# SOIL SURVEY OF
# Montague County, Texas

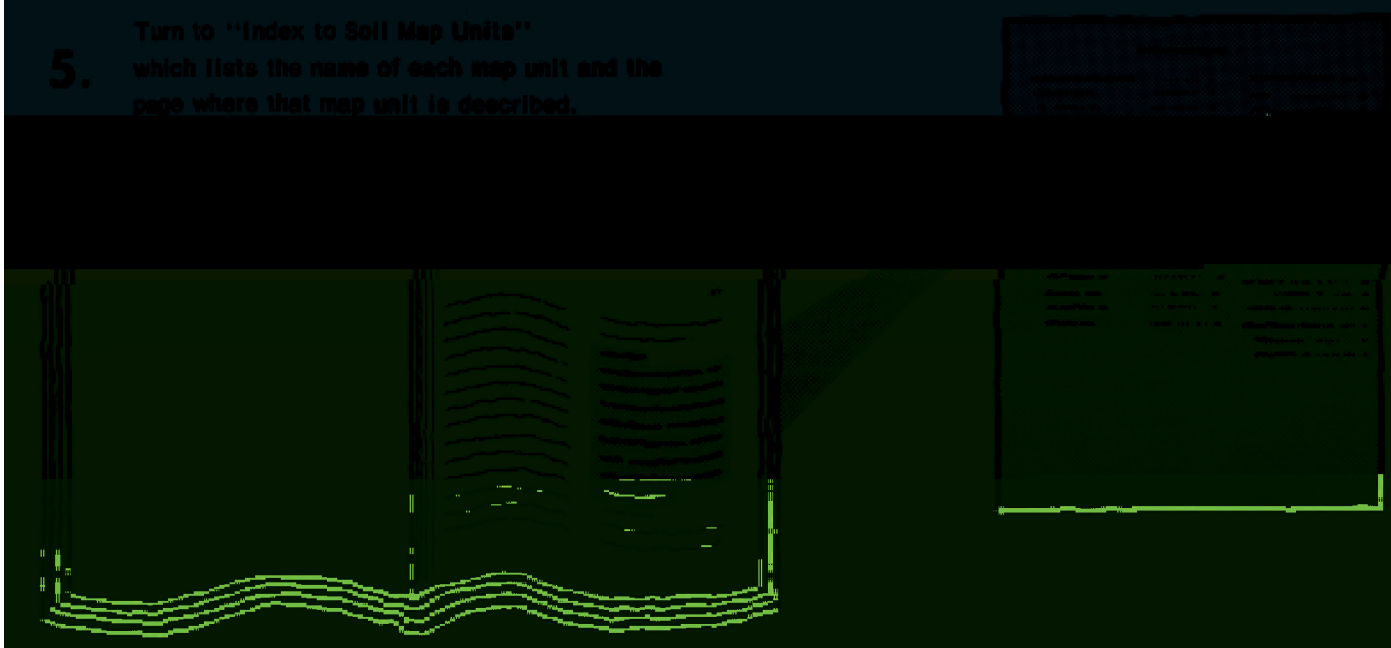
United States Department of Agriculture
Soil Conservation Service

In cooperation with
Texas Agricultural Experiment Station

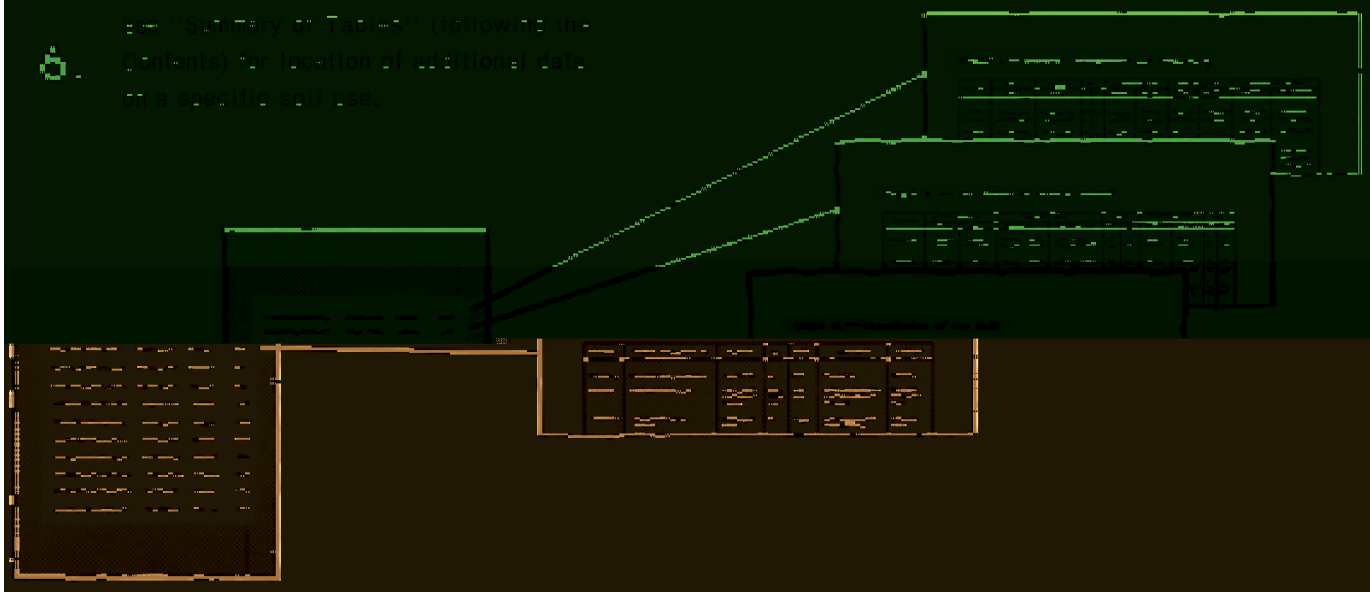
# HOW TO USE

# THIS SOIL SURVEY

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



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



"Contents" for each of the publication that will meet your specific needs.

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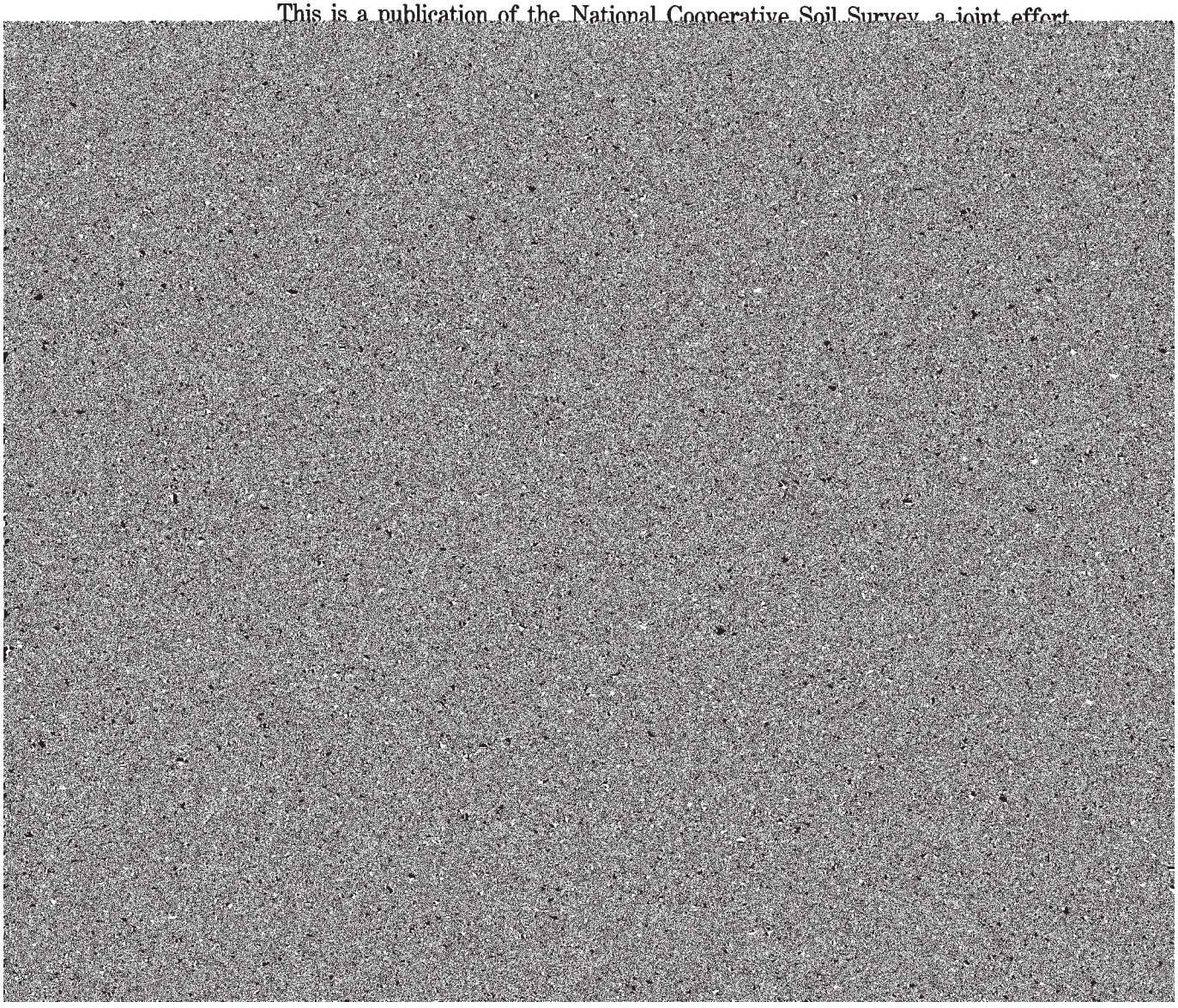

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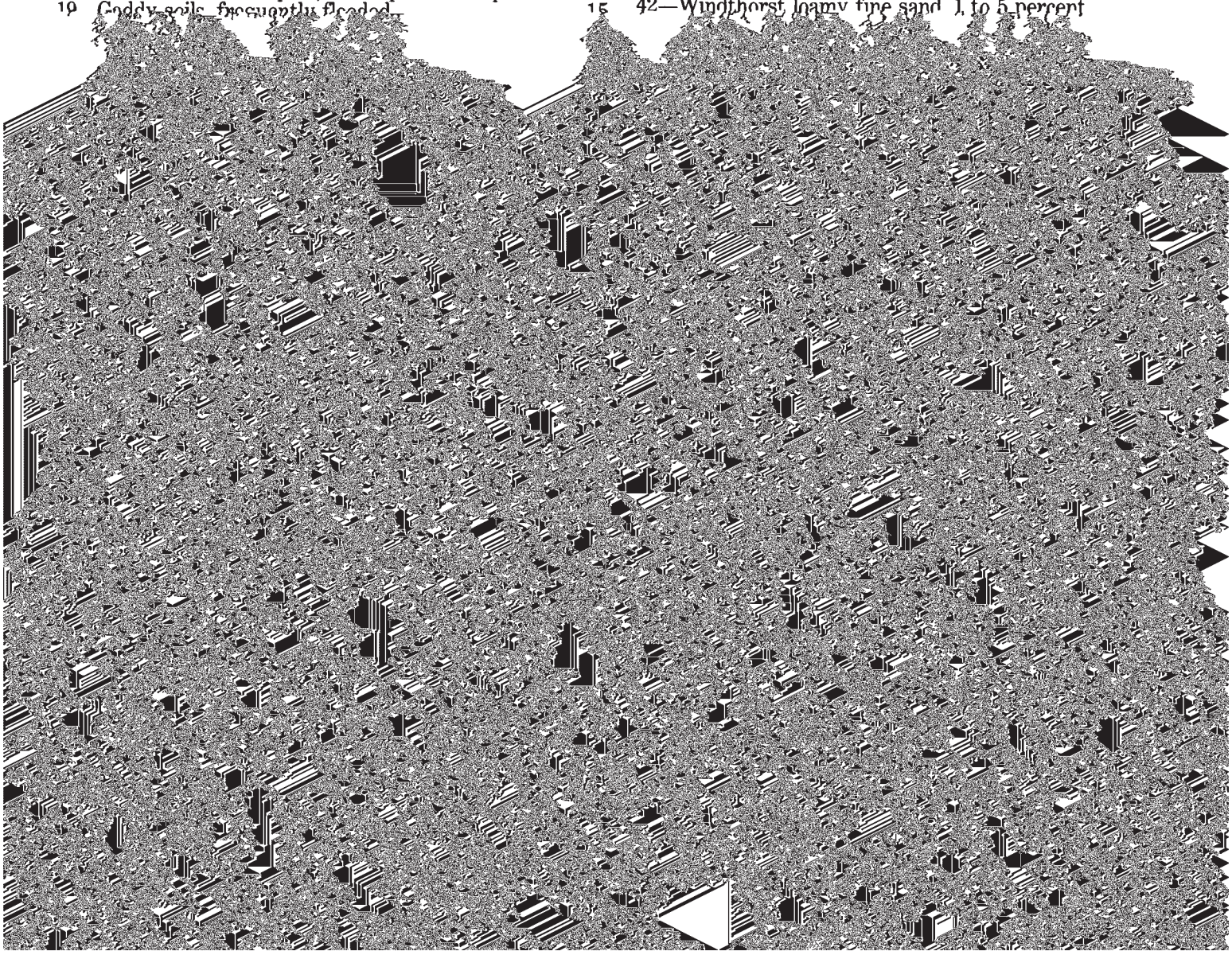

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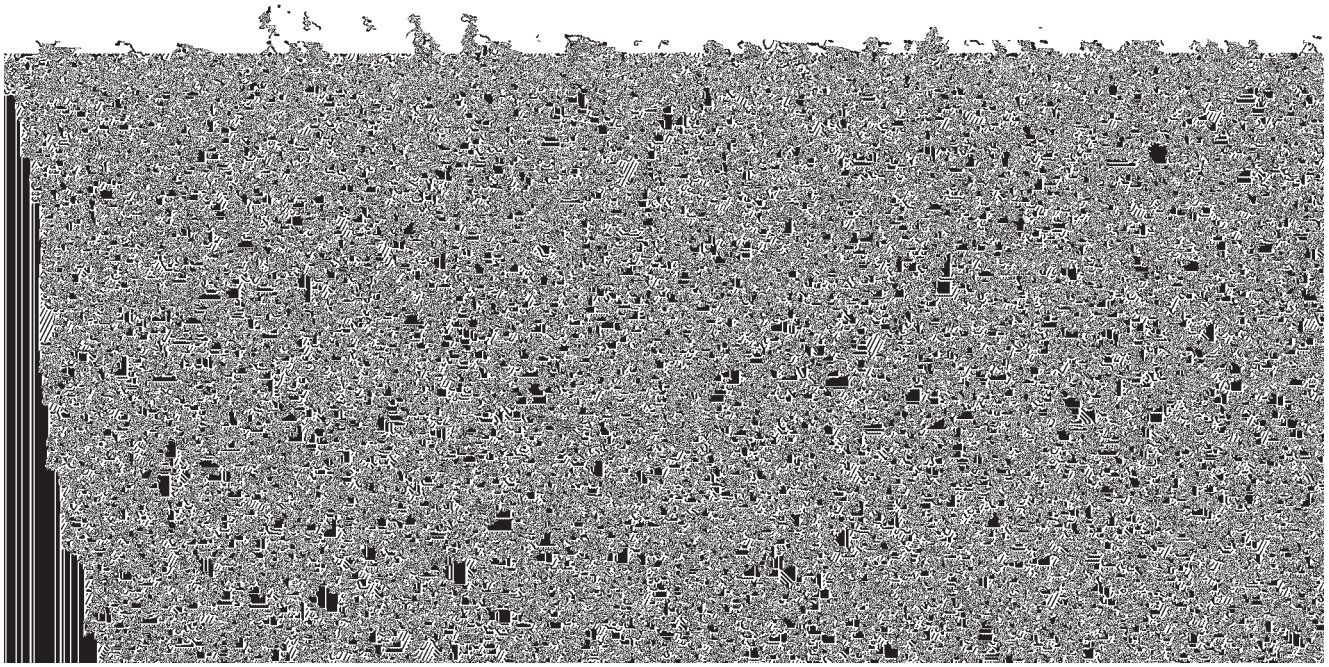

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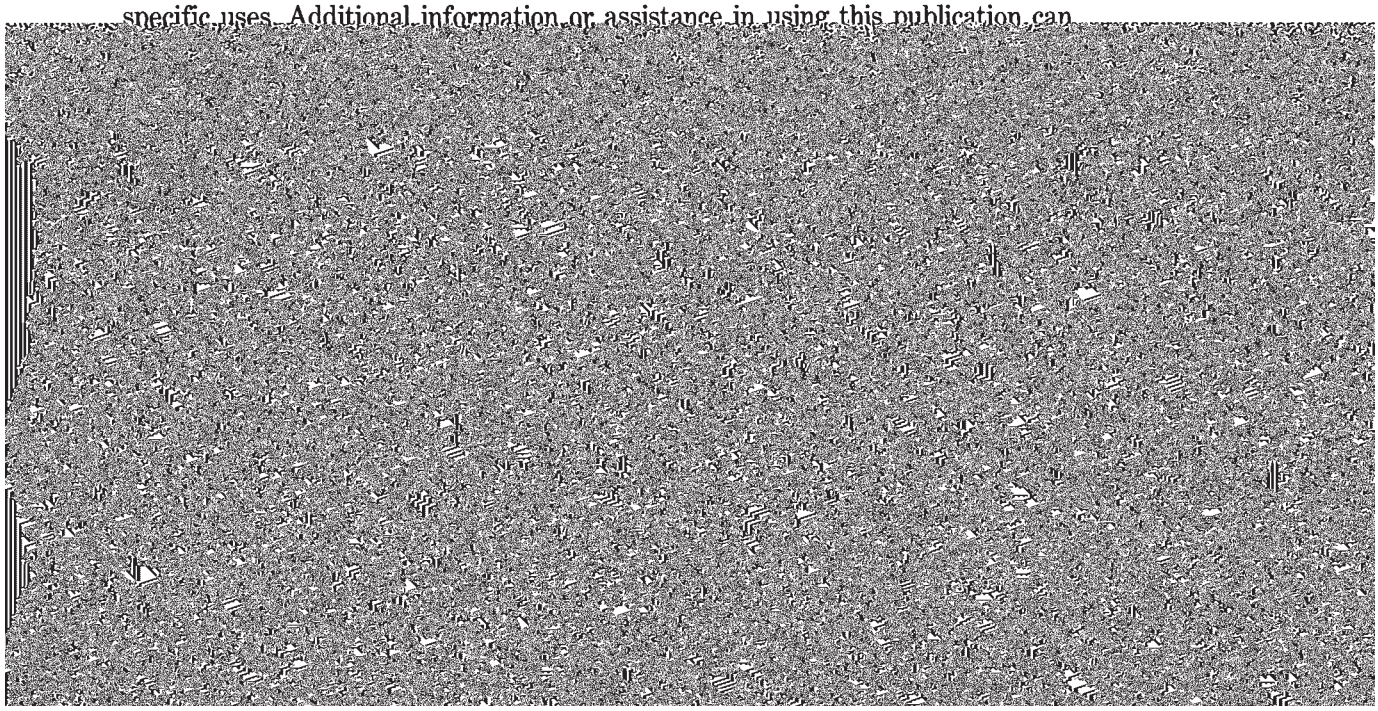
# Foreword

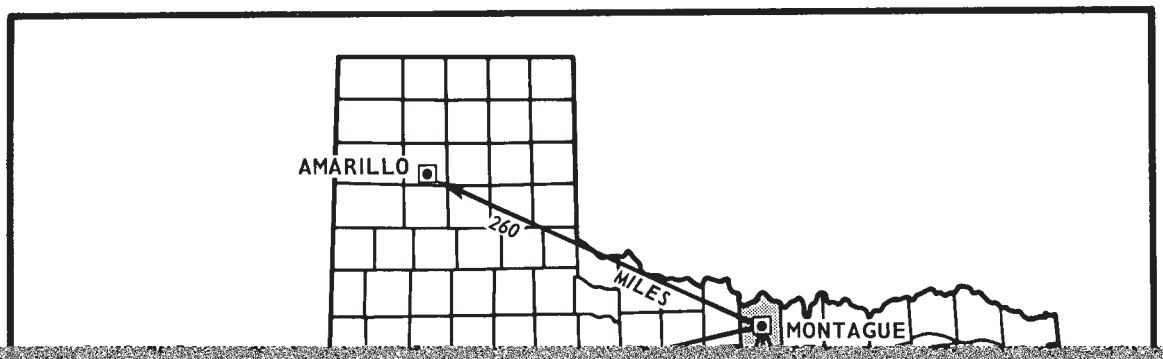
The Soil Survey of Montague County, Texas contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Many people assume that soils are all more or less alike. They are unaware that great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can

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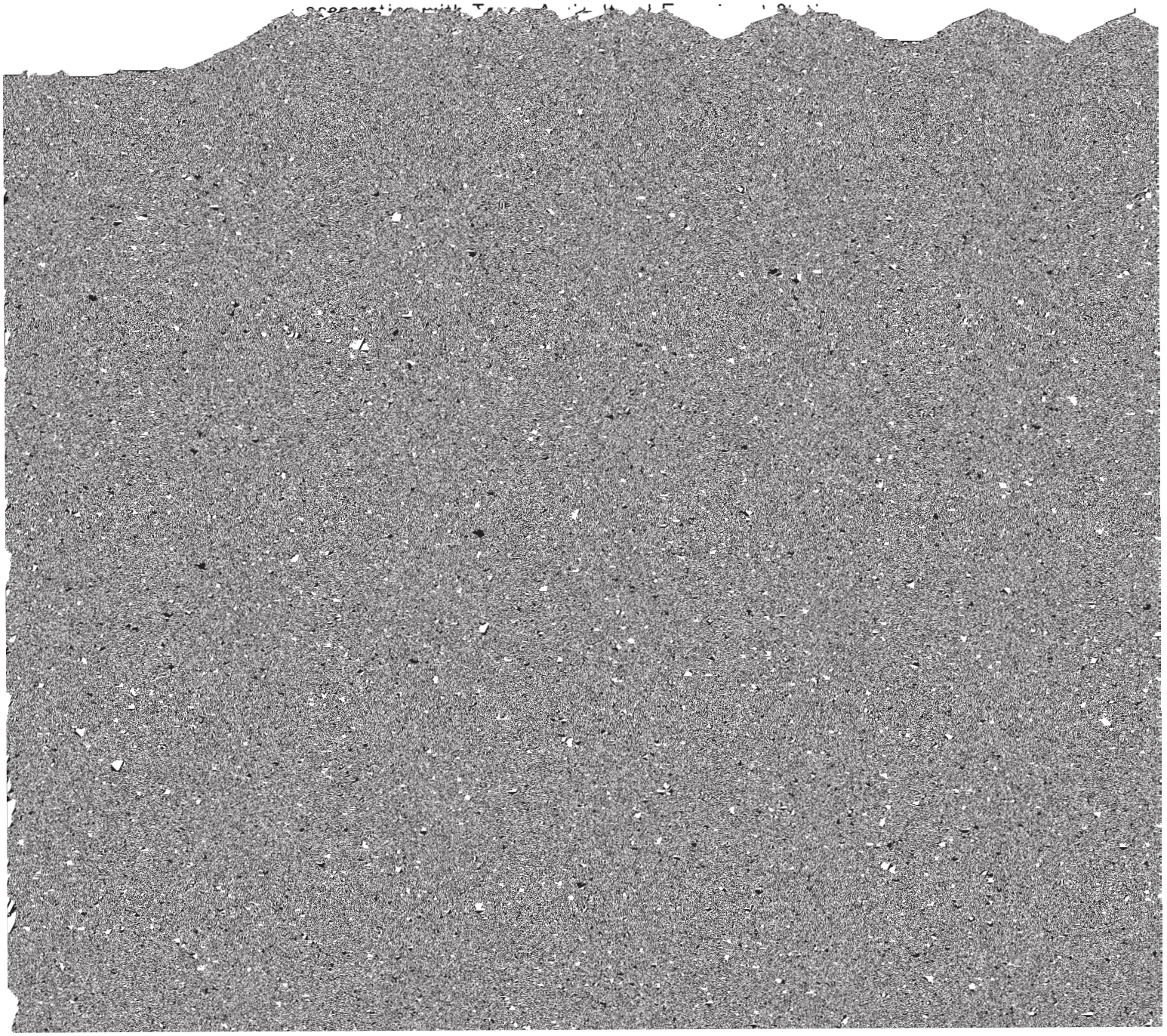
MILES
MONTAGUE

# SOIL SURVEY OF MONTAGUE COUNTY, TEXAS

By Dennis F. Clower, Soil Conservation Service

William J. Guckian, Billy J. Wagner, Rex A. Cockran, Charles R. Cail, Lee A. Putnam, and Lyle C. Lovelace, Soil Scientists, Soil Conservation Service, assisted in the field mapping

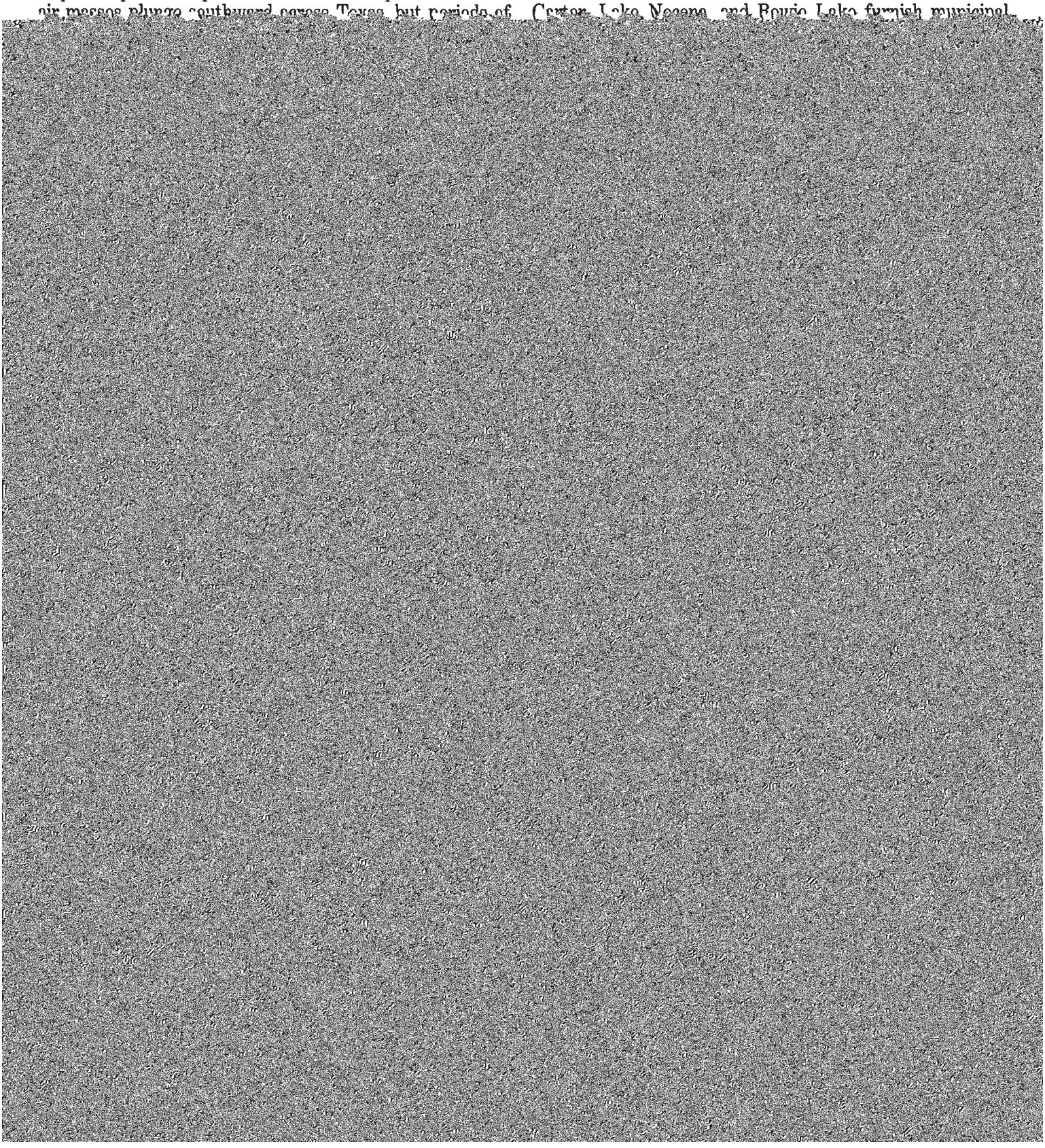
United States Department of Agriculture, Soil Conservation Service, in cooperation with Texas Agricultural Experiment Station



Winter temperatures are relatively mild; freezing temperatures occur only about 58 percent of winter nights. Rapid drops in temperature occur when polar Canadian air masses plunge southward across Texas, but periods of

landowners and have served as a solid tax base from which public facilities can be operated.

Water is another natural resource. Lake Amon G. Carter, Lake Nocona, and Bonie Lake furnish municipal



example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily useful to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

## General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the map units described in this survey. Each map unit is a unique natural landscape unit that has a distinct pattern of soils and of relief and drainage features. A unit typically consists of one or more soils of major extent and some soils of minor extent. It is named for the major soils. The kinds of soil in one unit can occur in other map units, but in a different pattern.

The map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds

## Descriptions of units

### 1. Windthorst-Duffau

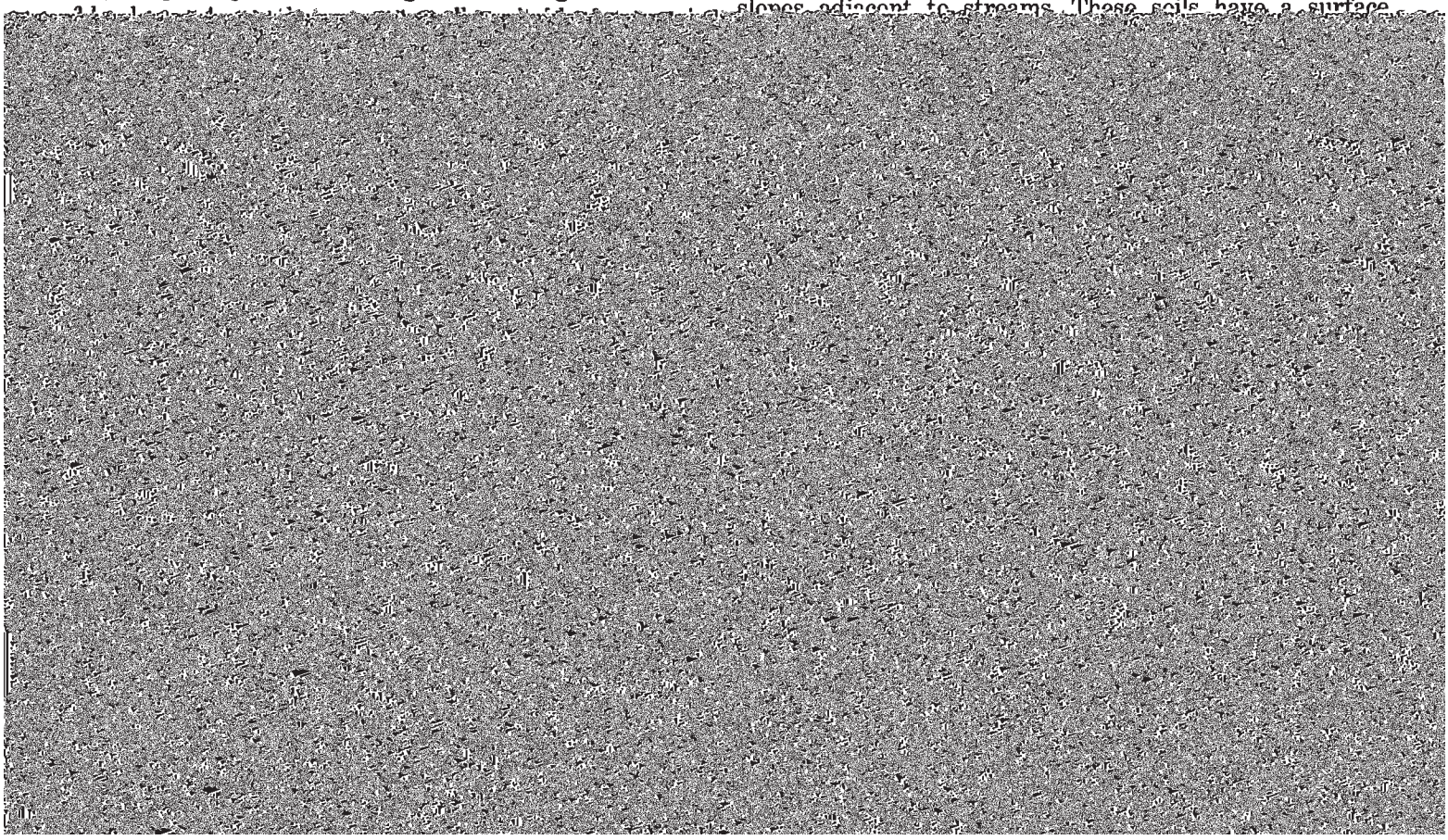
*Deep, loamy and sandy, gently sloping to sloping soils on uplands*

This unit is made up of gently sloping to sloping soils that have slopes of 1 to 8 percent. Most areas are dissected by numerous drainageways.

This unit makes up about 37 percent of the county. Windthorst soils make up about 44 percent of the unit; Duffau soils, about 38 percent; and less extensive areas of Chaney, Selden, Pulexas, Eufaula, and Patilo soils, the remaining 18 percent.

Windthorst soils are gently sloping; they are on convex ridgetops and in more sloping areas adjacent to streams. They have a surface layer of very friable, grayish brown, neutral fine sandy loam about 5 inches thick. The subsurface layer is very friable, very pale brown, neutral fine sandy loam that extends to a depth of 10 inches. The subsoil is firm, yellowish red, slightly acid sandy clay to a depth of 21 inches; firm, mottled red and reddish yellow, medium acid sandy clay to a depth of 36 inches; and firm, reddish yellow, slightly acid sandy clay loam to a depth of 55 inches. The underlying material is firm, light gray, moderately alkaline clay loam that extends to a depth of 60 inches or more.

Duffau soils are well drained; they are in slightly concave areas on broad ridgetops and on more sloping foot slopes adjacent to streams. These soils have a surface



### 2. Renfrow-Stoneburg-Anocon

*Deep and moderately deep, loamy, gently sloping to sloping soils on uplands*

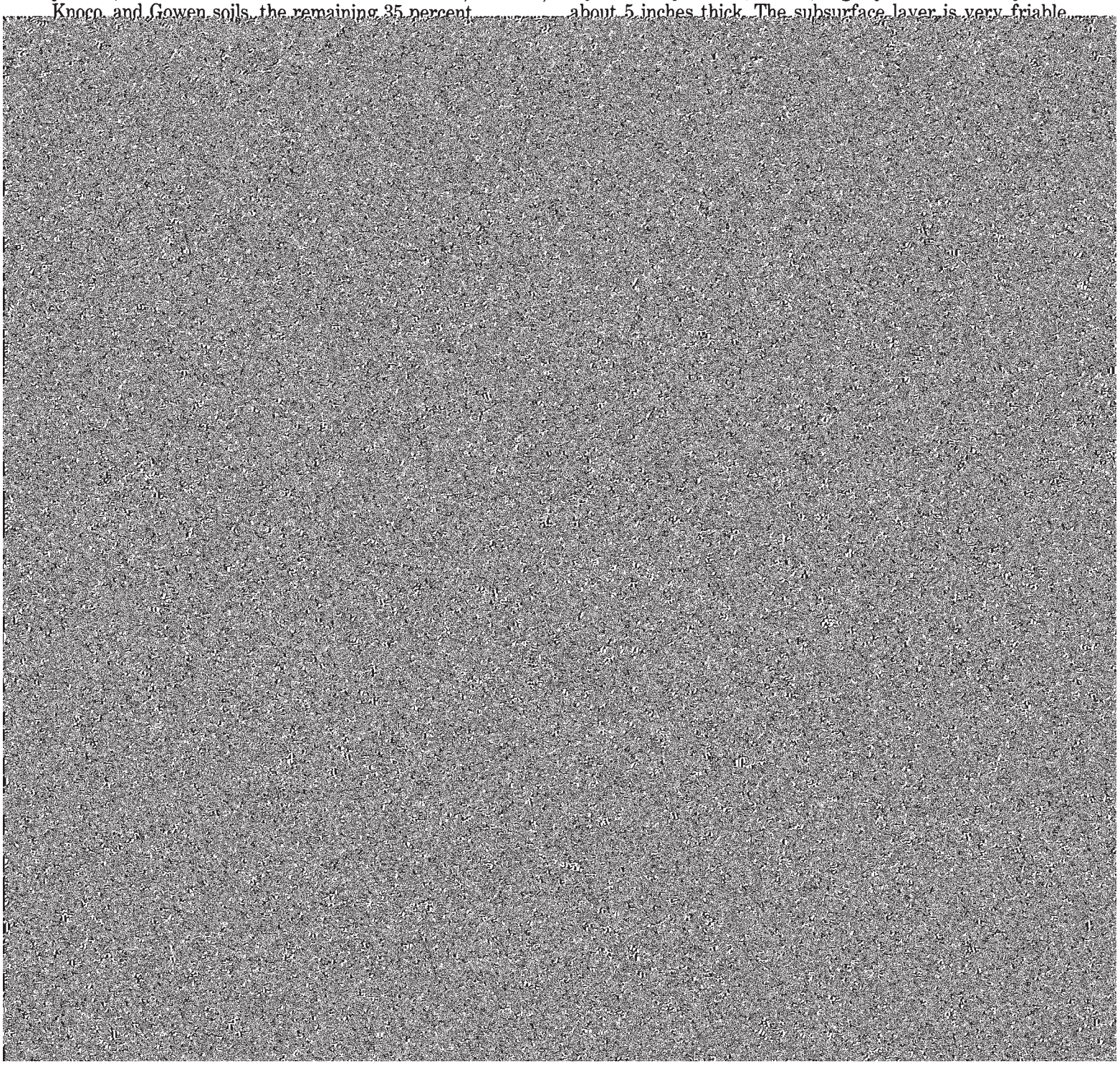
This unit is made up of dominantly gently sloping to undulating soils that have slopes of 1 to 8 percent.

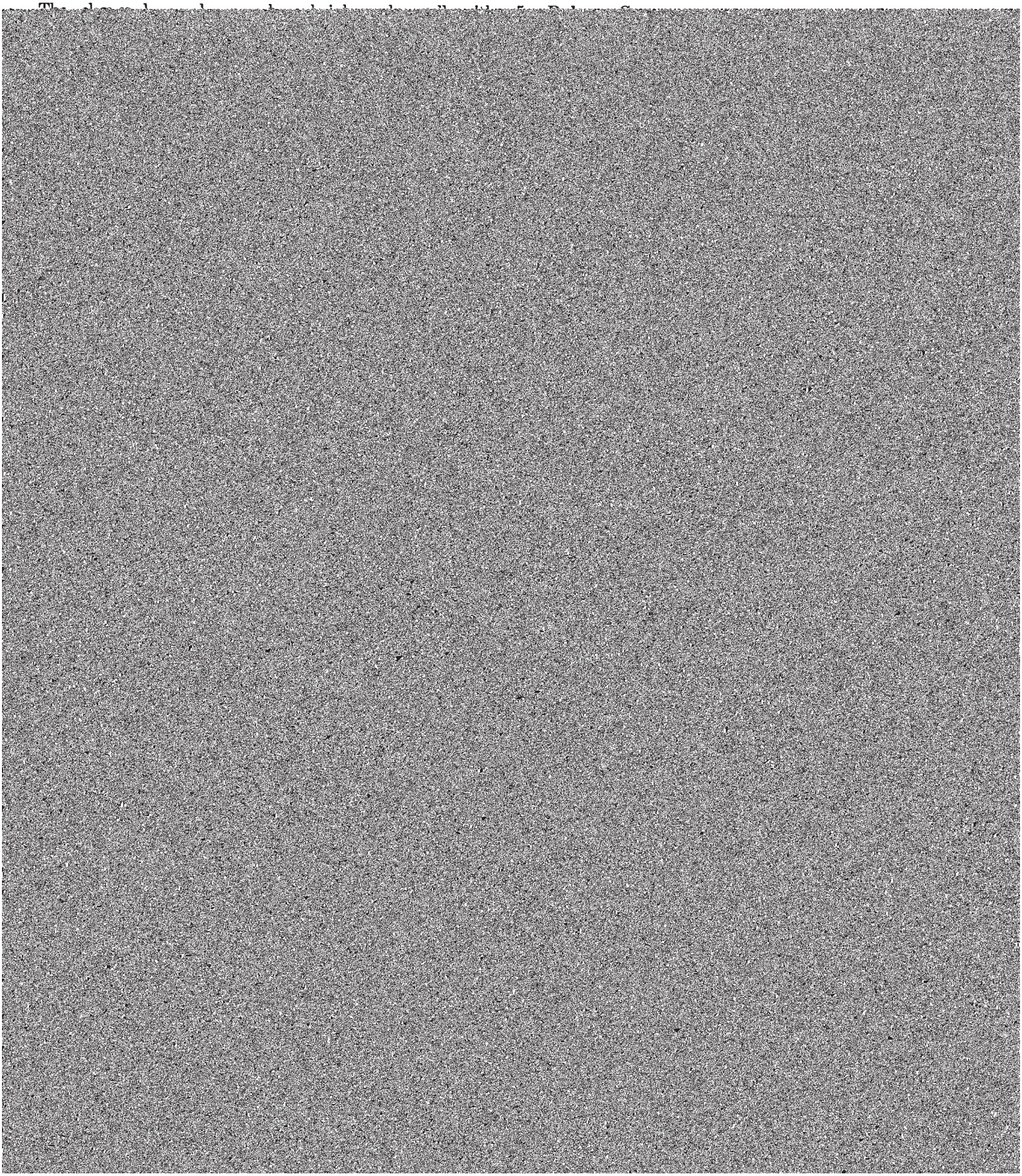
This unit makes up about 24 percent of the county. Renfrow soils make up about 30 percent of the unit; Stoneburg soils, about 18 percent; Anocon soils, about 17 percent; and less extensive areas of Waurika, Vernon, Knoco, and Gowen soils, the remaining 35 percent.

This map unit is made up of dominantly gently sloping to steep soils that have slopes of 2 to 25 percent.

This unit makes up about 17 percent of the county. Bonti soils make up about 29 percent of the unit; Cona soils, about 26 percent; Truce soils, about 19 percent; and less extensive areas of Exray, Owens, Vashti, and Gowen soils, the remaining 26 percent.

Bonti soils are on narrow to broad, convex ridgetops and are underlain by sandstone. They have a surface layer of very friable, brown, slightly acid fine sandy loam about 5 inches thick. The subsurface layer is very friable





depth of 45 inches; and friable, brown, slightly acid loam to a depth of 62 inches. The underlying material, to a depth of 70 inches or more, is friable, neutral, light yellowish brown loam.

Pulexas soils are frequently flooded soils in narrow areas on bottom lands.

The soils in this unit are used as rangeland and cropland. The main cultivated crops include wheat, grain sorghum, and cotton.

This unit has high potential as rangeland, pastureland and cropland. The potential for urban and recreational uses is high. These soils also have high potential for wildlife habitat.

### 7. Gaddy-Miller-Yahola

*Deep, sandy to clayey, nearly level soils on flood plains*

This unit is made up of nearly level soils that have slopes of 0 to 1 percent.

This unit makes up about 2 percent of the county. Gaddy soils make up about 55 percent of the unit; Miller soils, about 30 percent; and Yahola soils, the remaining 15 percent.

Gaddy soils are mainly in low areas on bottom lands and are flooded frequently. They have a surface layer of very friable, calcareous, light reddish brown loamy fine sand about 4 inches thick. The underlying material is very friable, calcareous, pink loamy fine sand that contains thin strata of fine sandy loam and that extends to a depth of 16 inches over loose, calcareous, pink fine sand that contains thin strata of fine sandy loam and that extends to a depth of 45 inches or more.

Miller soils are mainly in slightly depressional areas on bottom lands. They have a surface layer of firm, calcareous, reddish brown clay about 17 inches thick. The subsoil is very firm, calcareous, reddish brown clay to a depth of 39 inches and firm, calcareous, red silty clay loam to a depth of 50 inches. The substratum, to a depth of 60 inches or more, is very friable, calcareous, reddish yellow fine sandy loam.

Yahola soils, intermixed with Gaddy soils, are nearly level and are on bottom lands. They have a surface layer of very friable, reddish brown fine sandy loam about 8 inches thick. The underlying material, to a depth of 50 inches or more, is very friable, calcareous fine sandy loam that has thin strata of silt loam and loamy fine sand throughout. It is reddish yellow to a depth of 44 inches and pink below.

The soils in this unit are used mainly as rangeland and for improved pastures. A few fields are cultivated to wheat and forage sorghum.

This unit has high potential as rangeland and pastureland. Areas that are flooded only occasionally have high

## Broad land-use considerations

The soils in the county vary widely in their potential for major land uses, as indicated in table 2. For each land use, general ratings of the potential of each unit in relation to the other units are indicated. Kinds of soil limitations are also indicated in general terms. The ratings of soil potential reflect the relative cost of such practices and also the hazard of continued soil related problems after such practices are installed. The ratings do not consider location in relation to existing transportation systems or other kinds of facilities.

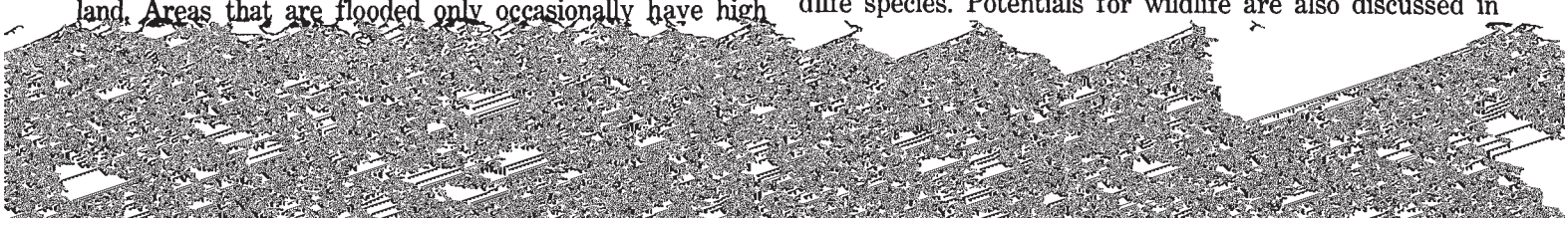
Kinds of land uses considered in table 2 are cultivated farm crops, rangeland, pastureland, urban uses, wildlife habitat, and recreation. Cultivated farm crops grown extensively include grain sorghum, wheat, oats, and peanuts. Rangeland refers to land on which native plants grow. Pastureland refers to land growing improved grasses such as Coastal bermudagrass. Urban includes residential, commercial, and industrial land uses. Wildlife habitat refers to land used to provide food and cover for wildlife. Recreation includes nature study area trails, camping and picnic areas, and the like.

