of Cheatham Street bridge on San Marcos River in Rio Vista Park; in San Marcos.

¹⁴Sunev silty clay loam: Fine-silty taxadjunct to Sunev series. From intersection of Texas 80 and Texas 21 in San Marcos, 1.8 miles southeast on Texas 80, 0.1 mile south and 0.5 mile west on county road, and 85 feet north.

¹⁵Tarpley clay: From intersection of Bishop Street and Franklin Drive in San Marcos, 1 mile southwest on private road.

¹⁶Tinn clay: 500 feet west of San Marcos River Bridge on I-35; in San Marcos.

¹⁷Tinn clay: In softball field parking lot, across Hopkins Street from Catholic Church; in San Marcos.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Altoga-----	Fine-silty, carbonatic, thermic Typic Ustochrepts
Anhalt-----	Very-fine, montmorillonitic, thermic Udic Chromusterts
Austin-----	Fine-silty, carbonatic, thermic Entic Haplustolls
Boerne-----	Coarse-loamy, carbonatic, thermic Fluventic Ustochrepts
Bolar-----	Fine-loamy, carbonatic, thermic Typic Calciustolls
Brackett-----	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Branyon-----	Fine, montmorillonitic, thermic Udic Pellusterts
Castephen-----	Loamy, carbonatic, thermic, shallow Entic Haplustolls
Comfort-----	Clayey-skeletal, mixed, thermic Lithic Argiustolls
Denton-----	Fine, montmorillonitic, thermic Vertic Calciustolls
Doss-----	Loamy, carbonatic, thermic, shallow Typic Calciustolls
Eckrant-----	Clayey-skeletal, montmorillonitic, thermic Lithic Haplustolls
Ferris-----	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Gruenc-----	Clayey, mixed, thermic, shallow Petrocalcic Paleustolls
Heiden-----	Fine, montmorillonitic, thermic Udic Chromusterts
Houston Black-----	Fine, montmorillonitic, thermic Udic Pellusterts
Krum-----	Fine, montmorillonitic, thermic Vertic Haplustolls
Lewisville-----	Fine-silty, mixed, thermic Typic Calciustolls
Medlin-----	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Oakalla-----	Fine-loamy, carbonatic, thermic Cumulic Haplustolls
Orif-----	Sandy-skeletal, carbonatic, thermic Typic Ustifluvents
Pedernales-----	Fine, mixed, thermic Udic Paleustalfs
Purves-----	Clayey, montmorillonitic, thermic Lithic Calciustolls
Real-----	Loamy-skeletal, carbonatic, thermic, shallow Typic Calciustolls
Rumple-----	Clayey-skeletal, mixed, thermic Udic Argiustolls
Seawillow-----	Fine-loamy, carbonatic, thermic Typic Ustochrepts
*Suney-----	Fine-loamy, carbonatic, thermic Typic Calciustolls
Tarpley-----	Clayey, montmorillonitic, thermic Lithic Vertic Argiustolls
Tinn-----	Fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls

* 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.

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