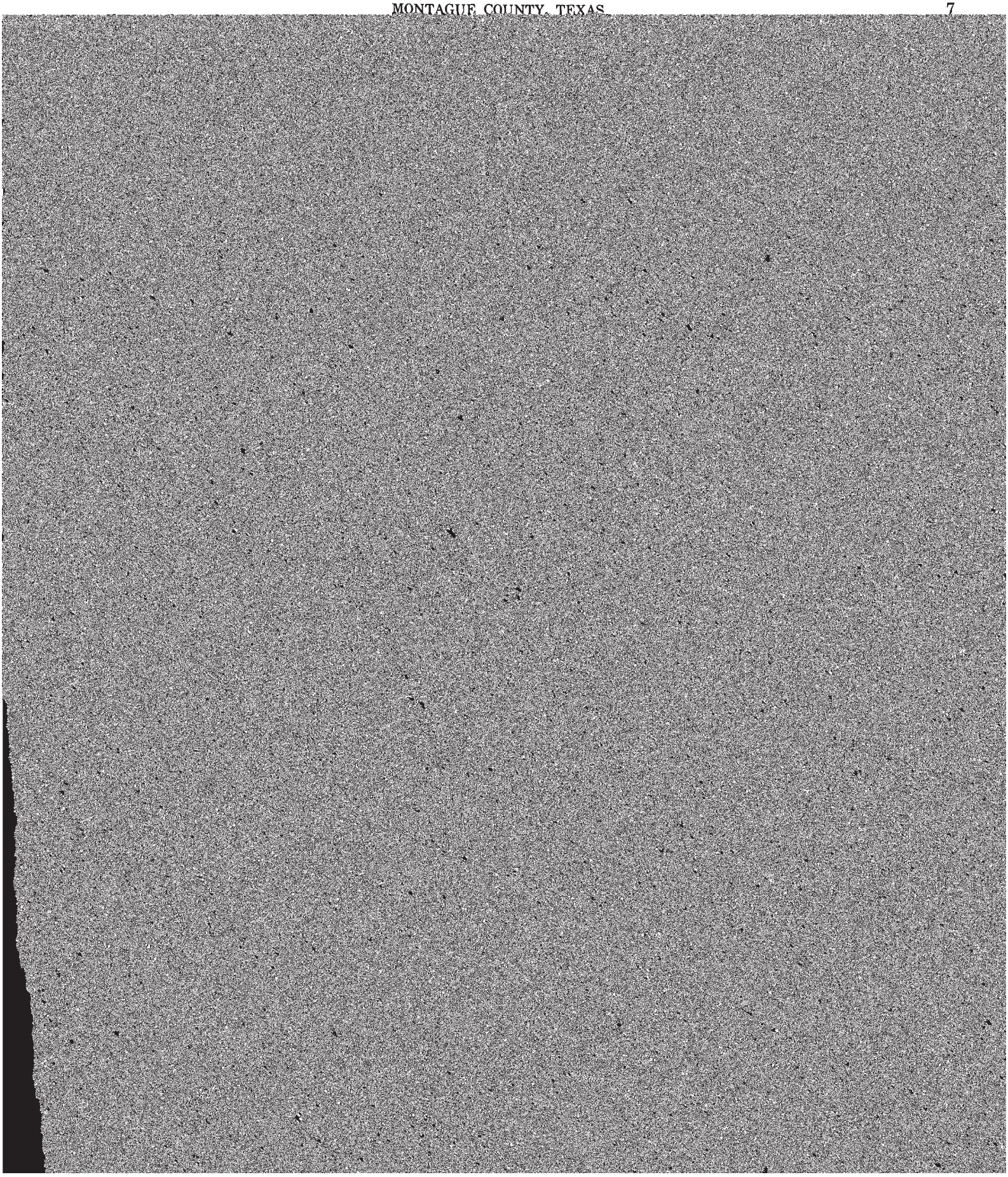
Each year considerable land is being developed for urban uses in Bowie, Nocona, and other towns in the county. About 15,953 acres were in urban or built-up areas in 1967, according to the Conservation Needs Inventory (4). Much of this acreage was suited as cropland. In general, in the survey area the soils that are well suited as cropland are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use.

Most soils in the county are favorable for urban development. The Pulexas-Gowen and Gaddy-Miller-Yahola units, however, are on flood plains, and flooding is a severe limitation. Also, urban development is costly on the soils that have hard bedrock just below the surface in the Aledo-Venus-Bolar unit.

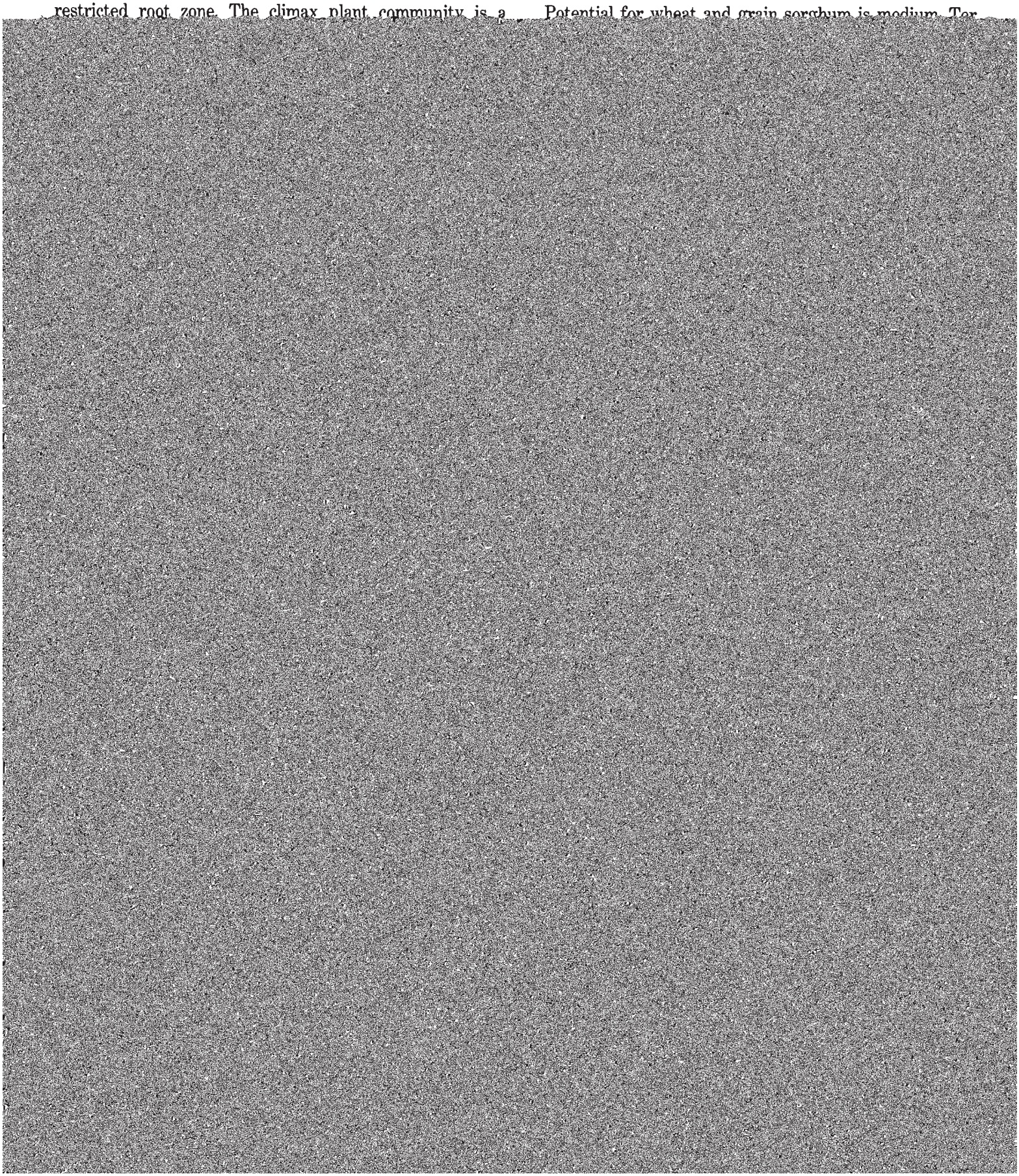
Most of the soils of the county have high potential as pastureland and rangeland. The hilly soils in the Bonti-Cona-Truce and Aledo-Venus-Bolar units have large stones and are shallow and limit the development and management of improved pastures.

The Bastrop-Teller unit has high potential for recreational development. The hardwood trees on the Bonti-Cona-Truce, Aledo-Venus-Bolar, and Windthorst-Duffau units enhance the beauty in much of the area. These three units also provide habitat for many important wildlife species. Potentials for wildlife are also discussed in



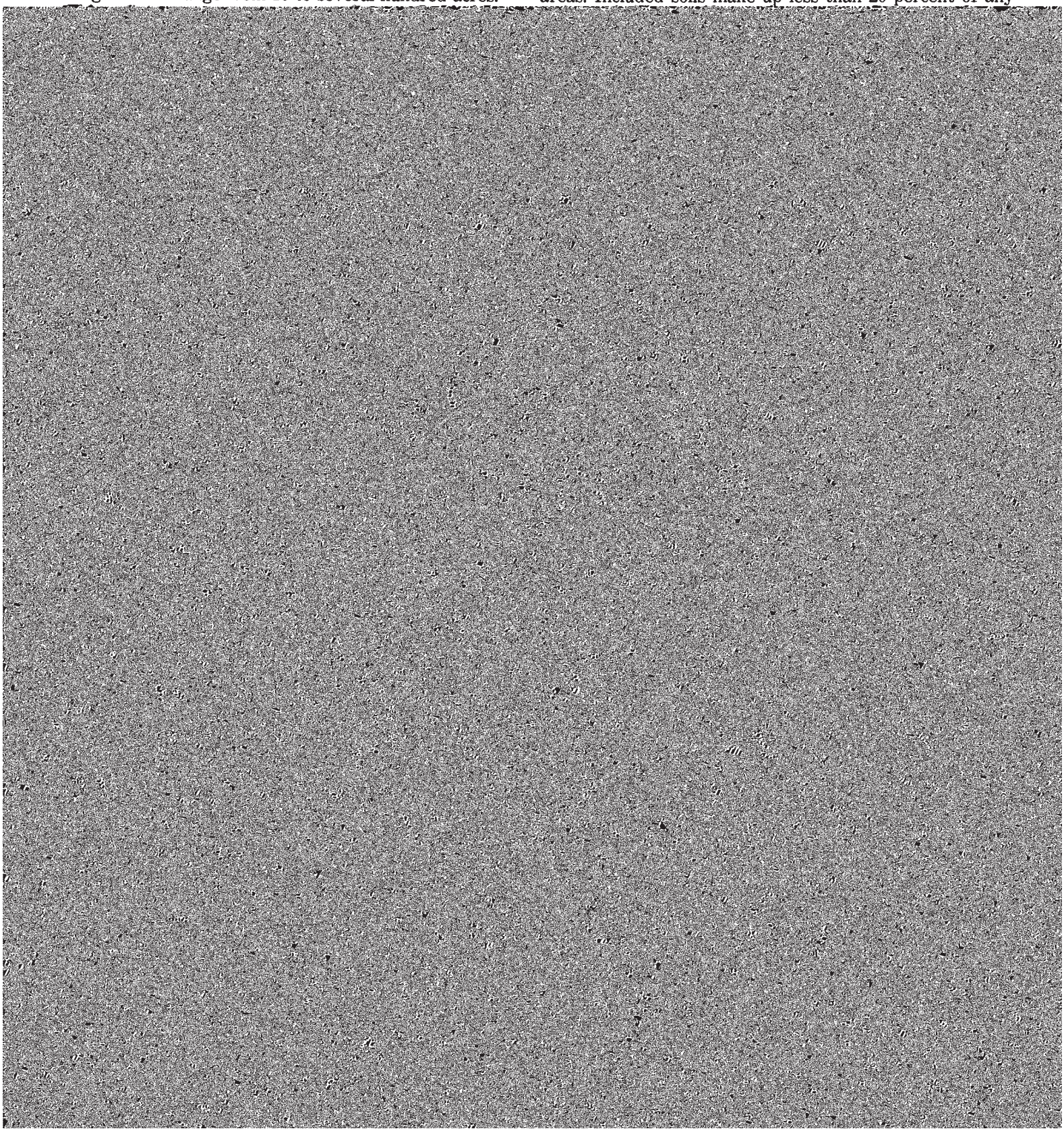


restricted root zone. The climax plant community is a ... Potential for wheat and grain sorghum is medium. Ter...



**4—Bastrop loam, 5 to 8 percent slopes.** This deep, sloping soil is on uplands. Slopes are slightly convex and average about 7 percent. Areas are irregularly shaped to enlongated and range from 10 to several hundred acres.

of soils that are similar to Bolar soils except that they are more clayey. Aledo soils are on knolls in areas of 0.5 acre to 3 acres; they make up about 4 percent of some mapped areas. Included soils make up less than 20 percent of any



moderately alkaline, grayish brown very gravelly clay loam to a depth of 10 inches. Limestone fragments, 3 to 15 inches across, cover from 1 to 50 percent of the surface; limestone fragments make up about 65 percent of the volume of the surface layer. The surface layer has an abrupt boundary and rests on a bed of hard, coarsely fractured limestone.

Aledo soils are well drained. Runoff is rapid. Permeability is moderate, and available water capacity is very low. The root zone is shallow. Natural fertility and organic matter content are moderately low.

Included with these soils in mapping are small areas of Venus soils on foot slopes. Also included on foot slopes are a few areas of soils that are similar to the Venus soils except that they are more clayey. These included soils make up less than 20 percent of any one mapped area.

The soils in this complex are not suitable for cultivated crops. They are used mainly as rangeland (fig. 2).

Potential for native range plants is medium. Rapid runoff, medium to very low available water capacity, and restricted rooting depth limits forage production to moderate yields during favorable years. The climax plant community is a mixture of tall and mid grasses, forbs, live oak, and Texas oak. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for most urban or recreational uses is low. Slope, corrosivity to uncoated steel, low strength, depth to bedrock, and the stony or gravelly surface layer are difficult to overcome. Capability subclass VIs; Bolar soil in Clay Loam range site; Aledo soil in Shallow range site.

**7—Bonti fine sandy loam, 2 to 5 percent slopes.** This moderately deep, gently sloping soil is on erosional uplands, mainly along slightly convex ridges. Slopes are smooth and average less than 3 percent. Areas are irregularly shaped and range from 10 to 350 acres in size.

This soil has a surface layer of very friable, brown, slightly acid fine sandy loam about 5 inches thick. The subsurface layer is very friable, pale brown, slightly acid fine sandy loam that extends to a depth of 8 inches. The subsoil is firm, yellowish red, strongly acid sandy clay that extends to a depth of 29 inches. It has an abrupt boundary and rests on strongly cemented sandstone.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is low. Natural fertility and organic matter content are moderately low.

Included with this soil in mapping are small areas of Exray soils, which are near the edges of ridgetops. Also included are small areas of Truce soils, which have a substratum of shaly clay. Also included on foot slopes are a few areas of soils that are similar to Bonti soils except that they have a less clayey subsoil. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and post oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat, oats, and grain sorghum is medium. Crop residue left on or near the soil surface helps prevent water erosion and conserve moisture. Contour farming and terraces are needed in most areas to prevent water erosion. When cuts or excavations exceed about 20 inches, there is a hazard of cutting into a bed of strongly cemented sandstone.

Potential for pasture production is medium. Improved grasses such as Kleingrass, weeping lovegrass, King Ranch bluestem, and Coastal bermudagrass are suited.

Potential for most urban or recreational uses is medium. Depth to rock and low strength restrict some uses. Capability subclass IIIe; Sandy Loam range site.

**8—Bonti-Exray complex, 5 to 25 percent slopes.** This is a complex of sloping to steep soils on uplands, mainly in a mass of low hills with narrow tops or in narrow bands along hillsides. Slopes are convex and average about 8 percent. Areas are irregularly shaped to elongated and range from 15 to several hundred acres.

Bonti soils make up about 29 percent of the complex; Exray soils, about 27 percent; and other closely associated soils, about 44 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Bonti soils are on ridgetops and in the less sloping areas in the complex. They have a surface layer of very friable, brown, neutral stony fine sandy loam about 4 inches thick. The subsurface layer is very friable, light yellowish brown, neutral stony fine sandy loam that extends to a depth of 10 inches. Sandstone fragments, 5 to 20 inches across, cover about 5 percent of the surface. The subsoil is firm, medium acid sandy clay; it is red to a depth of 17 inches and reddish yellow to a depth of 24 inches. The subsoil has an abrupt boundary and rests on a layer of strongly cemented sandstone.

Bonti soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is low. The root zone is moderately deep.

The Exray soils are on narrow ridgetops and in steeper areas that are closely associated with sandstone outcrops in the complex. They have a surface layer of friable, brown, slightly acid stony fine sandy loam about 3 inches thick. Sandstone fragments, 3 to 15 inches across, cover about 2 percent of the surface. The subsurface layer is friable, light yellowish brown, medium acid fine sandy loam that extends to a depth of 6 inches. The subsoil is firm, red, medium acid sandy clay that extends to a depth of 13 inches. The subsoil has an abrupt boundary and rests on a layer of strongly cemented, coarsely fractured sandstone.

Exray soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. Natural fertility and organic matter content are low.

Included with these soils in mapping are areas of moderately steep Truce soils, which are on side slopes

that have a substratum of shale. These soils make up about 17 percent of the mapped acreage. Also included are small areas of soils that are similar to Exray soils except that they have a loamy subsoil. These soils make up about 24 percent of the mapped acreage. Also included are very small areas of soils that are similar to Bonti soils except that they have a loamy subsoil.

The soils in this complex are not suitable for cultivated crops. They are used mainly as rangeland (fig. 3).

Potential for native plants is medium. Rapid runoff, medium to very low available water capacity, and restricted rooting depth limit forage production to moderate yields during favorable years. The climax plant community is a mixture of tall and mid grasses, forbs, and post oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for most urban or recreational uses is low. Slope, depth to bedrock, low strength, and the stony surface layer are difficult to overcome. Capability subclass VIIs; Sandstone Hills range site.

**9—Bosque loam, occasionally flooded.** This deep, nearly level soil is on flood plains along major streams. Slopes are smooth and range from 0 to 1 percent. Most areas of this soil are subject to flooding about once every 3 to 10 years, but some areas are rarely flooded because they are protected by flood-prevention structures. Areas are long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of friable, calcareous, dark brown loam about 22 inches thick. The subsoil is friable, calcareous, brown loam to a depth of 44 inches and friable, calcareous, grayish brown loam to a depth of 48 inches or more.

These soils are well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are small areas of Gowen and Pulexas soils and areas of light colored,

Potential for pasture production is high. Pasture grasses such as johnsongrass, Coastal bermudagrass, and Kleingrass are well suited.

This soil has low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some camping uses. Capability subclass IIw; Loamy Bottomland range site.

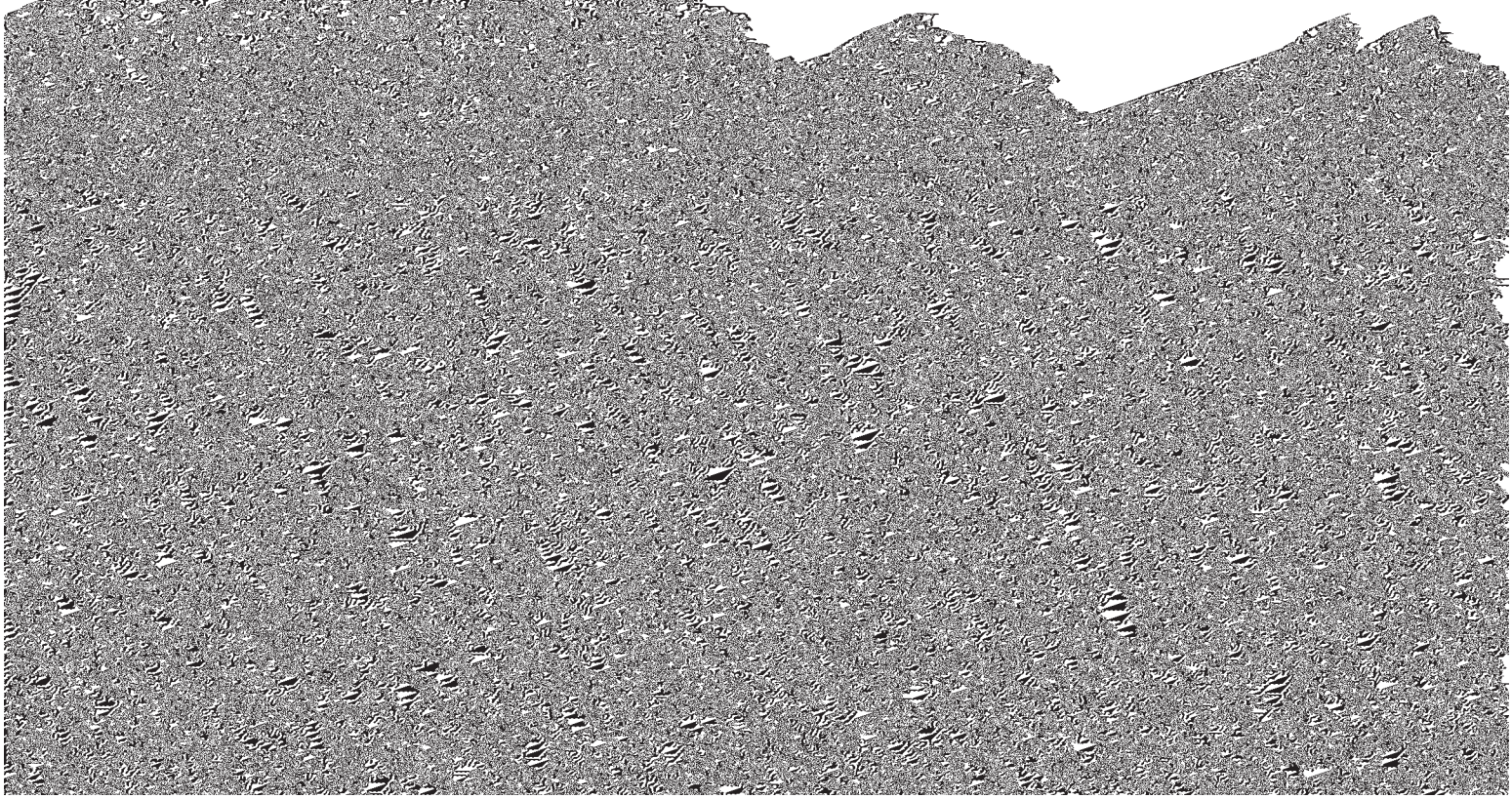
**10—Bosque soils, frequently flooded.** These deep, nearly level soils are on flood plains along small streams. Areas are long and narrow and are parallel to the stream channels. Slopes range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly loam, but is sandy loam or clay loam in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, to be interpreted for the expected use of the soils involved.

Bosque soils in this map unit typically have a surface layer of friable, calcareous, grayish brown loam about 19 inches thick. The subsoil is friable, calcareous, dark grayish brown loam to a depth of 33 inches and friable, calcareous, grayish brown loam to a depth of 48 inches or more.

These soils are well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are small areas of Gowen and Pulexas soils and areas of light colored,



in valleys. Slopes are smooth, slightly concave to plane, and average less than 2 percent. Soil areas are broad to irregularly shaped and range from 10 to 750 acres. In undisturbed areas, the surface is characterized by weak gilgai microrelief, which consists of microknolls and microdepressions. The microknolls are 2 to 10 inches higher than the microdepressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

This soil has a surface layer of very firm, calcareous, very dark gray silty clay to a depth of 33 inches and very firm, calcareous, dark gray silty clay to a depth of 65 inches or more.

This soil is moderately well drained. Runoff is slow to medium. When dry, this soil has wide, deep cracks that extend to the surface. Water enters dry, cracked soil rapidly, but it enters wet soil very slowly and seals the cracks. Permeability is very slow. Available water capacity is high. Natural fertility and organic matter content are high.

Included with this soil in mapping are small areas of Sanger soils and a few very small areas of dark gray clayey soils that are about 40 inches thick over limestone. Also included are a few areas of soils that have slopes of and light gray to a depth of 47 inches. The underlying material is very firm, reddish yellow and light gray, massive clay.

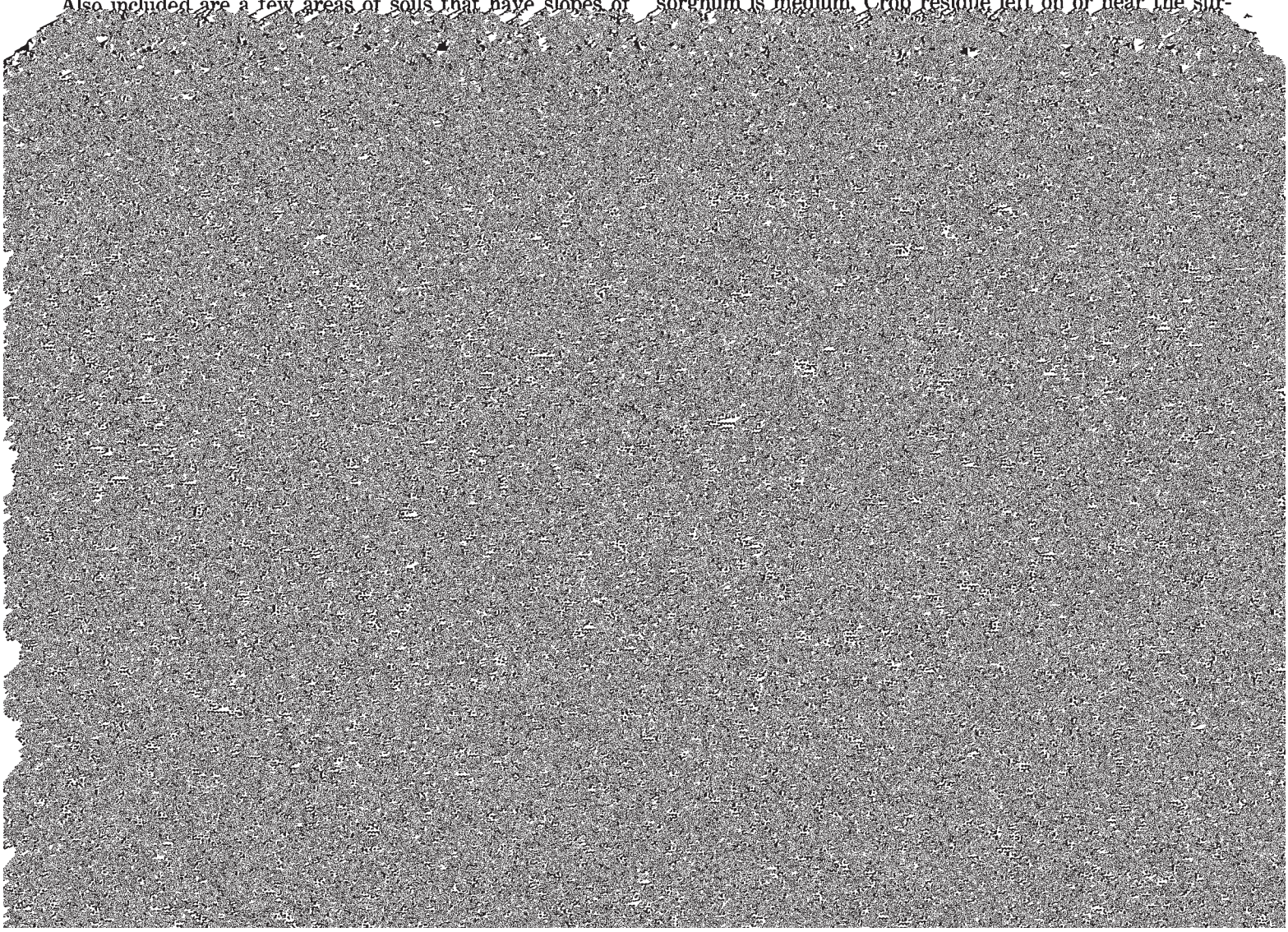
This soil is moderately well drained. Runoff is slow to medium. Permeability is slow. Available water capacity is medium.

Included with this soil in mapping are small areas of Selden and Windthorst soils. Also included are a few areas of gullied soils and a few areas of soils that have slopes of less than 2 percent. These included soils make up less than 20 percent of any one mapped area.

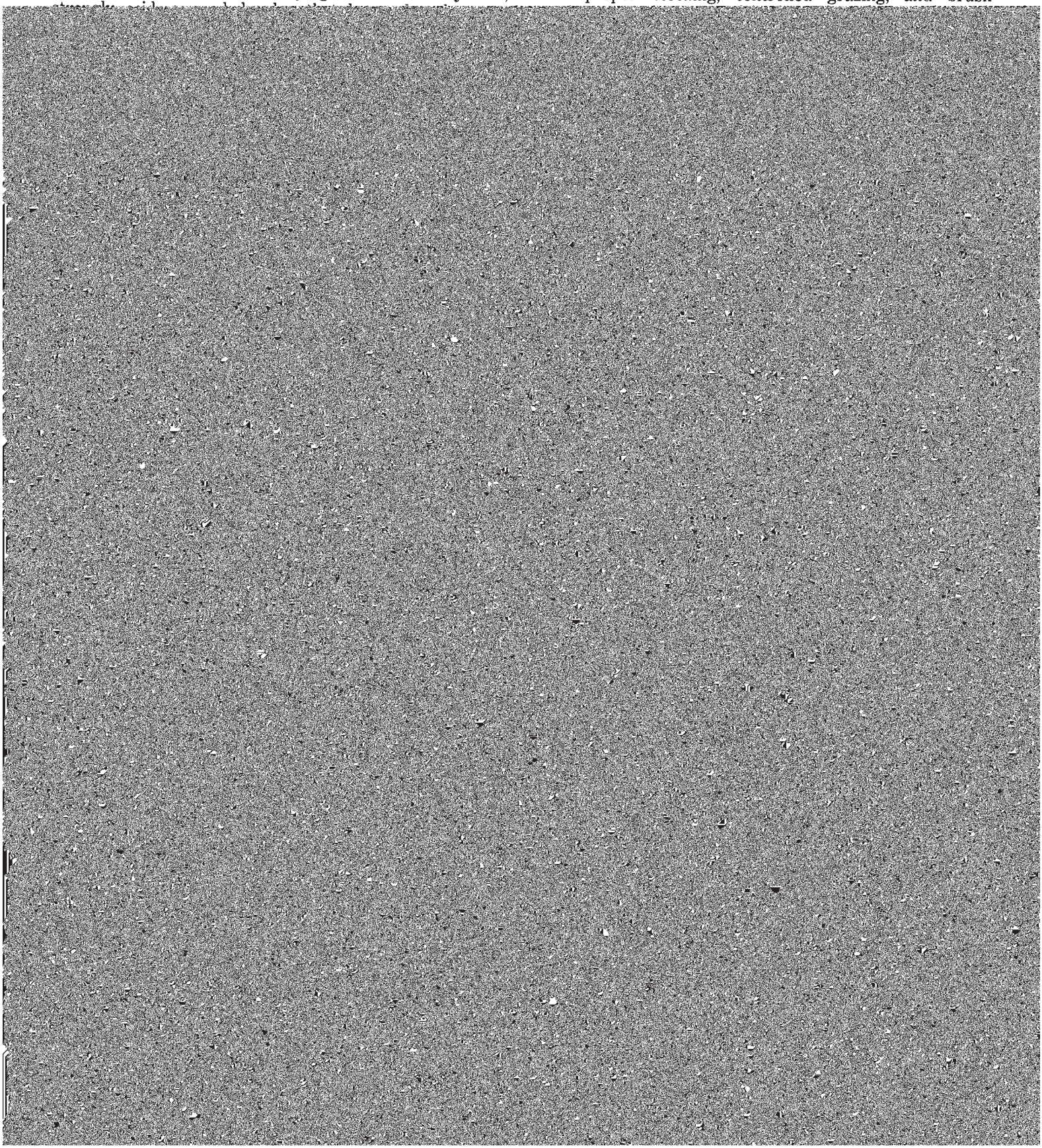
This soil is suitable for cultivated crops but is used mainly as pastureland. Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, weeping lovegrass, and Kleingrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for peanuts is high, and potential for grain sorghum is medium. Crop residue left on or near the sur-



depth of 33 inches. The underlying material is very firm, clude proper stocking, controlled grazing, and brush



Potential for most urban uses is medium. Low strength is the main limitation, but this can be overcome by good design and careful installation procedures. Potential for most recreational uses is high, but slope restricts some playground uses. Capability subclass IIIe; Sandy Loam range site.

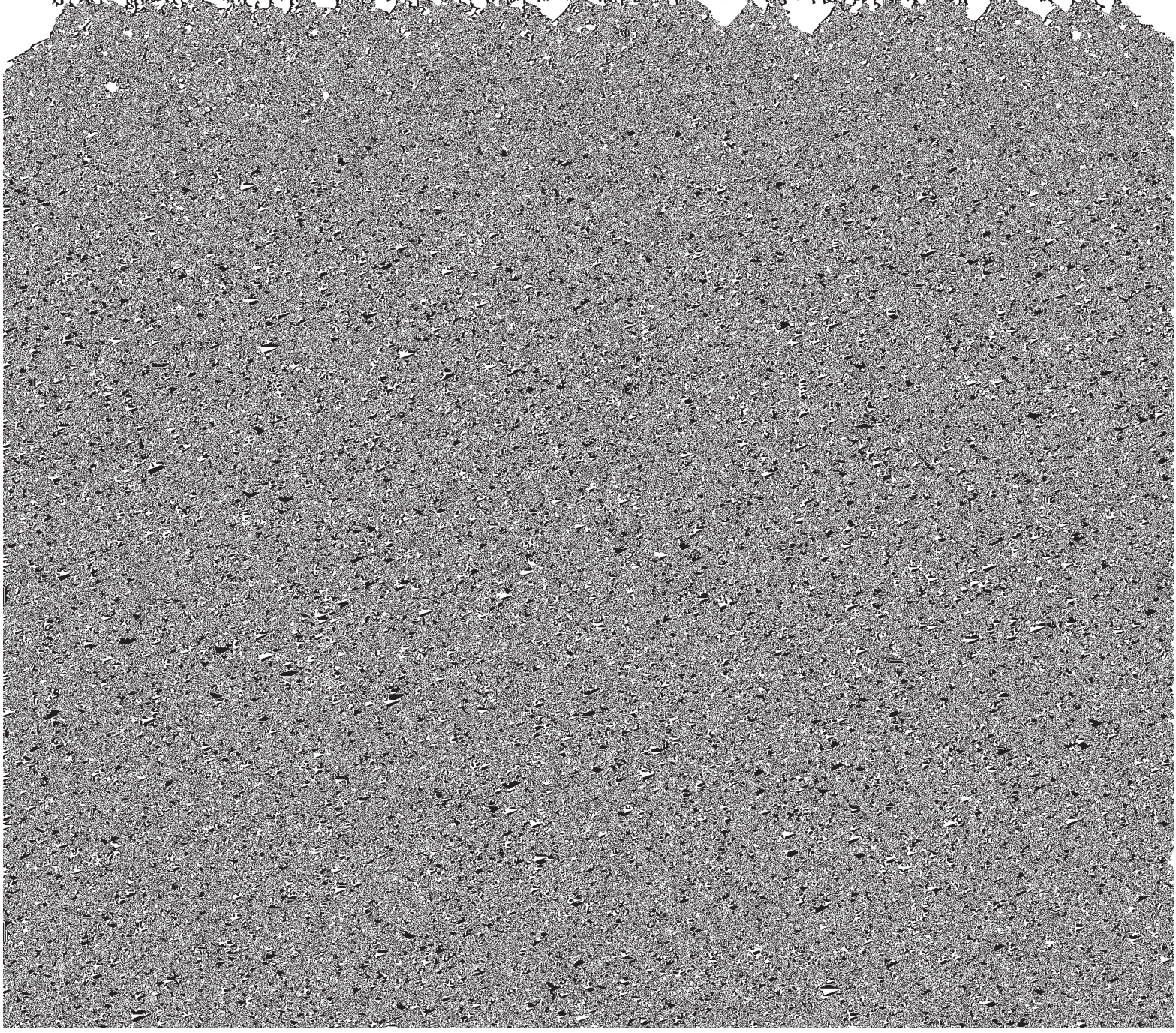
**16—Duffau fine sandy loam, 5 to 8 percent slopes.** This deep, sloping soil is on uplands. Slopes are smooth and average about 6 percent. Areas are irregularly shaped to long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of friable, brown, slightly acid fine sandy loam about 10 inches thick. The subsoil is friable, yellowish red, medium acid sandy clay loam to a

at intervals of 10 to 100 feet. Soil areas are irregularly shaped and range from 8 to 70 acres (fig. 6).

Duffau soils make up about 35 percent of this map unit; Windthorst soils, about 22 percent; and gullied areas, about 43 percent. The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Duffau soils are on the lower parts of slopes between gullies. They have a surface layer of friable, brown, slightly acid fine sandy loam about 3 inches thick. The subsurface layer is friable, pink, slightly acid fine sandy loam that extends to a depth of 6 inches. The subsoil is friable, slightly acid, yellowish red sandy clay loam to a



Patilo soils are in slightly concave areas and on foot slopes. They have a surface layer of loose, grayish brown, slightly acid fine sand about 4 inches thick. The subsurface layer is loose, pink, slightly acid fine sand that extends to a depth of 45 inches. The subsoil is firm, strongly acid sandy clay loam that is mottled in shades of light gray, reddish yellow, and red and that extends to a depth of 65 inches or more.

Patilo soils are moderately well drained. Runoff is slow. Permeability is moderately slow, and available water capacity is low. The root zone is deep and easily penetrated by plant roots. The hazard of soil blowing is high.

Included with these soils in mapping are small areas of soils that are similar to Eufaula soils except that they do not have yellowish red lamellae. Also included are soils that are similar to Patilo soils except that they are better drained and do not have gray mottles in the subsoil. Also included on foot slopes are a few areas of soils that have a sandy surface layer less than 40 inches thick. These included soils make up from 7 to 28 percent of any one mapped area.

The soils in this complex can be cultivated, but are used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for peanuts is medium. Crop residue left on or near the surface helps conserve moisture, control soil blowing, and maintain tilth.

Potential for pasture production is medium. Improved grasses such as weeping lovegrass and Coastal bermudagrass are suited to the soils in this complex.

This complex has medium potential for most urban uses. Slope, wetness, and the loose, sandy surface layer are the main limitations, but they can be overcome by good design and careful installation procedures. Potential for most recreational uses is low because of the sandy surface layer and slopes. Capability subclass IVs; Deep Sand range site.

**19—Gaddy soils, frequently flooded.** This is an undifferentiated group of deep, nearly level soils on low flood plains along the Red River. Areas are long and narrow and are parallel to and 2 to 10 feet above the river channel. Slopes range from 0 to 1 percent. Most areas are flooded about once or twice a year to once every 2 years. The surface layer is mainly loamy fine sand, but is fine sandy loam or clay loam in some areas. Individual areas range from 15 to 400 acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Gaddy soils in this map unit typically have a surface layer of very friable, calcareous, light reddish brown loamy fine sand about 4 inches thick. The underlying material is very friable, calcareous, pink loamy fine sand that contains thin strata of fine sandy loam to a depth of 16 inches and loose, calcareous, pink fine sand that contains thin strata of fine sandy loam to a depth of 45 inches or more.

These soils are somewhat excessively drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is low. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are small areas of Yahola soils. Also included are small areas of Miller soils in old sloughs or low areas where water stands for longer periods. A few small, oval sand dunes that average about 4 feet high and about 200 feet long are in some areas. Narrow areas between different levels of the flood plains have slopes of more than 1 percent. These included soils make up less than 20 percent of any one mapped area.

The soils in this map unit generally are unsuitable for cultivated crops because of the hazard of flooding. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildife habitat is medium.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

These soils have low potential for most urban or recreational uses. Flooding is a severe limitation and is very difficult to overcome. Capability subclass Vw; Sandy Bottomland range site.

**20—Gowen loam, occasionally flooded.** This deep, nearly level soil is on flood plains along major streams. Slopes are smooth and range from 0 to 1 percent. Most areas of this soil are subject to flooding about once every 3 to 10 years, but some areas are rarely flooded because they are protected by flood-prevention structures. Areas are long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of friable, dark grayish brown, neutral loam about 28 inches thick. The underlying material, extending to a depth of 52 inches or more, is friable, brown, neutral clay loam.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are a few areas of soils that are similar to Gowen soils except that they have a surface layer of light colored sandy loam and stratified lower layers. In the bottoms of the drainageways, some profiles have higher clay content than described as typical of the Gowen series. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is mainly used as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and

mid grasses, forbs, and scattered shrubs and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for oats, wheat, forage sorghum, and grain sorghum is high. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Pecans are well suited to the soil.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

This soil has low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some camping uses. Capability subclass IIw; Loamy Bottomland range site.

**21—Gowen soils, frequently flooded.** These deep, nearly level soils are on flood plains along small streams where channels have become filled with sand and debris. Areas are long and narrow. Slopes range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly loam, but is sandy loam or clay loam in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Gowen soils in this map unit typically have a surface layer of friable, brown, neutral, weakly stratified loam about 13 inches thick. The underlying material is friable, brown, mildly alkaline clay loam to a depth of 41 inches and friable, brown, moderately alkaline clay loam to a depth of 60 inches or more.

These soils are well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. **Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.**

Included with these soils in mapping are a few areas of Pulexas and Bosque soils. Also included near stream channels are a few areas of soils that are similar to Gowen soils except that they have a surface layer of light colored sandy loam and lower layers of stratified material. In the bottoms of drainageways, some included soils have higher clay content than that described as typical of the series. These included soils make up less than 30 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. These soils are subject to washing or scouring and to deposition of fresh alluvial sediments. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, scattered shrubs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

These soils have low potential for urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some playground and camping uses. Capability subclass Vw; Loamy Bottomland range site.

**22—Hensley loam, 1 to 5 percent slopes.** This shallow, gently sloping soil is on uplands, mainly along slightly convex limestone ridges. Slopes are smooth and average about 2 percent. Areas are irregularly shaped and range from 10 to 150 acres.

This soil has a surface layer of friable, brown, mildly alkaline loam about 4 inches thick. The subsoil is very firm, dark reddish brown, mildly alkaline clay that extends to a depth of 16 inches. It has an abrupt boundary and rests on a thick layer of strongly cemented, fractured limestone.

This soil is well drained. Runoff is medium. Permeability is slow, and available water capacity is very low. The root zone is shallow.

Included with this soil in mapping are small areas of Lindy soils and very small areas of Aledo soils. These included soils make up less than 15 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is medium mainly because of the restricted root zone. The climax plant community is a mixture of tall, mid, and short grasses, a few shrubs, and a few motts of live oak trees. Management needs include proper stocking and controlled grazing. Potential for wildlife habitat is medium.

Potential for small grains and grain sorghum is low. Crop residue left on the surface helps prevent water erosion, conserve moisture, and improve soil tilth and water intake.

Potential for pasture production is medium. Improved grasses such as Kleingrass, Coastal bermudagrass, weeping lovegrass, and King Ranch bluestem are suited.

Potential for most urban uses is low. Depth to bedrock is difficult to overcome. Capability subclass IVe; Redland range site.

**23—Lindy clay loam, 1 to 3 percent slopes.** This moderately deep, gently sloping soil is on uplands, mainly along slightly convex ridges. Areas are irregularly shaped and range from 10 to 180 acres.

This soil has a surface layer of friable, dark grayish brown, slightly alkaline clay loam about 6 inches thick. The subsoil is very firm, reddish brown, moderately alkaline clay that extends to a depth of 31 inches. It has an abrupt boundary and rests on a thick layer of strongly cemented, coarsely fractured limestone.

This soil is well drained. Runoff is medium. Permeability is slow, and available water capacity is low. The root zone is moderately deep.

Included with this soil in mapping are small areas of Hensley soils. Also included are a few areas of soils that

are similar to Lindy soils except that they have a dark brown subsoil; this soil is in concave areas. These included soils make up less than 25 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and a few shrubs and live oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for oats and grain sorghum is high. Crop residue left on or near the surface helps prevent water erosion, conserve moisture, and improve soil tilth and water intake. Contour farming and terraces are needed in most areas to prevent water erosion. When cuts or excavations exceed 20 inches, there is a hazard of cutting into a bed of strongly cemented limestone.

Potential for pasture production is medium. Improved grasses such as Kleingrass, Coastal bermudagrass, weeping lovegrass, and King Ranch bluestem are well suited.

Potential for most urban or recreational uses is medium. Depth to rock, low strength, and shrinking and swelling with changes in moisture restrict some uses. Capability subclass IIIe; Deep Redland range site.

**24—Miller clay, occasionally flooded.** This deep, nearly level soil is on flood plains, mainly along the Red River. Slopes are smooth to weakly concave and range from 0 to 1 percent. Most areas are subject to flooding about once every 2 to 5 years. Areas are long and narrow and range from 10 to 230 acres.

This soil has a surface layer of firm, calcareous, reddish brown clay about 17 inches thick. The subsoil is very firm, calcareous, reddish brown clay to a depth of 39 inches and firm, calcareous, red silty clay loam to a depth of 50 inches. The substratum, extending to a depth of 60 inches or more, is very friable, calcareous, reddish yellow fine sandy loam.

This soil is moderately well drained. Runoff is slow. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are medium.

Included with this soil in mapping are a few areas of soils that are similar to Miller soils except that they have a light colored, clayey surface layer. Also included are similar soils that have a clayey solum 20 to 35 inches thick over a fine sandy loam substratum. These included soils are in slightly convex areas and make up less than 30 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat, oats, grain sorghum, and alfalfa is high. This soil is difficult to till; tillage needs to be timely and kept to a minimum. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Native pecans grow in most areas; pecan orchards have been developed in some places.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

This soil has low potential for most urban or recreational uses. Flooding is a severe limitation and is very difficult to overcome. Capability subclass IIIw; Clayey Bottomland range site.

**25—Miller soils, frequently flooded.** These deep, nearly level soils are on flood plains, mainly along the Red River. Slopes are weakly concave to smooth and range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly clay, but is clay loam or silty clay in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Miller soils in this map unit have a surface layer of very firm, calcareous, reddish brown clay to a depth of 5 inches; firm, calcareous, reddish brown silty clay loam to a depth of 9 inches; and very firm, calcareous, reddish brown clay to a depth of 18 inches. The subsoil is very firm, calcareous, reddish brown clay to a depth of 35 inches and firm, calcareous, yellowish red silty clay to a depth of 47 inches. The substratum, extending to a depth of 55 inches or more, is very friable, calcareous, reddish yellow fine sandy loam.

This unit is moderately well drained. Runoff is slow. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are medium.

Included with this unit in mapping are a few areas of soils that are similar to Miller soils except that they have a light colored, clayey surface layer. Also included are similar soils that have a clayey surface layer 20 to 35 inches thick over a substratum of fine sandy loam. These included soils are in slightly convex areas and make up about 30 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited. Native pecans grow in most areas; pecan orchards have been developed in some places.

These soils have low potential for most urban or recreational uses. Flooding is a severe limitation and is very difficult to overcome. Capability subclass Vw; Clayey Bottomland range site.

**26—Pulexas fine sandy loam, occasionally flooded.** This deep, nearly level soil is on flood plains along small streams. Slopes are smooth and range from 0 to 1 percent. Most areas of this soil are subject to flooding about once every 3 to 10 years, but some areas are rarely flooded because they are protected by flood-prevention structures. Areas are long and narrow and range from 10 to several hundred acres in size.

This soil has a surface layer of very friable, pale brown, neutral fine sandy loam about 7 inches thick. The underlying material is very friable, brown, neutral fine sandy loam to a depth of 18 inches; friable, yellowish brown, neutral fine sandy loam to a depth of 42 inches; and friable, brown, mildly alkaline fine sandy loam below that.

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

Included with this soil in mapping are a few areas of Gowen soils. Also included are a few areas of soils that are similar to Pulexas soils except that they are more clayey. These included soils make up less than 20 percent of any one mapped area.

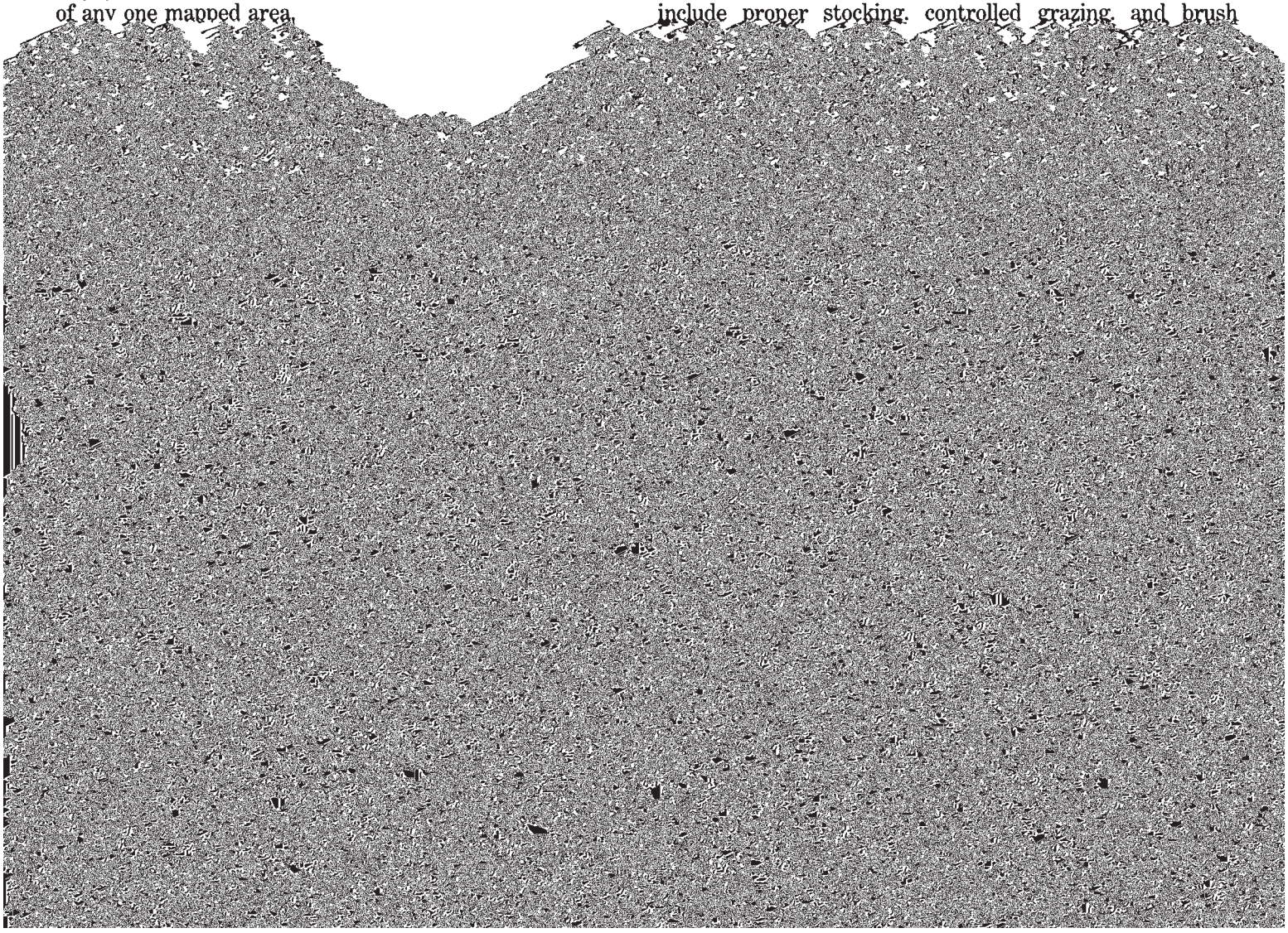
loam to a depth of 30 inches; friable, brown, moderately alkaline fine sandy loam to a depth of 42 inches; and friable, brown, moderately alkaline loam to a depth of 60 inches.

This unit is well drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots.

Included with this unit in mapping are a few areas of Gowen soils. Also included are a few areas of soils that are similar to Pulexas soils except that they are more clayey. These included soils make up less than 20 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. These soils are subject to washing or scouring and to deposition of fresh alluvial sediments. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

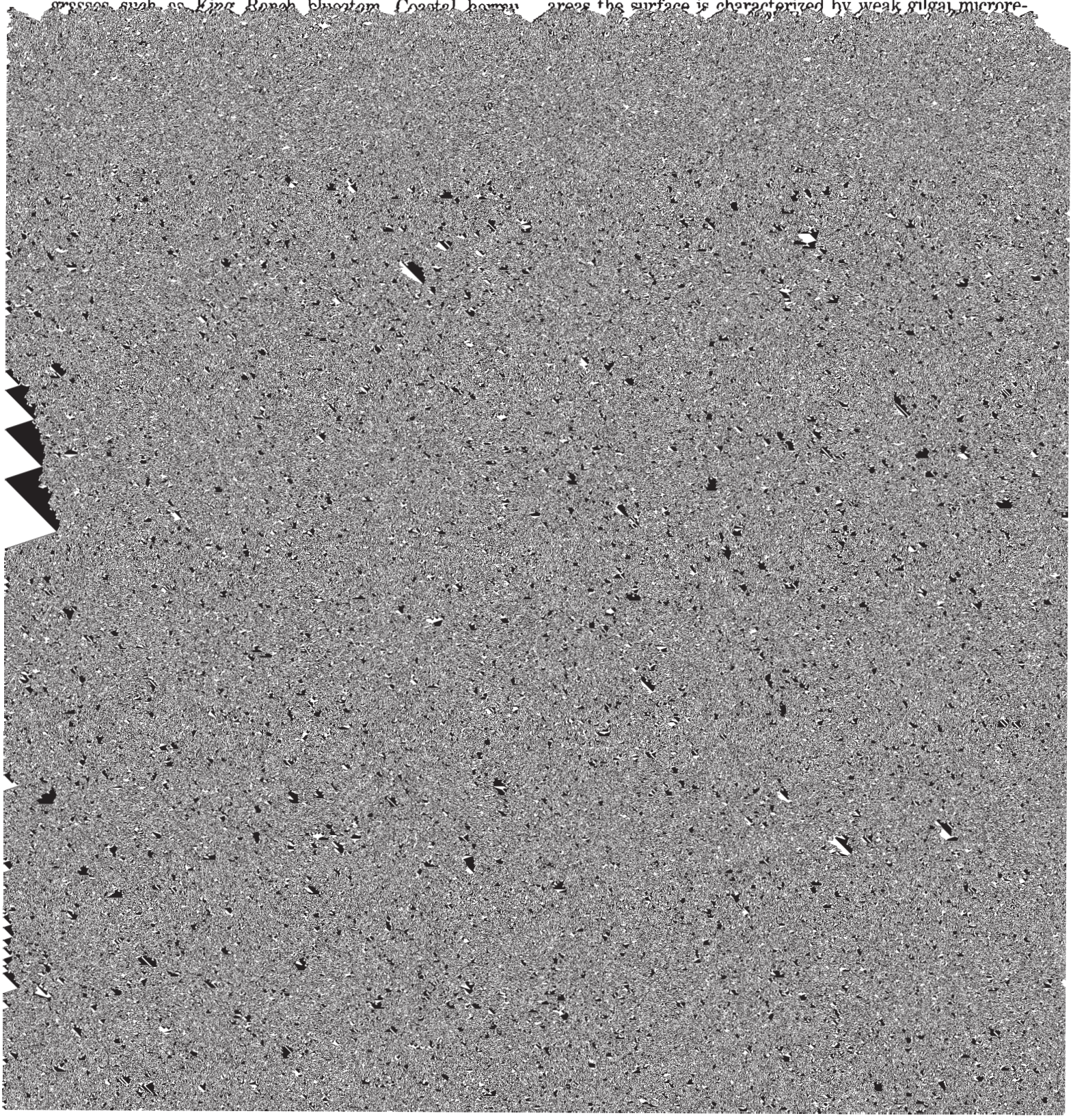
Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush



Potential for wheat and grain sorghum is medium. Terracing and contour farming help control water erosion. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is medium. Improved grasses such as *King Ranch bluestem, Coastal bermu-*

**30—Sanger stony clay, 5 to 12 percent slopes.** This deep, sloping to strongly sloping soil is on uplands in bands along hillsides. Slopes are slightly convex and average about 6 percent. Areas are long and narrow to oblong and range from 10 to 300 acres. In undisturbed areas the surface is characterized by weak gilgai microre-



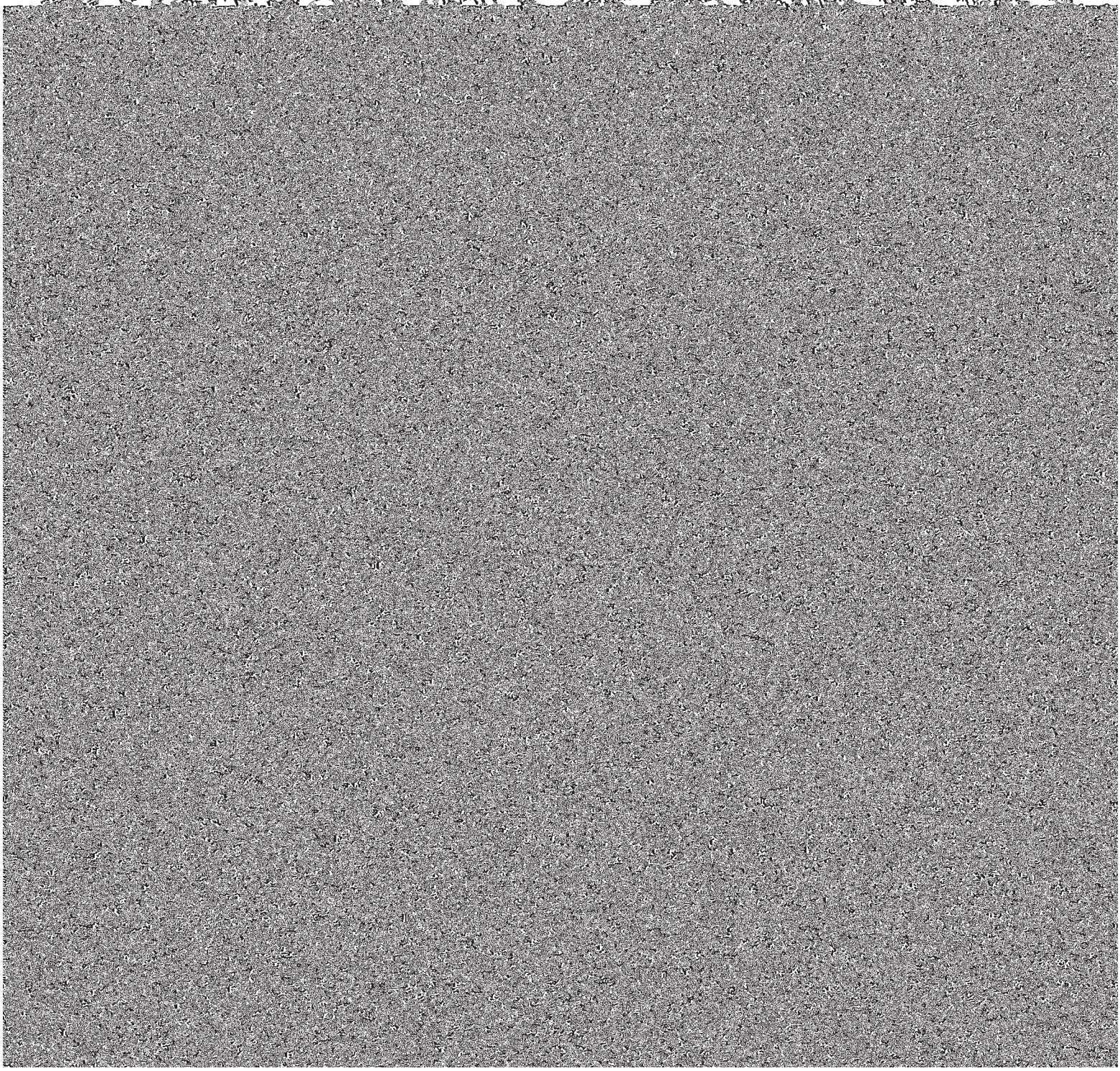
capacity is medium. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chaney and Duffau soils. Also included are soils that are similar to Selden soils except that they do not have gray mottles within 30 inches of the surface. Also included are a few areas of gullied soils. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as pastureland and rangeland. Potential for

loam about 10 inches thick. The subsoil is firm, yellowish brown, neutral sandy clay to a depth of 27 inches; firm, strong brown, neutral sandy clay that contains a few fragments of sandstone to a depth of 41 inches; and firm, yellowish red and brown, neutral clay loam to a depth of 62 inches or more.

Anocon soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of water erosion is moderate. Natural fertility and organic matter content are



fertility and organic matter content are moderately high. The soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastrop soils and small areas of Teller soils that have slopes of 1 to 2 percent. Also included are areas of soils that are similar to Teller soils except that they have a subsoil of very fine sandy loam in which clay content is less than 18 percent. A few small areas of depressional soils that have a more clayey subsoil are included along drainageways. These included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland, and it has high potential for this use. It is among the most productive of the county and is well suited to grain sorghum, cotton, wheat, oats, alfalfa, and corn. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, Kleingrass, and weeping lovegrass are well suited to this soil.

This soil has high potential for most urban or recreational uses. Seepage restricts use of the soil for sanitary landfills. Capability class I; Loamy Prairie range site.

**34—Truce fine sandy loam, 2 to 5 percent slopes.** This deep, gently sloping soil is on uplands. Slopes are smooth and average about 3 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of friable, yellowish brown, neutral fine sandy loam about 3 inches thick. The subsurface layer is friable, light yellowish brown, neutral fine sandy loam that extends to a depth of 6 inches. The subsoil is very firm, yellowish red, neutral clay to a depth of 16 inches; very firm, brown, neutral clay to a depth of 25 inches; and very firm, brownish yellow, moderately alkaline clay to a depth of 45 inches. The underlying material is massive, light gray and brownish yellow, clayey shale.

This soil is well drained. Runoff is rapid. Permeability is slow, and available water capacity is medium. Natural fertility and organic matter content are moderately low.

Potential for pasture production is medium. Improved grasses such as King Ranch bluestem, Kleingrass, weeping lovegrass, and Coastal bermudagrass are suited to this soil.

Potential for wheat, oats, and grain sorghum is medium. Crop residue left on or near the surface helps prevent water erosion and conserve moisture. Contour farming and terracing are needed in most areas to prevent water erosion.

Potential for most urban or recreational uses is medium. Low strength, shrinking and swelling with changes in moisture, slow permeability, and the clay subsoil are the main limitations. Capability subclass IIIe; Light Sandy Loam range site.

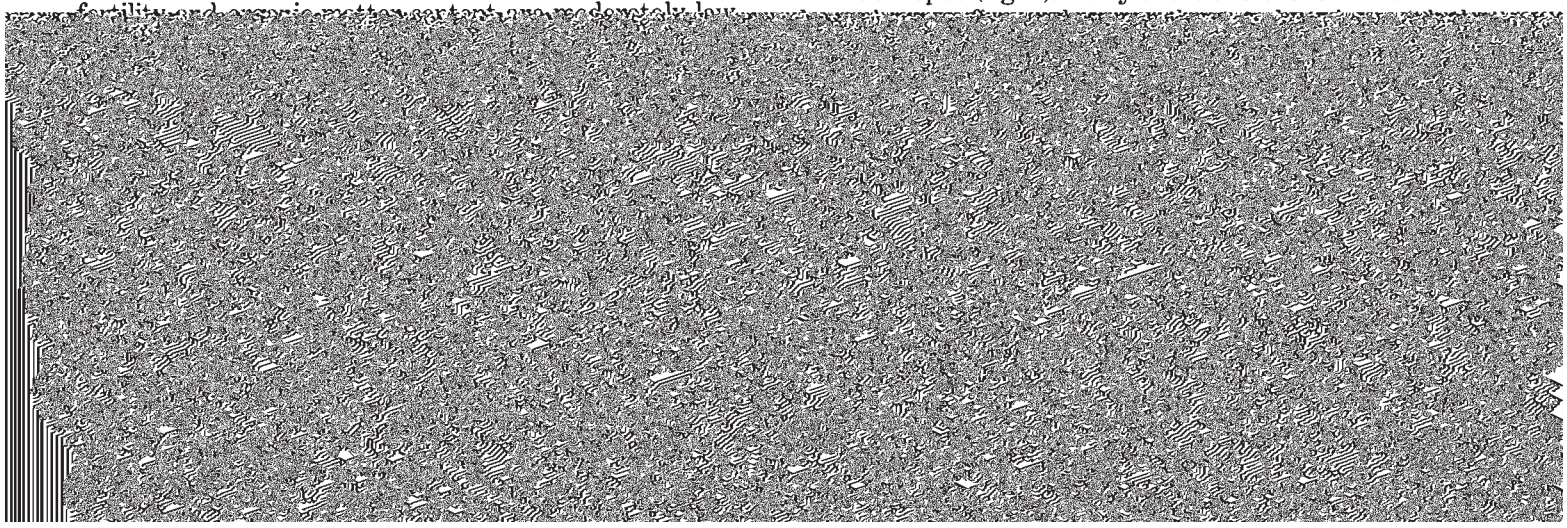
**35—Truce-Owens complex, 5 to 20 percent slopes.** This is a complex of sloping to moderately steep soils on uplands, mainly on a mass of low hills or in narrow bands along hillsides. Slopes are convex and average about 12 percent. Areas are irregularly shaped to elongated and range from 15 to several hundred acres.

Truce soils make up about 49 percent of the complex; Owens soils, about 22 percent; and other associated soils, about 29 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Truce soils, which are sloping and strongly sloping, are on side slopes. They have a surface layer of very friable, pale brown, neutral stony fine sandy loam about 3 inches thick. The subsurface layer is very friable, light yellowish brown, neutral stony fine sandy loam that extends to a depth of 7 inches. Sandstone fragments, 1 to 15 inches across, cover about 15 percent of the surface. The subsoil is very firm, yellowish red, slightly acid clay to a depth of 14 inches; very firm, strong brown, slightly acid clay to a depth of 26 inches; and very firm, mottled strong brown and brownish yellow, neutral clay to a depth of 41 inches. The underlying material to a depth of 48 inches is pale yellow, moderately alkaline clayey shale.

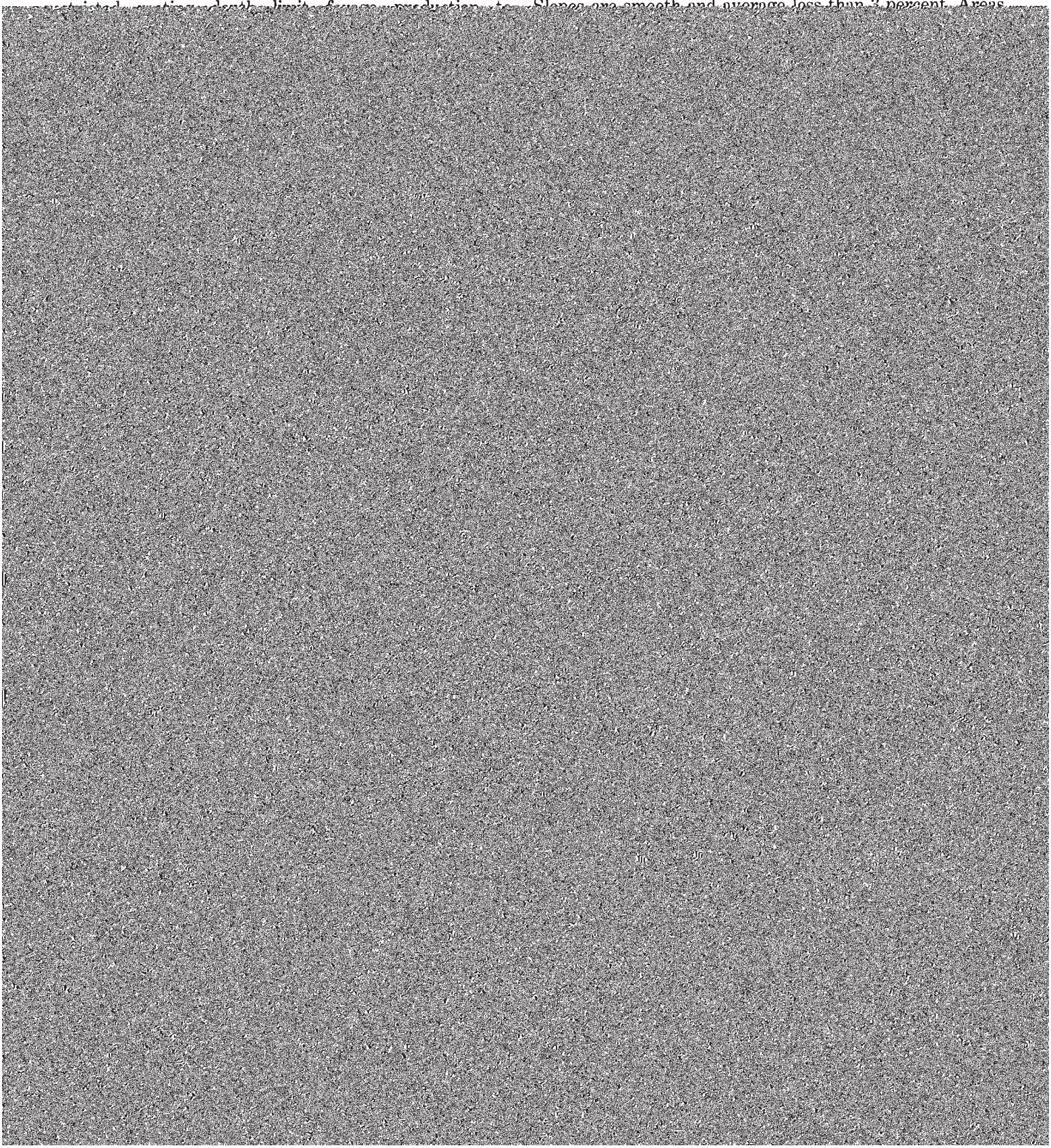
Truce soils are well drained. Runoff is rapid. Permeability is slow, and available water capacity is low. The hazard of water erosion is moderate.

Owens soils, which are moderately steep to steep, are on side slopes (fig. 8). Many areas are eroded. The surface



Potential for native range plants is medium. Rapid runoff, medium to low available water capacity, and [illegible] limit forage production to

**37—Vashti fine sandy loam, 2 to 5 percent slopes.** This moderately deep, gently sloping soil is on uplands. Slopes are smooth and average less than 3 percent. Areas



Included with this soil in mapping are areas of Duffau soils and small areas of Sanger soils. Also included, on foot slopes, are a few areas of soils that are similar to Venus soils except that they have a dark surface layer more than 20 inches thick. Also included are a few areas of gullied soils and a few areas of soils that have slopes of 3 to 5 percent. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and a few motts of live oak trees and shrubs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

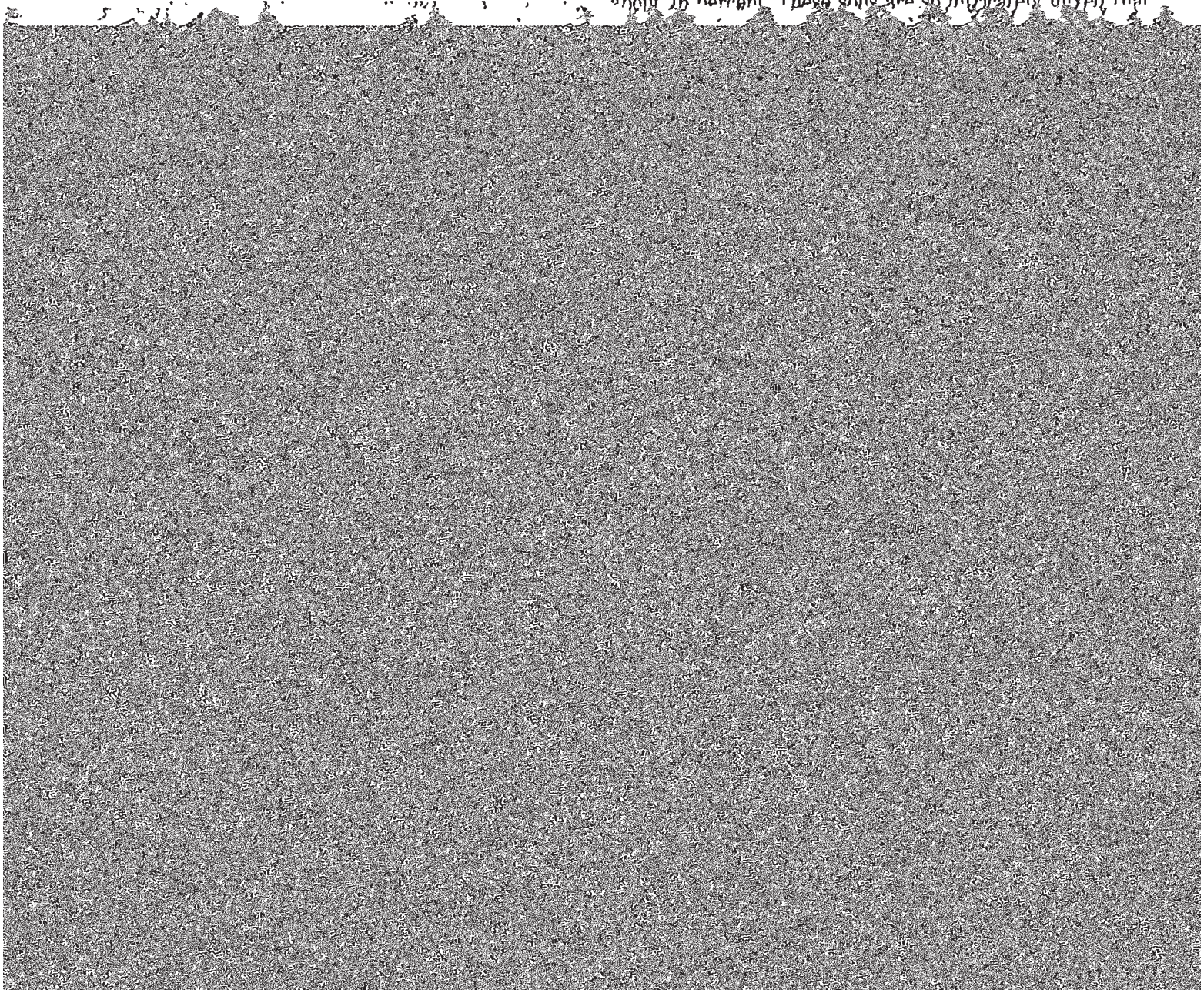
Potential for oats and wheat is medium. Crop residue left on or near the surface helps prevent water erosion,

Potential for pasture production is low. Improved grasses such as King Ranch bluestem are suited.

Potential for most urban or recreational uses is low. Low strength, shrinking and swelling upon wetting and drying, and the clayey surface layer are difficult to overcome. Capability subclass IVe; Shallow Clay range site.

**40—Vernon-Knoco complex, 5 to 25 percent slopes, severely eroded.** This is a complex of sloping to steep soils on uplands, mainly in narrow bands along hillsides. Slopes are convex and average about 12 percent. Shallow gullies, 1 to 10 feet wide and 1 to 5 feet deep, commonly dissect these areas at intervals of 10 to 100 feet. These shallow gullies have sloping sides. Areas are irregularly shaped to elongated and range from 10 to several hundred acres.

Vernon soils make up about 46 percent of the complex; Knoco soils, about 38 percent; and other associated soils, about 16 percent. These soils are so intricately mixed that

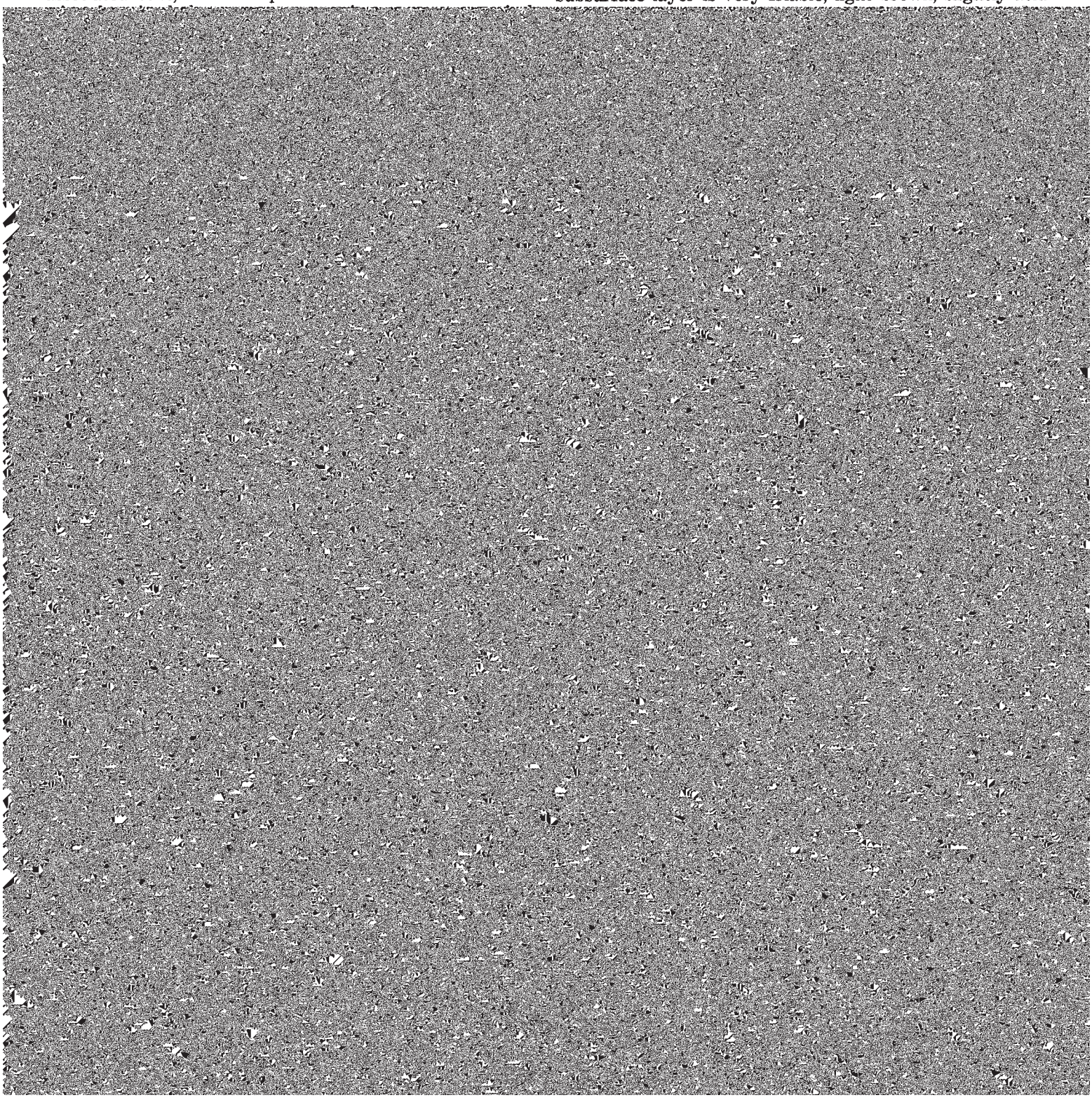


**41—Waurika-Renfrow complex, 0 to 1 percent slopes.** This is a complex of nearly level soils on uplands, mainly along small drainageways and in depressional areas. Slopes are smooth and concave. Areas are irregularly shaped to elongated and range from 10 to 300 acres.

Waurika soils make up about 64 percent of the complex; Renfrow soils, about 25 percent; and other closely associated soils, about 11 percent. These soils are so in-

**42—Windthorst loamy fine sand, 1 to 5 percent slopes.** This deep, gently sloping soil is in slightly convex areas on uplands. Slopes are smooth and average about 2 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of very friable, brown, slightly acid loamy fine sand about 4 inches thick. The subsurface layer is very friable, light brown, slightly acid



brown, neutral fine sandy loam that extends to a depth of 10 inches. The subsoil is firm, yellowish red, slightly acid sandy clay to a depth of 21 inches; firm, mottled red and reddish yellow, medium acid sandy clay to a depth of 36 inches; and firm, reddish yellow, slightly acid sandy clay loam to a depth of 55 inches. The underlying material is firm, light gray, moderately alkaline clay loam that extends to a depth of 60 inches or more (fig. 10).

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

Included with this soil in mapping are areas of Duffau and Chaney soils. Also included are a few areas of soils that have slopes of less than 2 percent. There are small eroded areas in most old cultivated fields, and sheet erosion occurs on the upper parts of slopes and in convex areas. These eroded areas have a thinner surface layer of fine sandy loam that is redder than the surface layer in uneroded areas because some material from the subsoil has been mixed into it by tillage. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland and pastureland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled

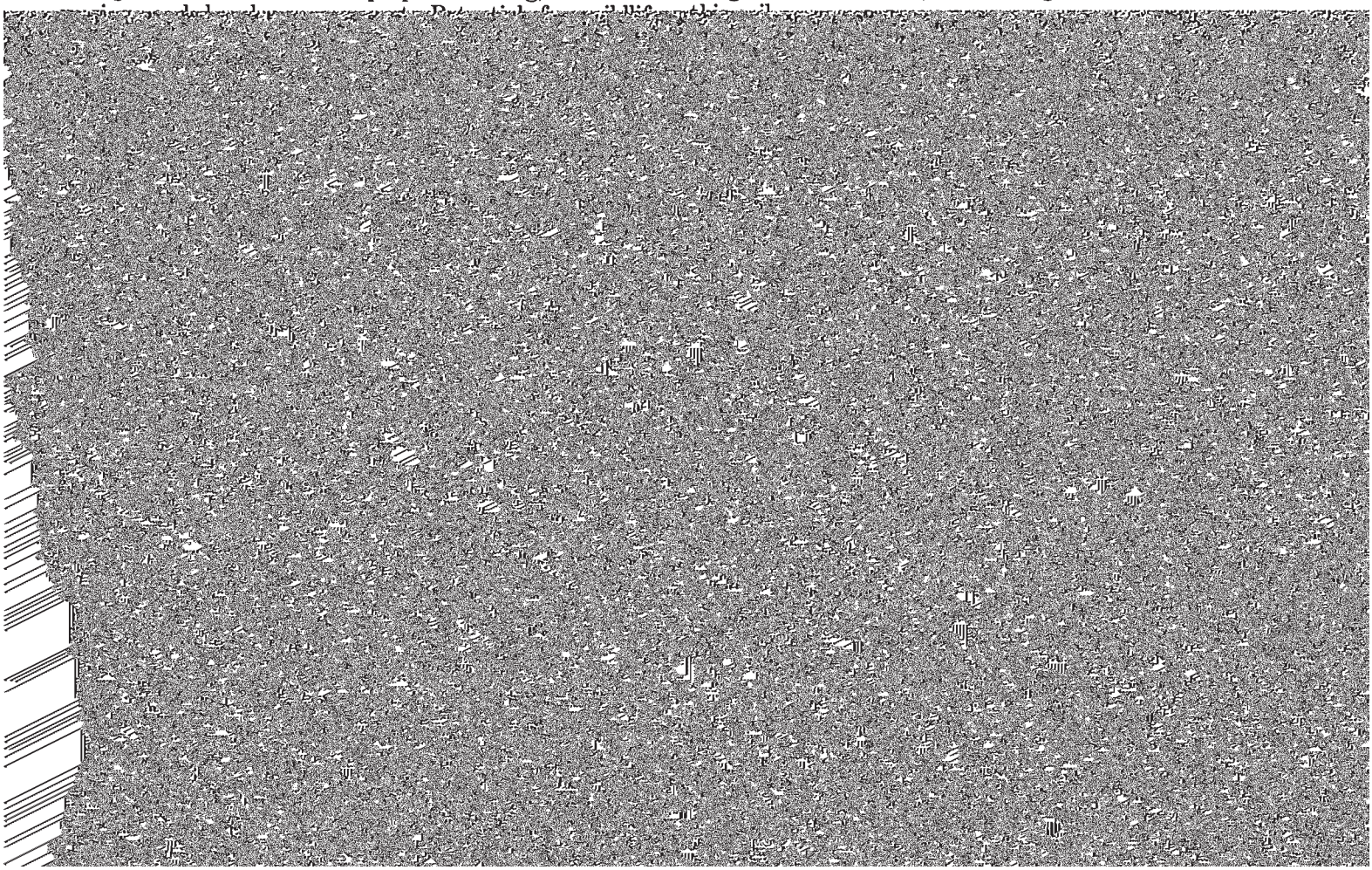
This soil is moderately well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is medium. The hazard of water erosion is high.

Included with this soil in mapping are areas of Duffau soils. There are small gullied areas in most old cultivated fields, and sheet erosion occurs on the upper parts of slopes and in convex areas. These eroded areas have a thin surface layer of fine sandy loam that is redder and contains more clay than the surface layer in uneroded areas because material from the subsoil has been mixed with it by tillage. Also included are a few areas of soils that have a sandy surface layer. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for peanuts, grain sorghum, and oats is medium. Crop residue left on or near the surface helps conserve moisture and maintain tilth. Terraces and contour farming help control water erosion.

Potential for pasture production is medium. Improved grasses such as Coastal bermudagrass, weeping lovegrass, King Ranch bluestem, and Kleingrass are well suited to



yellowish red, slightly acid sandy clay loam to a depth of 55 inches. The underlying material is massive, very pale brown sandy clay.

Windthorst soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is medium. The hazard of water erosion is high.

Duffau soils are on the lower parts of slopes. They have a surface layer of friable, dark brown, slightly acid fine sandy loam about 6 inches thick. The subsoil to a depth of 60 inches is friable, yellowish red, slightly acid sandy clay loam.

Duffau soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is medium. The hazard of water erosion is high.

Included with these soils in mapping are small areas of severely eroded Chaney and Selden soils. Included soils make up less than 20 percent of any one mapped area.

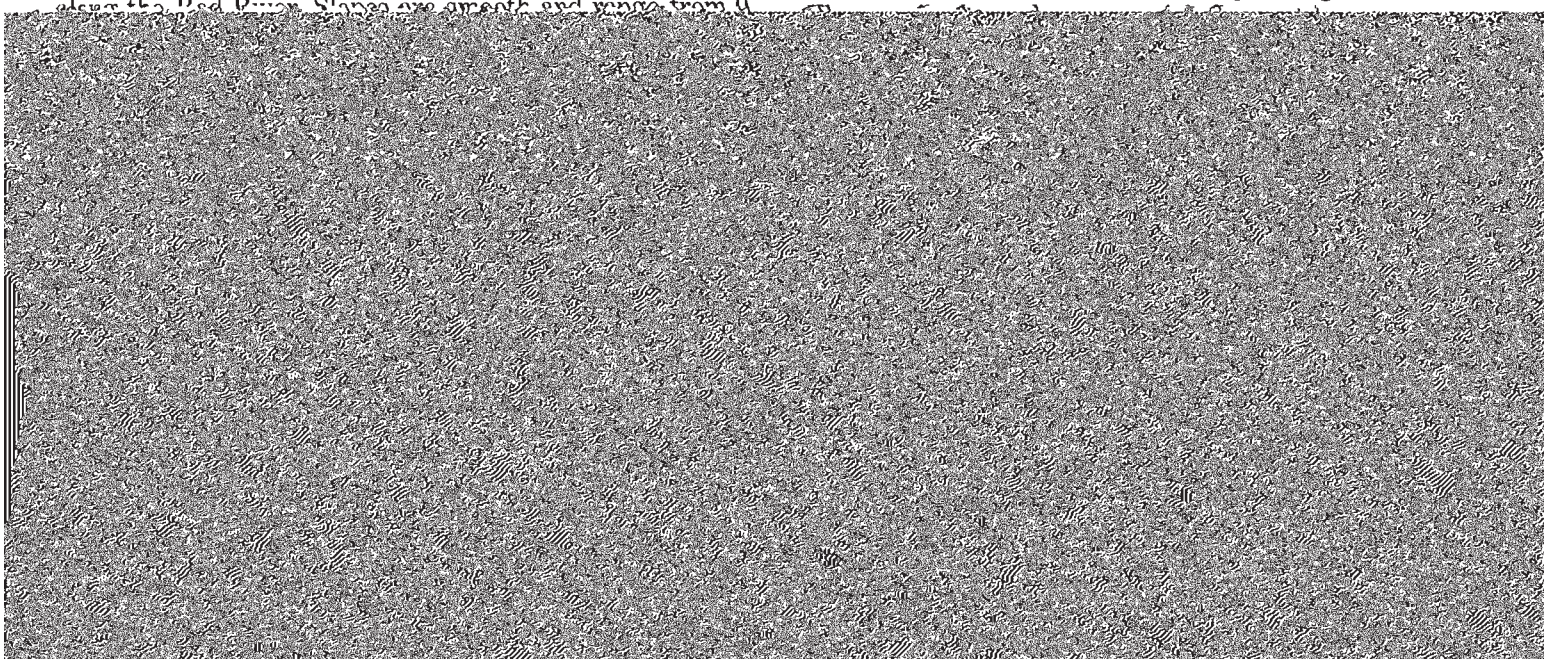
The soils in this map unit are not suitable for cultivated crops. They are used mainly as rangeland or for wildlife habitat.

Potential for native range plants is medium. Forage production is limited by the rapid runoff and by the surface layer of clay in gullied areas. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is medium. Soil areas to be reclaimed need to be shaped and sodded to improved grasses such as Coastal bermudagrass.

These soils have low potential for most urban or recreational uses. Low strength, shrinking and swelling with changes in moisture, and gullied areas are the main limitations. Capability subclass VIe; Sandy Loam range site.

**46—Yahola-Gaddy complex, occasionally flooded.** This is a complex of nearly level soils on flood plains along the Red River. Slopes are smooth and range from 0 to 1 percent.



medium. The root zone is deep and easily penetrated by plant roots.

Gaddy soils are in plane to slightly convex areas. Gaddy soils make up a higher percentage of this mapping unit at slightly lower elevations adjacent to the river channel than in higher areas. They have a surface layer of very friable, calcareous, reddish yellow fine sandy loam about 9 inches thick. The underlying material to a depth of 60 inches is very friable, calcareous, light brown loamy fine sand that has a few thin strata of reddish brown clay loam throughout.

Gaddy soils are somewhat excessively drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is low. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are areas of more clayey soils; these soils have texture of clay loam. They are in depressional areas and make up about 18 percent of the mapped area. Gaddy soils that have a surface layer of loamy fine sand make up as much as 10 percent of any mapped area; these soils are on slight ridges. Narrow areas between different levels of the flood plains have slopes of more than 1 percent.

These soils are suitable for cultivated crops but are mainly used as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat, forage sorghum, alfalfa, and grain sorghum is medium. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Pecans are well suited to the soil.

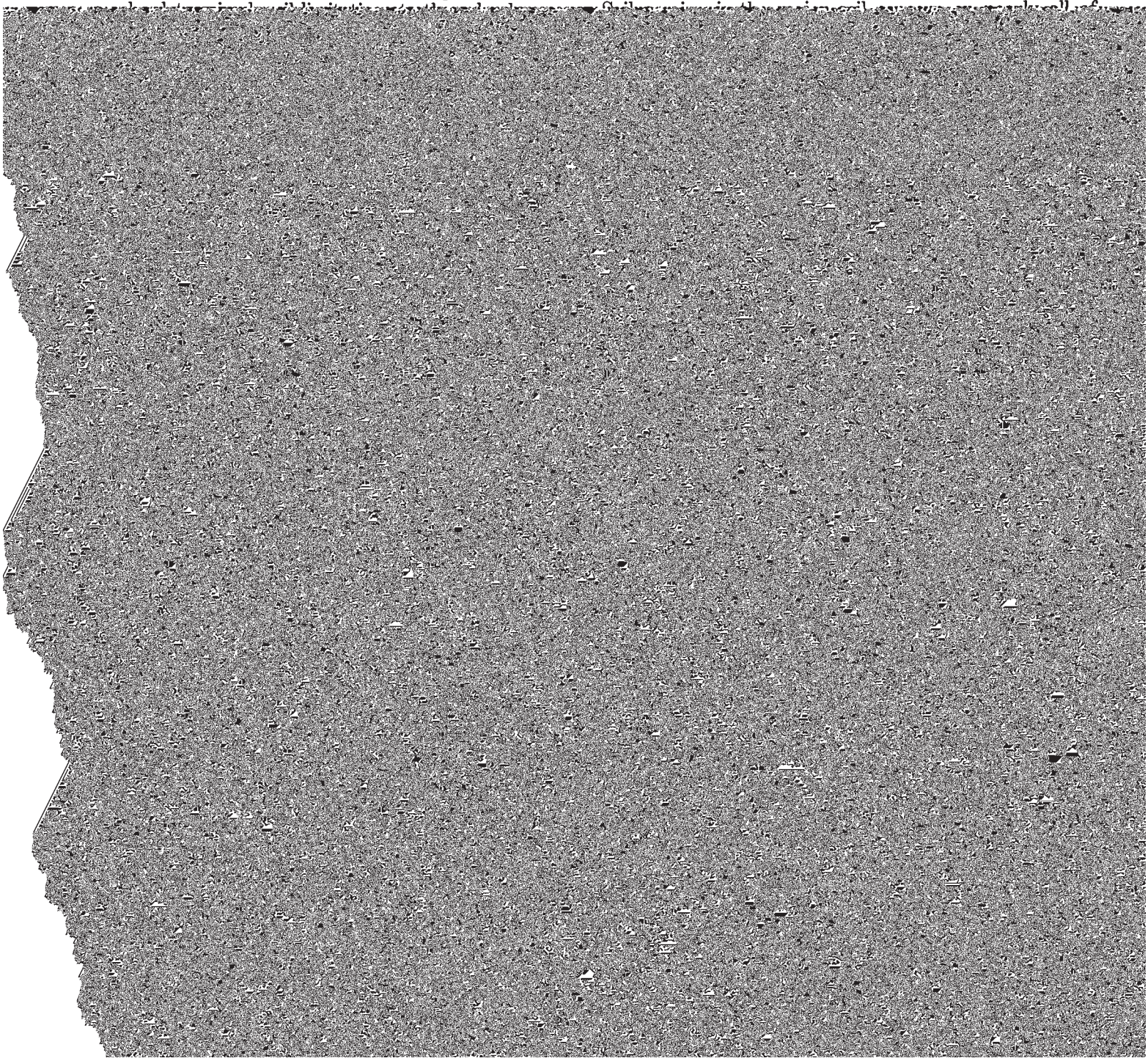
Potential for pasture production is high. Improved grasses, such as Coastal bermudagrass and Kleingrass, are well suited to the soils in this complex (fig. 11).

affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and as sites for buildings, highways and other transportation systems, sanitary facilities, parks and other recreation facilities, and wildlife habitat. From the data presented, the potential of each soil for specified land

wheat and oats; 444 acres, for rotation hay and pasture; and the rest was idle cropland.

The potential of the soils in Montague County for increased production of food is high. Many thousand acres of potentially good cropland is currently used as rangeland and pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.



dry and bare of vegetation or surface mulch. Stripcropping, vegetative cover, or surface mulch minimizes soil blowing on these soils. Most crops provide adequate cover during the growing season, but do not leave enough residue for soil protection and improvement. Such crops as peanuts need to be followed by a cover crop such as rye and vetch.

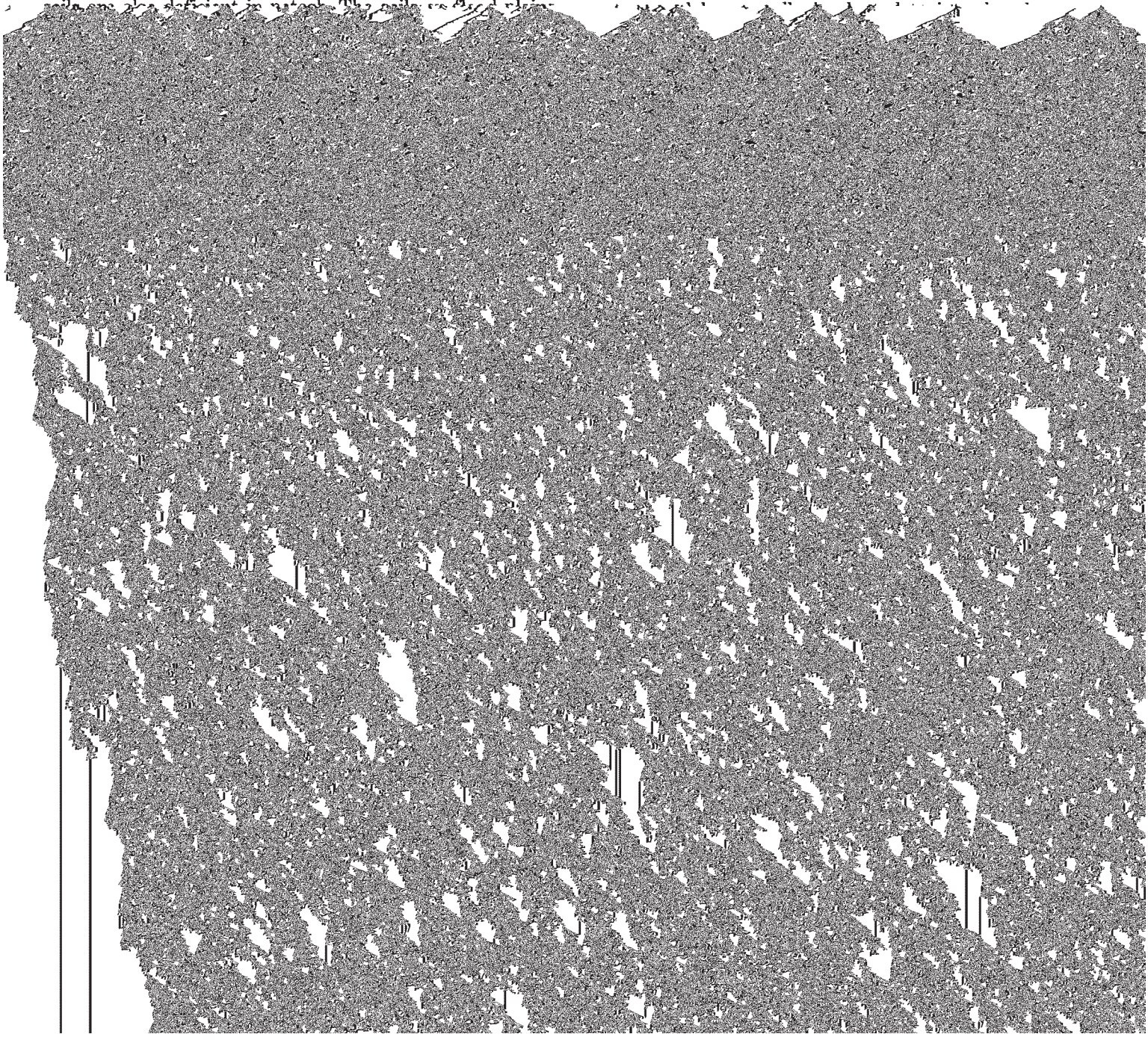
Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil fertility is naturally low in most soils of the uplands in the survey area. These soils are most often deficient in nitrogen and phosphorus and a few sandy soils are also deficient in potash. The soils used for

most horticultural crops. Sprinkler irrigation works satisfactorily on gently sloping soils and is generally the only type suitable for the more sandy soils. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Pasture is important in Montague County because the raising of livestock is the main farm enterprise. For the past several years, the trend has been to convert land from other uses to pasture and hay. Land used for



such as Coastal bermudagrass. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides erosion control and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen,

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

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

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

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

Class VII soils have very severe limitations that make

On many ranches the forage produced on rangeland is supplemented by tame pastures, crop stubble, and small grain. In winter the native forage is often supplemented with protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

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

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the potential production of vegetation in favorable, normal, and unfavorable years; the common plant names; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

*Potential production* refers to the amount of vegetation that can be expected to grow annually on well-managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

*Dry weight* refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

*Common plant names* are given for the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community, an evaluation of the present condition of the particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the western and northwestern parts of the county, the rangeland is generally an open grassland prairie. The soils are loamy and deep or moderately deep and have a subsoil of clay loam or clay. These soils support tall and mid grasses, and potential productivity is medium to high. In much of the central and eastern parts of the county, the rangeland is generally an oak savannah rangeland, commonly called West Cross Timbers. The soils are deep, loamy or sandy, and have a subsoil of sandy clay or sandy clay loam. These soils support post oak and blackjack oak trees and tall grasses such as little bluestem, big bluestem, and indiangrass. The potential productivity is high.

The major management concern on most of the rangeland is the control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. Controlling brush and minimizing soil erosion are also important management concerns. If sound range management based on the soil survey information and rangeland inventories is applied, the potential for increasing the productivity of range in the area is good (fig. 12).

## Engineering

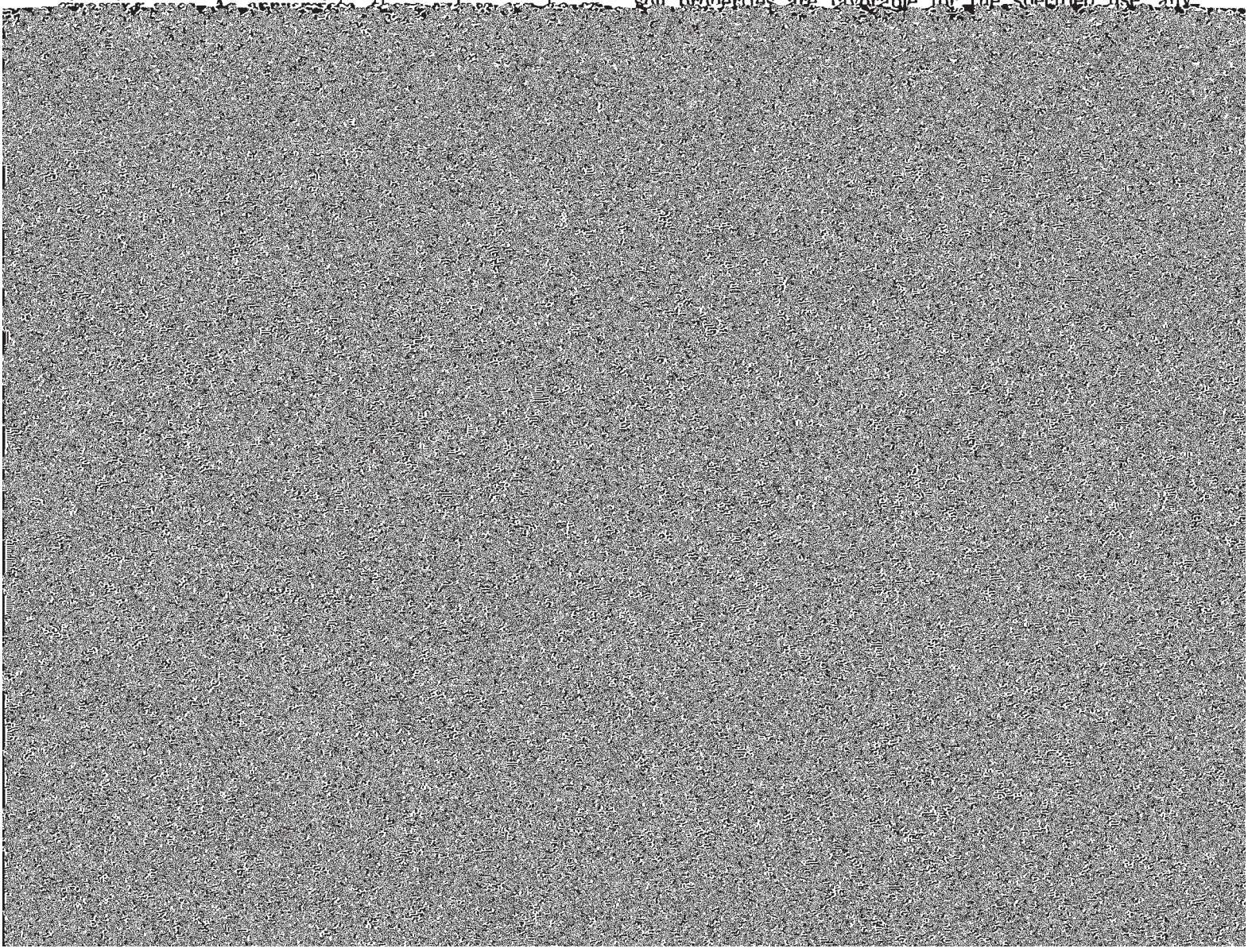
ROBERT C. BROWN, engineer, Soil Conservation Service, helped plan and write this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this section are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, and the likelihood of flooding. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in en-



The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

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

## Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties are favorable for the specified use; any

water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

*Local roads and streets* referred to in table 7 have an

with installation. Excessive slope may cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the of-

may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil and covered daily with topsoil. The limitations caused by soil texture, depth to bedrock, and content of stones do not apply to this type of landfill. Soil wetness, however, can be a limitation because of difficulty in operating equipment.

*Daily cover for landfill* should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

### Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, poor, or unsuited. The texture, thickness, and

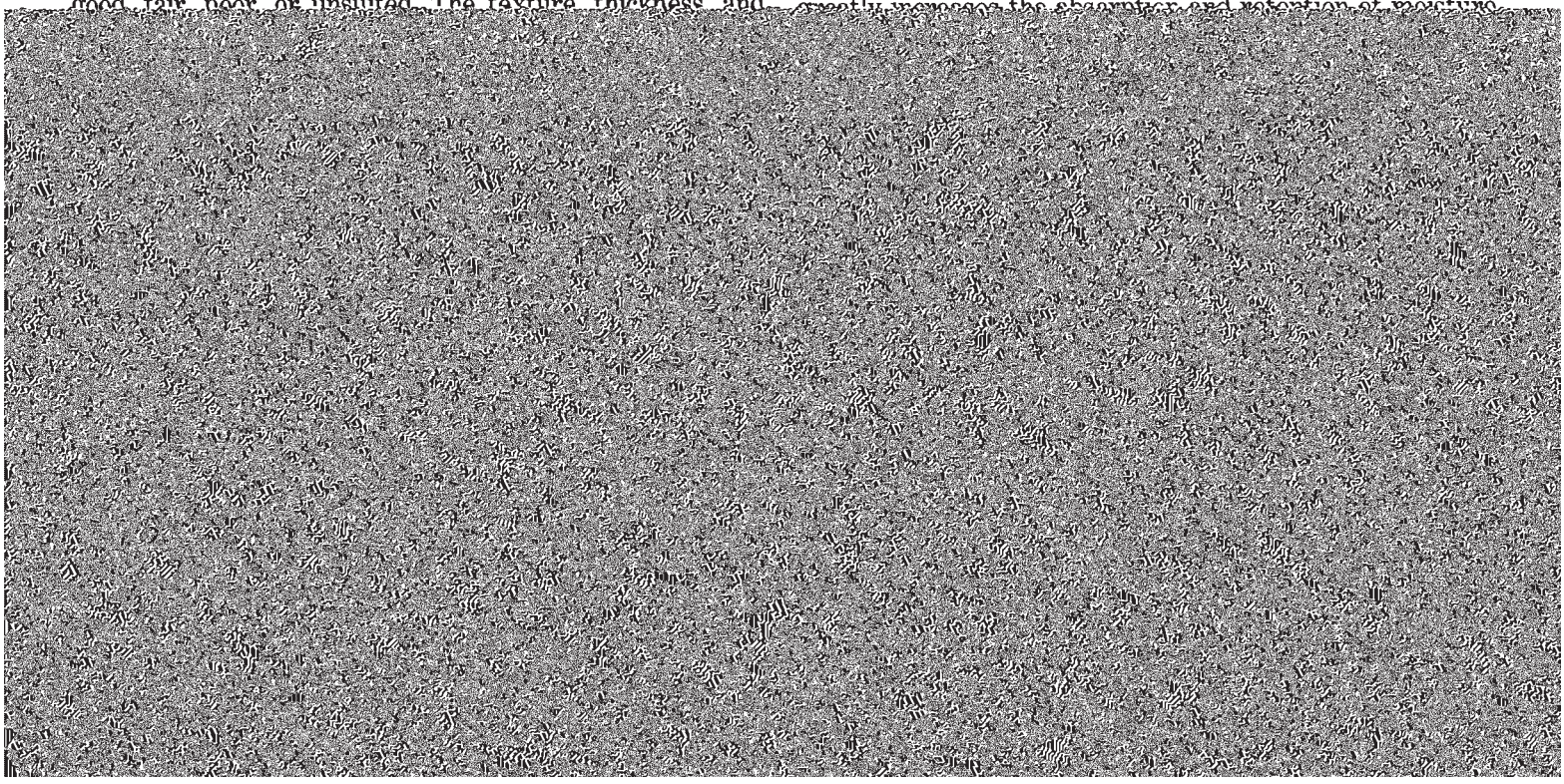
Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

*Sand* and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

*Topsoil* is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture



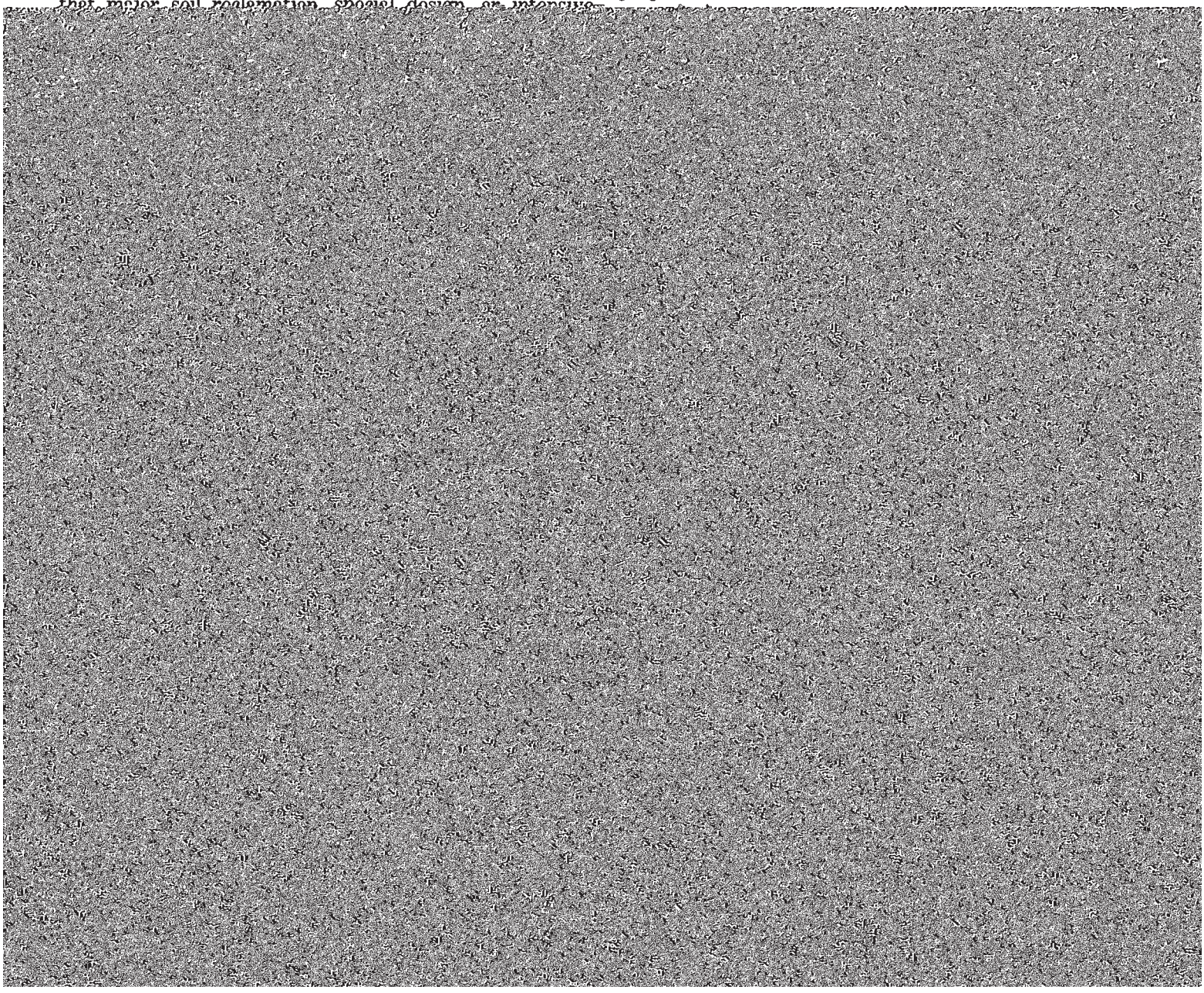
## Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive

of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

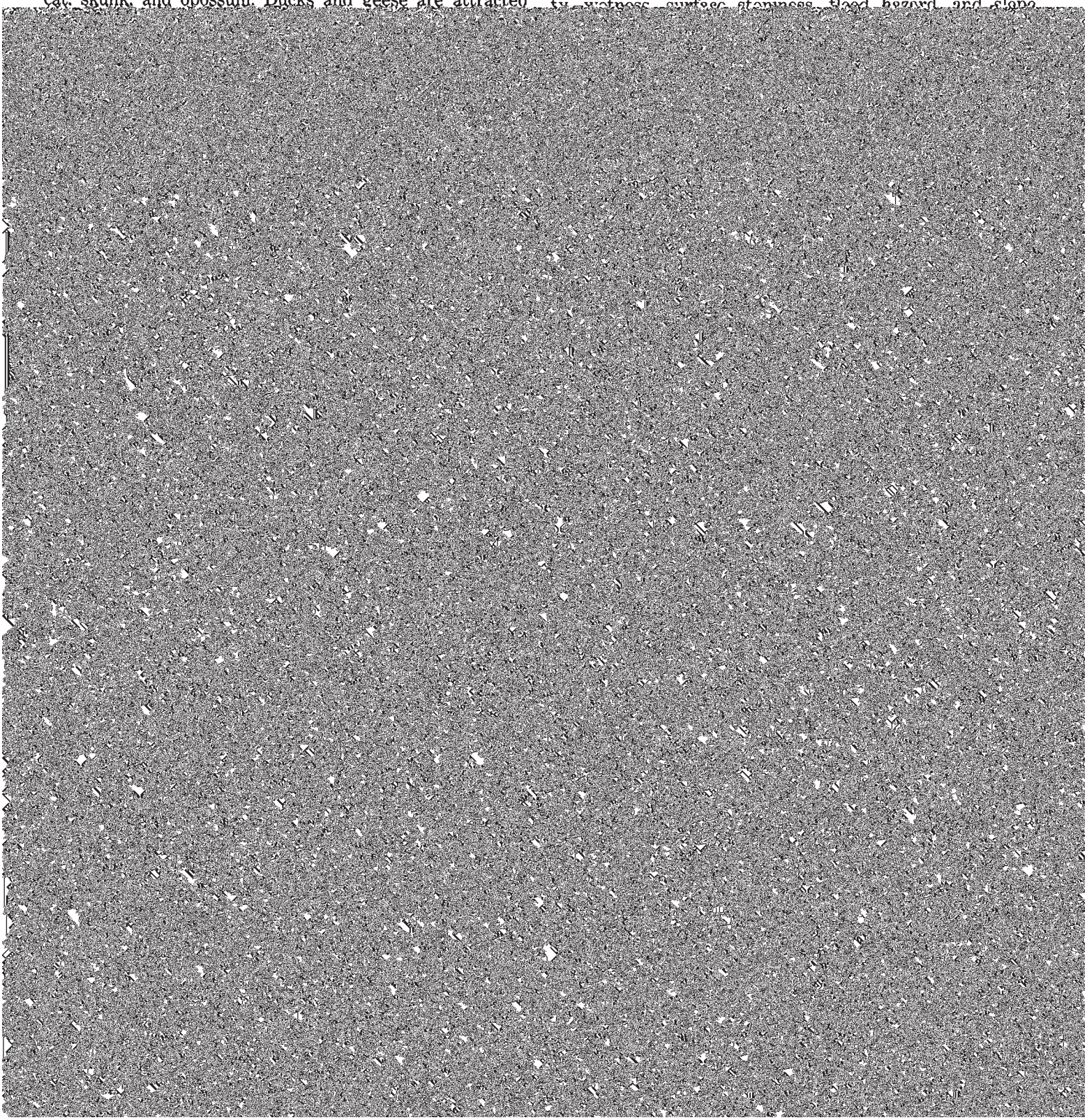
The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be off-



## Wildlife habitat

Wildlife resources are important in Montague County as a source of recreation and income. Deer, turkey, quail, dove, squirrel, and rabbit are the main kinds of wildlife in the county. Important furbearers include racoon, fox, bobcat, skunk, and opossum. Ducks and geese are attracted

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are Kleingrass, lovegrass, johnsongrass, and alfalfa. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope.



*Rangeland habitat* consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include white-tailed deer, bobcat, coyote, raccoon, skunk, meadowlark, and lark bunting.

## Soil properties

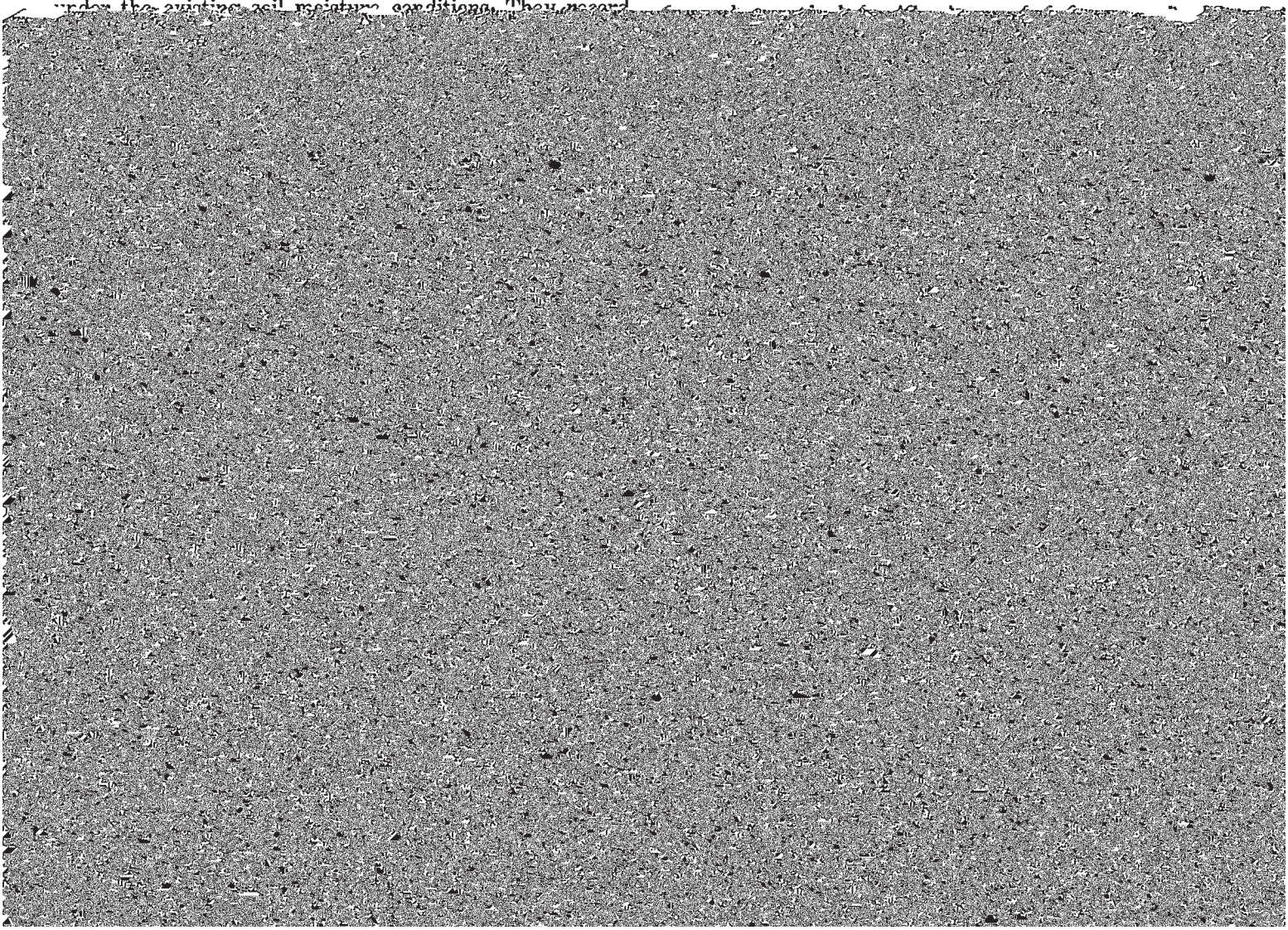
Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record

clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two



liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted in table 13.

## Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

*Permeability* is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

*Available water capacity* is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics [illegible]

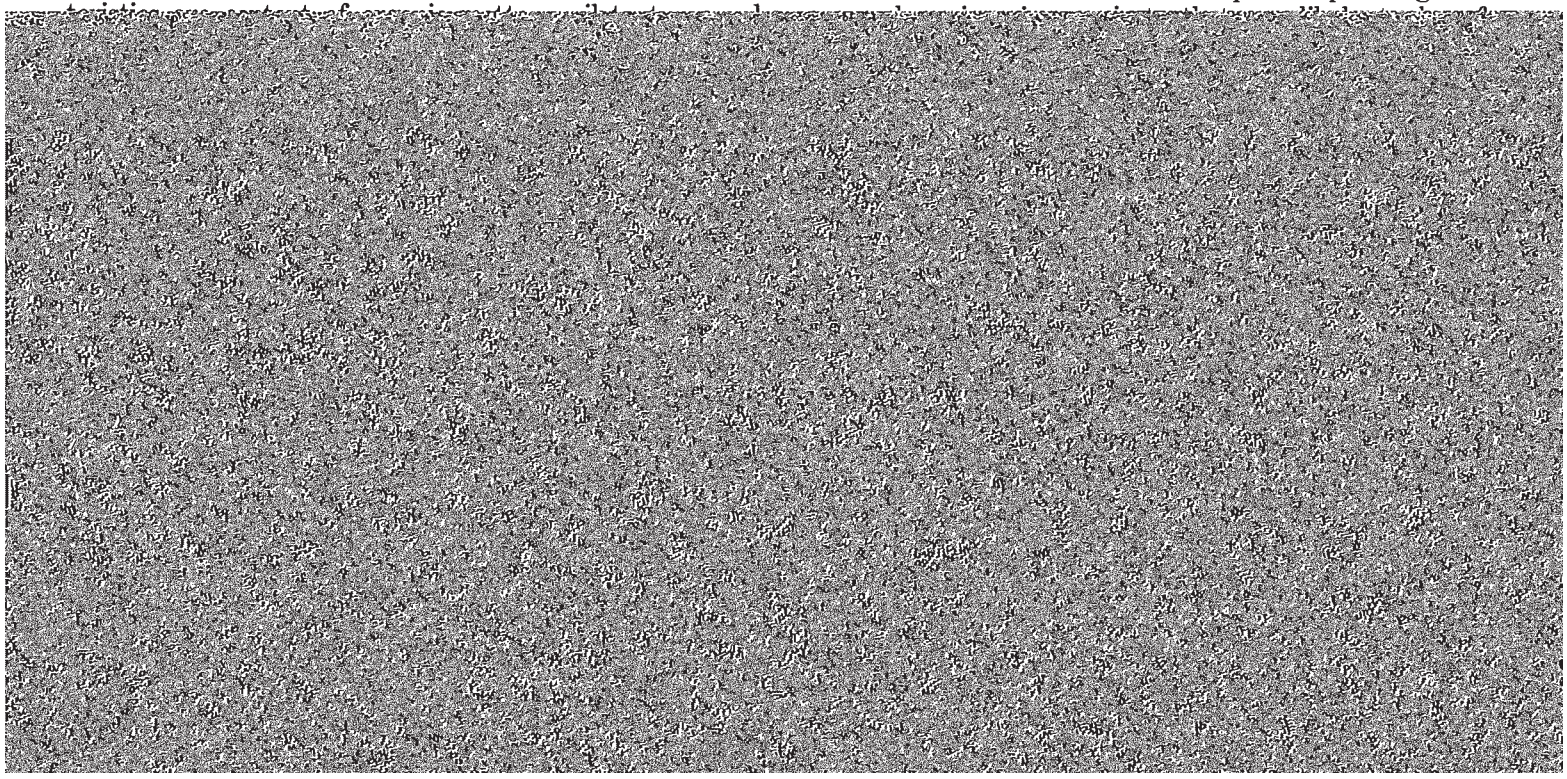
that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

*Risk of corrosion* pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

*Erosion factors* are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment (*6*). The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

## Soil and water features

Table 15 contains information helpful in planning land



Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Flooding* is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and information that relates the position of each soil on the landscape and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

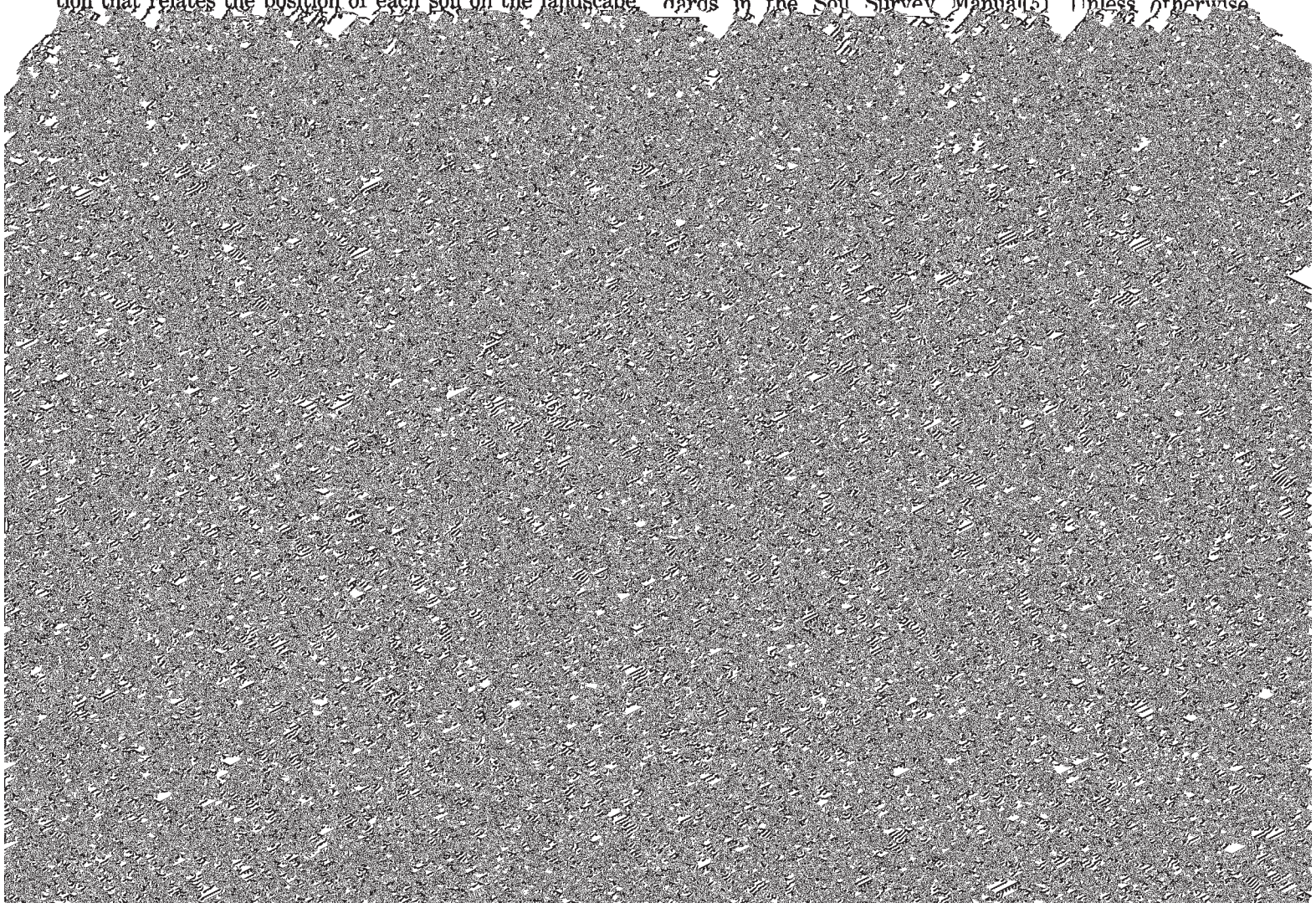
# Classification of the soils

In this section, the soil series recognized in the survey area are described, the current system of classifying soils is defined, and the soils in the area are classified according to the current system.

## Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual(5). Unless otherwise

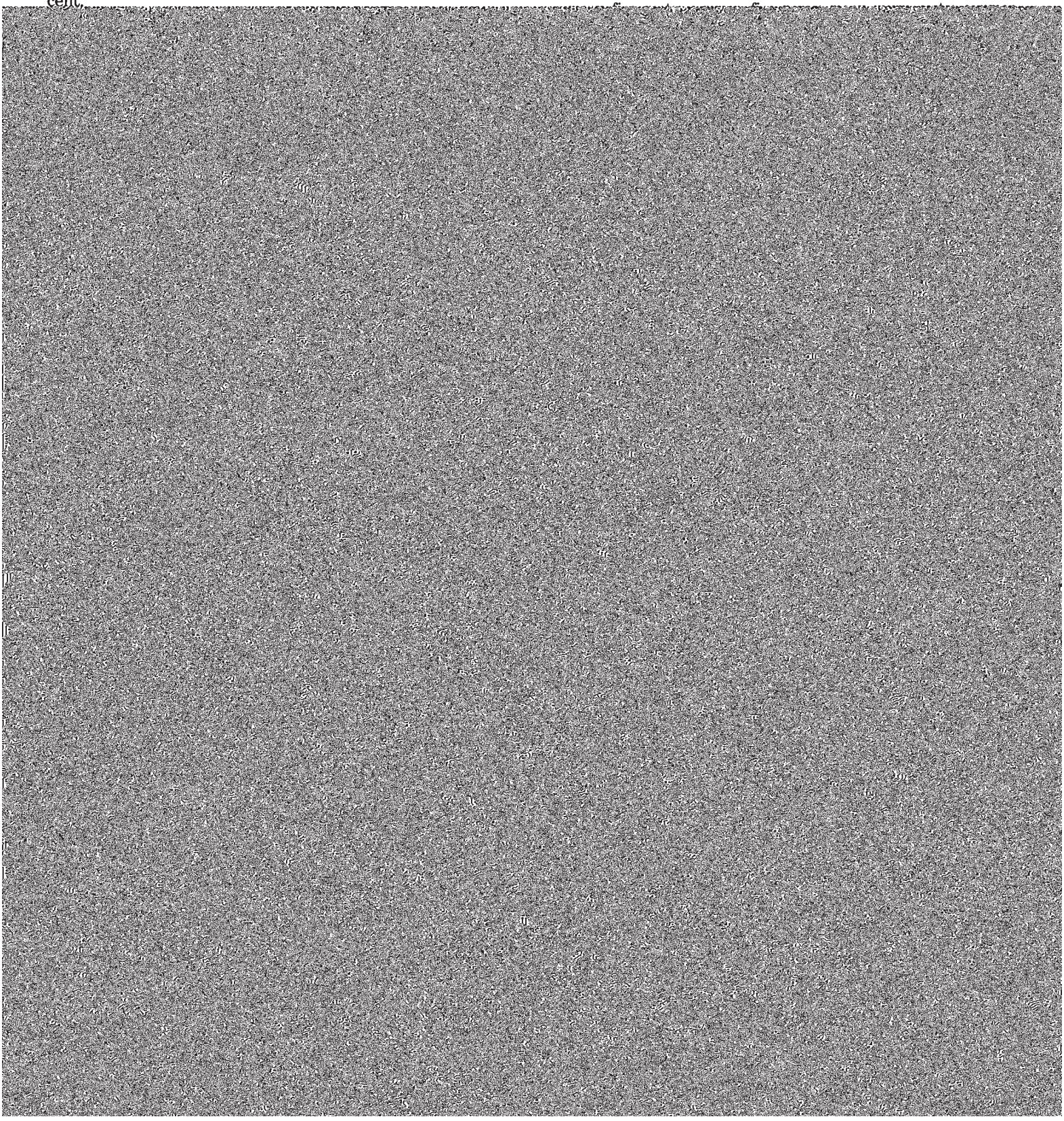


## Anocon series

The Anocon series consists of deep, loamy soils on uplands. These soils formed in materials weathered from sandstone and shaly clay. Slope ranges from 1 to 5 percent.

A1—0 to 7 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 4/2) moist; moderate very fine subangular blocky structure; slightly hard, very friable; many fine roots; many worm casts; few fine siliceous pebbles; slightly acid; gradual smooth boundary.

B21t—7 to 30 inches; red (2.5YR 5/6) loam, reddish brown (2.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable;



The B2ca horizon is brown, grayish brown, pale brown, or very pale brown loam, clay loam, or silty clay loam. Noncarbonate clay content ranges from 20 to 35 percent.

The R layer is fractured limestone that is interbedded with calcareous, clayey marl.

## Bonti series

The Bonti series consists of moderately deep, loamy soils that are clayey in the lower part. These soils are on uplands. They formed in interbedded sandstone and clays. Slope ranges from 2 to 20 percent.

Typical pedon of Bonti fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1806 and Texas Highway 59 in Montague, about 4.8 miles west on Farm Road 1806 to its intersection with county road; 0.5 mile south on county road; and 15 feet west of county road right-of-way in native grass pasture:

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

A2—5 to 8 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, very friable; common fine roots; few round siliceous pebbles; slightly acid; clear smooth boundary.

B21t—8 to 19 inches; yellowish red (5YR 5/6) sandy clay, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots and few tree roots; common thin clay films on faces of peds; few sandstone pebbles less than 25 mm in diameter; strongly acid; gradual smooth boundary.

B22t—19 to 29 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; common fine distinct strong brown mottles; moderate fine subangular blocky structure; very hard, firm; few fine roots; common thin clay films on faces of peds; few thin layers of sandstone fragments about 4 inches in diameter in lower part; [illegible]

um carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B21—22 to 44 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; common fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B22—44 to 65 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; few fine faint yellowish brown mottles; weak fine subangular blocky structure; hard, friable; many threads and films of calcium carbonate; common fine concretions of calcium carbonate; calcareous; moderately alkaline.

The 10- to 40-inch control section is loam or clay loam; clay content ranges from 20 to 35 percent.

The A horizon is dark grayish brown, brown, or very dark grayish brown. It ranges from 20 to 50 inches in thickness.

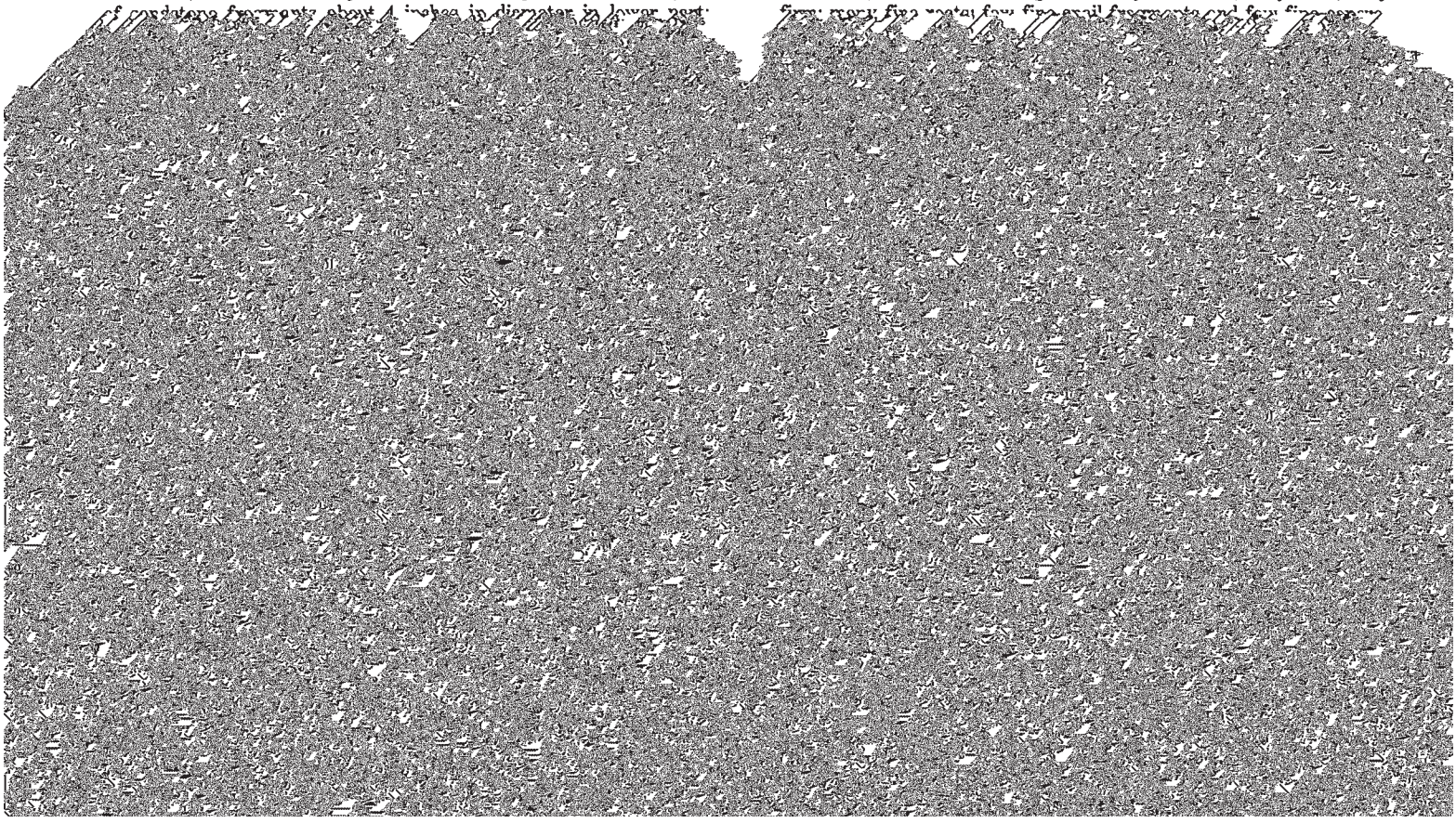
The B2 horizon is brown, pale brown, or yellowish brown loam or clay loam. Lenses of fine sandy loam are in some pedons.

## Branyon series

The Branyon series consists of deep, clayey soils on uplands. These soils formed in ancient alluvium or outwash materials. Slope ranges from 1 to 3 percent.

Typical pedon of Branyon silty clay, 1 to 3 percent slopes; from the intersection of Texas Highway 59 and U.S. Highway 82 at Saint Jo, about 5.2 miles southwest on Texas Highway 59 to intersection with oilfield road; 2.0 miles south on oilfield road; 0.4 mile west and north of oil tanks on field road to pond dam; and 120 feet north of pond dam in a microhigh in native grass pasture:

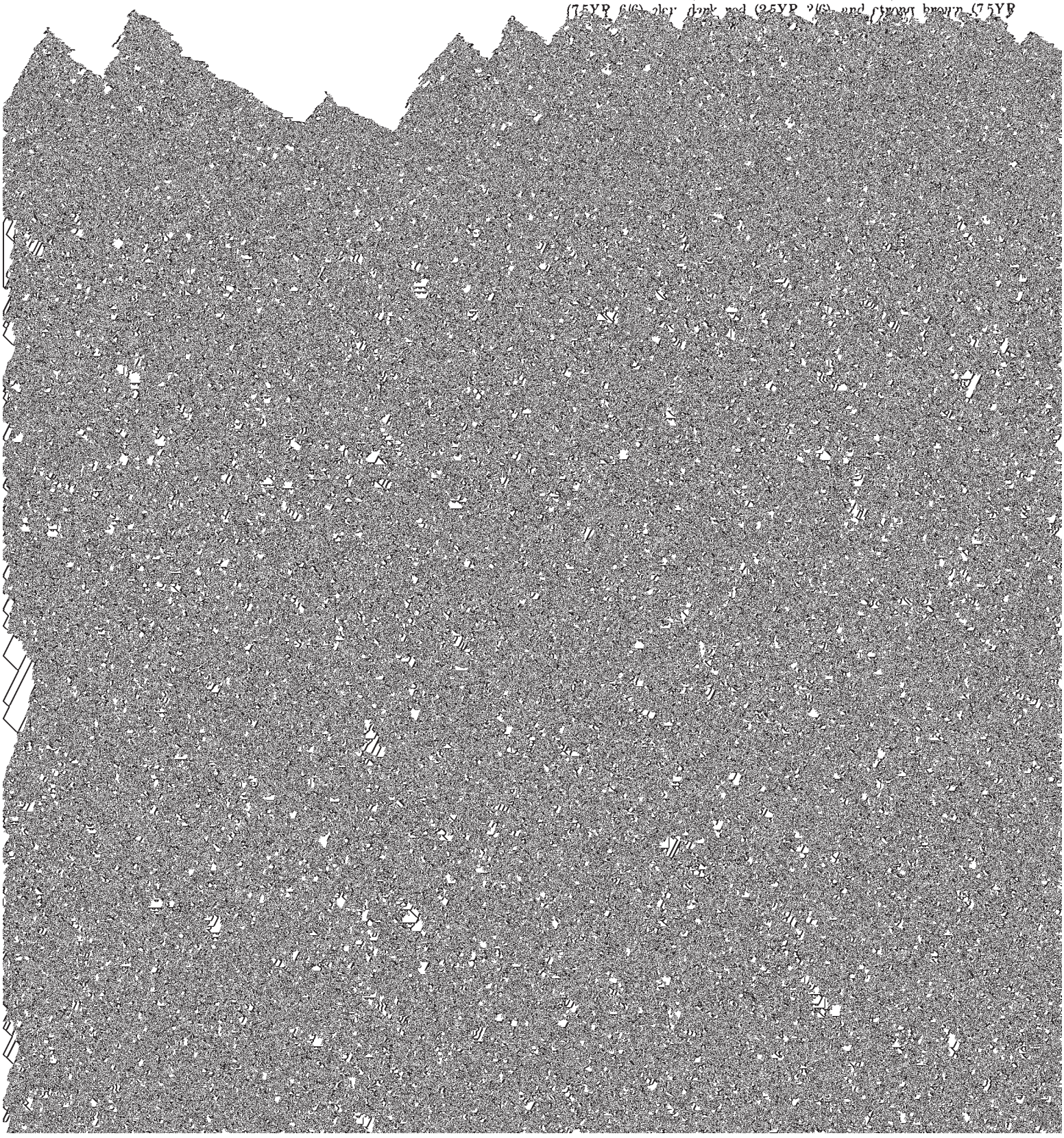
A11—0 to 33 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate fine angular blocky structure; very hard, very [illegible]



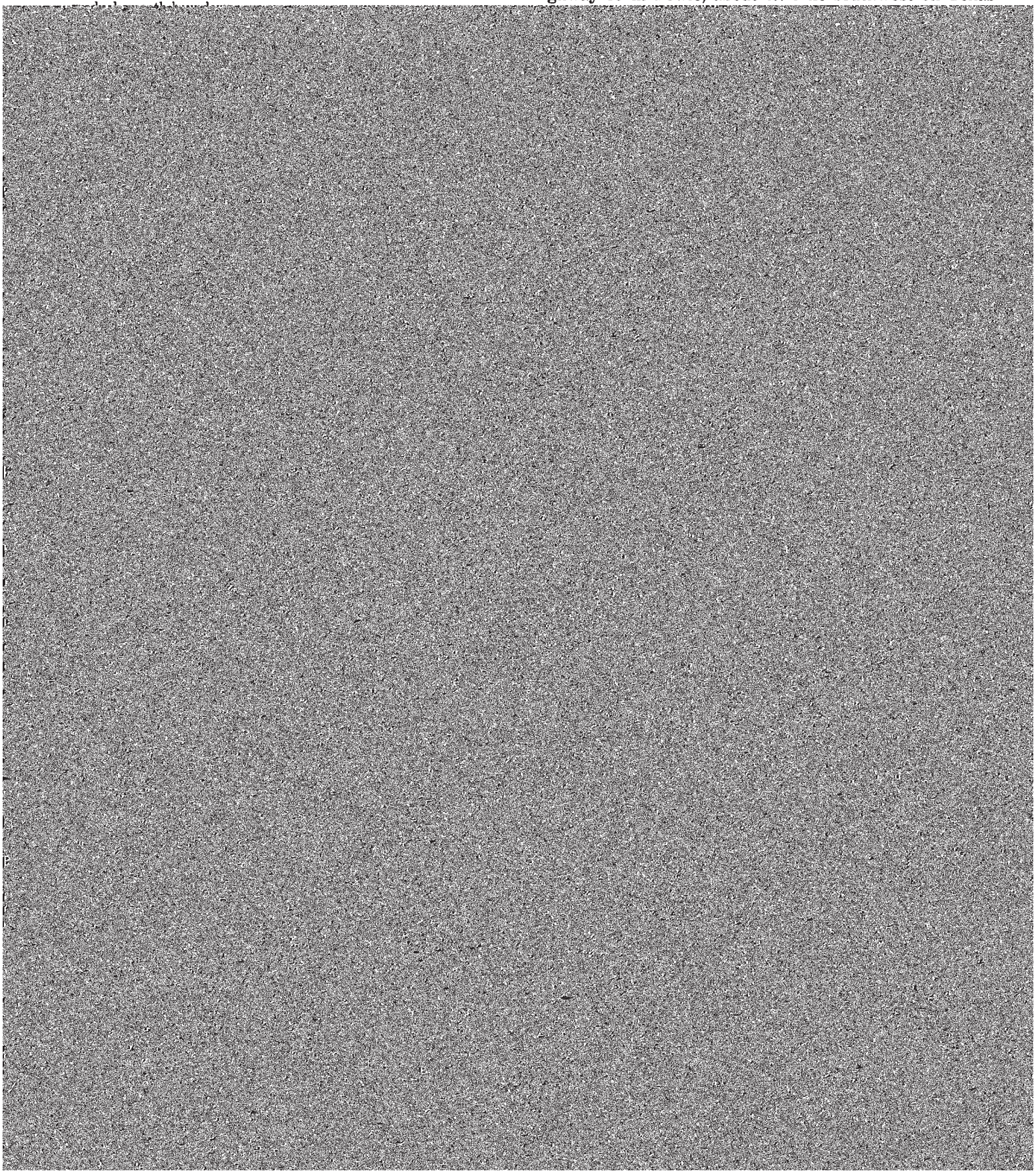
on Texas Highway 114 to its intersection with county road; 0.3 mile southeast on county road to intersection with paved road; 300 feet south on paved road; and 25 feet east of road right-of-way in cultivated peach orchard:

6/6); moderate medium subangular blocky structure; very hard, very firm; common fine roots; thin continuous clay films; few pockets of clean sand grains; about 5 to 10 percent by volume rounded quartz pebbles; strongly acid; clear wavy boundary.

B22t—17 to 27 inches; mottled red (2.5YR 4/6) and reddish yellow (7.5YR 6/6) clay; dark red (2.5YR 3/6) and strong brown (7.5YR



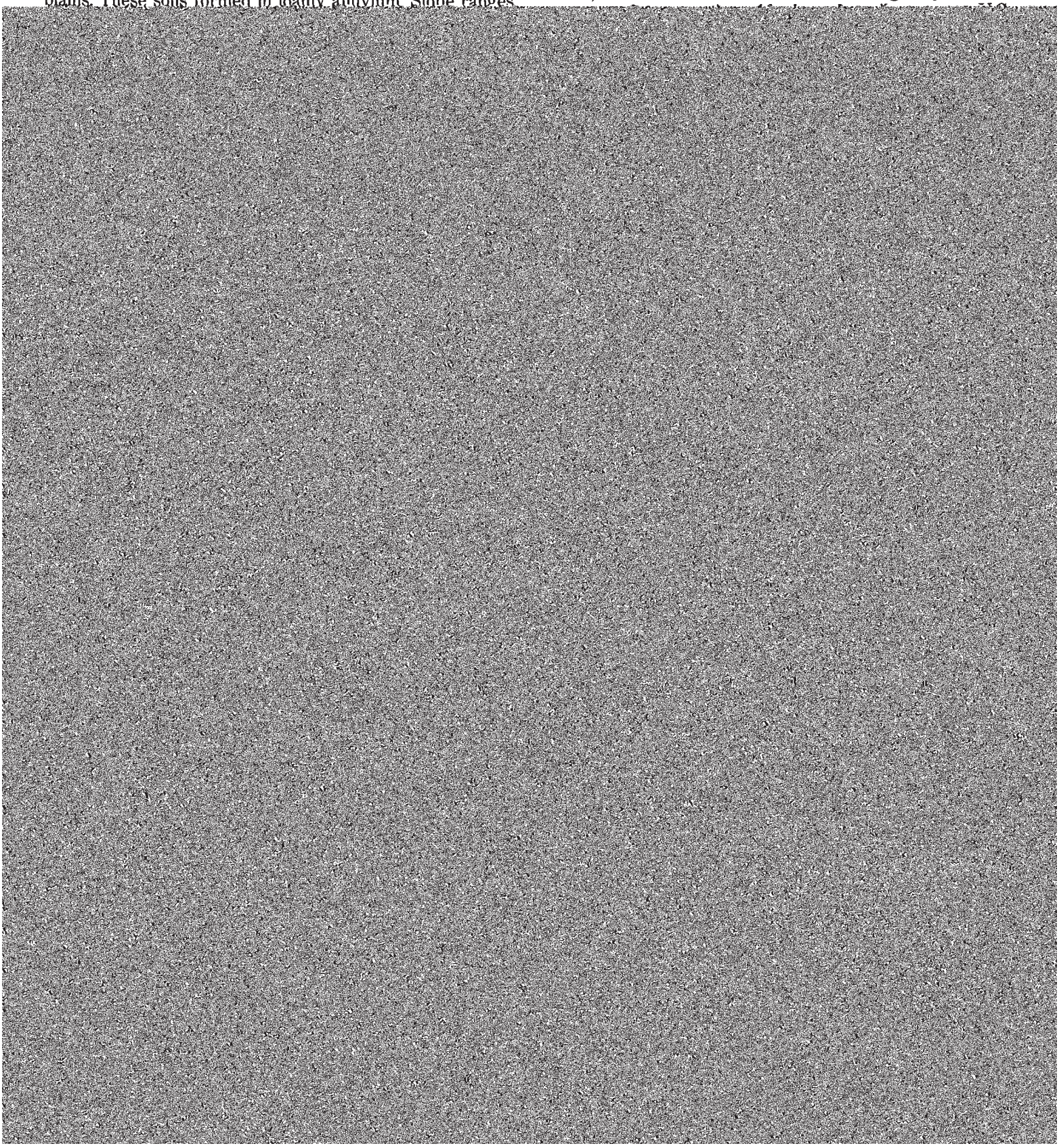
few fine pockets of clean sand grains in lower part; medium acid; Highway 59 in Bowie; about 0.7 mile southwest on Texas



**Gowen series**

The Gowen series consists of deep, loamy soils on flood plains. These soils formed in loamy alluvium. Slope ranges

Typical pedon of Knoco stony clay in an area of Vernon-Knoco complex, 5 to 25 percent slopes, severely eroded; from the intersection of U.S. Highway 81 and



## Miller series

The Miller series consists of deep, reddish, clayey soils on flood plains. These soils formed in clayey alluvium along the Red River. Slope ranges from 0 to 1 percent.

Typical pedon of Miller clay, occasionally flooded; from the intersection of U.S. Highway 81 and U.S. Highway 82 in Ringgold, 0.9 mile east on U.S. Highway 82 to intersection with county road; 0.2 mile east and 2.5 miles north on county road to pasture entrance gate at a barn; 0.4 mile east and north on pasture road; and 50 feet east of road in native pasture:

A11—0 to 9 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; weak fine blocky structure; very hard, firm; common fine roots; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

A12—9 to 17 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine blocky structure; very hard, very firm; common fine roots; few very fine masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21—17 to 39 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate fine blocky structure; very hard, very firm; common fine roots; few very fine masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—39 to 50 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate fine subangular blocky structure; hard, firm; few

The A1 horizon is brown, light olive brown, grayish brown, or reddish brown. It is moderately alkaline, but some pedons are noncalcareous in the A horizon. Fragments of sandstone and pebbles of quartz are on the surface of some pedons.

The B2 horizon is grayish brown, light olive brown, brown, or reddish brown clay or clay loam.

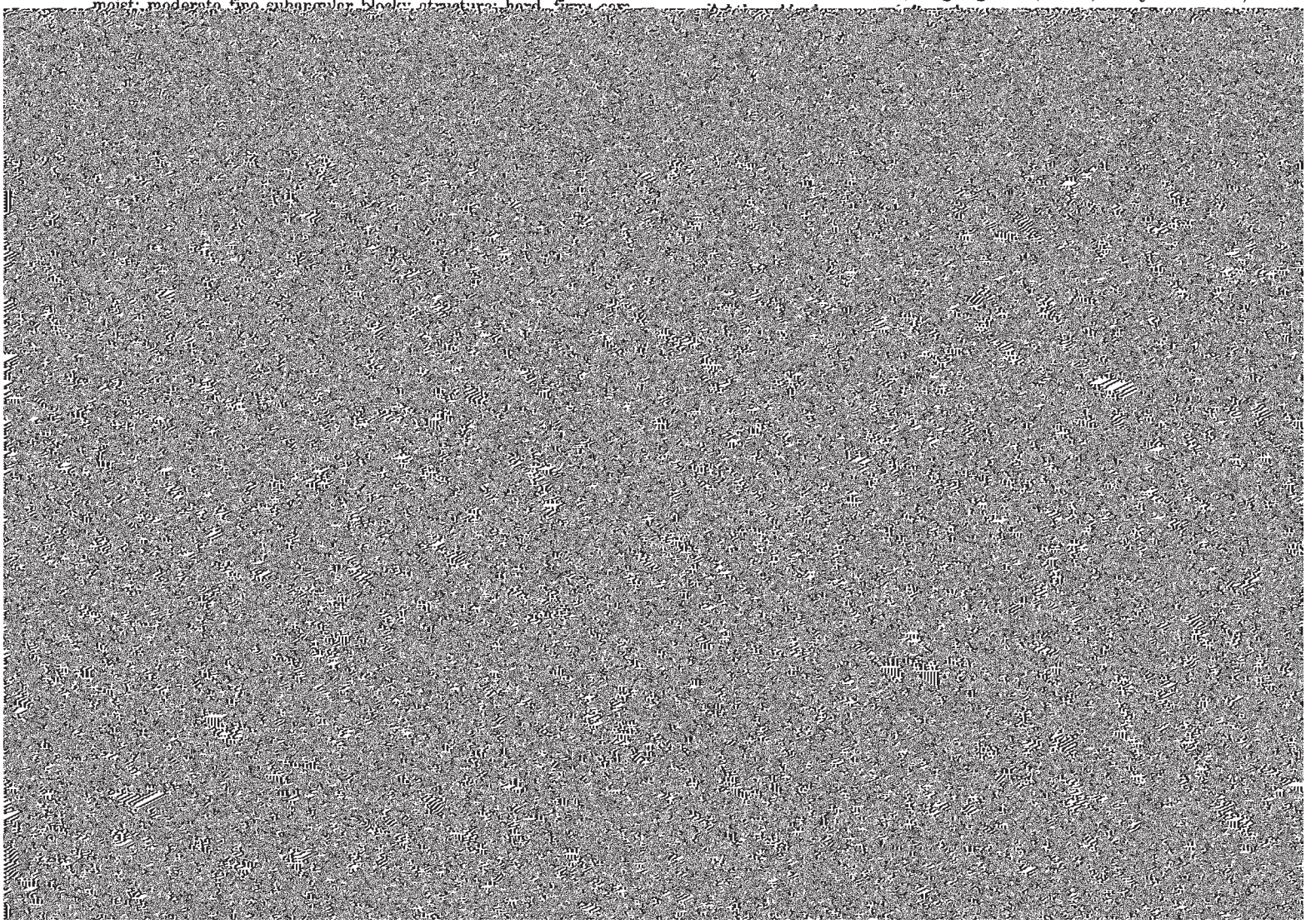
The Cr horizon is olive, light gray, light yellowish brown, or reddish brown shaly clay.

## Patilo series

The Patilo series consists of deep, sandy soils on uplands. These soils formed in thick beds of sandy material. Slope ranges from 1 to 8 percent, but is dominantly 2 to 5 percent.

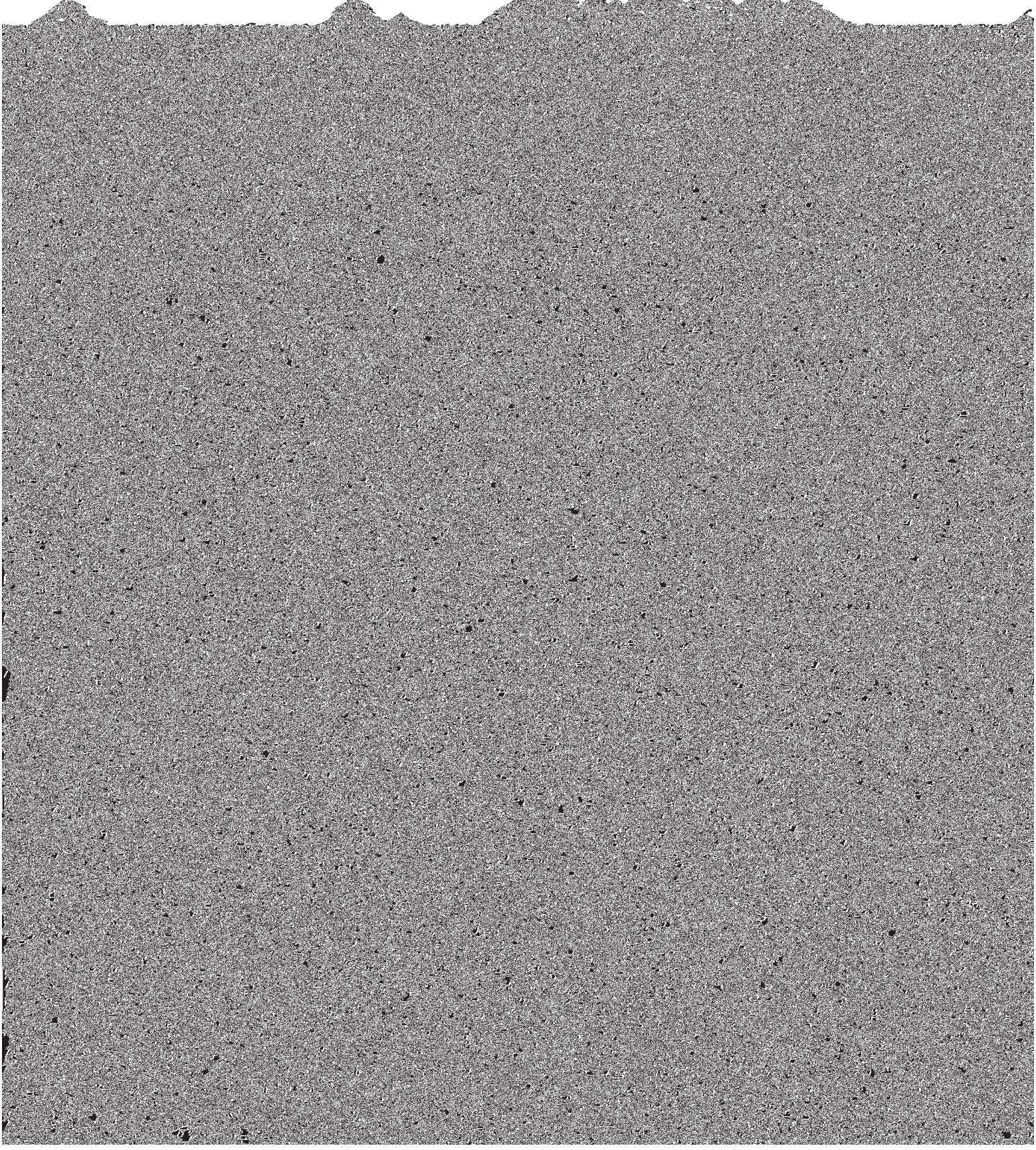
Typical pedon of Patilo fine sand in an area of Eufaula-Patilo complex, 1 to 8 percent slopes; from the intersection of Farm Road 103 and Farm Road 1956 in Nocona, 12.1 miles east on Farm Road 1956 to farmhouse and pasture entrance gate; 0.8 mile north on pasture road to electric transmission line; and 400 feet east of road in native pasture:

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many fine roots;



C1—5 to 30 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; thin strata of brown

southwest on county road; and 300 feet north of county road right-of-way in native pasture:



The A1 horizon is brown, light brown, grayish brown, dark grayish brown, or light grayish brown. The A2 horizon is light brown, very pale brown, pale brown, or light yellowish brown. The A1 and A2 horizons are strongly acid through neutral.

The B21t and B22t horizons are reddish yellow, brownish yellow, light

north on county road; and 75 feet northeast of corner of county road right-of-way:

Ap—0 to 7 inches; brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) moist; weak fine subangular blocky structure; slightly hard, very

B3—25 to 45 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; weak medium blocky structure; very hard, very firm; few soft masses and concretions of calcium carbonate in lower part; few fine black concretions; calcareous; moderately alkaline; gradual wavy boundary.

Cr—45 to 55 inches; mottled light gray (10YR 7/2) and brownish yellow (10YR 6/6) clayey shale; massive; few soft masses of calcium carbonate and gypsum crystals in upper part; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness.

The A1 horizon is brown, pale brown, or dark grayish brown fine sandy loam or stony fine sandy loam. Content of sandstone fragments varies from none to about 20 percent, by volume. The fragments range in size from 3 to 25 inches in diameter. Reaction is slightly acid or neutral. The A2 horizon is brown, pale brown, or light yellowish brown. It is medium acid, slightly acid, or neutral.

The B21t horizon is reddish brown, dark reddish brown, red, or yellowish red clay or sandy clay. It is slightly acid through mildly alkaline.

The B22t horizon is brown, yellowish brown, reddish brown, brownish yellow, or yellowish red clay or sandy clay. Reaction is neutral through moderately alkaline.

The B3 horizon is light yellowish brown, strong brown, or brownish yellow clay, clay loam, or sandy clay. Reaction is neutral through moderately alkaline.

## Vashti series

The Vashti series consists of moderately deep, loamy soils on uplands. These soils formed in loamy materials weathered from sandstone. Slope ranges from 2 to 5 percent.

Typical pedon of Vashti fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1759 and Farm Road 103 in Nocona, 2.0 miles west on Farm Road

The Ap horizon is brown, grayish brown, or light yellowish brown. The A2 horizon is pale brown, light gray, light yellowish brown, or brown. The Ap and A2 horizons are slightly acid or neutral.

The B21t, B22t, and B23t horizons are yellowish brown, brownish yellow, strong brown, brown, or yellow or are light gray and have grayish, reddish, and yellowish mottles. They are sandy clay loam or clay loam. Reaction ranges from neutral through medium acid.

## Venus series

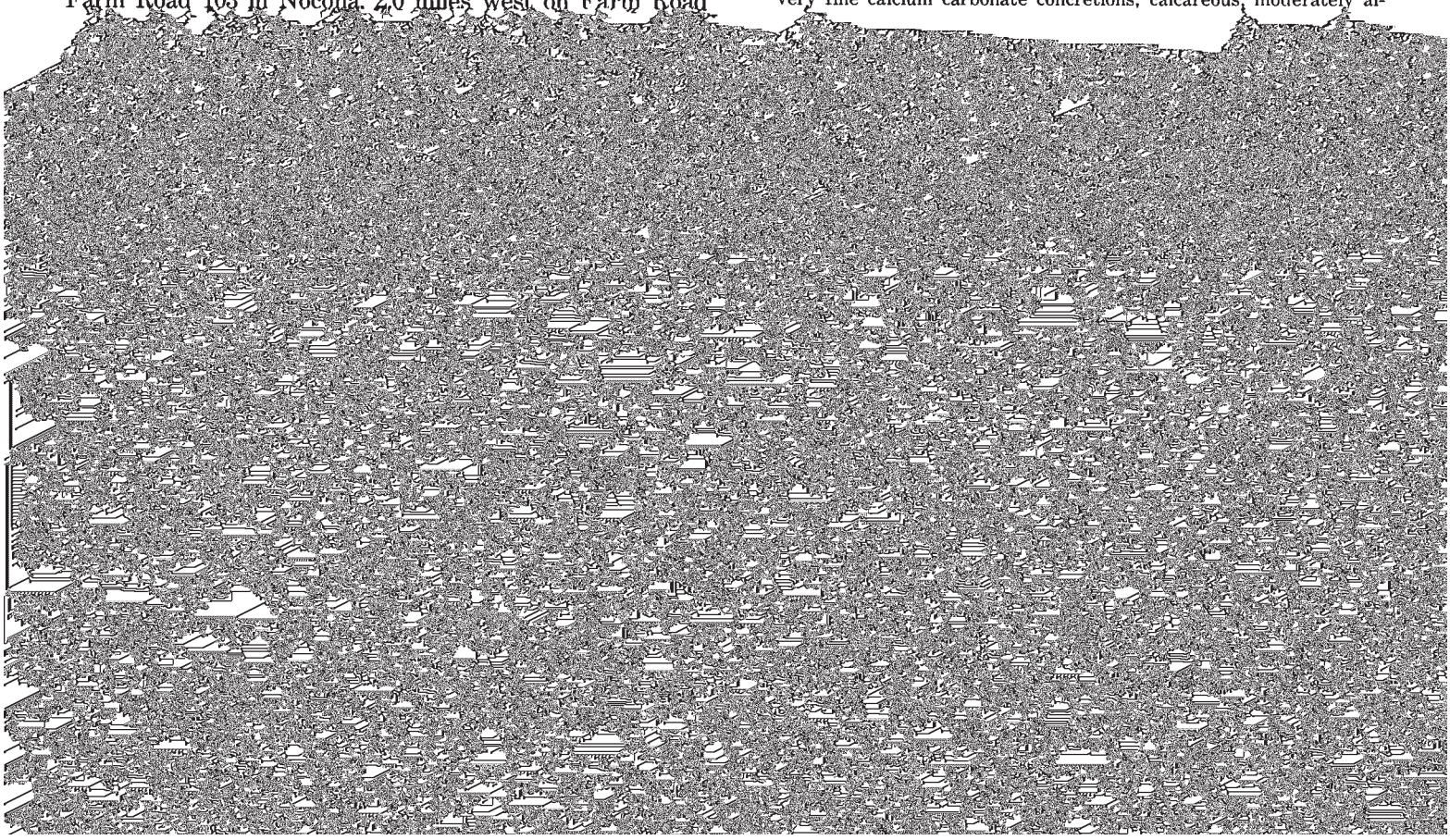
The Venus series consists of deep, loamy soils on uplands. These soils formed in thick beds of calcareous, loamy sediments. Slope ranges from 5 to 8 percent.

Typical pedon of Venus loam, 5 to 8 percent slopes; from the intersection of U.S. Highway 82 and Farm Road 2382 in Saint Jo, about 0.8 mile east on U.S. Highway 82 to intersection with county road; 0.5 mile southeast on county road; and 50 feet southwest of county road right-of-way in native pasture:

A1—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; common fine pores; few fine limestone pebbles less than 1 cm in diameter; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—12 to 48 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; common fine threads and films of calcium carbonate; few fine pitted concretions of calcium carbonate; about 16 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—48 to 60 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; common fine threads of calcium carbonate in pores; few very fine calcium carbonate concretions; calcareous; moderately al-



Depth to bedrock ranges from 20 to 40 inches. Fragments of sandstone and pebbles of quartz are on the surface of some pedons.

The A1 horizon is reddish brown, dark reddish brown, reddish gray, or brown.

The B2 horizon is reddish brown, dark red, red, or weak red clay or silty clay.

The Cr horizon is red, yellowish red, or reddish brown, massive clay, shaly clay, or clayey shale.

## Waurika series

The Waurika series consists of deep soils that have a loamy surface layer and a clayey subsoil. These soils are on uplands. They formed in thick beds of clayey sediments. Slope ranges from 0 to 1 percent.

Typical pedon of Waurika silt loam in an area of Waurika-Renfrow complex, 0 to 1 percent slopes; from the intersection of U.S. Highway 287 and Farm Road 174 northwest of Bowie, 4.0 miles northwest on U.S. Highway 287 to intersection with county road; 159 feet south on county road; 84 feet west of county road right-of-way in a native grass pasture:

A1—0 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

A2—11 to 14 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots; slightly acid; abrupt smooth boundary.

B21t—14 to 24 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; weak medium blocky structure; very hard; very firm; common fine roots; continuous thin clay films on faces of peds; neutral; gradual smooth boundary.

B22t—24 to 33 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard; very firm; common fine roots; continuous thin clay films on faces of peds; moderately alkaline; gradual smooth boundary.

B3ca—33 to 54 inches; brown (7.5YR 5/2) silty clay, dark brown (7.5YR

Typical pedon of Windthorst fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 455 and Farm Road 677 in Forestburg, 1.5 miles on Farm Road 455 to intersection with cemetery road, and 10 feet northwest in native pasture:

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary.

A2—5 to 10 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; neutral; abrupt smooth boundary.

B21t—10 to 21 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; very hard, firm; many fine roots; few worm casts; common distinct clay films; slightly acid; gradual smooth boundary.

B22t—21 to 36 inches; mottled red (2.5YR 5/8) and reddish yellow (7.5YR 6/6) sandy clay, red (2.5YR 4/8) and strong brown (7.5YR 5/6) moist; few fine distinct very pale brown mottles; moderate medium blocky structure; very hard, firm; common fine roots; common thin clay films; medium acid; gradual wavy boundary.

B3—36 to 55 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; common medium prominent red (2.5YR 4/8) and light gray (10YR 7/1) mottles; weak medium blocky structure; very hard, firm; few fine roots; slightly acid; gradual wavy boundary.

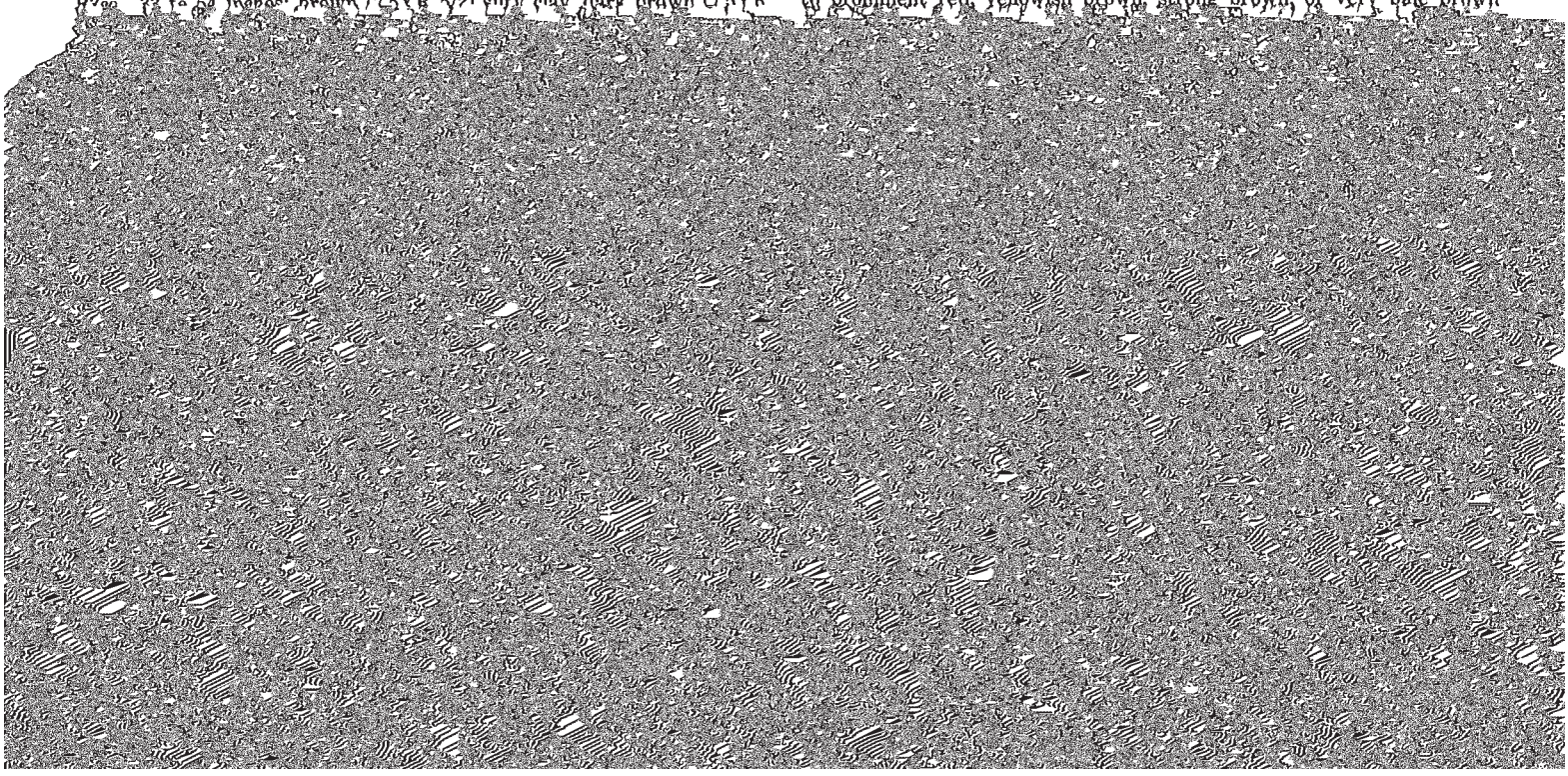
C—55 to 60 inches; light gray (10YR 7/1) clay loam; common fine distinct brownish yellow mottles; massive; very hard, firm; moderately alkaline.

The solum ranges from 35 to 60 inches in thickness. Content of siliceous pebbles ranges from none to 8 percent.

The A1 horizon is brown, grayish brown, or dark grayish brown. The A2 horizon is very pale brown, pale brown, light brown, or pink. The A1 and A2 horizons are fine sandy loam or loamy fine sand. They are medium acid through neutral.

The B21t horizon is red, dark red, yellowish red, or reddish yellow sandy clay or clay. It is medium acid or slightly acid.

The B22t horizon is yellowish red, reddish yellow, or red and has faint to prominent red, yellowish brown, strong brown, or very pale brown



C1—8 to 24 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; common fine roots; few worm casts; few thin strata of loamy fine sand and silt loam; calcareous; moderately alkaline; clear smooth boundary.

C2—24 to 44 inches; reddish yellow (5YR 7/6) fine sandy loam, reddish yellow (5YR 6/6) moist; massive; soft, very friable; few fine roots; few thin strata of loamy fine sand and silt loam; calcareous; moderately alkaline; gradual smooth boundary.

C3—44 to 50 inches; pink (5YR 7/4) fine sandy loam, reddish yellow (5YR 6/6) moist; single grained; loose; stratified; calcareous; moderately alkaline.

The A horizon is reddish brown, light reddish brown, yellowish red, or brown. It is mildly alkaline or moderately alkaline.

The C horizon is light brown, light reddish brown, yellowish red, reddish yellow, or pink fine sandy loam or loam and has thin strata of coarser or finer textured materials throughout. Some pedons are loamy fine sand below a depth of 40 inches.

## Classification

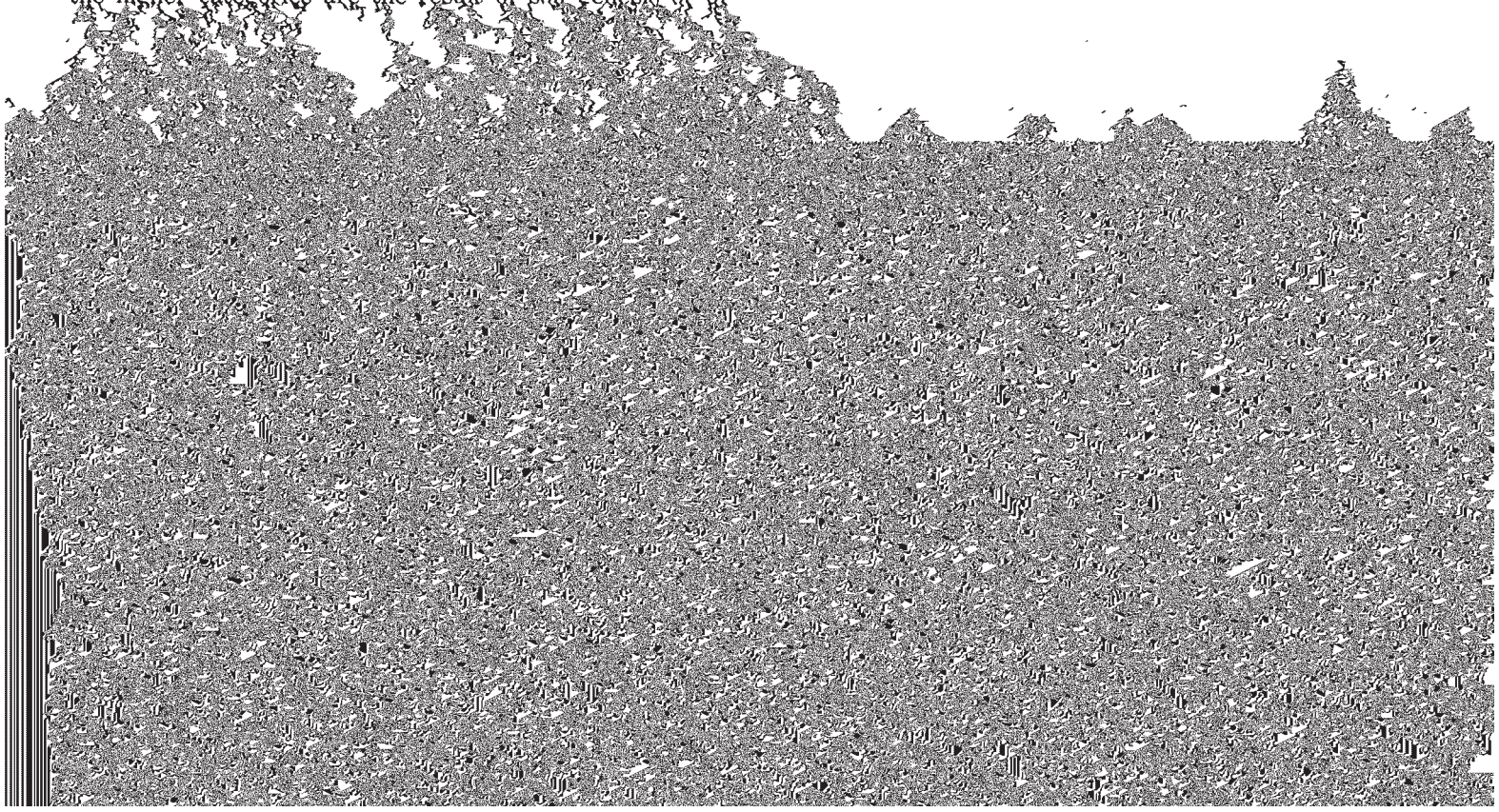
The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Calciustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, thermic Typic Calciustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An exam-

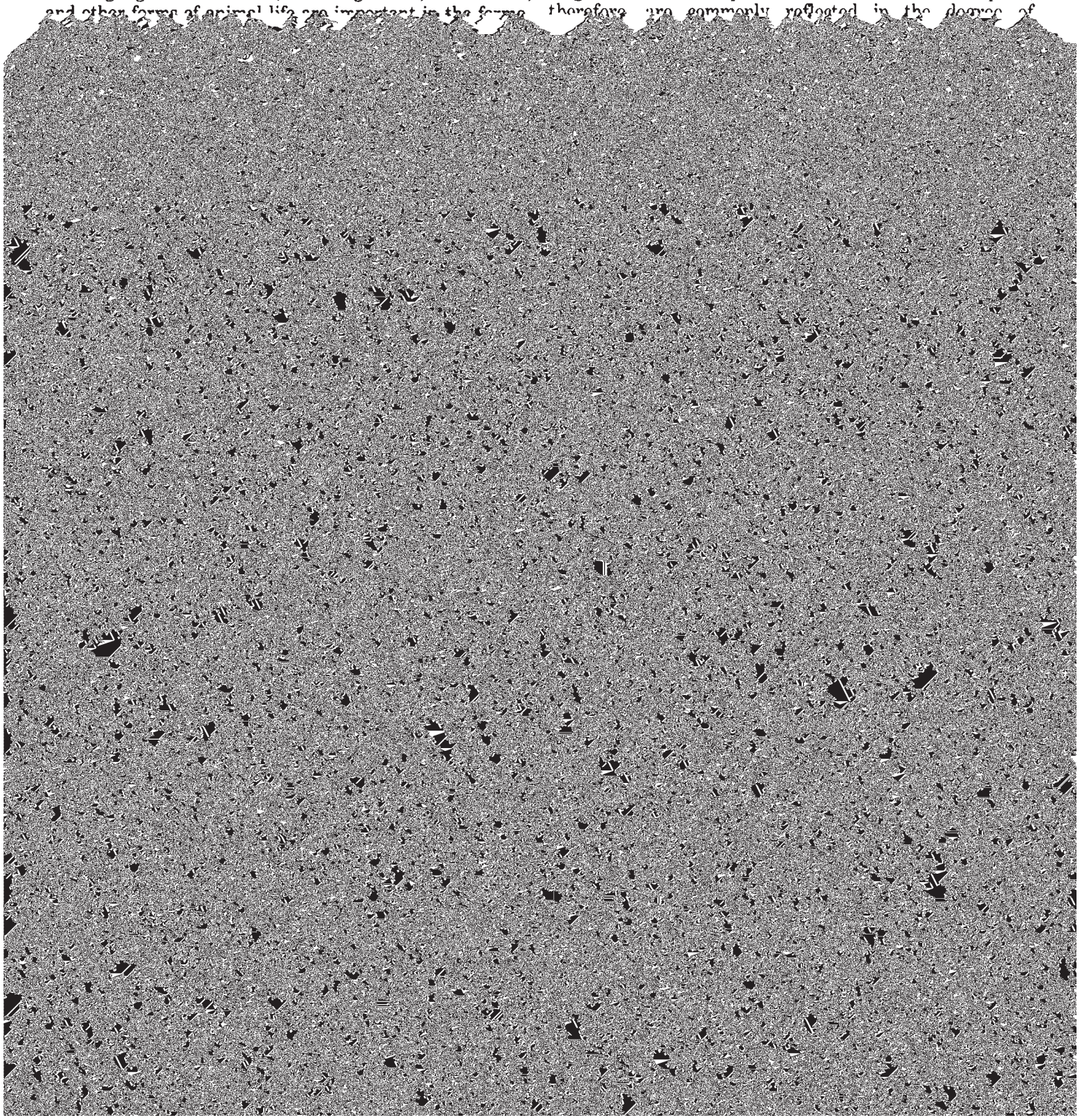


*Climate.*—Montague County has a subhumid, warm-temperate, continental climate. The subhumid climate has promoted moderately rapid soil development. Climate is uniform throughout the county, although its effect has been modified locally by relief and runoff.

*Living organisms.*—Plants, micro-organisms, earthworms, and other forms of animal life are important in the forma-

tle stream dissection northeast of Spanish Fort to broad interstream divides with strongly sloping sides in the southwestern and eastern parts of the county.

*Time.*—A long time generally is required for the formation of soils that have distinct horizons. The differences in length of time that parent material has been in place, therefore, are commonly reflected in the degree of



| | *Inches* |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Medium | 6 to 9 |
| High | More than 9 |

**Bedding planes.** Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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

**Buried soil.** A developed soil that was once exposed but is now overlain by a more recently formed soil.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

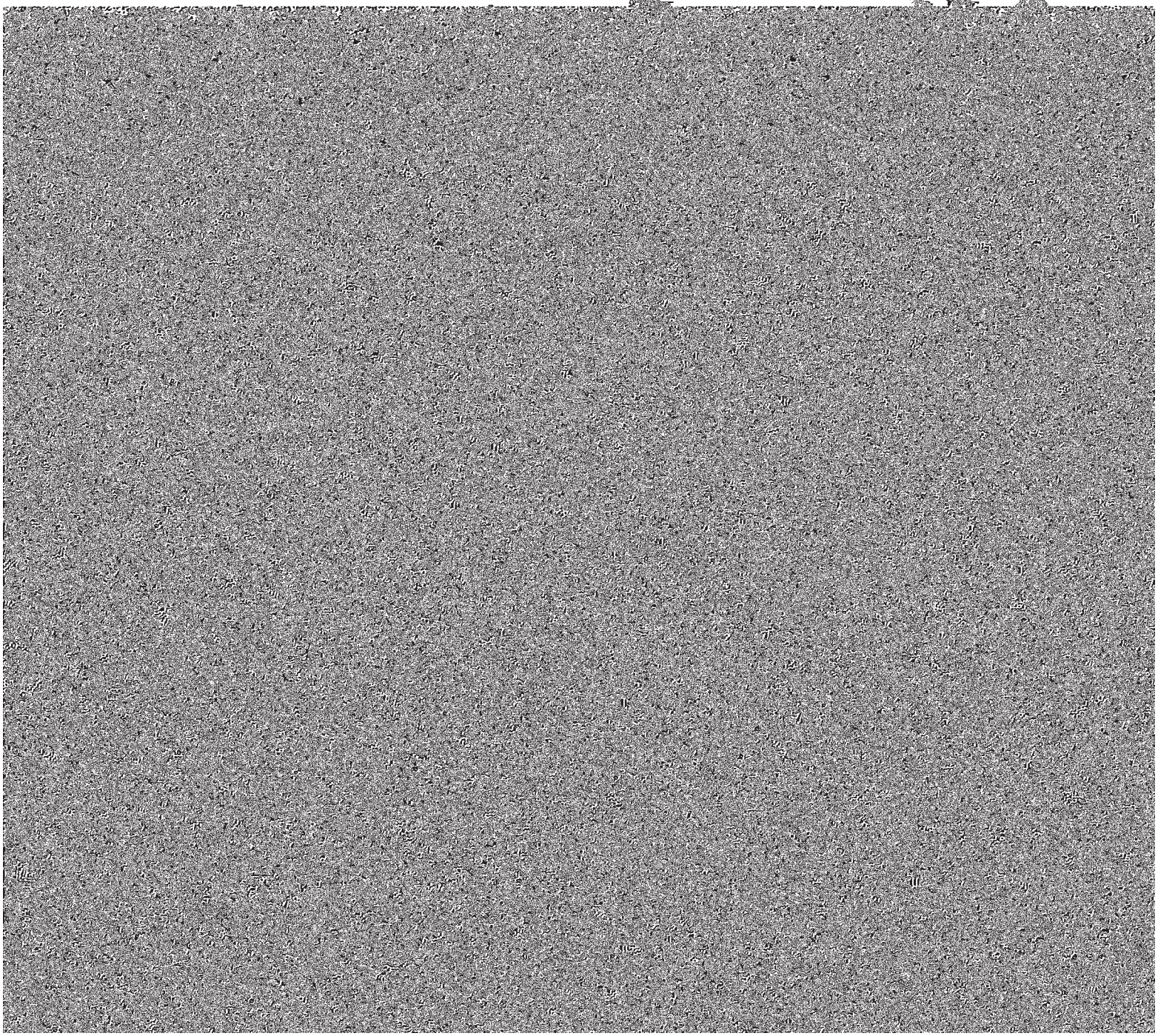
**Convex slope.** A land surface that is curved like the exterior of a sphere or arch.

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

**Cutbanks cave.** Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

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

**Depth to rock.** Bedrock at a depth that adversely affects the specified use.



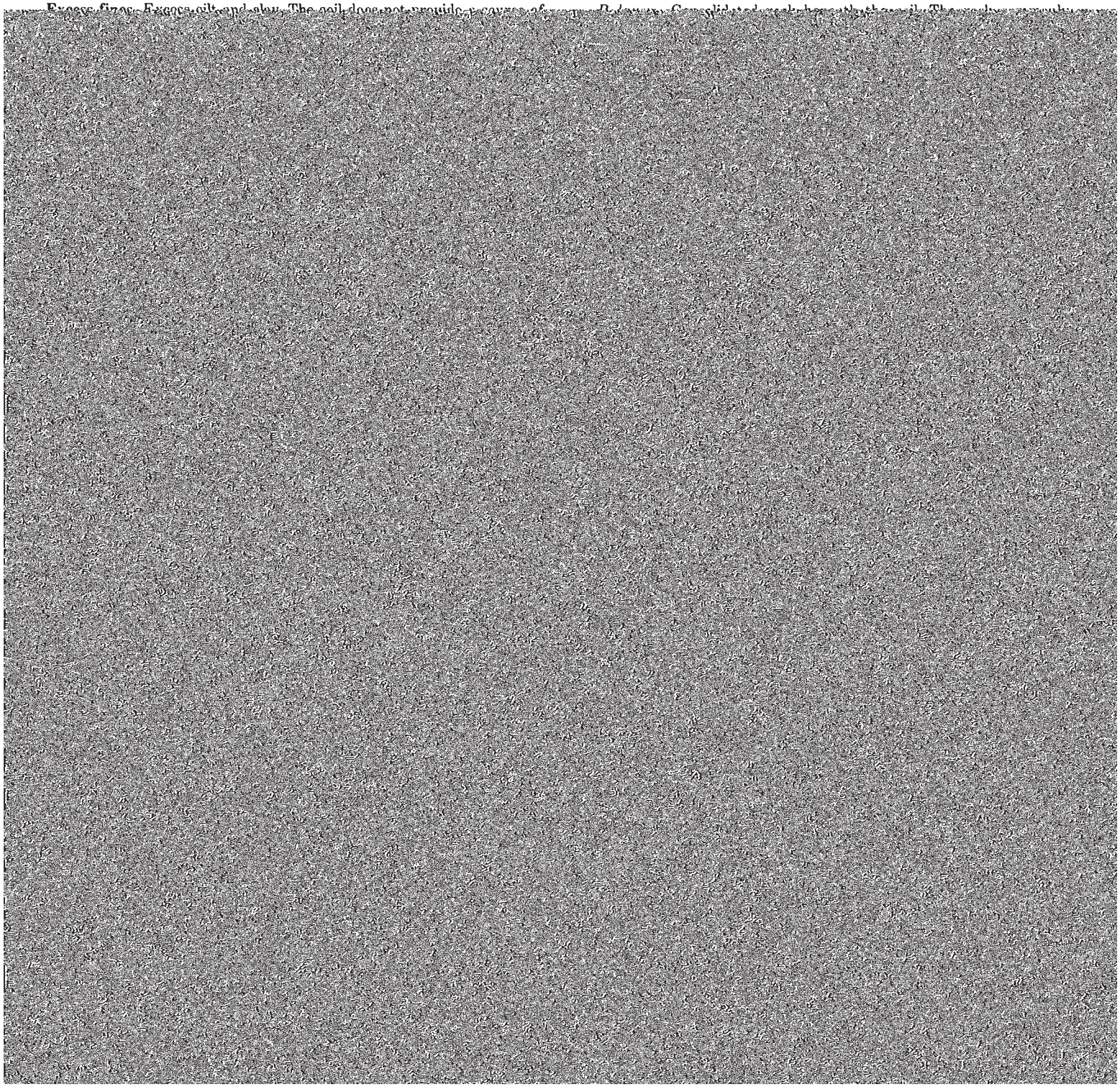
**Erosion.** The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*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 a bare surface.

browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks 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 from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.



**Percs slowly.** The slow movement of water through the soil adversely affecting the specified use.

**Permeability.** The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the 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 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

**Phase, soil.** A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

**pH value.** (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

**Piping.** Moving water of subsurface tunnels or pipelike cavities in 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 a semisolid to a plastic state.

**Poor outlets.** Surface or subsurface drainage outlets difficult or expensive to install.

**Pores, soil.** Open channels in the soil material caused by roots and forms of animal life, such as earthworms and insects.

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

**Range (or rangeland).** Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

**Range condition.** The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent*, *good*, *fair*, and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

**Range site.** An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in

**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.

**Seepage.** The rapid movement of water through the soil. Seepage adversely affects the specified use.

**Series, soil.** A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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

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

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

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

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

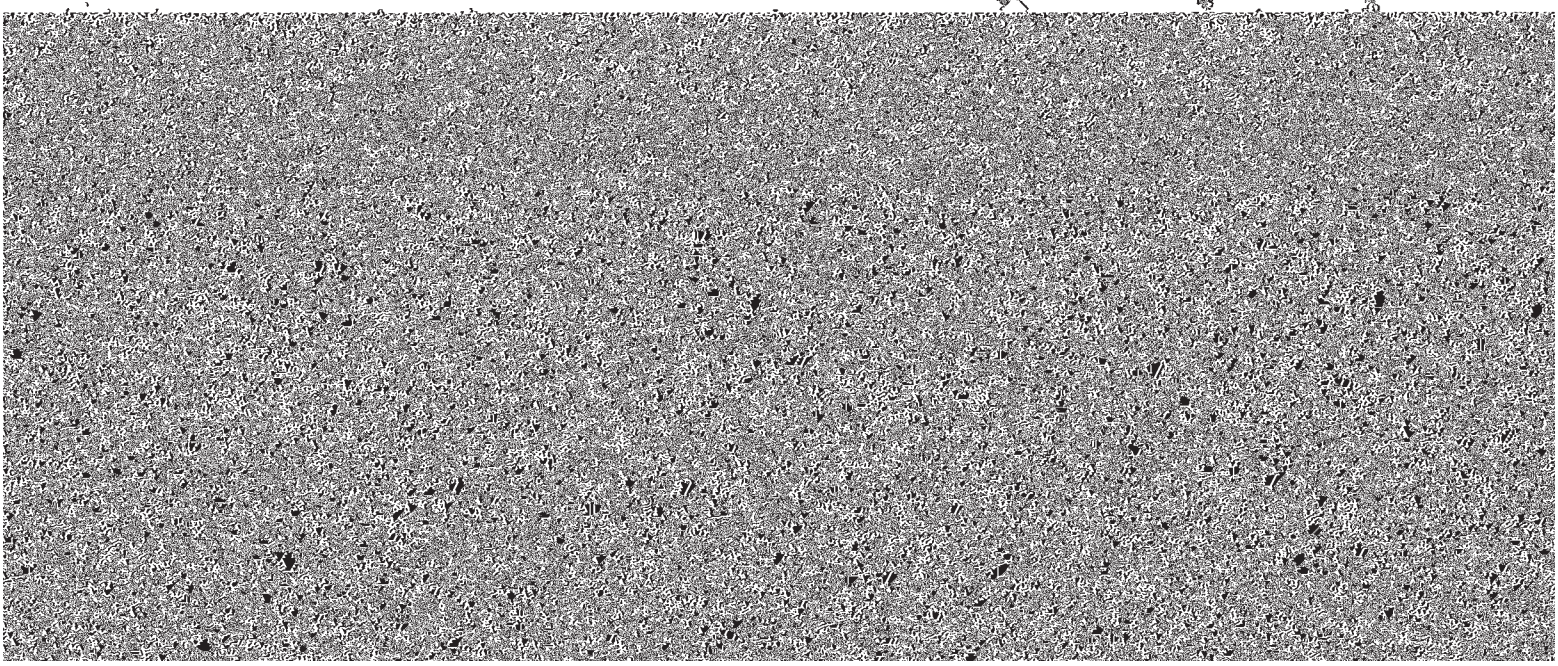
**Slow intake.** The slow movement of water into the soil.

**Slow refill.** The slow filling of ponds, resulting from restricted permeability in the soil.

**Small stones.** Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

**Soil.** A natural, three-dimensional body at the earth's surface that 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.

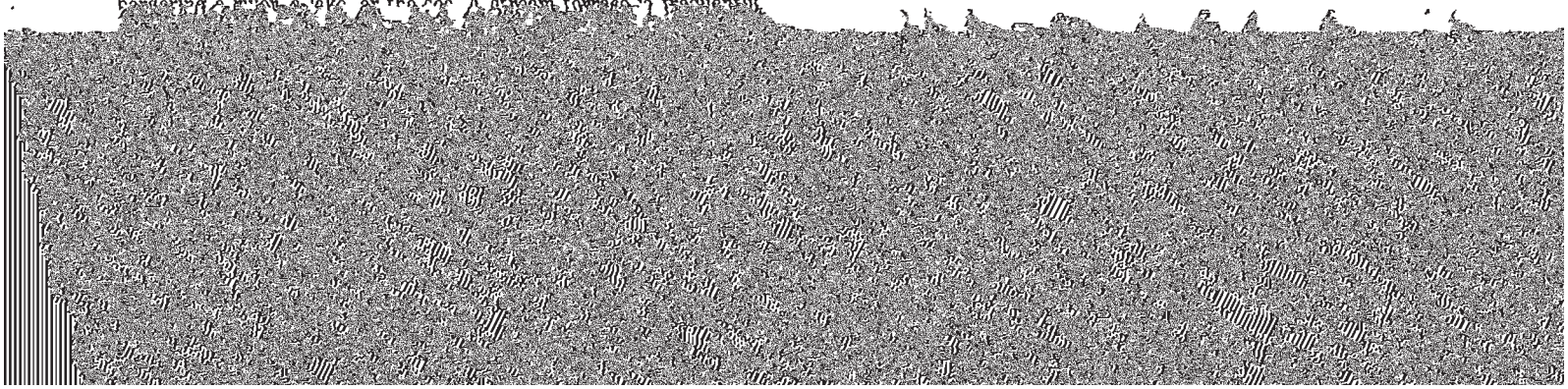
**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand*



**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 or management.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. A stream terrace is frequently



lated to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

**Too clayey.** Soil slippery and sticky when wet and slow to dry.

**Too sandy.** Soil soft and loose; droughty and low in fertility.

**Topsoil** (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Unstable fill.** Risk of caving or sloughing in banks of fill material.

# Illustrations

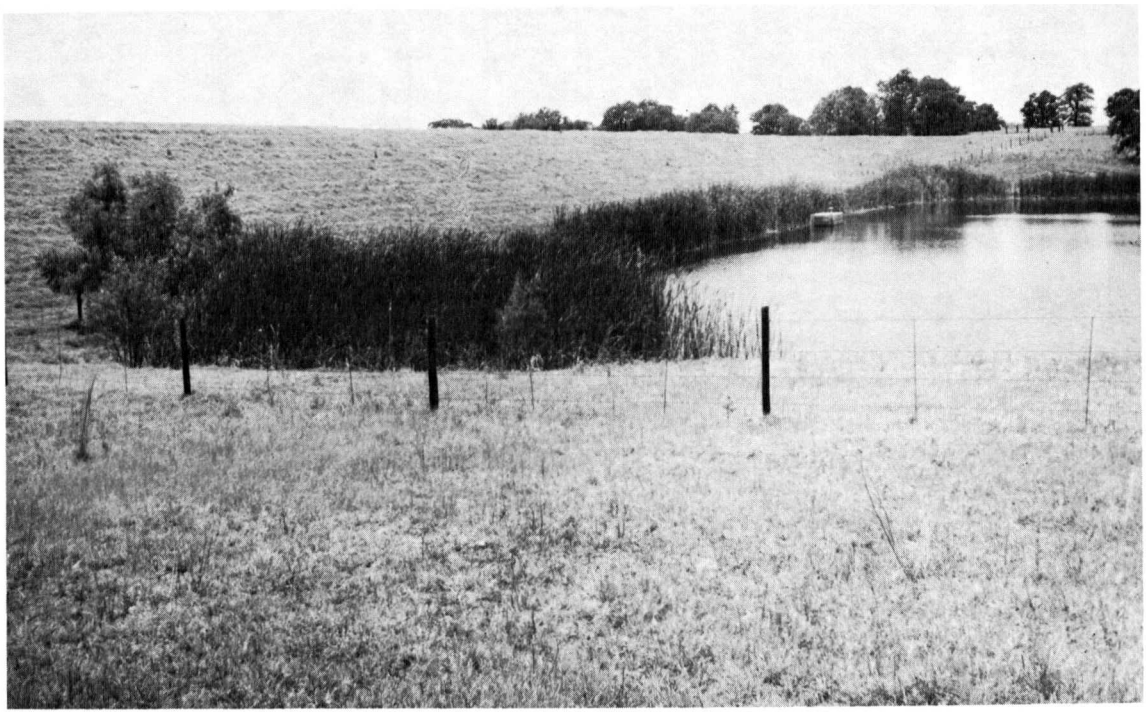


*Figure 1.*—Floodwater retarding structure in an area of Duffau fine sandy loam, 5 to 8 percent slopes. Cattails break up wave action and help prevent erosion along the front of the dam.

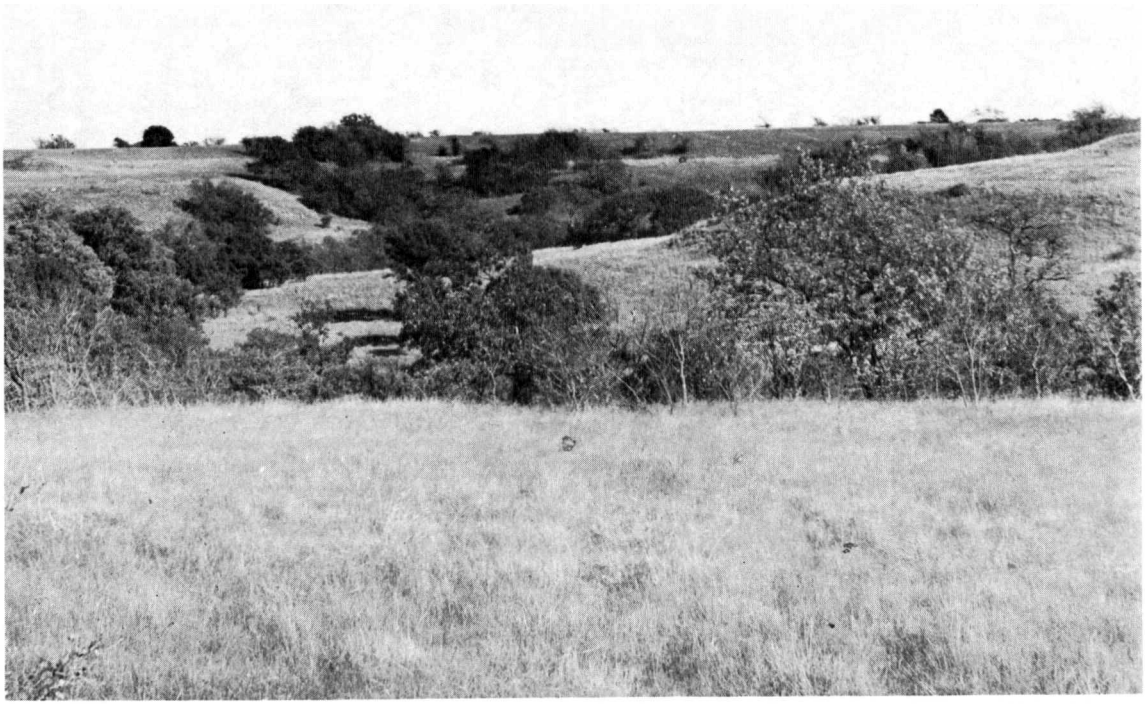


*Figure 2.*—Area of Bolar-Aledo complex, 3 to 20 percent slopes.

*Figure 3.*—Area of Bonti-Exray complex, 5 to 25 percent slopes, in Sandstone Hills range site.

*Figure 4.*—Young apple orchard on Chaney loamy fine sand, 2 to 5 percent slopes.

*Figure 5.*—This area of Duffau fine sandy loam, 2 to 5 percent slopes, has been cleared and planted to Ermelo lovegrass.

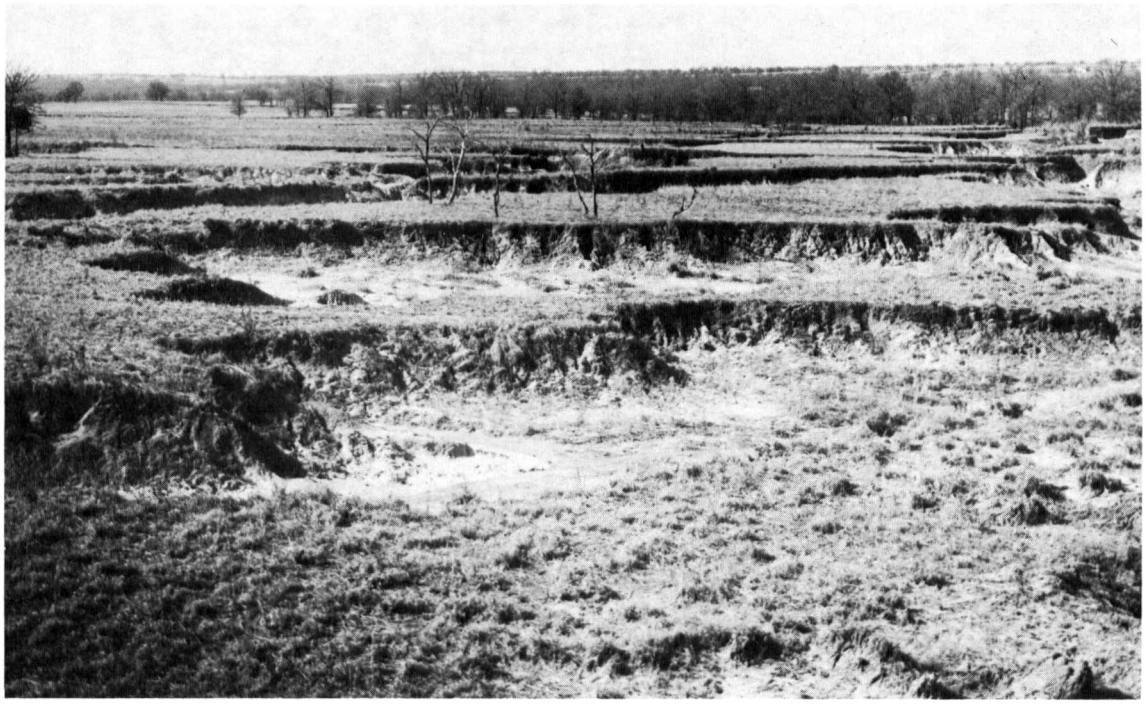


*Figure 6.*—Area of Duffau and Windthorst soils, gullied. Gullies are as deep as 30 feet in areas of Duffau soils on the lower parts of slopes.

*Figure 7.*—Native hayland meadow on Sanger silty clay, 3 to 5 percent slopes.

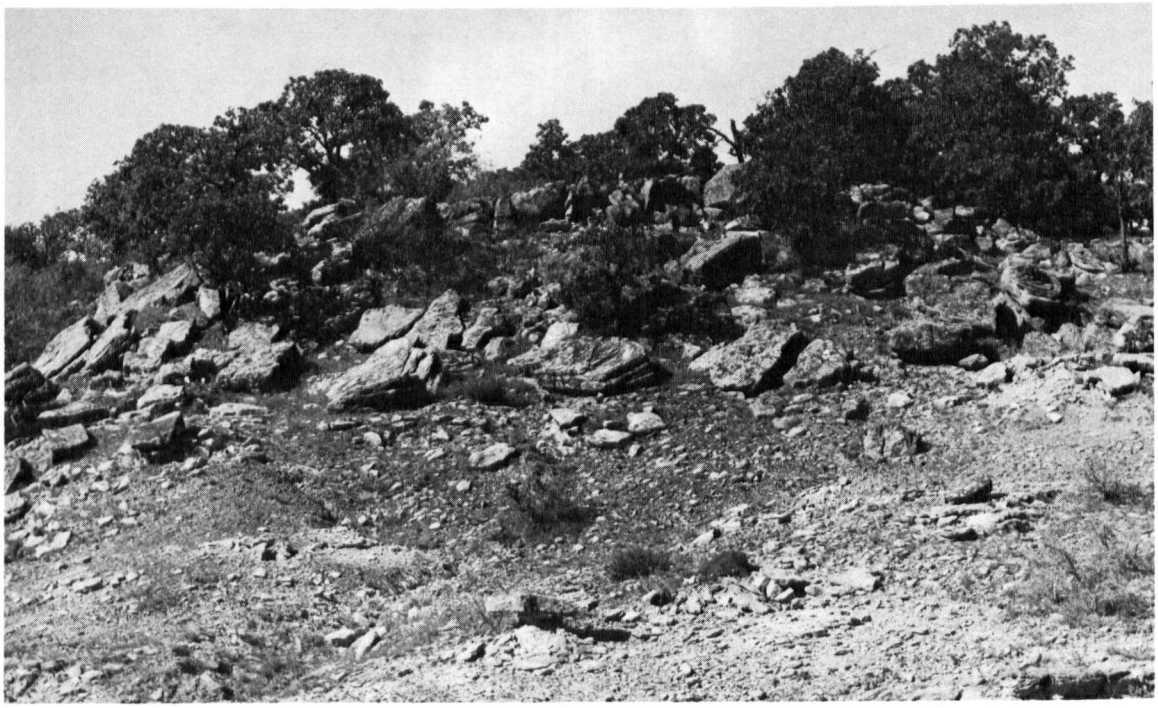


*Figure 8.*—Area of Owens stony clay in an area of Truce-Owens complex, 5 to 20 percent slopes. The sandstone outcrops are common in areas of this mapping unit.

*Figure 9.*—Area of Ustolls-Rock outcrop association, steep.

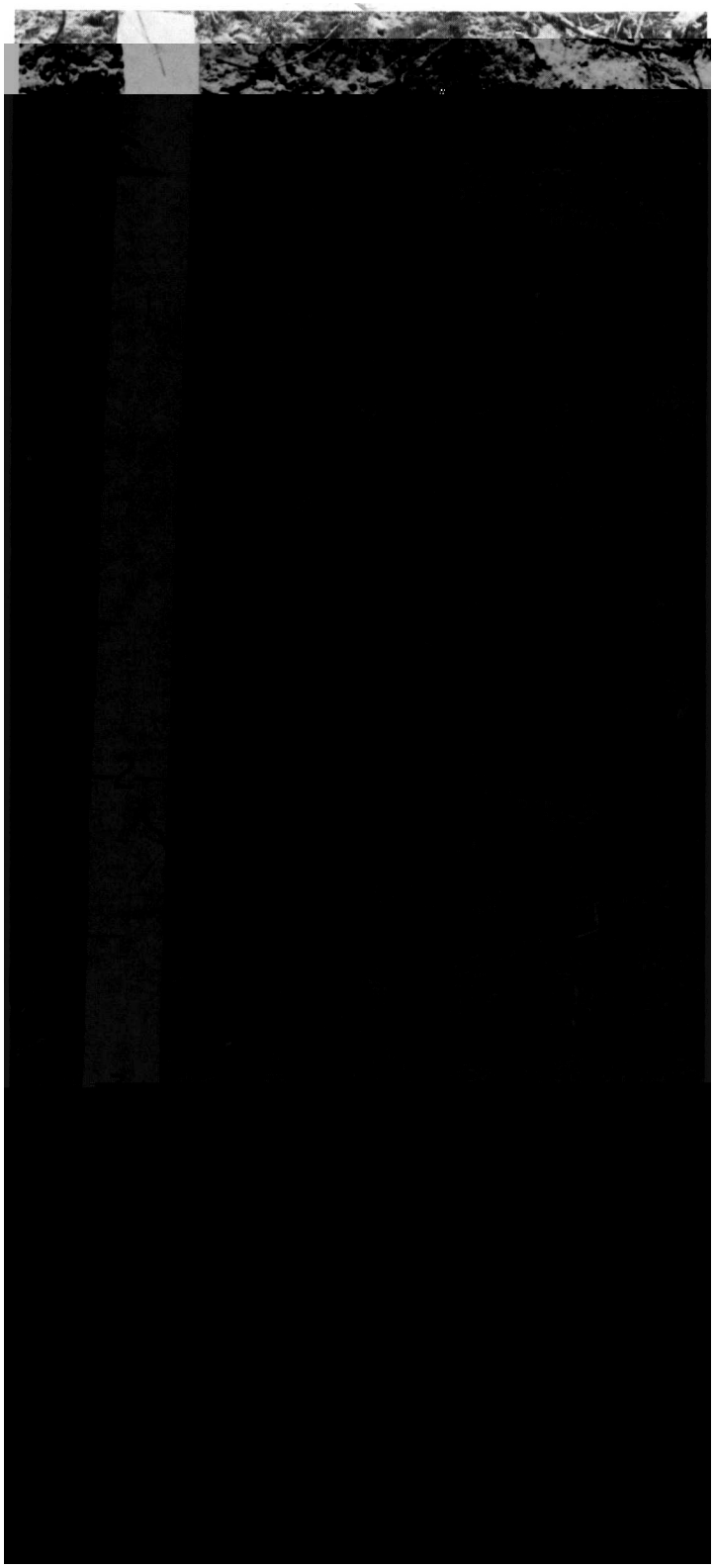


*Figure 10.*—Profile of Windthorst fine sandy loam, 2 to 5 percent slopes. Note the blocky structure of the sandy clay material between depths of 10 and 36 inches.

*Figure 11.*—Coastal bermudagrass on Yahola-Gaddy complex, occasionally flooded.

*Figure 12.*—Sandy Loam range site showing recovery of native tall grasses following mechanical brush control and deferred grazing. The soil is Duffau fine sandy loam, 2 to 5 percent slopes.

# Tables

TABLE 1.—TEMPERATURE AND PRECIPITATION DATA

[Data from Bowie, elevation 1,124 feet. Period of record 1956-67]

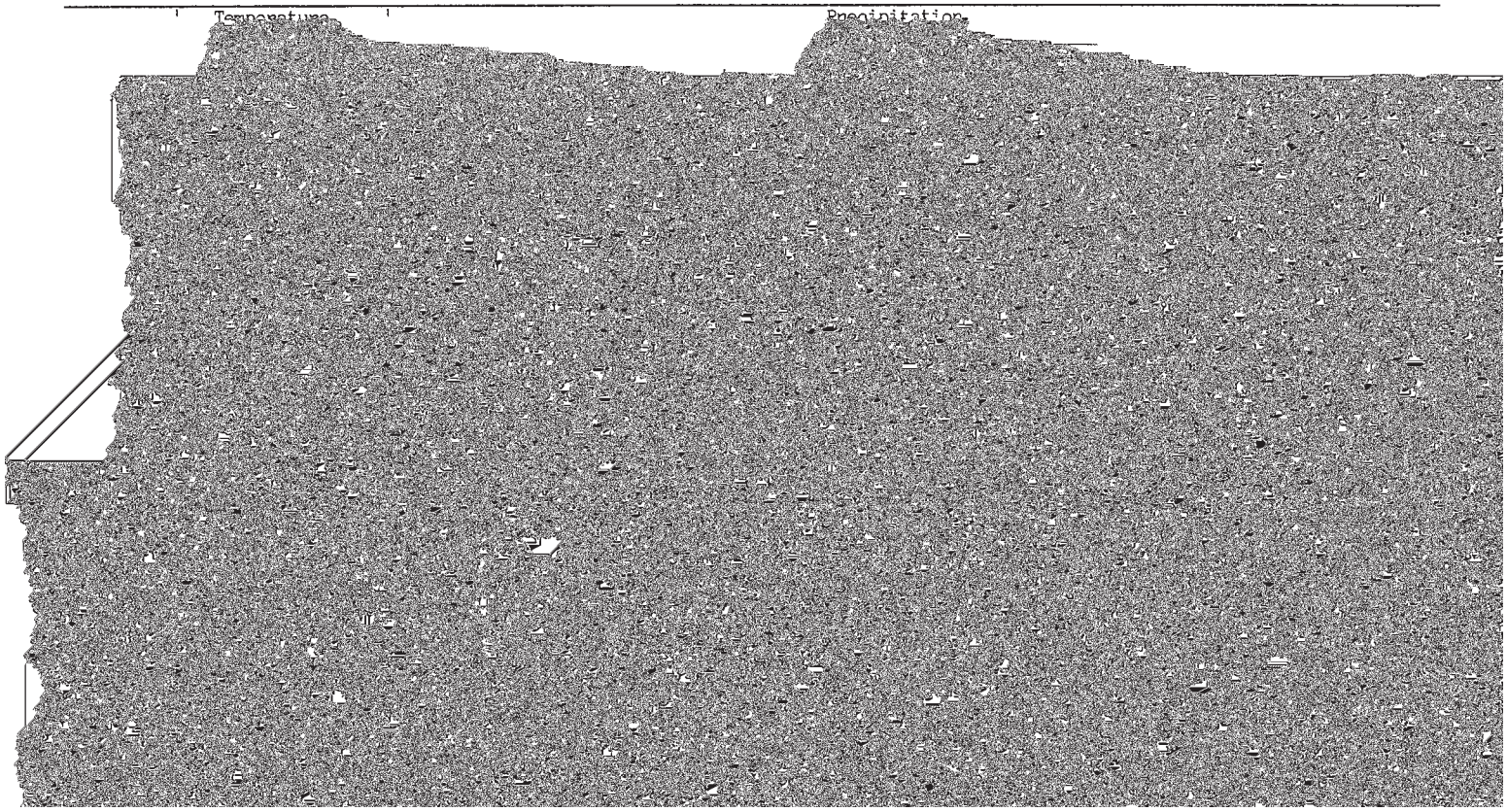


TABLE 2.—POTENTIALS AND LIMITATIONS OF MAP UNITS FOR SPECIFIED USES

| Map unit | Extent of area | Cultivated farm crops | Rangeland | Pastureland | Urban uses | Wildlife habitat | Recreation |
|---|---|---|---|---|---|---|---|
| | Pct | | | | | | |
| 1. Windthorst-Duffau | 37 | Medium: erosion. | High | High | Medium: shrink-swell, low strength. | High | Medium: slope, slow percolation. |
| 2. Renfrow-Stoneburg-Anocon | 24 | Medium: slow percolation. | High | High | Medium: shrink-swell, low strength. | High | Medium: slope, slow percolation. |
| 3. Bonti-Cona-Truce | 17 | Medium: slope, large stones. | High | Medium: large stones, rooting depth. | Medium: shrink-swell, slope, depth to rock. | High | Medium: slope, slow percolation. |
| 4. Aledo-Venus-Bolar | 8 | Medium: slope, rooting depth, large stones. | Medium: rooting depth. | Medium: rooting depth, large stones. | Medium: depth to rock, shrink-swell. | Medium: rooting depth, clayey surface. | Medium: slope, slow percolation, clayey surface. |
| 5. Fulexas-Gowen | 8 | Medium: floods. | High | High | Low: floods. | High | Medium: floods. |
| 6. Bastrop-Teller | 4 | High | High | High | High | High | High. |
| 7. Gaddy-Miller-Yahola | 2 | Medium: floods, too sandy. | High | High | Low: floods. | Medium: floods, too sandy. | Medium: floods. |

TABLE 3.—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| 1 | Aledo gravelly clay loam, 1 to 8 percent slopes | 8,970 | 1.5 |
| 2 | Anocon-Stoneburg association, undulating | 30,140 | 5.0 |
| 3 | Bastrop loam, 2 to 5 percent slopes | 13,970 | 2.3 |
| 4 | Bastrop loam, 5 to 8 percent slopes | 3,190 | 0.5 |
| 5 | Bolar clay loam, 2 to 5 percent slopes | 1,210 | 0.2 |
| 6 | Bolar-Aledo complex, 3 to 20 percent slopes | 12,840 | 2.1 |
| 7 | Bonti fine sandy loam, 2 to 5 percent slopes | 21,520 | 3.6 |
| 8 | Bonti-Exray complex, 5 to 25 percent slopes | 27,526 | 4.6 |
| 9 | Bosque loam, occasionally flooded | 4,020 | 0.7 |
| 10 | Bosque soils, frequently flooded | 760 | 0.1 |
| 11 | Branyon silty clay, 1 to 3 percent slopes | 2,800 | 0.5 |
| 12 | Chaney loamy fine sand, 2 to 5 percent slopes | 10,710 | 1.8 |
| 13 | Cona association, hilly | 26,850 | 4.5 |
| 14 | Duffau loamy fine sand, 1 to 5 percent slopes | 23,770 | 4.0 |
| 15 | Duffau fine sandy loam, 2 to 5 percent slopes | 21,090 | 3.5 |
| 16 | Duffau fine sandy loam, 5 to 8 percent slopes | 25,150 | 4.2 |
| 17 | Duffau and Windthorst soils, gullied | 6,040 | 1.0 |
| 18 | Eufaula-Patilo complex, 1 to 8 percent slopes | 1,770 | 0.3 |
| 19 | Gaddy soils, frequently flooded | 4,470 | 0.7 |
| 20 | Gowen loam, occasionally flooded | 4,200 | 0.7 |
| 21 | Gowen soils, frequently flooded | 14,210 | 2.4 |
| 22 | Hensley loam, 1 to 5 percent slopes | 2,080 | 0.3 |
| 23 | Lindy clay loam, 1 to 3 percent slopes | 1,750 | 0.3 |
| 24 | Miller clay, occasionally flooded | 1,530 | 0.3 |
| 25 | Miller soils, frequently flooded | 1,860 | 0.3 |
| 26 | Pulexas fine sandy loam, occasionally flooded | 8,060 | 1.3 |
| 27 | Pulexas soils, frequently flooded | 23,270 | 3.9 |

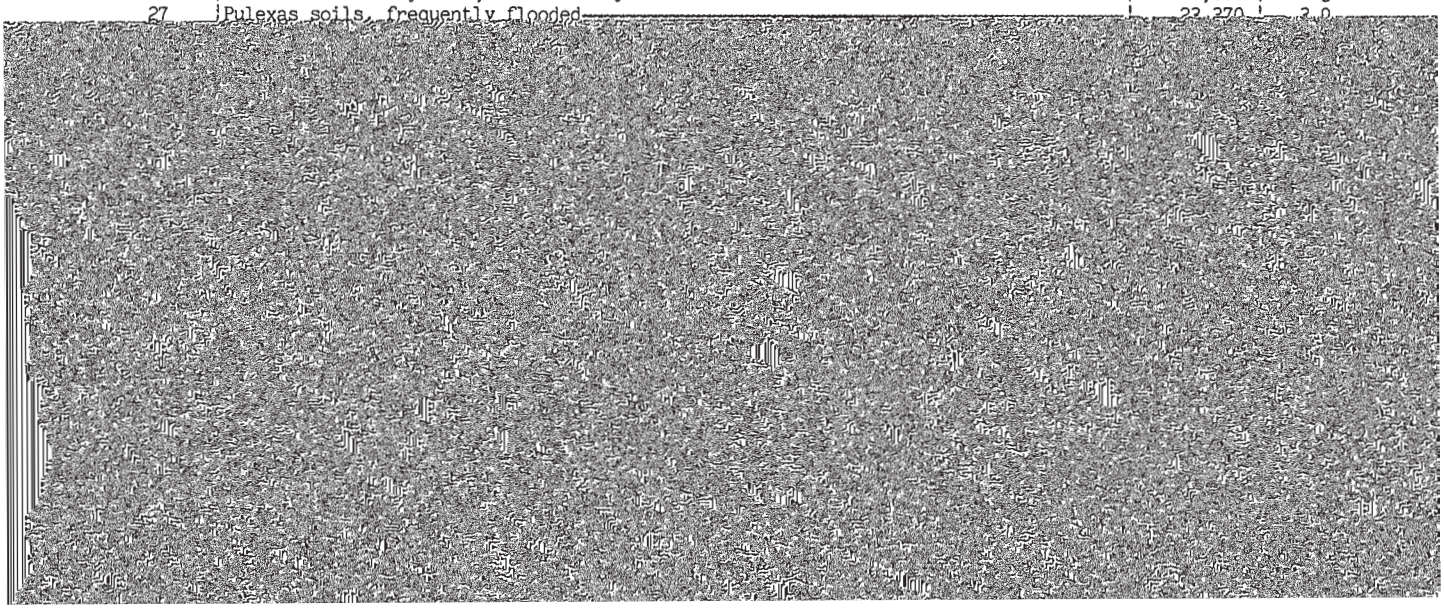


TABLE 4.—YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

| Soil name and map symbol | Grain sorghum | Wheat | Peanuts | Improved bermuda-grass | Oats | Peaches |
|---|---|---|---|---|---|---|
| | Bu | Bu | Lb | AUM[1] | Bu | Bu |
| Aledo: | | | | | | |
| 1 | — | — | — | — | — | — |
| Anocon: | | | | | | |
| 2[2]: | | | | | | |
| Anocon part | 40 | 20 | — | 6.0 | 40 | — |
| Stoneburg part | 40 | 20 | — | 5.0 | 40 | — |
| Bastrop: | | | | | | |
| 3 | 45 | 25 | — | 6.0 | 40 | — |
| 4 | 40 | 20 | — | 5.5 | 35 | — |
| Bolar: | | | | | | |
| 5 | 35 | 25 | — | 5.0 | 35 | — |
| 2[6] | — | — | — | — | — | — |
| Bonti: | | | | | | |
| 7 | 35 | 20 | — | 3.5 | 30 | — |
| 2[8] | — | — | — | — | — | — |
| Bosque: | | | | | | |
| 9 | 65 | 30 | — | 6.5 | 60 | — |
| 2[10] | — | — | — | 6.5 | — | — |
| Branyon: | | | | | | |
| 11 | 70 | 30 | — | 6.5 | 60 | — |
| Chaney: | | | | | | |
| 12 | 35 | 20 | 1,200 | 6.0 | 35 | 95 |
| Cona: | | | | | | |
| 2[13] | — | — | — | — | — | — |
| Duffau: | | | | | | |
| 14 | 40 | 20 | 1,400 | 6.5 | 35 | 100 |
| 15 | 40 | 20 | 1,200 | 6.0 | 35 | 95 |
| 16 | 30 | 20 | 800 | 5.5 | 30 | — |
| 2[17] | — | — | — | — | — | — |
| Eufaula: | | | | | | |
| 2[18] | — | — | — | 4.0 | — | — |
| Gaddy: | | | | | | |
| 2[19] | — | — | — | 6.0 | — | — |
| Gowen: | | | | | | |
| 20 | 70 | 30 | — | 7.0 | 60 | — |
| 2[21] | — | — | — | 7.0 | — | — |
| Hensley: | | | | | | |
| 22 | 20 | 15 | — | 3.0 | 35 | — |
| Lindy: | | | | | | |
| 23 | 50 | 25 | — | 5.0 | 45 | — |
| Miller: | | | | | | |
| 24 | 60 | 30 | — | 6.5 | 55 | — |

See footnotes at end of table.

TABLE 4.—YIELDS PER ACRE OF CROPS AND PASTURE—Continued

| Soil name and map symbol | Grain sorghum | Wheat | Peanuts | Improved bermuda-grass | Oats | Peaches |
|---|---|---|---|---|---|---|
| | Bu | Bu | Lb | AUM[1] | Bu | Bu |
| Miller: | | | | | | |
| 225 | — | — | — | 5.5 | — | — |
| Pulexas: | | | | | | |
| 26 | 70 | 30 | 1,200 | 7.0 | 50 | — |
| 227 | — | — | — | 7.0 | — | — |
| Renfrow: | | | | | | |
| 28 | 30 | 25 | — | 3.5 | 35 | — |
| Sanger: | | | | | | |
| 29 | 55 | 20 | — | 6.0 | 45 | — |
| 30 | — | — | — | 3.5 | — | — |
| Selden: | | | | | | |
| 31 | 40 | 20 | 1,400 | 5.5 | 35 | 100 |
| Stoneburg: | | | | | | |
| 232: | | | | | | |
| Stoneburg part | 40 | 20 | — | 5.0 | 40 | — |
| Anocon part | 40 | 20 | — | 6.0 | 40 | — |
| Teller: | | | | | | |
| 33 | 60 | 30 | — | 7.0 | 50 | — |
| Truce: | | | | | | |
| 34 | 30 | 20 | — | 4.0 | 20 | — |
| 235 | — | — | — | — | — | — |
| Ustolls: | | | | | | |
| 236: | | | | | | |
| Ustolls part | — | — | — | — | — | — |
| Rock outcrop part. | | | | | | |
| Vashti: | | | | | | |
| 37 | 35 | 20 | 900 | 5.0 | 35 | — |
| Venus: | | | | | | |
| 38 | 50 | 20 | — | 6.0 | 35 | — |
| Vernon: | | | | | | |
| 39 | 15 | 10 | — | — | 20 | — |
| 240 | — | — | — | — | — | — |
| Waurika: | | | | | | |
| 241 | 40 | 25 | — | 4.5 | 40 | — |
| Windthorst: | | | | | | |
| 42 | 30 | 20 | 1,200 | 6.0 | 30 | 150 |
| 43 | 35 | 20 | 1,000 | 5.0 | 35 | 125 |
| 44 | 30 | 20 | 800 | 4.5 | 25 | — |
| 245 | — | — | — | 3.5 | — | — |
| Yahola: | | | | | | |
| 246 | 45 | 25 | — | 6.5 | 50 | — |

TABLE 5.—CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Dashes mean no acreage]

| Class | Total acreage | Major management concerns | | |
|---|---|---|---|---|
| | | Erosion (e) | Wetness (w) | Soil problem (s) |
| | | Acres | Acres | Acres |
| I | 9,070 | — | — | — |
| II | 42,240 | 2,800 | 39,440 | — |
| III | 291,510 | 289,980 | 1,530 | — |
| IV | 72,900 | 71,130 | — | 1,770 |
| V | 44,670 | — | 44,670 | — |
| VI | 86,530 | 45,950 | — | 40,580 |
| VII | 50,776 | 8,170 | — | 42,606 |
| VIII | — | — | — | — |

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

| Soil name and map symbol | Range site name | Potential production | | Common plant name | Composition |
|---|---|---|---|---|---|
| | | Kind of year | Dry weight | | |
| | | | Lb/acre | | Pct |
| Aledo: | | | | | |
| 1 | Shallow | Favorable | 3,000 | Little bluestem | 20 |
| | | Normal | 2,000 | Sideoats grama | 20 |
| | | Unfavorable | 1,800 | Indiangrass | 15 |
| | | | | Big bluestem | 10 |
| | | | | Other perennial grasses | 25 |
| | | | | Perennial forbs | 5 |
| | | | | Trees | 5 |
| Anocon: | | | | | |
| [1]2: | | | | | |
| Anocon part | Loamy Prairie | Favorable | 7,000 | Little bluestem | 30 |
| | | Normal | 5,000 | Indiangrass | 20 |
| | | Unfavorable | 3,500 | Big bluestem | 15 |
| | | | | Sideoats grama | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Other annual grasses | 5 |
| | | | | Perennial forbs | 5 |
| Stoneburg part | Loamy Prairie | Favorable | 7,000 | Little bluestem | 30 |
| | | Normal | 5,000 | Indiangrass | 20 |
| | | Unfavorable | 3,500 | Big bluestem | 15 |
| | | | | Sideoats grama | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Other annual grasses | 5 |
| | | | | Perennial forbs | 5 |
| Bastrop: | | | | | |
| 3, 4 | Sandy Loam | Favorable | 5,500 | Little bluestem | 50 |
| | | Normal | 4,500 | Indiangrass | 15 |
| | | Unfavorable | 3,000 | Big bluestem | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Perennial forbs | 5 |
| | | | | Trees | 5 |
| Bolar: | | | | | |
| 5 | Clay Loam | Favorable | 6,000 | Little bluestem | 30 |
| | | Normal | 5,000 | Indiangrass | 15 |
| | | Unfavorable | 3,000 | Big bluestem | 10 |
| | | | | Sideoats grama | 10 |
| | | | | Perennial forbs | 15 |
| | | | | Other perennial grasses | 15 |
| | | | | Trees | 5 |
| [1]6: | | | | | |
| Bolar part | Clay Loam | Favorable | 6,000 | Little bluestem | 30 |
| | | Normal | 5,000 | Indiangrass | 15 |
| | | Unfavorable | 3,000 | Big bluestem | 10 |
| | | | | Sideoats grama | 10 |
| | | | | Perennial forbs | 15 |
| | | | | Other perennial grasses | 10 |
| | | | | Trees | 10 |
| Aledo part | Shallow | Favorable | 3,000 | Little bluestem | 20 |
| | | Normal | 2,000 | Sideoats grama | 20 |
| | | Unfavorable | 1,800 | Indiangrass | 15 |
| | | | | Big bluestem | 10 |
| | | | | Other perennial grasses | 25 |
| | | | | Perennial forbs | 5 |
| | | | | Trees | 5 |

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

| Soil name and map symbol | Range site name | Potential production | | Common plant name | Composition |
|---|---|---|---|---|---|
| | | Kind of year | Dry weight | | |
| | | | Lb/acre | | Pct |
| Bonti: | | | | | |
| 7 | Sandy Loam | Favorable | 4,500 | Little bluestem | 30 |
| | | Normal | 3,500 | Big bluestem | 10 |
| | | Unfavorable | 3,000 | Indiangrass | 10 |
| | | | | Sideoats grama | 10 |
| | | | | Perennial forbs | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Trees | 10 |
| | | | | Other annual grasses | 5 |
| [1]8: | | | | | |
| Bonti part | Sandstone Hills | Favorable | 4,000 | Little bluestem | 35 |
| | | Normal | 3,000 | Indiangrass | 10 |
| | | Unfavorable | 2,500 | Sideoats grama | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Trees | 15 |
| | | | | Other annual grasses | 10 |
| | | | | Perennial forbs | 5 |
| Exray part | Sandstone Hills | Favorable | 4,000 | Little bluestem | 35 |
| | | Normal | 3,000 | Indiangrass | 10 |
| | | Unfavorable | 2,500 | Sideoats grama | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Trees | 15 |
| | | | | Other annual grasses | 10 |
| | | | | Perennial forbs | 5 |
| Bosque: | | | | | |
| 9, [1]10 | Loamy Bottomland | Favorable | 6,500 | Indiangrass | 20 |
| | | Normal | 5,000 | Little bluestem | 20 |
| | | Unfavorable | 3,500 | Switchgrass | 10 |
| | | | | Big bluestem | 10 |
| | | | | Other perennial grasses | 25 |
| | | | | Trees | 10 |
| | | | | Perennial forbs | 5 |
| Branyon: | | | | | |
| 11 | Blackland | Favorable | 7,000 | Little bluestem | 40 |
| | | Normal | 5,500 | Indiangrass | 13 |
| | | Unfavorable | 3,500 | Big bluestem | 12 |
| | | | | Meadow dropseed | 10 |
| | | | | Other perennial grasses | 10 |
| | | | | Perennial forbs | 10 |
| | | | | Trees | 5 |
| Chaney: | | | | | |
| 12 | Loamy Sand | Favorable | 4,500 | Little bluestem | 30 |
| | | Normal | 4,000 | Big bluestem | 10 |
| | | Unfavorable | 2,000 | Indiangrass | 10 |

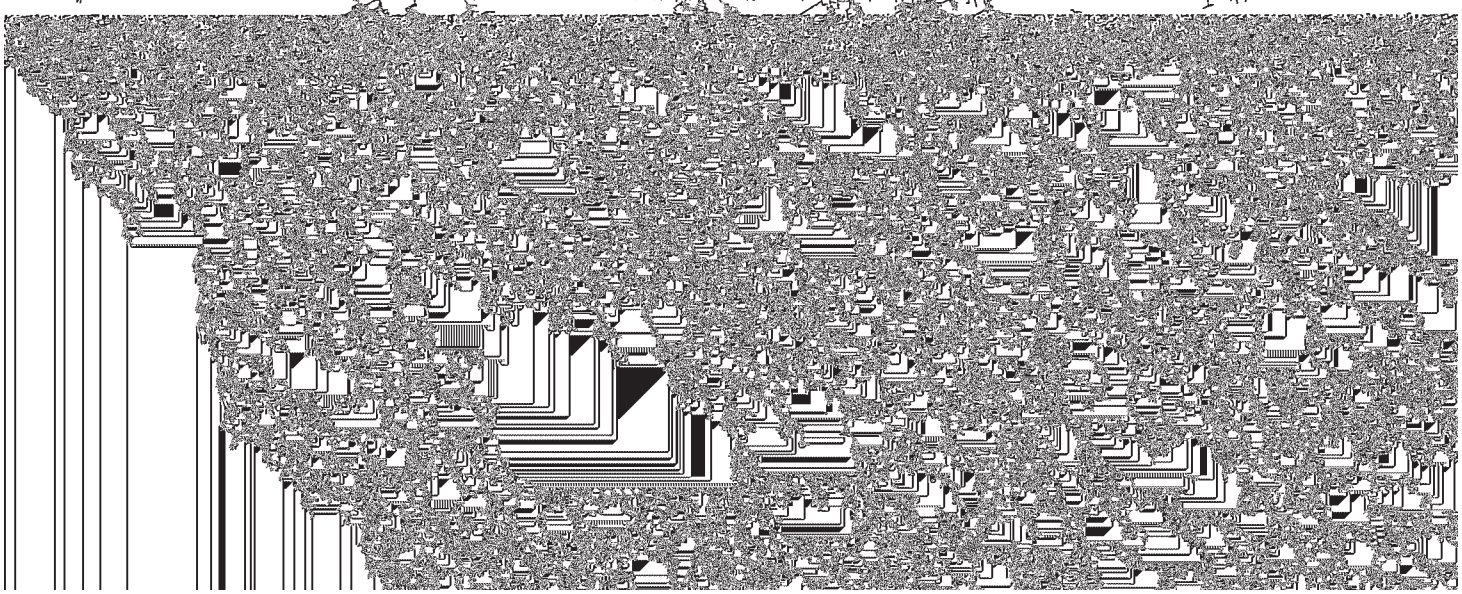


TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

| | Potential production | |
|---|---|---|

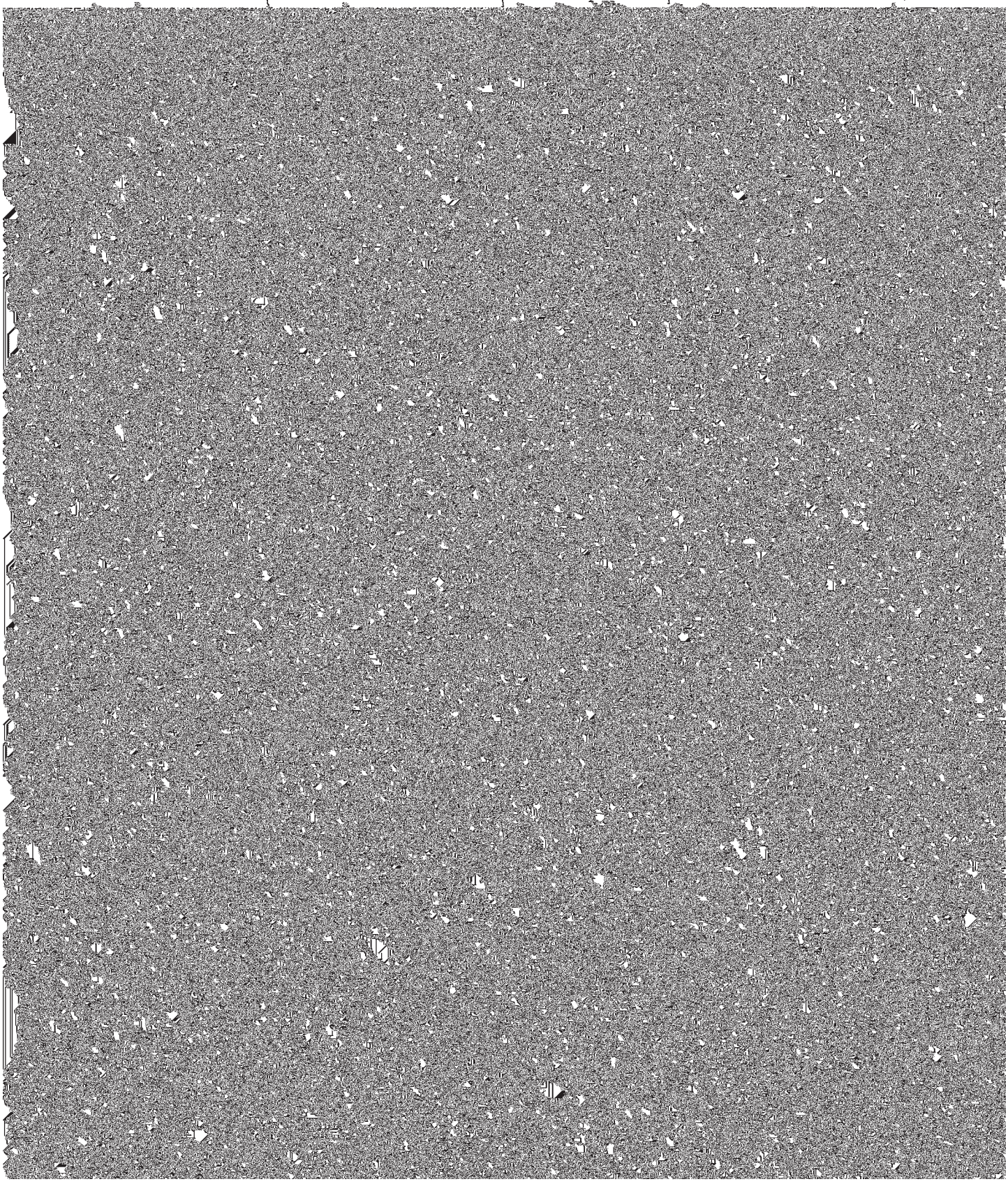


TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

| Soil name and map symbol | Range site name | Potential production | | Common plant name | Composition |
|---|---|---|---|---|---|
| | | Kind of year | Dry weight | | |
| | | | Lb/acre | | Pct |
| Lindy: | | | | | |
| 23 | Deep Redland | Favorable | 6,000 | Little bluestem | 25 |
| | | Normal | 5,000 | Big bluestem | 15 |
| | | Unfavorable | 4,000 | Indiangrass | 15 |
| | | | | Other perennial grasses | 35 |
| | | | | Perennial forbs | 5 |
| | | | | Shrubs | 5 |
| Miller: | | | | | |
| 24, [1]25 | Clayey Bottomland | Favorable | 5,000 | Sideoats grama | 35 |
| | | Normal | 3,500 | Western wheatgrass | 15 |
| | | Unfavorable | 2,000 | Arizona cottontop | 10 |

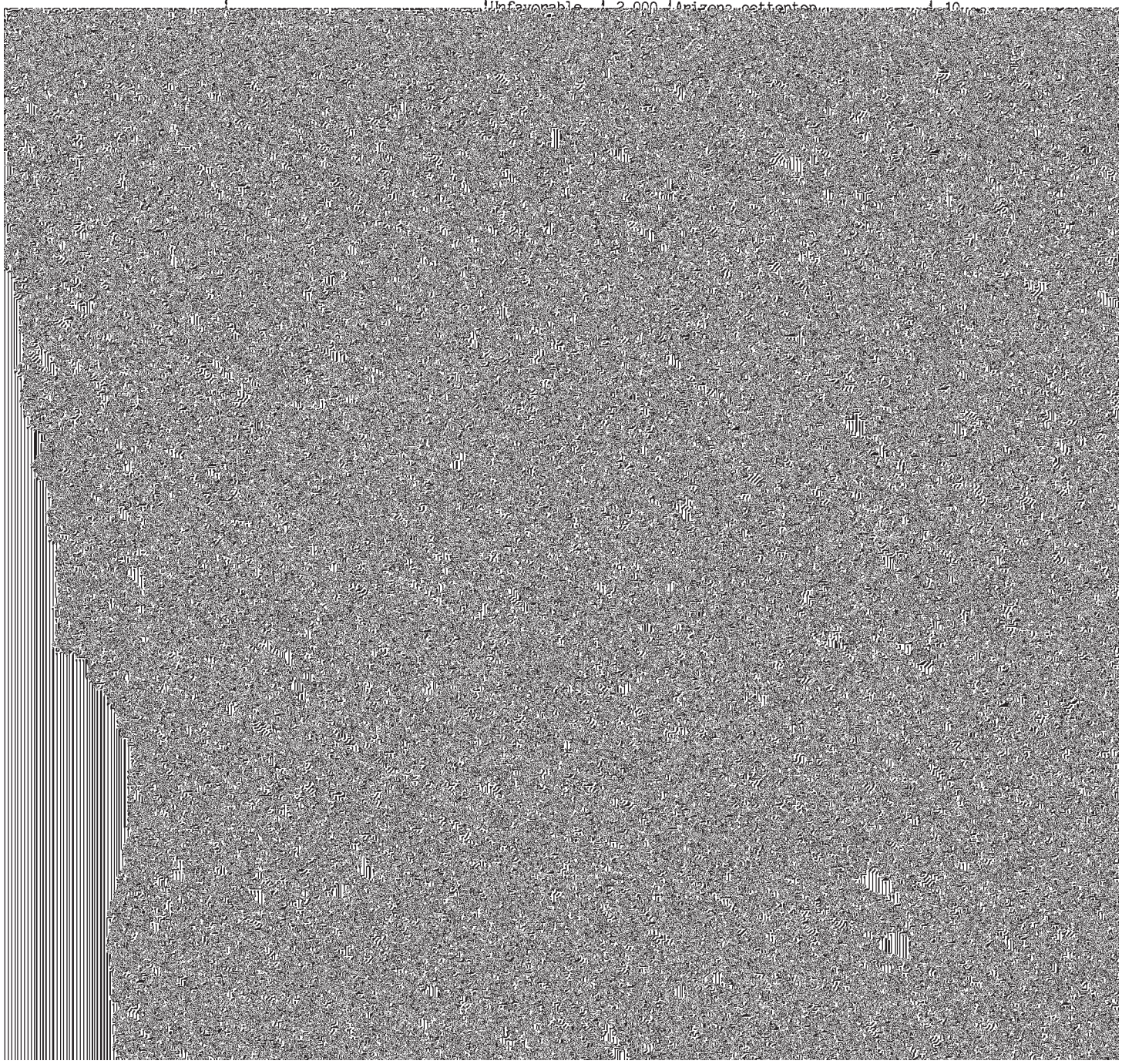


TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

| Soil name and map symbol | Range site name | Potential production | | Common plant name | Composition |
|---|---|---|---|---|---|
| | | Kind of year | Dry weight | | |
| | | | Lb/acre | | Pct |
| Teller: | | | | | |
| 33 | Loamy Prairie | Favorable | 6,000 | Little bluestem | 30 |
| | | Normal | 4,500 | Big bluestem | 20 |
| | | Unfavorable | 3,000 | Indiangrass | 10 |
| | | | | Switchgrass | 10 |
| | | | | Other perennial grasses | 20 |
| | | | | Perennial forbs | 10 |
| Truce: | | | | | |
| 34 | Tight Sandy Loam | Favorable | 4,000 | Sideoats grama | 30 |
| | | Normal | 3,000 | Silver bluestem | 10 |
| | | Unfavorable | 2,000 | Vine-mesquite | 10 |
| | | | | Other perennial grasses | 30 |
| | | | | Perennial forbs | 10 |
| | | | | Trees | 10 |
| [1]35: | | | | | |
| Truce part | Sandstone Hills | Favorable | 4,000 | Little bluestem | 25 |
| | | Normal | 3,000 | Sideoats grama | 20 |
| | | Unfavorable | 2,500 | Indiangrass | 10 |
| | | | | Trees | 15 |
| | | | | Other perennial grasses | 15 |
| | | | | Other annual grasses | 10 |
| | | | | Perennial forbs | 5 |
| Owens part | Rocky Hills | Favorable | 1,700 | Sideoats grama | 30 |
| | | Normal | 1,200 | Silver bluestem | 15 |
| | | Unfavorable | 900 | Buffalograss | 10 |
| | | | | Vine-mesquite | 10 |
| | | | | Other perennial grasses | 25 |
| | | | | Perennial forbs | 5 |
| | | | | Shrubs | 5 |
| Ustolls: | | | | | |
| [1]36: | | | | | |
| Ustolls part | Steep Rocky | Favorable | 3,500 | Little bluestem | 50 |
| | | Normal | 3,000 | Indiangrass | 10 |
| | | Unfavorable | 2,500 | Other perennial grasses | 25 |
| | | | | Trees | 10 |
| | | | | Perennial forbs | 5 |
| Rock outcrop part. | | | | | |
| Vashti: | | | | | |
| 37 | Sandy Loam | Favorable | 6,000 | Little bluestem | 30 |
| | | Normal | 4,500 | Big bluestem | 10 |
| | | Unfavorable | 3,000 | Indiangrass | 10 |
| | | | | Sideoats grama | 10 |
| | | | | Other perennial grasses | 20 |
| | | | | Perennial forbs | 10 |
| | | | | Trees | 10 |
| Venus: | | | | | |
| 38 | Clay Loam | Favorable | 6,500 | Little bluestem | 20 |
| | | Normal | 5,000 | Indiangrass | 15 |
| | | Unfavorable | 3,000 | Big bluestem | 10 |
| | | | | Sideoats grama | 10 |
| | | | | Other perennial grasses | 25 |
| | | | | Perennial forbs | 15 |
| | | | | Trees | 5 |
| Vernon: | | | | | |
| 39 | Shallow Clay | Favorable | 1,750 | Sideoats grama | 40 |
| | | Normal | 1,500 | Buffalograss | 15 |
| | | Unfavorable | 900 | Meadow dropseed | 15 |
| | | | | Other perennial grasses | 20 |
| | | | | Perennial forbs | 5 |
| | | | | Shrubs | 5 |

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITES—Continued

| Soil name and map symbol | Range site name | Potential production | | Common plant name | Composition |
|---|---|---|---|---|---|
| | | Kind of year | Dry weight | | |
| | | | Lb/acre | | Pct |
| Vernon: | | | | | |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITES—Continued

| Soil name and map symbol | Range site name | Potential production | | Common plant name | Composition |
|---|---|---|---|---|---|
| | | Kind of year | Dry weight | | |
| | | | Lb/acre | | Pct |
| Yahola: [1]46: | | | | | |
| Yahola part | Loamy Bottomland | Favorable | 7,000 | Little bluestem | 30 |
| | | Normal | 4,900 | Big bluestem | 10 |
| | | Unfavorable | 3,500 | Indiangrass | 10 |
| | | | | Switchgrass | 10 |
| | | | | Other perennial grasses | 15 |
| | | | | Trees | 10 |
| | | | | Annual forbs | 10 |
| | | | | Sedges | 5 |
| Gaddy part | Sandy Bottomland | Favorable | 3,800 | Little bluestem | 20 |
| | | Normal | 3,000 | Switchgrass | 15 |
| | | Unfavorable | 2,000 | Indiangrass | 10 |
| | | | | Big bluestem | 10 |
| | | | | Other perennial grasses | 10 |
| | | | | Annual forbs | 15 |
| | | | | Trees | 10 |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.—BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Aledo: | | | | | |
| 1 | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. |
| Anocon: | | | | | |
| 2: | | | | | |
| Anocon part | Moderate: too clayey. | Moderate: shrink-swell, low strength. | Moderate: shrink-swell, low strength. | Moderate: shrink-swell. | Severe: low strength. |
| Stoneburg part | Severe: depth to rock. | Moderate: depth to rock. | Severe: depth to rock. | Moderate: depth to rock. | Moderate: depth to rock. |
| Bastrop: | | | | | |

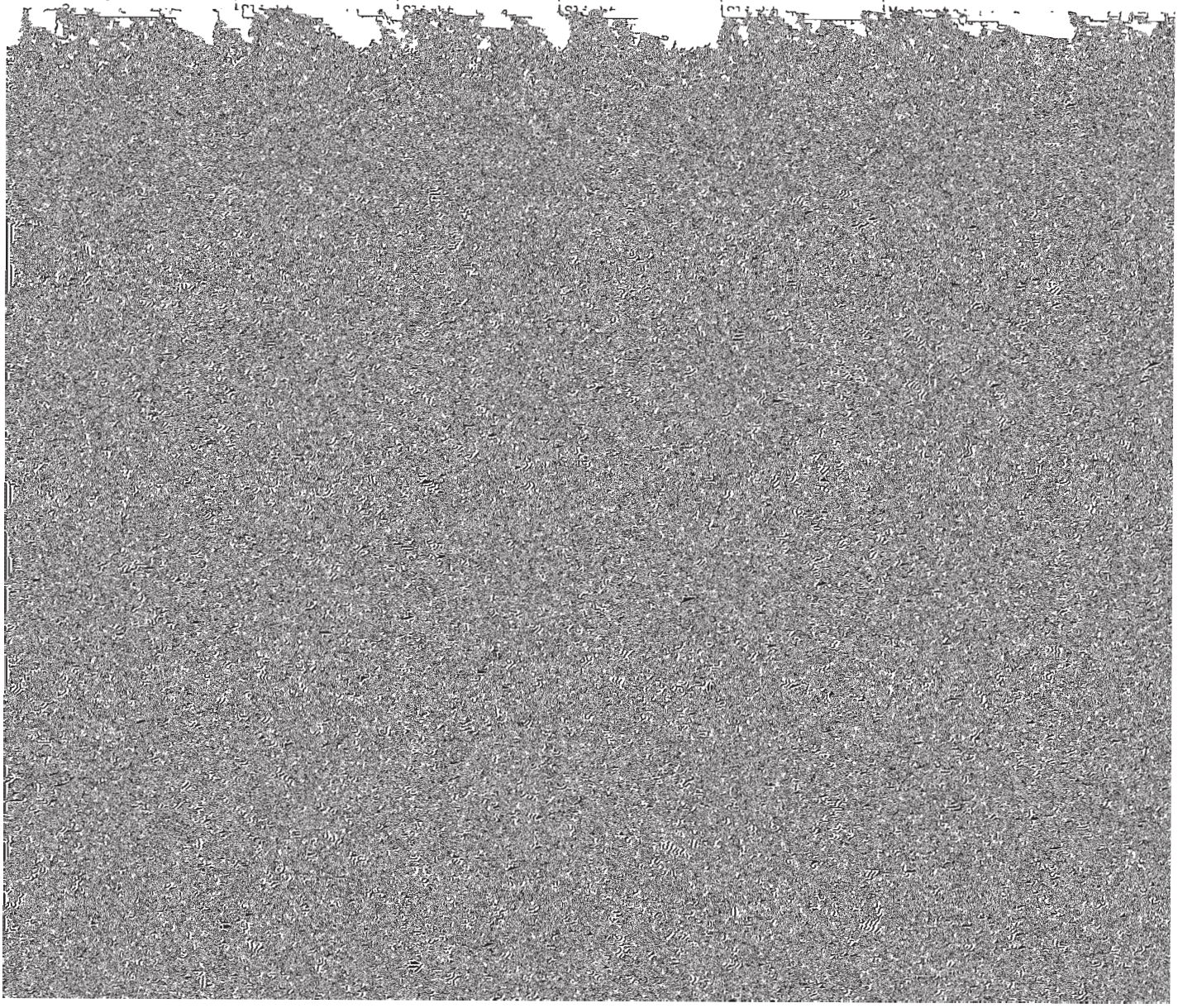


TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Duffau: 14, 15, 16 | Slight | Moderate: low strength. | Moderate: low strength. | Moderate: slope, low strength. | Moderate: low strength. |
| 17: Duffau part | Slight | Moderate: low strength. | Moderate: low strength. | Moderate: slope, low strength. | Moderate: low strength. |
| Windthorst part | Moderate: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell, slope. | Severe: low strength. |
| Eufaula: 18: Eufaula part | Severe: cutbanks cave. | Slight | Slight | Moderate: slope. | Slight. |
| Patilo part | Severe: cutbanks cave. | Slight | Moderate: wetness. | Moderate: slope. | Slight. |
| Gaddy: 19 | Severe: floods, cutbanks cave. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. |
| Gowen: 20 | Severe: floods. | Severe: floods. | Severe: floods. | Moderate: floods. | Moderate: shrink-swell, floods. |
| 21 | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. |

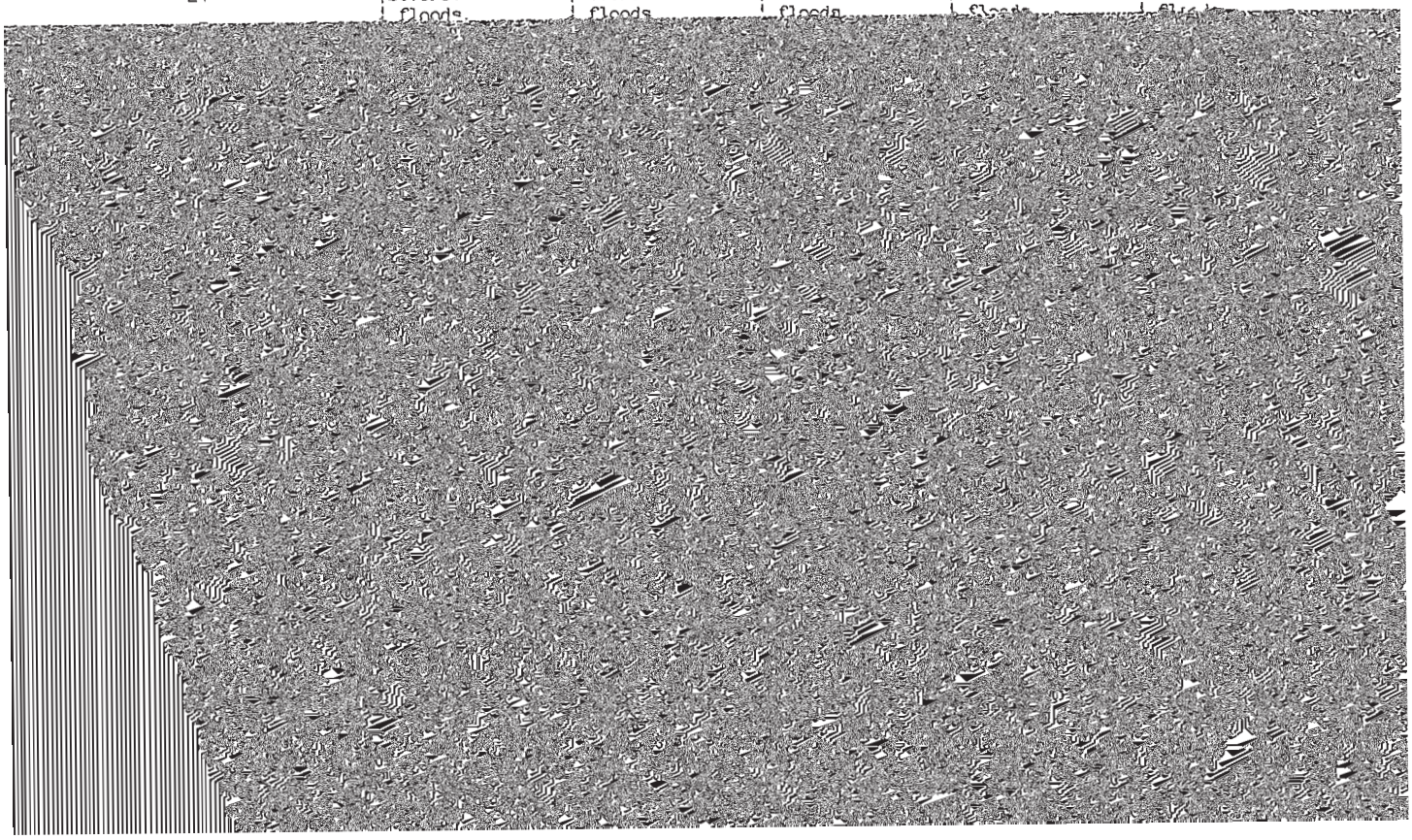


TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|
| Selden: | | | | | |
| 31 | Moderate: wetness. | Slight | Moderate: wetness. | Slight | Moderate: low strength. |
| Stoneburg: | | | | | |
| 132: | | | | | |
| Stoneburg part | Severe: depth to rock. | Moderate: depth to rock. | Severe: depth to rock. | Moderate: depth to rock. | Moderate: depth to rock. |
| Anocon part | Moderate: too clayey. | Moderate: shrink-swell, low strength. | Moderate: shrink-swell, low strength. | Moderate: shrink-swell. | Severe: low strength. |
| Teller: | | | | | |
| 33 | Slight | Slight | Slight | Slight | Moderate: low strength. |
| Truce: | | | | | |
| 34 | Severe: too clayey. | Moderate: shrink-swell. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: low strength. |
| 135: | | | | | |
| Truce part | Severe: too clayey, large stones. | Moderate: shrink-swell. | Moderate: shrink-swell. | Severe: slope. | Severe: low strength. |
| Owens part | Severe: too clayey. | Severe: shrink-swell. | Severe: shrink-swell. | Severe: shrink-swell, slope. | Severe: shrink-swell. |
| Ustolls: | | | | | |
| 136: | | | | | |
| Ustolls part | Severe: slope, large stones. | Severe: slope, large stones. | Severe: slope, large stones. | Severe: slope, large stones. | Severe: slope. |
| Rock outcrop part. | | | | | |
| Vashti: | | | | | |
| 37 | Severe: depth to rock. | Moderate: depth to rock. | Severe: depth to rock, wetness. | Moderate: depth to rock. | Moderate: depth to rock. |
| Venus: | | | | | |
| 38 | Slight | Slight | Slight | Moderate: slope. | Moderate: low strength. |
| Vernon: | | | | | |
| 39 | Severe: too clayey. | Severe: low strength, shrink-swell. | Severe: low strength, shrink-swell. | Severe: low strength, shrink-swell. | Severe: low strength, shrink-swell. |
| 140: | | | | | |
| Vernon part | Severe: too clayey. | Severe: low strength. | Severe: low strength. | Severe: low strength. | Severe: low strength. |

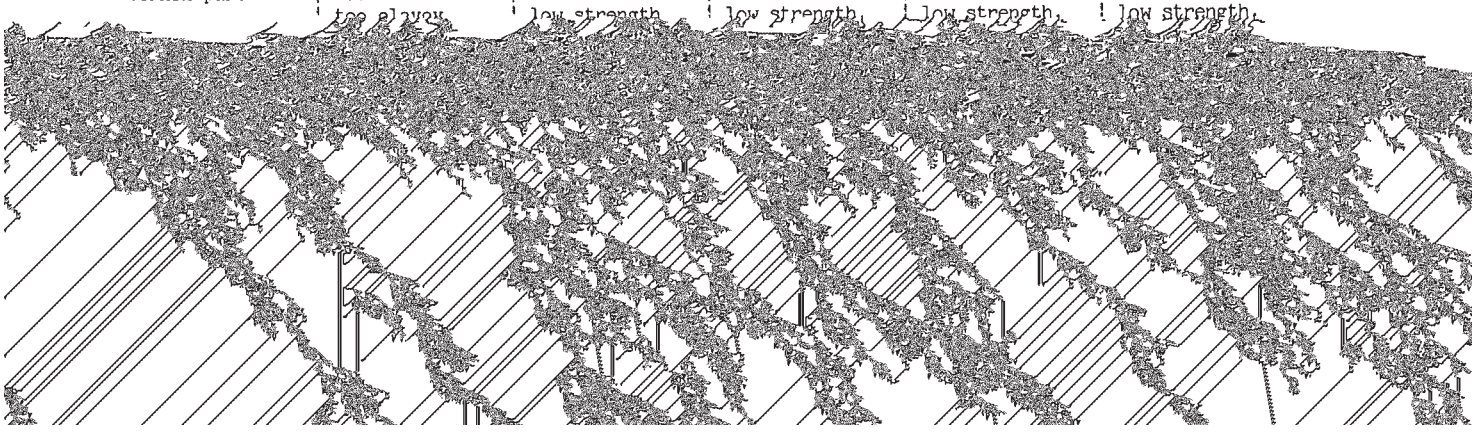


TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

| Soil name and map symbol | Shallow excavations | Dwellings without basements | Dwellings with basements | Small commercial buildings | Local roads and streets |
|---|---|---|---|---|---|

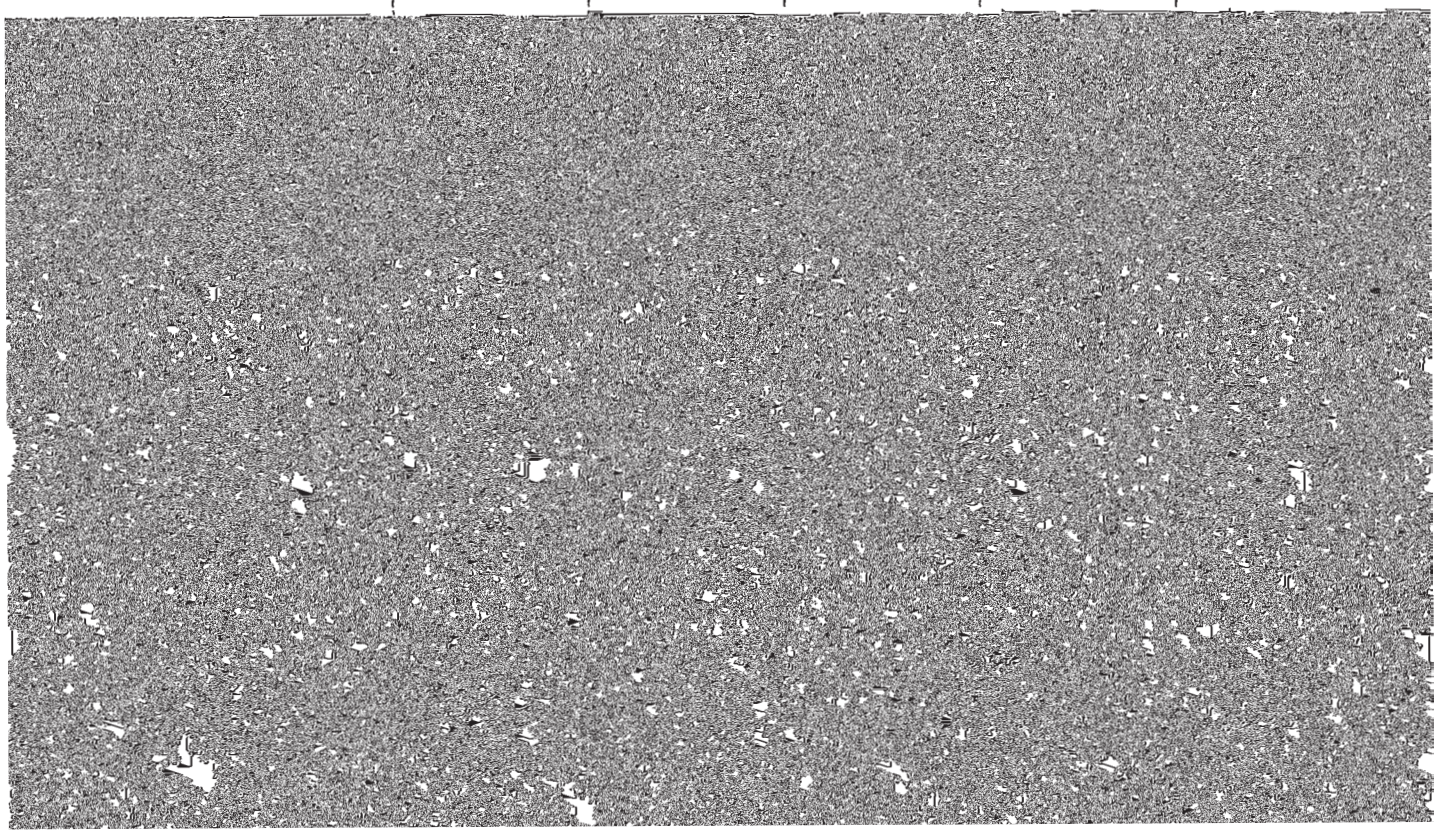


TABLE 8.—SANITARY FACILITIES

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Aledo: | | | | | |
| 1 | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer, small stones. |
| Anocon: | | | | | |
| [1]2: | | | | | |
| Anocon part | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| Stoneburg part | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: thin layer. |
| Bastrop: | | | | | |
| 3, 4 | Moderate: percs slowly. | Moderate: seepage. | Slight | Slight | Good. |
| Bolar: | | | | | |
| 5 | Severe: depth to rock. | Severe: depth to rock. | Moderate: depth to rock. | Slight | Fair: too clayey. |
| [1]6: | | | | | |
| Bolar part | Severe: depth to rock. | Severe: slope, depth to rock. | Moderate: depth to rock. | Slight | Fair: too clayey. |
| Aledo part | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Moderate: slope. | Poor: thin layer, small stones. |
| Bonti: | | | | | |
| 7 | Severe: percs slowly, depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: depth to rock. |
| [1]8: | | | | | |
| Bonti part | Severe: percs slowly, depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Moderate: slope. | Poor: large stones. |
| Exray part | Severe: depth to rock. | Severe: depth to rock, slope. | Severe: depth to rock. | Moderate: slope. | Poor: thin layer, large stones. |
| Bosque: | | | | | |
| 9, [1]10 | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Good. |
| Branyon: | | | | | |
| 11 | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey. |
| Chaney: | | | | | |
| 12 | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Poor: thin layer. |
| Cona: | | | | | |
| [1]13 | Severe: slope, percs slowly. | Severe: slope. | Moderate: slope, too clayey. | Severe: slope. | Fair: large stones, too clayey. |

See footnote at end of table.

TABLE 8.—SANITARY FACILITIES—Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Duffau: 14, 15, 16 | Slight | Moderate: seepage, slope. | Slight | Slight | Good. |
| [1]17: Duffau part | Slight | Moderate: seepage, slope. | Slight | Slight | Good. |
| Windthorst part | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| Eufaula: [1]18: Eufaula part | Slight | Severe: seepage. | Severe: seepage. | Severe: seepage. | Poor: too sandy. |
| Patilo part | Moderate: percs slowly. | Severe: seepage. | Moderate: too sandy, wetness. | Moderate: seepage. | Poor: too sandy. |
| Gaddy: [1]19 | Severe: floods. | Severe: seepage, floods. | Severe: seepage, too sandy, floods. | Severe: floods, seepage. | Fair: too sandy. |
| Gowen: 20 | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Good. |
| [1]21 | Severe: floods. | Severe: floods. | Severe: floods. | Severe: floods. | Good. |
| Hensley: 22 | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Poor: thin layer. |
| Lindy: 23 | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: thin layer, too clayey. |
| Miller: 24, [1]25 | Severe: percs slowly, floods. | Severe: floods. | Severe: floods, too clayey. | Severe: floods. | Poor: too clayey, hard to pack. |
| Pulexas: 26, [1]27 | Severe: | Severe: | Severe: | Severe: | Good. |

TABLE 8.—SANITARY FACILITIES—Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Stoneburg: | | | | | |
| [1]32: | | | | | |
| Stoneburg part | Severe: depth to rock, percs slowly. | Severe: depth to rock. | Severe: depth to rock. | Slight | Fair: thin layer. |
| Anocon part | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| Teller: | | | | | |
| 33 | Slight | Severe: seepage. | Severe: seepage. | Slight | Good. |
| Truce: | | | | | |
| 34 | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: thin layer. |
| [1]35: | | | | | |
| Truce part | Severe: percs slowly. | Severe: slope, large stones. | Severe: too clayey, large stones. | Moderate: slope. | Poor: thin layer, large stones. |
| Owens part | Severe: percs slowly. | Severe: slope. | Severe: too clayey. | Moderate: slope. | Poor: too clayey, area reclaim. |
| Ustolls: | | | | | |
| [1]36: | | | | | |
| Ustolls part | Severe: slope, large stones. | Severe: slope, large stones. | Severe: slope, large stones. | Severe: slope. | Poor: slope, large stones. |
| Rock outcrop part. | | | | | |
| Vashti: | | | | | |
| 37 | Severe: depth to rock. | Severe: depth to rock. | Severe: depth to rock. | Severe: wetness. | Fair: thin layer, area reclaim. |
| Venus: | | | | | |
| 38 | Slight | Moderate: seepage. | Slight | Slight | Good. |
| Vernon: | | | | | |
| 39 | Severe: percs slowly. | Moderate: slope. | Severe: too clayey. | Slight | Poor: too clayey. |
| [1]40: | | | | | |
| Vernon part | Severe: percs slowly. | Severe: slope. | Severe: too clayey. | Slight | Poor: too clayey. |
| Knoco part | Severe: percs slowly. | Severe: slope. | Severe: too clayey. | Severe: slope. | Poor: too clayey. |
| Waurika: | | | | | |
| [1]41: | | | | | |
| Waurika part | Severe: percs slowly, wetness. | Slight | Severe: too clayey. | Severe: wetness. | Poor: thin layer. |
| Renfrow part | Severe: percs slowly. | Slight | Severe: too clayey. | Slight | Poor: thin layer. |
| Windthorst: | | | | | |
| 42, 43, 44 | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |
| [1]45: | | | | | |
| Windthorst part | Severe: percs slowly. | Moderate: slope. | Moderate: too clayey. | Slight | Fair: too clayey. |

See footnote at end of table.

TABLE 8.—SANITARY FACILITIES—Continued

| Soil name and map symbol | Septic tank absorption fields | Sewage lagoon areas | Trench sanitary landfill | Area sanitary landfill | Daily cover for landfill |
|---|---|---|---|---|---|
| Windthorst: | | | | | |
| Duffau part | Slight | Moderate: seepage, slope. | Slight | Slight | Good. |
| Yahola: | | | | | |
| 146: | | | | | |
| Yahola part | Severe: floods. | Severe: seepage, floods. | Severe: floods, seepage. | Severe: floods, seepage. | Good. |
| Gaddy part | Severe: floods. | Severe: seepage, floods. | Severe: seepage, too sandy, floods. | Severe: floods, seepage. | Fair: too sandy. |

TABLE 9.—CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Aledo: 1 | Poor: thin layer. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: thin layer, small stones. |
| Anocon: 2: | | | | |
| Anocon part | Fair: shrink-swell, low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Stoneburg part | Poor: thin layer. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Bastrop: 3, 4 | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Bolar: 5 | Poor: | Unsuited: | Unsuited: | Fair: |

TABLE 9.—CONSTRUCTION MATERIALS—Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Duffau: | | | | |
| 14 | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too sandy. |
| 15, 16 | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| [1]17: | | | | |
| Duffau part | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Windthorst part | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Eufaula: | | | | |
| [1]18: | | | | |
| Eufaula part | Good | Poor: excess fines. | Unsuited: excess fines. | Poor: too sandy. |
| Patilo part | Good | Fair: excess fines. | Unsuited: excess fines. | Poor: too sandy. |
| Gaddy: | | | | |
| [1]19 | Good | Poor: excess fines. | Unsuited: excess fines. | Poor: too sandy. |
| Gowen: | | | | |
| 20, [1]21 | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Good. |
| Hensley: | | | | |
| 22 | Poor: thin layer. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer, too clayey. |
| Lindy: | | | | |
| 23 | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: too clayey. |
| Miller: | | | | |
| 24, [1]25 | Poor: low strength, shrink-swell. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey. |
| Pulexas: | | | | |
| 26, [1]27 | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Good. |
| Renfrow: | | | | |
| 28 | Poor: low strength, shrink-swell. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Sanger: | | | | |
| 29 | Poor: shrink-swell, low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey. |
| 30 | Poor: shrink-swell, low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey, large stones. |
| Selden: | | | | |
| 31 | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too sandy. |
| Stoneburg: | | | | |
| [1]32: | | | | |
| Stoneburg part | Poor: thin layer. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |

See footnote at end of table.

TABLE 9.—CONSTRUCTION MATERIALS—Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Stoneburg: | | | | |
| Anocon part | Fair: shrink-swell, low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Teller: | | | | |
| 33 | Good | Unsuited: excess fines. | Unsuited: excess fines. | Good. |
| Truce: | | | | |
| 34 | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| [1]35: | | | | |
| Truce part | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: large stones. |
| Owens part | Poor: shrink-swell. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey. |
| Ustolls: | | | | |
| [1]36: | | | | |
| Ustolls part | Poor: slope. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: slope, large stones. |
| Rock outcrop part. | | | | |
| Vashti: | | | | |
| 37 | Poor: thin layer. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Venus: | | | | |
| 38 | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Good. |
| Vernon: | | | | |
| 39 | Poor: shrink-swell, low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey. |
| [1]40: | | | | |
| Vernon part | Poor: shrink-swell, low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey. |
| Knoco part | Poor: low strength, shrink-swell. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too clayey. |
| Waurika: | | | | |
| [1]41: | | | | |
| Waurika part | Poor: low strength, shrink-swell. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Renfrow part | Poor: low strength, shrink-swell. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Windthorst: | | | | |
| 42 | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Poor: too sandy. |
| 43, 44 | Poor: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |

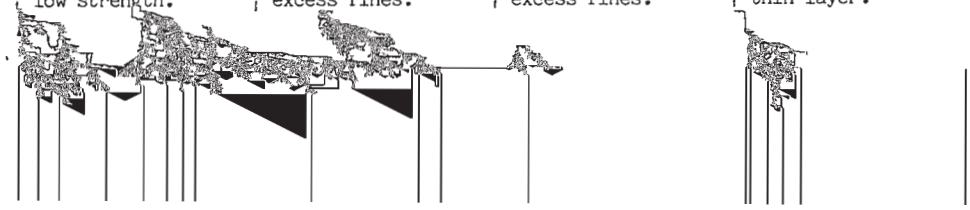


TABLE 9.—CONSTRUCTION MATERIALS—Continued

| Soil name and map symbol | Roadfill | Sand | Gravel | Topsoil |
|---|---|---|---|---|
| Windthorst: | | | | |
| Duffau part | Fair: low strength. | Unsuited: excess fines. | Unsuited: excess fines. | Fair: thin layer. |
| Yahola: | | | | |
| 146: | | | | |
| Yahola part | Fair: low strength. | Poor: excess fines. | Unsuited: excess fines. | Good. |
| Caddy part | Good | Poor | Unsuited | Fair |

TABLE 10.—WATER MANAGEMENT

["Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

| Soil name and map symbol | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|

TABLE 10.—WATER MANAGEMENT—Continued

| Soil name and map symbol | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|
| Duffau: [1]17: | | | | | |
| Duffau part | Moderate: seepage. | Moderate: erodes easily, piping. | Not needed | Erodes easily | Erodes easily. |
| Windthorst part | Moderate: seepage. | Moderate: compressible. | Percs slowly | Percs slowly, erodes easily. | Percs slowly, erodes easily. |
| Eufaula: [1]18: | | | | | |
| Eufaula part | Severe: seepage. | Moderate: unstable fill, piping. | Not needed | Seepage, fast intake, droughty. | Erodes easily, droughty, fast intake. |
| Patilo part | Severe: seepage. | Moderate: seepage, piping. | Cutbanks cave | Piping, erodes easily. | Droughty. |
| Gaddy: [1]19 | Severe: seepage. | Moderate: unstable fill, piping. | Not needed | Erodes easily | Erodes easily. |
| Gowen: 20 | Moderate: seepage. | Moderate: compressible. | Not needed | Favorable | Favorable. |
| [1]21 | Moderate: seepage. | Moderate: compressible. | Not needed | Wetness | Favorable. |
| Hensley: 22 | Severe: depth to rock. | Severe: thin layer. | Not needed | Depth to rock | Percs slowly, rooting depth. |
| Lindy: 23 | Severe: depth to rock. | Moderate: piping, thin layer. | Not needed | Rooting depth | Rooting depth. |
| Miller: 24, [1]25 | Slight | Moderate: unstable fill, compressible. | Floods, percs slowly. | Not needed | Percs slowly. |
| Pulexas: 26, [1]27 | Severe: seepage. | Moderate: unstable fill, seepage, piping. | Not needed | Not needed | Favorable. |
| Renfrow: 28 | Slight | Moderate: unstable fill, compressible. | Not needed | Erodes easily, percs slowly. | Erodes easily, percs slowly. |
| Sanger: 29 | Slight | Moderate: unstable fill, compressible. | Slope, percs slowly. | Percs slowly | Percs slowly, slope. |
| 30 | Slight | Moderate: unstable fill, low strength. | Not needed | Large stones, slope, percs slowly. | Percs slowly, slope, large stones. |
| Selden: 31 | Moderate: seepage. | Slight | Percs slowly | Erodes easily | Erodes easily. |

See footnote at end of table.

TABLE 10.—WATER MANAGEMENT—Continued

| Soil name and map symbol | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|
| Stoneburg: | | | | | |
| 132: | | | | | |
| Stoneburg part | Severe: depth to rock. | Moderate: thin layer. | Not needed | Favorable | Favorable. |
| Anocon part | Slight | Slight | Not needed | Favorable | Favorable. |
| Teller: | | | | | |
| 33 | Severe: seepage. | Moderate: unstable fill, piping. | Not needed | Favorable | Favorable. |
| Truce: | | | | | |
| 34 | Slight | Moderate: low strength. | Not needed | Favorable | Favorable. |
| 135: | | | | | |
| Truce part | Slight | Severe: large stones. | Not needed | Slope, large stones. | Slope, large stones. |
| Owens part | Slight | Moderate: compressible. | Not needed | Slope, rooting depth. | Droughty, erodes easily. |
| Ustolls: | | | | | |
| 136: | | | | | |
| Ustolls part | Severe: slope | Severe: large stones. | Not needed | Slope, large stones. | Slope, large stones. |
| Rock outcrop part. | | | | | |
| Vashti: | | | | | |
| 37 | Severe: depth to rock. | Moderate: thin layer. | Depth to rock | Depth to rock | Favorable. |
| Venus: | | | | | |
| 38 | Severe: seepage. | Moderate: piping. | Not needed | Slope | Favorable. |
| Vernon: | | | | | |
| 39 | Slight | Moderate: compressible, low strength, shrink-swell. | Not needed | Complex slope, percs slowly. | Droughty, percs slowly, slope. |
| 140: | | | | | |
| Vernon part | Slight | Moderate: compressible, low strength, shrink-swell. | Not needed | Complex slope, percs slowly. | Droughty, percs slowly, slope. |
| Knoco part | Slight | Moderate: low strength, shrink-swell. | Not needed | Not needed | Not needed. |
| Waurika: | | | | | |
| 141: | | | | | |
| Waurika part | Slight | Moderate: compressible, unstable fill, shrink-swell. | Wetness | Not needed | Not needed. |
| Renfrow part | Slight | Moderate: unstable fill, compressible. | Not needed | Not needed | Not needed. |
| Windthorst: | | | | | |
| 42, 43, 44 | Moderate: seepage. | Moderate: compressible. | Percs slowly | Percs slowly, erodes easily. | Percs slowly, erodes easily. |

See footnote at end of table.

TABLE 10.—WATER MANAGEMENT—Continued

| Soil name and map symbol | Pond reservoir areas | Embankments, dikes, and levees | Drainage | Terraces and diversions | Grassed waterways |
|---|---|---|---|---|---|
| Windthorst: 145: | | | | | |
| Windthorst part | Moderate: seepage. | Moderate: compressible. | Percs slowly | Percs slowly, erodes easily. | Percs slowly, erodes easily. |
| Duffau part | Moderate: seepage. | Moderate: erodes easily, piping. | Not needed | Erodes easily | Erodes easily. |
| Yahola: 146: | | | | | |

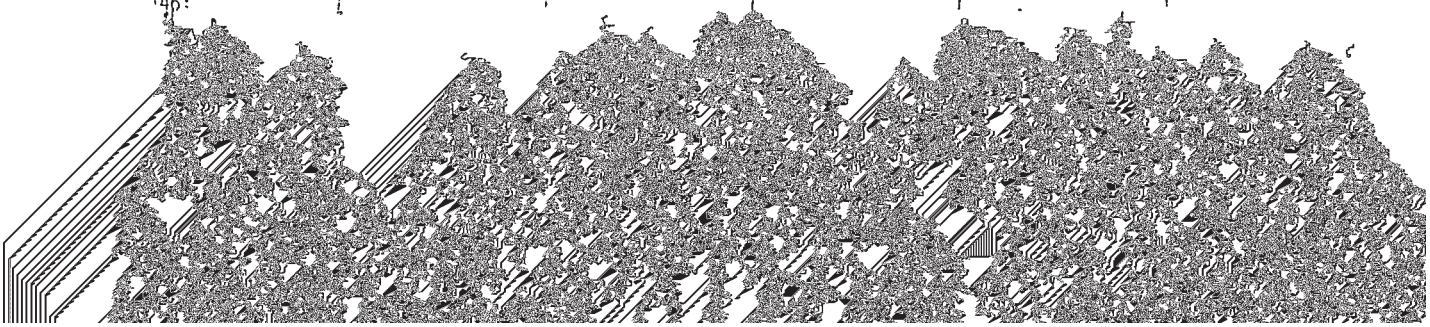


TABLE 11.—RECREATIONAL DEVELOPMENT

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," [illegible]

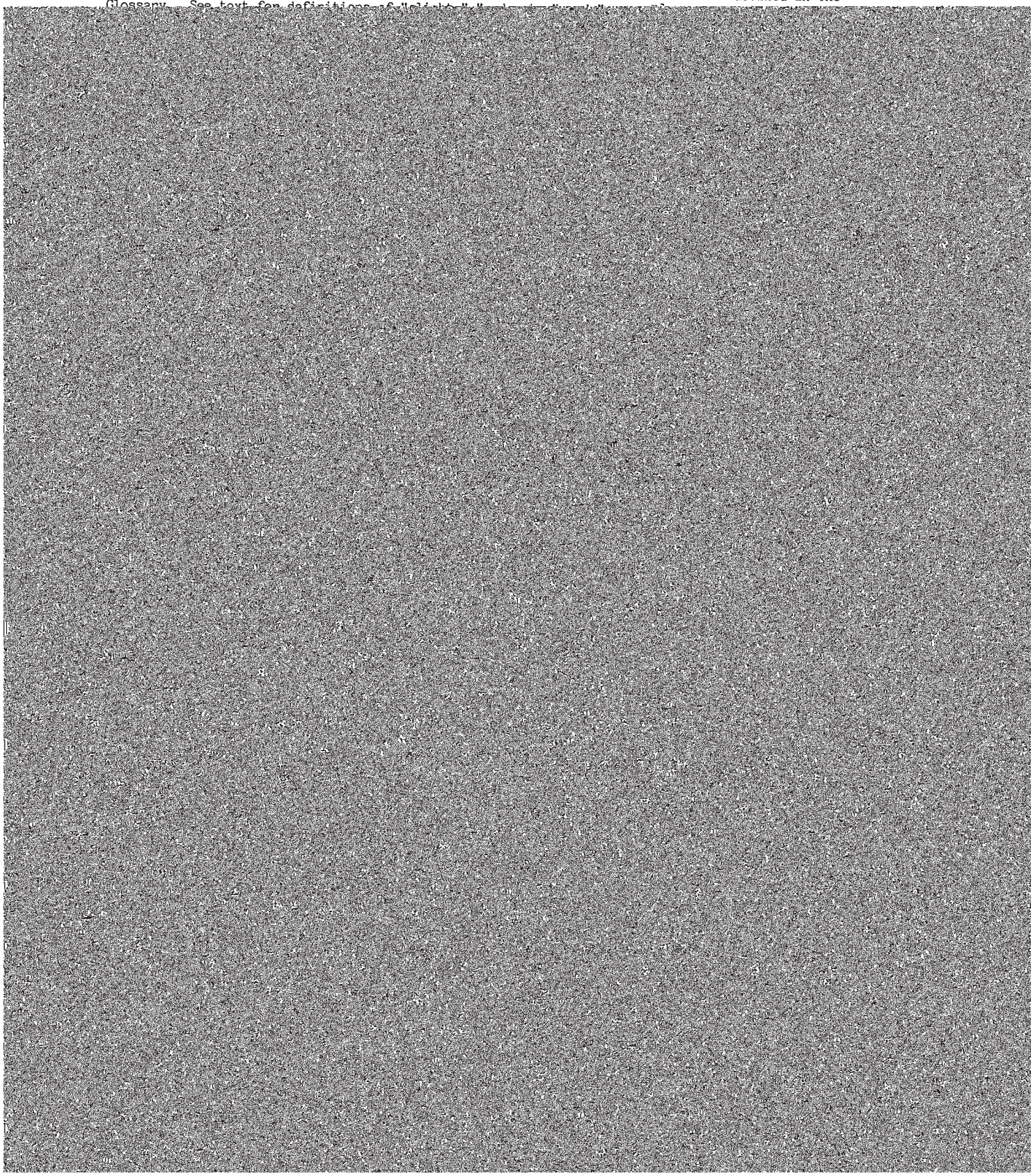


TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Duffau: | | | | |
| 15 | Slight | Slight | Moderate: slope. | Slight. |
| 16 | Slight | Slight | Severe: slope. | Slight. |
| [1]17: | | | | |
| Duffau part | Slight | Slight | Moderate: slope. | Slight. |
| Windthorst part | Moderate: percs slowly. | Slight | Moderate: percs slowly. | Slight. |
| Eufaula: | | | | |
| [1]18: | | | | |
| Eufaula part | Moderate: too sandy. | Moderate: too sandy. | Severe: too sandy. | Severe: too sandy. |
| Patilo part | Severe: too sandy. | Severe: too sandy. | Severe: too sandy. | Severe: too sandy. |
| Gaddy: | | | | |
| [1]19 | Severe: floods. | Severe: floods. | Severe: floods. | Moderate: floods. |
| Gowen: | | | | |
| 20 | Severe: | Moderate: | Moderate: | Moderate: |

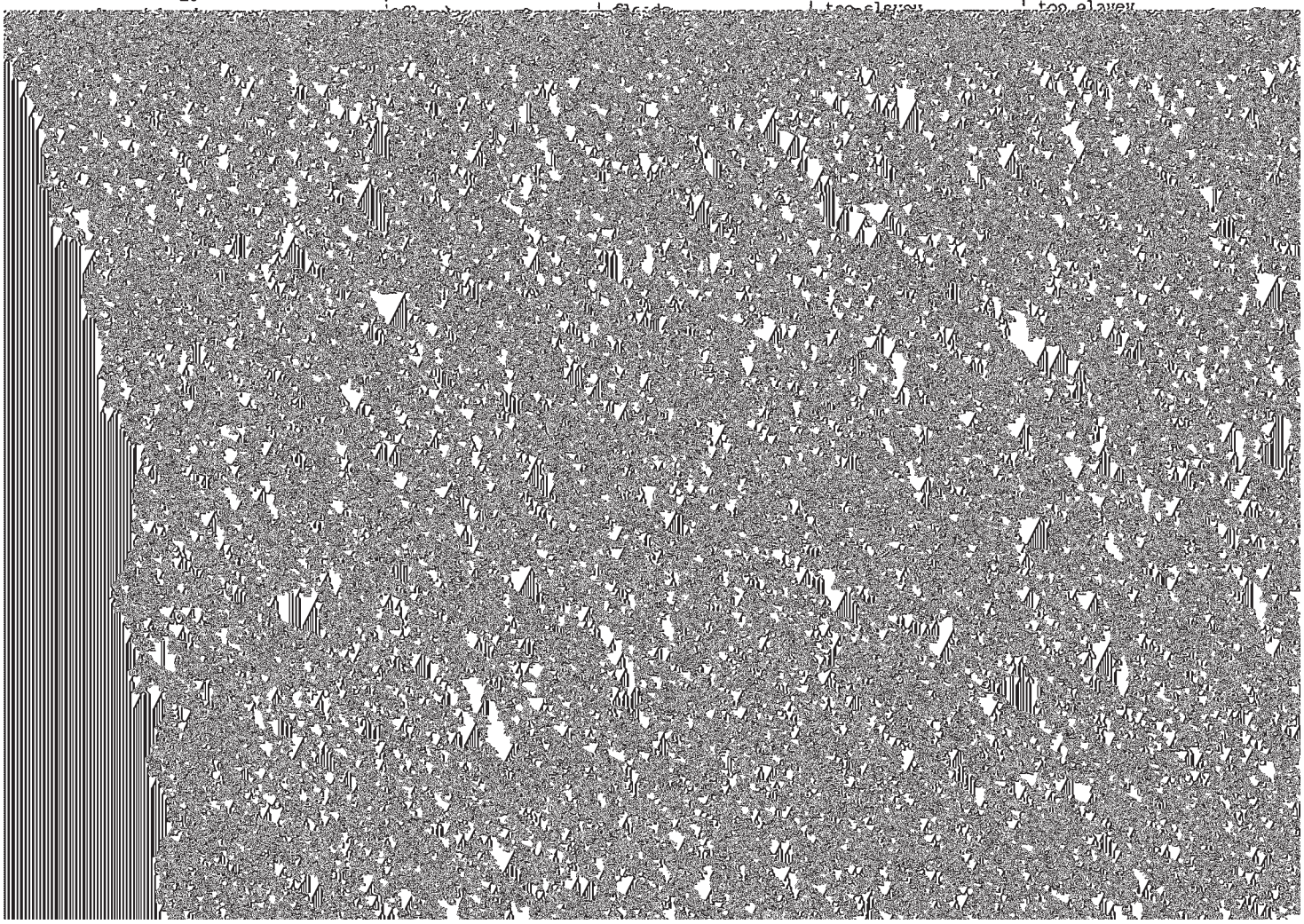


TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Sanger: | | | | |
| 30 | Severe: too clayey, percs slowly. | Severe: too clayey. | Severe: too clayey, percs slowly, large stones. | Severe: too clayey. |
| Selden: | | | | |
| 31 | Moderate: too sandy, percs slowly. | Moderate: too sandy. | Severe: too sandy, soil blowing. | Moderate: too sandy. |
| Stoneburg: | | | | |
| [1]32: | | | | |
| Stoneburg part | Slight | Slight | Moderate: slope. | Slight. |
| Anocon part | Slight | Slight | Moderate: slope. | Slight. |
| Teller: | | | | |
| 33 | Slight | Slight | Slight | Slight. |
| Truce: | | | | |
| 34 | Moderate: percs slowly. | Slight | Moderate: percs slowly, slope. | Slight. |
| [1]35: | | | | |
| Truce part | Moderate: large stones, percs slowly. | Moderate: slope, large stones. | Severe: slope, large stones. | Moderate: large stones. |
| Owens part | Severe: | Severe: | Severe: | Severe: |

TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

| Soil name and map symbol | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| Waurika: | | | | |
| 141: | | | | |
| Waurika part | Severe: wetness, percs slowly. | Moderate: wetness. | Severe: wetness, percs slowly. | Moderate: wetness. |
| Renfrow part | Severe: | Slight | Severe: | Slight. |

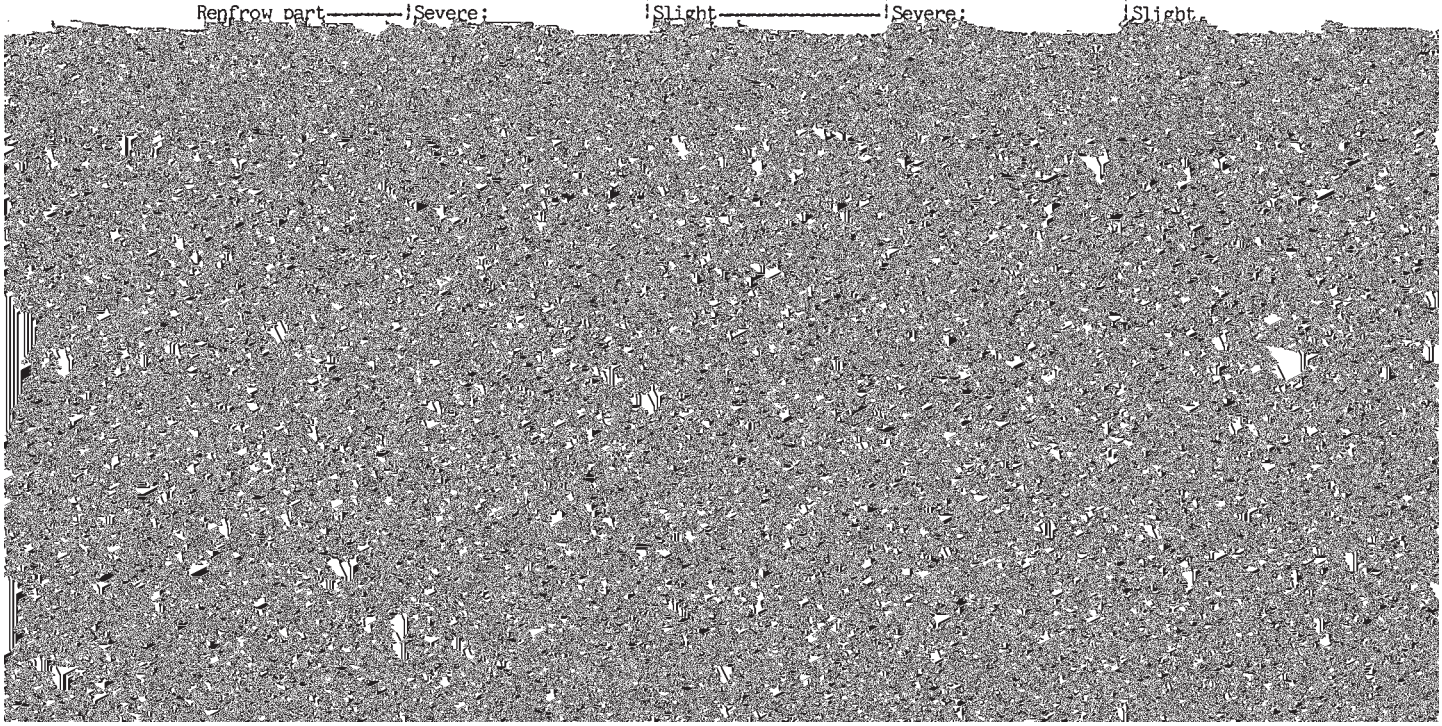


TABLE 12.—WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

| Soil name and map symbol | Potential for habitat elements | | | | | | Potential as habitat for— | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Wetland wildlife | Rangeland wildlife |
| Aledo: | | | | | | | | | |
| 1 | Poor | Poor | Poor | Fair | Very poor. | Very poor. | Poor | Very poor. | Poor. |
| Anocon: | | | | | | | | | |
| [1]2: | | | | | | | | | |
| Anocon part | Good | Good | Good | Good | Very poor. | Very poor. | Good | Very poor. | Good. |
| Stoneburg part | Good | Good | Good | Good | Very poor. | Very poor. | Good | Very poor. | Good. |
| Bastrop: | | | | | | | | | |
| 3, 4 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| Bolar: | | | | | | | | | |
| 5 | Fair | Good | Fair | Fair | Poor | Very poor. | Fair | Very poor. | Fair. |
| [1]6: | | | | | | | | | |
| Bolar part | Poor | Poor | Fair | Fair | Poor | Very poor. | Poor | Very poor. | Fair. |
| Aledo part | Poor | Poor | Poor | Fair | Very poor. | Very poor. | Poor | Very poor. | Poor. |
| Bonti: | | | | | | | | | |
| 7 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| [1]8: | | | | | | | | | |
| Bonti part | Very poor. | Very poor. | Good | Good | Poor | Very poor. | Poor | Very poor. | Good. |
| Exray part | Very poor. | Very poor. | Fair | Fair | Very poor. | Very poor. | Poor | Very poor. | Fair. |
| Bosque: | | | | | | | | | |
| 9 | Good | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| [1]10 | Very poor. | Poor | Fair | Good | Poor | Very poor. | Poor | Very poor. | Fair. |
| Branyon: | | | | | | | | | |
| 11 | Good | Good | Poor | Fair | Poor | Poor | Fair | Poor | Fair. |
| Chaney: | | | | | | | | | |
| 12 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| Cona: | | | | | | | | | |
| [1]13 | Poor | Fair | Good | Good | Very poor. | Very poor. | Fair | Very poor. | Good. |
| Duffau: | | | | | | | | | |
| 14 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| 15, 16 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| [1]17: | | | | | | | | | |
| Duffau part | Poor | Fair | Good | Good | Poor | Very poor. | Fair | Very poor. | Good. |

See footnote at end of table.

TABLE 12.—WILDLIFE HABITAT POTENTIALS—Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | Potential as habitat for— | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain and | Grasses | Wild herba- | Shrubs | Wetland | Shallow | Open- land wild- | Wetland wild- | Range- land wild- |

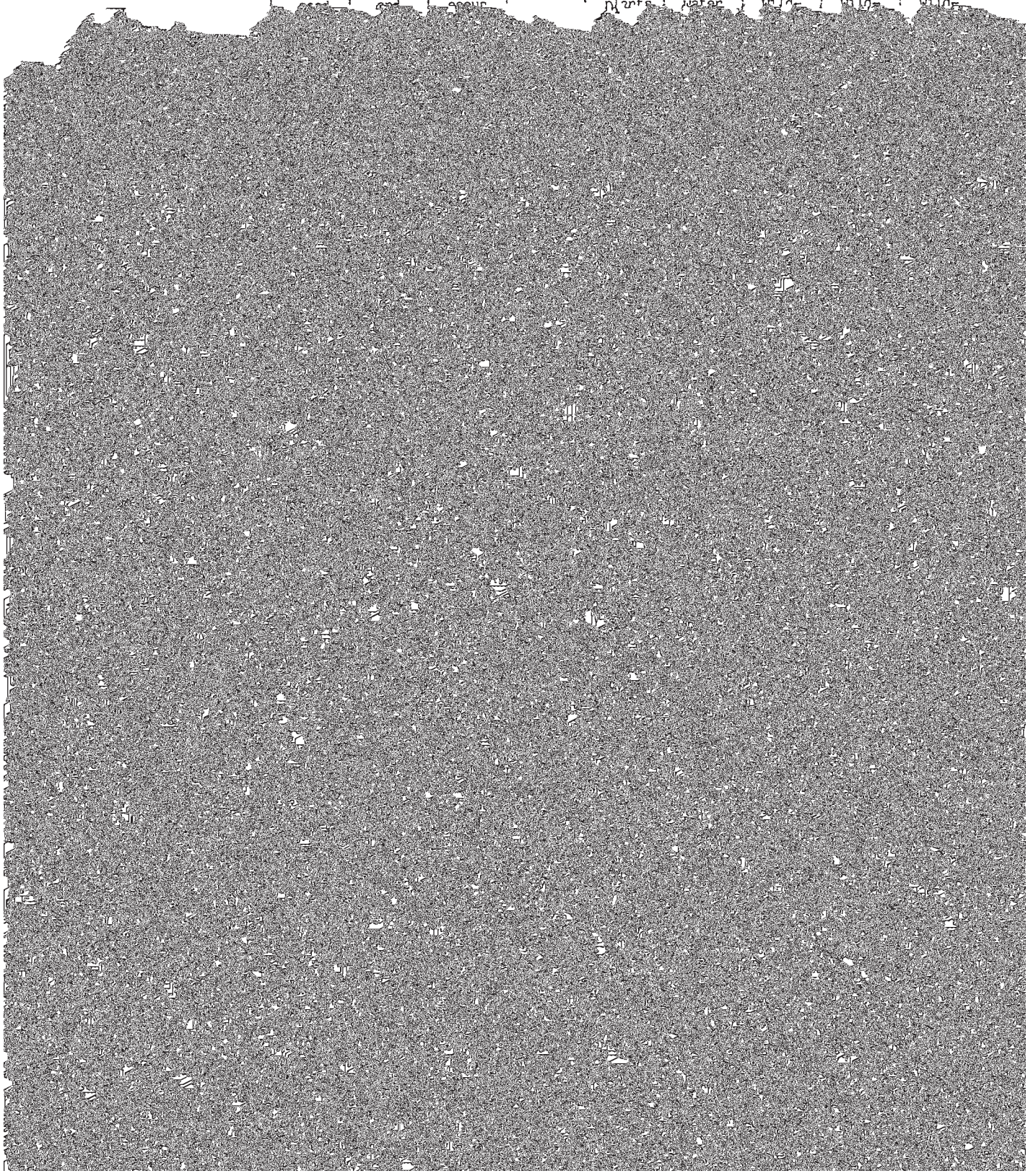


TABLE 12.—WILDLIFE HABITAT POTENTIALS—Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | Potential as habitat for— | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Wetland wildlife | Rangeland wildlife |
| Teller: | | | | | | | | | |
| 33 | Good | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| Truce: | | | | | | | | | |
| 34 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| [1]35: | | | | | | | | | |
| Truce part | Very poor. | Very poor. | Good | Good | Very poor. | Very poor. | Poor | Very poor. | Good. |
| Owens part | Very poor. | Very poor. | Fair | Poor | Very poor. | Very poor. | Poor | Very poor. | Poor. |
| Ustolls: | | | | | | | | | |
| [1]36: | | | | | | | | | |
| Ustolls part | Very poor. | Very poor. | Fair | Fair | Very poor. | Very poor. | Poor | Very poor. | Fair. |
| Rock outcrop part. | | | | | | | | | |
| Vashti: | | | | | | | | | |
| 37 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| Venus: | | | | | | | | | |
| 38 | Fair | Good | Good | Fair | Poor | Very poor. | Good | Very poor. | Fair. |
| Vernon: | | | | | | | | | |
| 39 | Fair | Fair | Poor | Fair | Poor | Very poor. | Fair | Very poor. | Fair. |
| [1]40: | | | | | | | | | |
| Vernon part | Fair | Fair | Poor | Fair | Poor | Very poor. | Fair | Very poor. | Fair. |
| Knoco part | Very poor. | Very poor. | Poor | Very poor. | Very poor. | Very poor. | Very poor. | Very poor. | Very poor. |
| Waurika: | | | | | | | | | |
| [1]41: | | | | | | | | | |
| Waurika part | Fair | Good | Fair | Fair | Fair | Fair | Fair | Fair | Fair. |
| Renfrow part | Good | Good | Good | Fair | Poor | Very poor. | Good | Very poor. | Fair. |
| Windthorst: | | | | | | | | | |
| 42, 43 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| 44 | Fair | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |
| [1]45: | | | | | | | | | |
| Windthorst part | Poor | Fair | Good | Good | Poor | Very poor. | Fair | Very poor. | Good. |
| Duffau part | Poor | Fair | Good | Good | Poor | Very poor. | Fair | Very poor. | Good. |
| Yahola: | | | | | | | | | |
| [1]46: | | | | | | | | | |
| Yahola part | Good | Good | Good | Good | Poor | Very poor. | Good | Very poor. | Good. |

See footnote at end of table.

TABLE 12.—WILDLIFE HABITAT POTENTIALS—Continued

| Soil name and map symbol | Potential for habitat elements | | | | | | Potential as habitat for— | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous plants | Shrubs | Wetland plants | Shallow water areas | Openland wildlife | Wetland wildlife | Rangeland wildlife |
| Yahola: Gaddy part | Fair | Fair | Fair | Fair | Very poor. | Very poor. | Fair | Very poor. | Fair. |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Aledo: | | | | | | | | | | | |
| 1 | 0–5 | Gravelly clay loam. | CL, GC, GM, SC | A–4, A–6 | 0–20 | 65–95 | 60–90 | 55–90 | 40–70 | 30–40 | 10–20 |
| | 5–14 | Very gravelly clay loam, very gravelly loam. | GC, GM, SC | A–2–4, A–2–6 | 5–30 | 35–55 | 30–50 | 25–50 | 15–35 | 30–40 | 10–20 |
| | 14–18 | Weathered bedrock. | — | — | — | — | — | — | — | — | — |
| Anocon: | | | | | | | | | | | |
| 12: | | | | | | | | | | | |

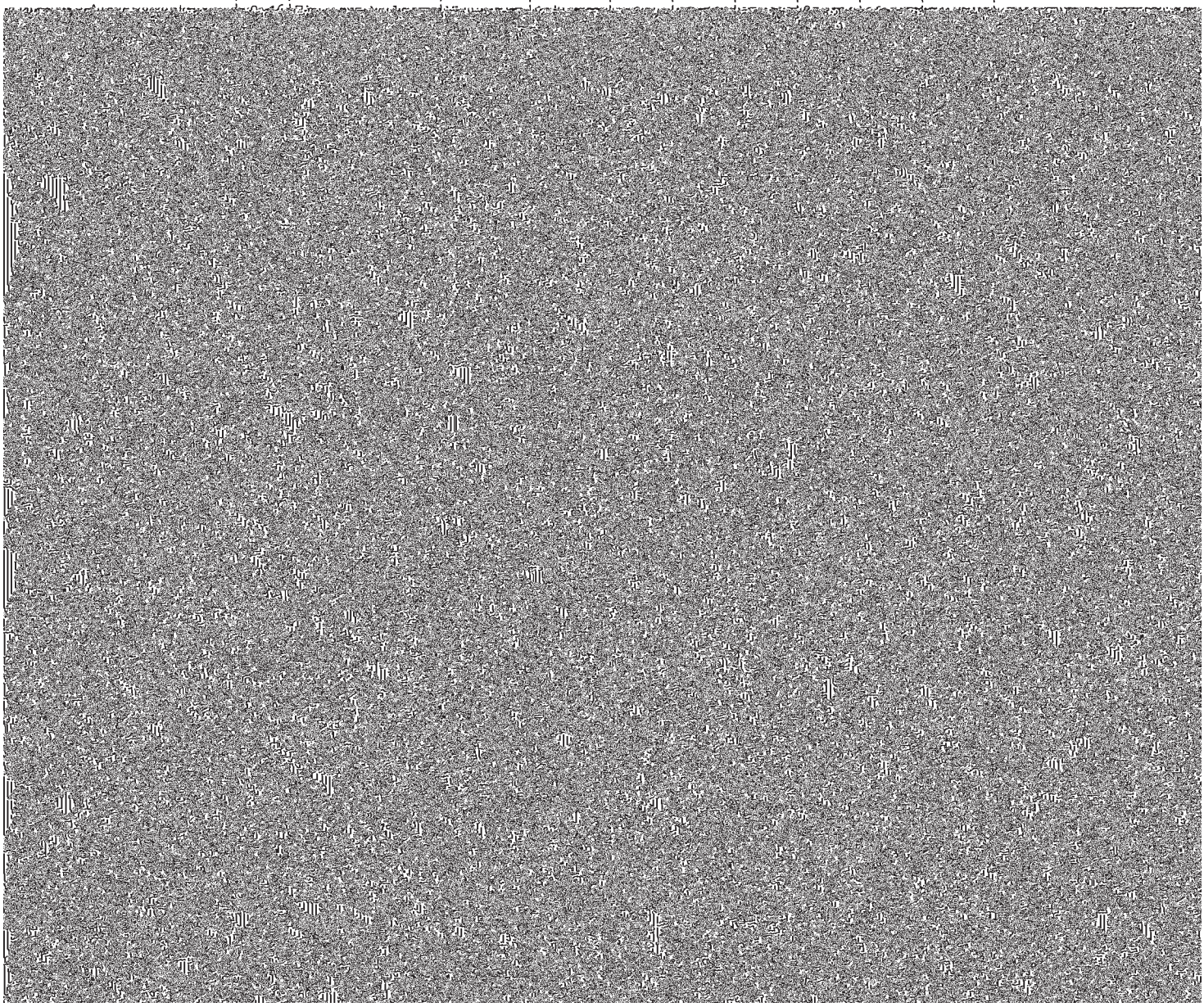


TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Bonti: | | | | | | | | | | | |
| 7 | 0–8 | Fine sandy loam | SM, SM–SC, ML, CL–ML | A–4, A–2–4 | 0–2 | 90–100 | 90–100 | 70–100 | 25–70 | 18–30 | 2–7 |
| | 8–29 | Clay, clay loam, sandy clay. | CL | A–6, A–7 | 0–4 | 80–100 | 80–100 | 70–100 | 51–75 | 30–45 | 18–25 |
| | 29–32 | Weathered bedrock. | — | — | — | — | — | — | — | — | — |
| [1]8: | | | | | | | | | | | |
| Bonti part | 0–10 | Stony fine sandy loam. | SM, SM–SC, ML, CL–ML | A–4, A–2–4 | 8–25 | 75–90 | 75–90 | 55–90 | 30–55 | 18–30 | 2–7 |
| | 10–24 | Clay, clay loam, sandy clay. | CL | A–6, A–7 | 0–4 | 80–100 | 80–100 | 70–100 | 51–75 | 30–45 | 18–25 |
| | 24–27 | Weathered bedrock. | — | — | — | — | — | — | — | — | — |
| Exray part | 0–6 | Stony fine sandy loam. | GM–GC, GC, SC, SM–SC | A–2–4, A–4 | 5–30 | 65–90 | 65–85 | 55–80 | 30–50 | 20–30 | 5–10 |
| | 6–13 | Clay, sandy clay, clay loam. | CL, SC | A–6, A–7 | 0–20 | 80–100 | 80–100 | 80–100 | 48–80 | 30–45 | 15–25 |
| | 13–16 | Weathered bedrock. | — | — | — | — | — | — | — | — | — |
| Bosque: | | | | | | | | | | | |
| 9, [1]10 | 0–22 | Loam | CL, CL–ML | A–4, A–6 | 0 | 100 | 95–100 | 80–100 | 55–95 | 24–40 | 7–22 |
| | 22–44 | Loam, clay loam | CL | A–4, A–6, A–7–6 | 0 | 100 | 95–100 | 95–100 | 55–80 | 26–45 | 10–25 |
| | 44–65 | Loam, clay loam, clay. | CL, CL–ML | A–4, A–6, A–7–6 | 0 | 98–100 | 95–100 | 80–100 | 55–95 | 24–45 | 7–25 |
| Branyon: | | | | | | | | | | | |
| 11 | 0–65 | Clay, silty clay | CH | A–7–6 | 0 | 95–100 | 75–100 | 75–100 | 75–100 | 60–80 | 35–55 |
| Chaney: | | | | | | | | | | | |
| 12 | 0–10 | Loamy fine sand | SM, SM–SC, SP–SM | A–2–4, A–4, A–3 | 0 | 80–100 | 80–100 | 65–98 | 7–45 | <25 | NP–4 |
| | 10–47 | Clay, sandy clay | CL, CH | A–7–6 | 0 | 90–100 | 90–100 | 90–100 | 51–85 | 42–60 | 24–42 |
| | 47–52 | Sandy clay, clay, sandy clay loam. | CL, CH, SC | A–6, A–7–6, A–2–6 | 0 | 90–100 | 90–100 | 80–100 | 30–70 | 25–55 | 11–40 |
| Cona: | | | | | | | | | | | |
| [1]13 | 0–8 | Stony sandy loam | SM, SC, SM–SC | A–2–4, A–4 | 0–30 | 80–100 | 70–95 | 70–80 | 25–40 | 15–25 | 2–8 |
| | 8–33 | Sandy clay, clay | CL, CH | A–6, A–7 | 0–20 | 80–100 | 75–95 | 65–90 | 51–80 | 36–55 | 18–35 |
| | 33–45 | Shaly clay | CL, CH | A–7 | 0–10 | 80–100 | 65–95 | 55–90 | 51–85 | 41–55 | 20–35 |
| Duffau: | | | | | | | | | | | |
| 14 | 0–11 | Loamy fine sand | SM, SM–SC | A–2–4, A–4 | 0 | 95–100 | 95–100 | 75–98 | 15–40 | <22 | NP–4 |
| | 11–48 | Sandy clay loam, clay loam, loam. | SC, CL | A–6 | 0 | 95–100 | 95–100 | 80–100 | 36–65 | 30–40 | 15–24 |
| | 48–70 | Sandy clay loam, loam, fine sandy loam. | SC, CL, CL–ML, SM | A–4, A–6 | 0 | 95–100 | 95–100 | 80–100 | 40–65 | 20–36 | 2–18 |

See footnote at end of table.

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

| Soil name and map symbol | 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 | |
| Duffau: | | | | | | | | | | | |
| 15, 16 | 0–12 | Fine sandy loam | SM, SM–SC, ML, CL–ML | A–4, A–2–4 | 0 | 95–100 | 95–100 | 75–90 | 30–60 | <25 | NP–7 |
| | 12–45 | Sandy clay loam, clay loam, loam. | SC, CL | A–6 | 0 | 95–100 | 95–100 | 80–100 | 36–65 | 30–40 | 15–24 |
| | 45–70 | Sandy clay loam, loam, fine sandy loam. | SC, CL, CL–ML, SM | A–4, A–6 | 0 | 95–100 | 95–100 | 80–100 | 40–65 | 20–36 | 2–18 |
| [1]17: | | | | | | | | | | | |
| Duffau part | 0–6 | Fine sandy loam | SM, SM–SC, ML, CL–ML | A–4, A–2–4 | 0 | 95–100 | 95–100 | 75–90 | 30–60 | <25 | NP–7 |
| | 6–39 | Sandy clay loam, clay loam, loam. | SC, CL | A–6 | 0 | 95–100 | 95–100 | 80–100 | 36–65 | 30–40 | 15–24 |
| | 39–62 | Sandy clay loam, loam, fine sandy loam. | SC, CL, CL–ML, SM | A–4, A–6 | 0 | 95–100 | 95–100 | 80–100 | 40–65 | 20–36 | 2–18 |
| Windthorst part | 0–4 | Fine sandy loam | SM, SM–SC, CL–ML | A–4 | 0 | 95–100 | 90–100 | 75–100 | 36–75 | <28 | NP–7 |
| | 4–48 | Clay, sandy clay, clay loam. | CL, CH | A–6, A–7–6 | 0 | 95–100 | 95–100 | 85–100 | 51–90 | 35–53 | 20–35 |
| | 48–60 | Sandy clay loam, clay, fine sandy loam. | SC, CL | A–4, A–6, A–7–6 | 0 | 85–100 | 80–100 | 75–100 | 36–90 | 25–45 | 8–28 |
| Eufaula: | | | | | | | | | | | |
| [1]18: | | | | | | | | | | | |
| Eufaula part | 0–80 | Fine sand, loamy fine sand. | SM, SP–SM | A–2, A–3 | 0 | 100 | 98–100 | 82–100 | 5–35 | —— | NP |
| Patilo part | 0–45 | Fine sand | SM, SP–SM, SM–SC | A–2–4, A–3 | 0 | 100 | 95–100 | 85–100 | 8–28 | <25 | NP–5 |
| | 45–65 | Sandy clay loam | SC | A–2, A–4, A–6 | 0 | 90–100 | 90–100 | 90–100 | 25–50 | 22–36 | 8–20 |
| Gaddy: | | | | | | | | | | | |
| [1]19 | 0–4 | Loamy fine sand | SM | A–2 | 0 | 100 | 98–100 | 90–100 | 15–35 | —— | NP |
| | 4–45 | Loamy fine sand, fine sand. | SM | A–2 | 0 | 100 | 98–100 | 90–100 | 15–35 | —— | NP |
| Gowen: | | | | | | | | | | | |
| 20, [1]21 | 0–28 | Loam, clay loam | CL | A–6, A–7–6 | 0 | 100 | 95–100 | 85–100 | 60–85 | 28–43 | 11–25 |
| | 28–52 | Clay loam, loam | CL | A–4, A–6, A–7–6 | 0 | 100 | 95–100 | 85–100 | 55–85 | 25–43 | 10–25 |
| Hensley: | | | | | | | | | | | |
| 22 | 0–4 | Loam | CL, CL–ML | A–6, A–4 | 0–2 | 80–100 | 75–100 | 70–100 | 60–85 | 20–40 | 5–20 |
| | 4–16 | Clay, clay loam | CL, CH | A–6, A–7 | 0–10 | 80–100 | 75–100 | 70–100 | 60–95 | 35–55 | 18–35 |
| | 16–20 | Unweathered bedrock. | —— | —— | —— | —— | —— | —— | —— | —— | —— |
| Lindy: | | | | | | | | | | | |
| 23 | 0–6 | Clay loam | CL, CL–ML | A–4, A–6 | 0–15 | 75–100 | 70–100 | 70–100 | 60–85 | 20–40 | 5–20 |
| | 6–31 | Clay loam, clay | CL, CH | A–6, A–7 | 0–5 | 80–100 | 75–100 | 75–100 | 65–90 | 35–60 | 15–35 |
| | 31–35 | Unweathered bedrock. | —— | —— | —— | —— | —— | —— | —— | —— | —— |

See footnote at end of table.

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

| Soil name and map symbol | 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 | |
| Miller: | | | | | | | | | | | |
| 34 [illegible] | 0-17 | Clay | CL, CH | A-6, A-7 | 0 | 100 | 98-100 | 96-100 | 80-99 | 35-60 | 15-35 |

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Teller: | | | | | | | | | | | |
| 33 | 0–14 | Loam | SM, SC, ML, CL | A–4 | 0 | 100 | 100 | 94–100 | 36–85 | <30 | NP–10 |
| | 14–45 | Sandy clay loam, clay loam, loam | SC, CL | A–6, A–4 | 0 | 100 | 100 | 90–100 | 45–85 | 24–40 | 7–18 |
| | 45–70 | Fine sandy loam, very fine sandy loam, loam. | SM, SC, ML, CL | A–4, A–6 | 0 | 100 | 100 | 94–100 | 45–85 | 20–34 | 3–13 |
| Truce: | | | | | | | | | | | |
| 34 | 0–6 | Fine sandy loam | CL–ML, CL, SM–SC, SC | A–4 | 0 | 75–100 | 75–100 | 70–100 | 40–75 | 18–30 | 5–10 |
| | 6–45 | Clay, sandy clay, clay loam. | CL | A–6, A–7 | 0 | 80–100 | 80–100 | 80–100 | 50–80 | 30–45 | 20–30 |
| | 45–55 | Shaly weathered bedrock. | — | — | — | — | — | — | — | — | — |
| [1]35: | | | | | | | | | | | |
| Truce part | 0–7 | Stony fine sandy loam. | SC, CL–ML, SC | A–4 | 5–20 | 70–90 | 70–85 | 65–85 | 36–60 | 18–30 | 5–10 |
| | 7–41 | Clay, sandy clay, clay loam. | CL | A–6, A–7 | 0–10 | 80–100 | 80–100 | 80–100 | 50–80 | 30–45 | 20–30 |
| | 41–48 | Shaly weathered bedrock. | — | — | — | — | — | — | — | — | — |
| Owens part | 0–4 | Stony clay | CL, CH | A–7–6 | 5–20 | 90–100 | 80–100 | 70–100 | 60–95 | 45–60 | 22–32 |
| | 4–18 | Clay, clay loam | CL, CH | A–7–6 | 0–5 | 95–100 | 90–100 | 85–100 | 75–95 | 45–60 | 22–32 |
| | 18–30 | Shaly clay bedrock. | CL, CH | A–6, A–7–6 | 0–5 | 90–100 | 85–100 | 80–100 | 55–95 | 40–55 | 25–35 |
| Ustolls: | | | | | | | | | | | |
| [1]36: | | | | | | | | | | | |
| Ustolls part | 0–80 | Variable | — | — | — | — | — | — | — | — | — |
| Rock outcrop part. | | | | | | | | | | | |
| Vashti: | | | | | | | | | | | |

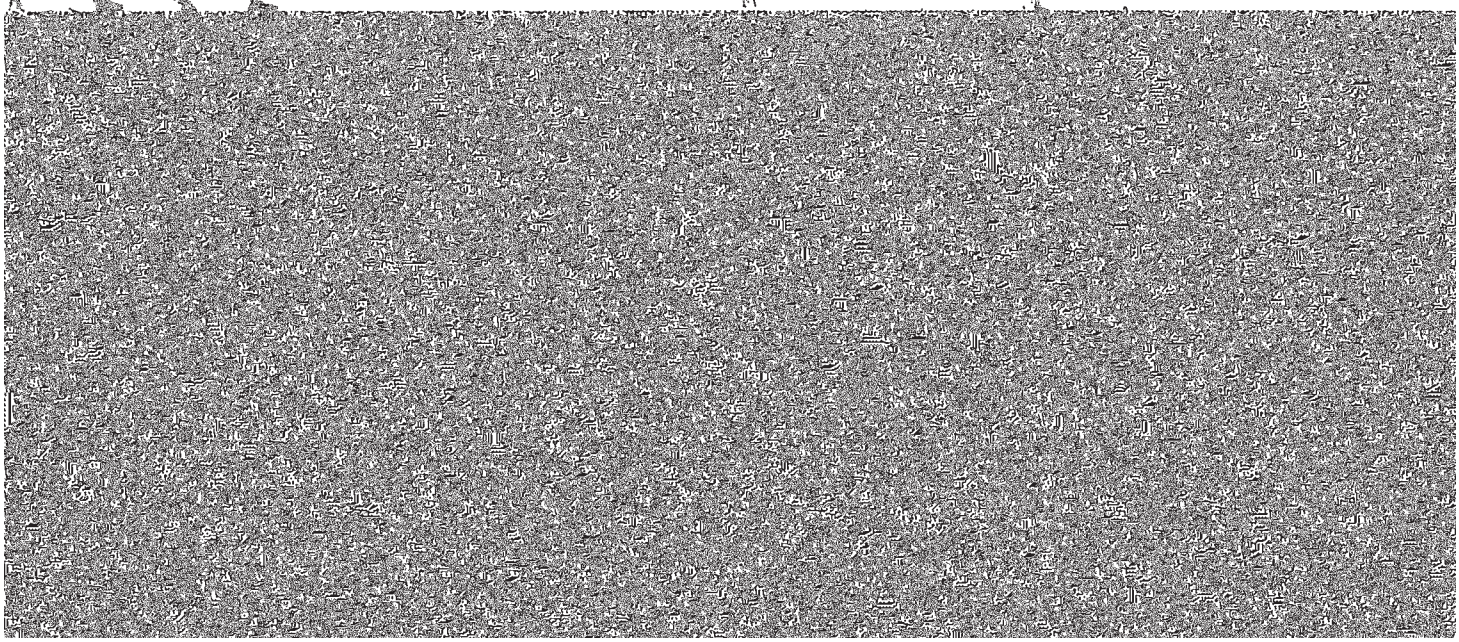


TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

| Soil name and | Depth | USDA texture | Classification | | Frag- | Percentage passing sieve number— | | | | Liquid | Plas- |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | ments > 3 | 4 | 10 | 40 | 200 | limit | ticity index |

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS—Continued

| Soil name and map symbol | Depth | USDA texture | Classification | | Fragments > 3 inches | Percentage passing sieve number— | | | | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | | | | | Pct | |
| Windthorst: | | | | | | | | | | | |
| Duffau part | 0–6 | Fine sandy loam | SM, SM–SC, ML, CL–ML | A–4, A–2–4 | 0 | 95–100 | 95–100 | 75–90 | 30–60 | <25 | NP–7 |
| | 6–40 | Sandy clay loam, clay loam, loam. | SC, CL | A–6 | 0 | 95–100 | 95–100 | 80–100 | 36–65 | 30–40 | 15–24 |
| | 40–60 | Sandy clay loam, loam, fine sandy loam. | SC, CL, CL–ML, SM | A–4, A–6 | 0 | 95–100 | 95–100 | 80–100 | 40–65 | 20–36 | 2–18 |
| Yahola: [1]46: | | | | | | | | | | | |
| Yahola part | 0–8 | Fine sandy loam | SM, SC, ML, CL | A–4 | 0 | 100 | 95–100 | 90–100 | 36–85 | <30 | NP–10 |
| | 8–44 | Fine sandy loam, loam. | SM, SC, ML, CL | A–4 | 0 | 100 | 95–100 | 90–100 | 36–85 | <30 | NP–10 |
| | 44–50 | Fine sandy loam, loam, loamy fine sand. | SM, SC, ML, CL | A–4, A–2 | 0 | 100 | 95–100 | 90–100 | 15–85 | <30 | NP–10 |
| Gaddy part | 0–9 | Fine sandy loam | SM, SC, ML, CL | A–4 | 0 | 100 | 98–100 | 94–100 | 36–80 | <30 | NP–10 |
| | 9–60 | Loamy fine sand, fine sand. | SM | A–2 | 0 | 100 | 98–100 | 90–100 | 15–35 | — | NP |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T |
|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | | | | | |
| Aledo: | | | | | | | | | |
| 1 | 0-5 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate | Moderate | Low | 0.32 | 1 |
| | 5-14 | 0.6-2.0 | 0.05-0.12 | 7.9-8.4 | Low | Moderate | Low | 0.32 | |
| | 14-18 | — | — | — | — | — | — | — | |
| Anocon: | | | | | | | | | |
| [1]2: | | | | | | | | | |
| Anocon part | 0-16 | 2.0-6.0 | 0.11-0.18 | 6.1-7.3 | Low | Low | Low | 0.32 | 5 |
| | 16-39 | 0.2-0.6 | 0.14-0.18 | 6.1-7.8 | Moderate | Moderate | Low | 0.32 | |
| | 39-65 | 0.2-0.6 | 0.12-0.18 | 6.6-8.4 | Moderate | Moderate | Low | 0.32 | |
| Stoneburg part | 0-10 | 2.0-6.0 | 0.11-0.20 | 6.1-7.3 | Low | Low | Low | 0.24 | 2 |
| | 10-39 | 0.2-0.6 | 0.12-0.20 | 6.1-7.3 | Moderate | Moderate | Low | 0.32 | |
| | 39-42 | — | — | — | — | — | — | — | |
| Bastrop: | | | | | | | | | |
| 3, 4 | 0-7 | 2.0-6.0 | 0.11-0.17 | 5.6-7.3 | Low | Low | Low | 0.24 | 5 |
| | 7-70 | 0.6-2.0 | 0.15-0.19 | 6.1-8.4 | Low | Moderate | Low | 0.32 | |
| Bolar: | | | | | | | | | |
| 5 | 0-9 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | High | Low | 0.32 | 2 |
| | 9-27 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | High | Low | 0.32 | |
| | 27-30 | — | — | — | — | — | — | — | |
| [1]6: | | | | | | | | | |
| Bolar part | 0-13 | 0.6-2.0 | 0.10-0.18 | 7.9-8.4 | Moderate | High | Low | 0.32 | 2 |
| | 13-28 | 0.6-2.0 | 0.11-0.20 | 7.9-8.4 | Moderate | High | Low | 0.32 | |
| | 28-30 | — | — | — | — | — | — | — | |
| Aledo part | 0-8 | 0.6-2.0 | 0.07-0.18 | 7.9-8.4 | Moderate | Moderate | Low | 0.32 | 1 |
| | 8-15 | — | — | — | — | — | — | — | |
| Bonti: | | | | | | | | | |
| 7 | 0-8 | 0.6-2.0 | 0.11-0.15 | 5.6-7.3 | Low | Low | Moderate | 0.37 | 2 |
| | 8-29 | 0.2-0.6 | 0.15-0.20 | 5.1-6.0 | Moderate | High | Moderate | 0.28 | |
| | 29-32 | — | — | — | — | — | — | — | |
| [1]8: | | | | | | | | | |
| Bonti part | 0-10 | 0.6-2.0 | 0.08-0.12 | 5.6-7.3 | Low | Low | Moderate | 0.32 | 2 |
| | 10-24 | 0.2-0.6 | 0.15-0.20 | 5.1-6.0 | Moderate | High | Moderate | 0.28 | |
| | 24-27 | — | — | — | — | — | — | — | |
| Exray part | 0-6 | 0.6-2.0 | 0.08-0.14 | 6.1-7.3 | Low | Low | Low | 0.37 | 1 |
| | 6-13 | 0.2-0.6 | 0.12-0.20 | 5.6-6.5 | Moderate | High | Moderate | 0.32 | |
| | 13-16 | — | — | — | — | — | — | — | |
| Bosque: | | | | | | | | | |
| 9, [1]10 | 0-22 | 0.6-2.0 | 0.15-0.20 | 7.4-8.4 | Low | High | Low | 0.28 | 5 |
| | 22-44 | 0.6-2.0 | 0.15-0.20 | 7.4-8.4 | Low | High | Low | 0.28 | |
| | 44-65 | 0.6-2.0 | 0.11-0.18 | 7.9-8.4 | Low | High | Moderate | 0.28 | |
| Branyon: | | | | | | | | | |
| 11 | 0-65 | <0.06 | 0.15-0.18 | 7.9-8.4 | Very high | High | Low | 0.32 | 5 |
| Chaney: | | | | | | | | | |
| 12 | 0-10 | 2.0-6.0 | 0.05-0.10 | 5.6-7.3 | Very low | Low | Low | 0.20 | 5 |
| | 10-47 | 0.06-0.2 | 0.15-0.18 | 5.6-6.5 | Moderate | High | Moderate | 0.28 | |
| | 47-52 | 0.06-0.2 | 0.15-0.18 | 5.6-7.8 | Moderate | High | Moderate | 0.28 | |

See footnote at end of table.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

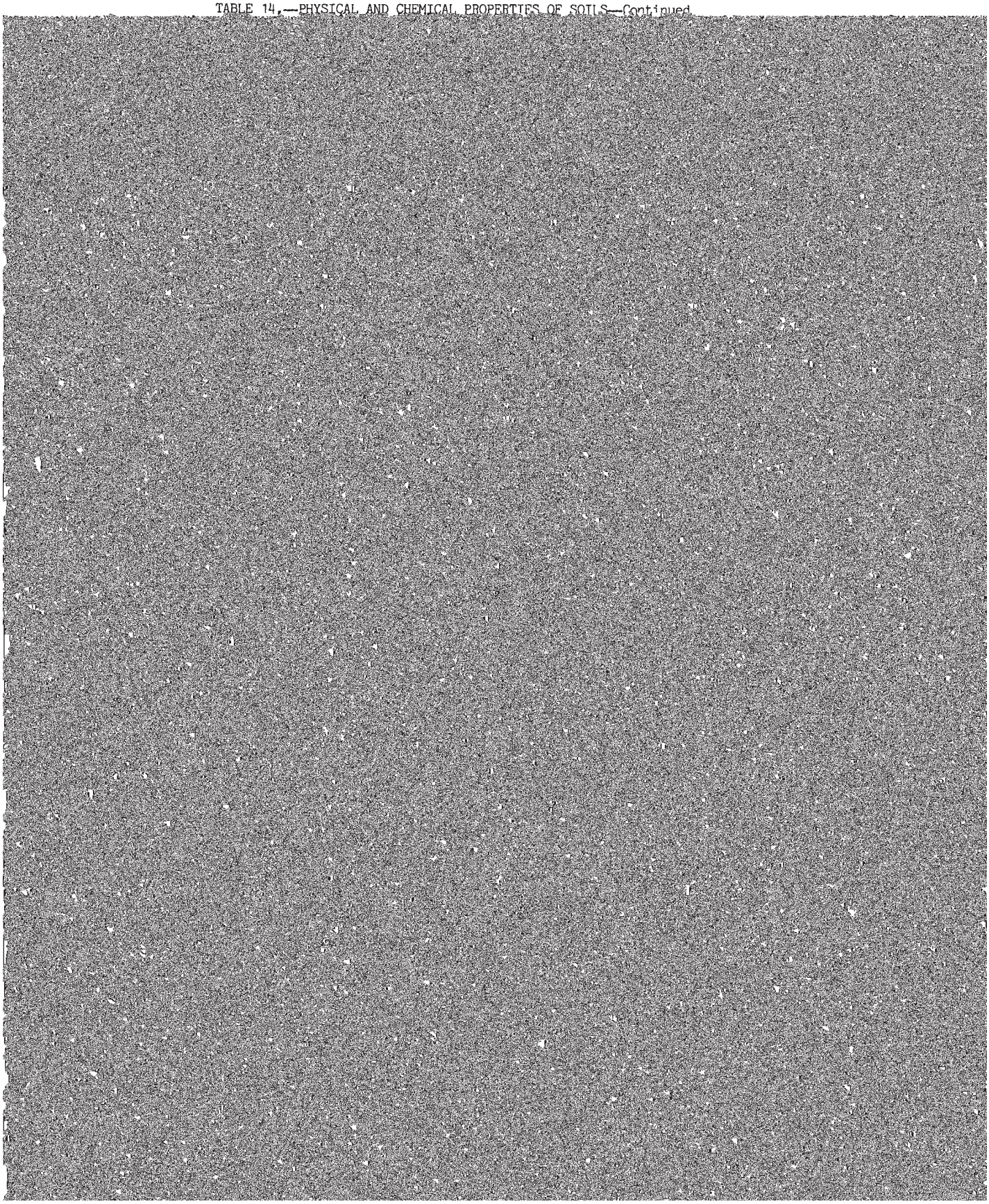


TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T |
|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | | | | | |
| Sanger: | | | | | | | | | |
| 30 | 0-9 | <0.06 | 0.10-0.18 | 7.4-8.4 | High | High | Low | 0.28 | 5 |
| | 9-43 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | High | Low | 0.32 | |
| | 43-65 | <0.06 | 0.12-0.18 | 7.9-8.4 | High | High | Low | 0.32 | |
| Selden: | | | | | | | | | |
| 31 | 0-15 | 2.0-6.0 | 0.05-0.09 | 5.6-7.3 | Very low | Low | Low | 0.17 | 5 |
| | 15-66 | 0.2-0.6 | 0.12-0.17 | 5.1-6.5 | Low | High | Moderate | 0.24 | |
| Stoneburg: | | | | | | | | | |
| 32: | | | | | | | | | |
| Stoneburg part | 0-11 | 2.0-6.0 | 0.11-0.20 | 6.1-7.3 | Low | Low | Low | 0.24 | 2 |
| | 11-16 | 0.6-2.0 | 0.12-0.20 | 6.1-7.3 | Low | Moderate | Low | 0.32 | |
| | 16-26 | 0.2-0.6 | 0.12-0.20 | 6.1-7.3 | Moderate | Moderate | Low | 0.32 | |
| | 26-35 | 0.2-0.6 | 0.12-0.20 | 6.1-7.8 | Moderate | Moderate | Low | 0.32 | |
| | 35-40 | — | — | — | — | — | — | — | |
| Anocon part | 0-10 | 2.0-6.0 | 0.11-0.18 | 6.1-7.3 | Low | Low | Low | 0.32 | 5 |
| | 10-41 | 0.2-0.6 | 0.14-0.18 | 6.1-7.8 | Moderate | Moderate | Low | 0.32 | |
| | 41-62 | 0.2-0.6 | 0.12-0.18 | 6.6-8.4 | Moderate | Moderate | Low | 0.32 | |
| Teller: | | | | | | | | | |
| 33 | 0-14 | 2.0-6.0 | 0.12-0.16 | 5.6-6.5 | Low | Low | Moderate | 0.28 | 5 |
| | 14-45 | 0.6-2.0 | 0.14-0.18 | 5.6-6.5 | Low | Low | Moderate | 0.28 | |

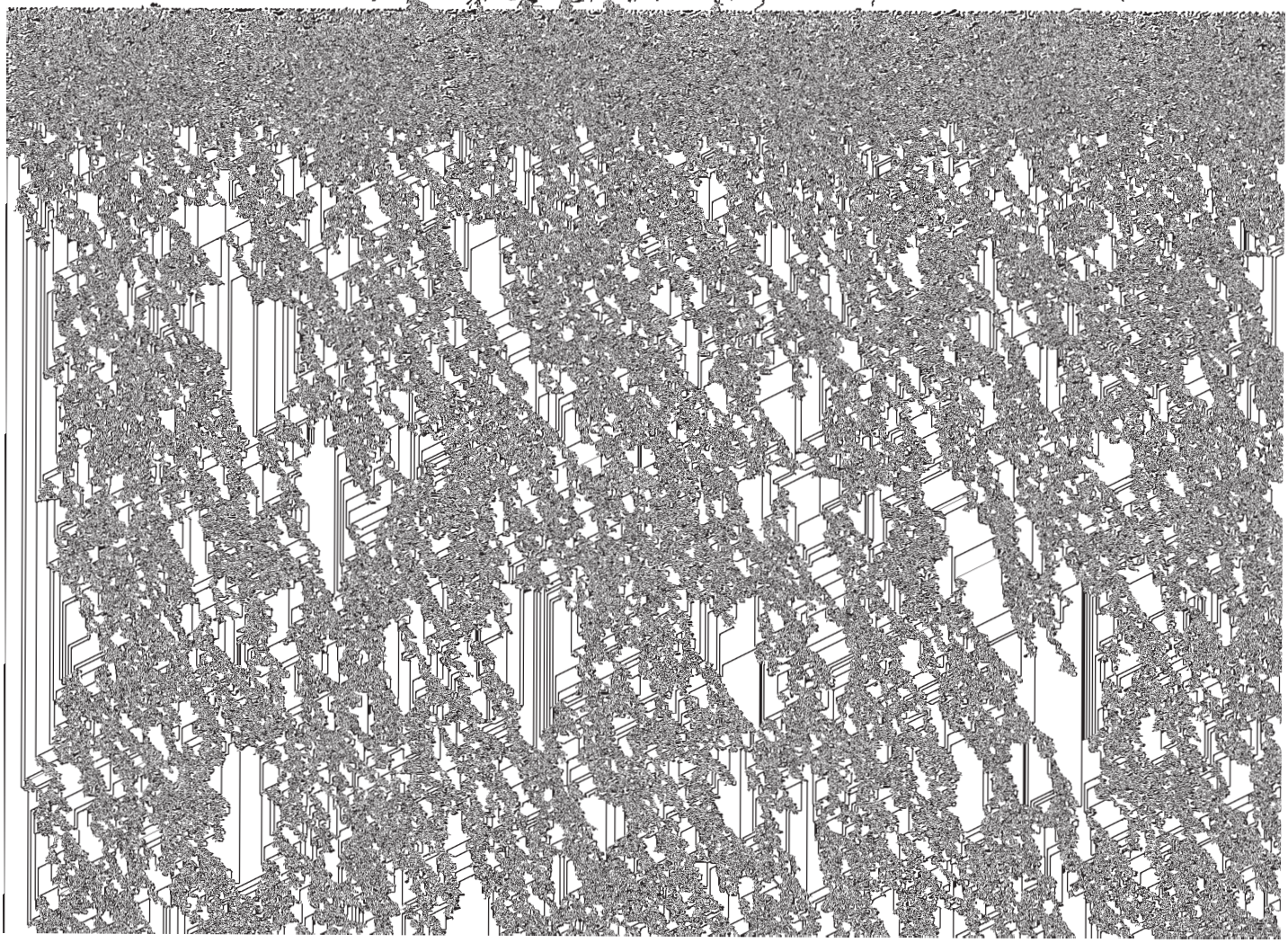


TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

| Soil name and map symbol | Depth | Permeability | Available water capacity | Soil reaction | Shrink-swell potential | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete | Erosion factors: K | Erosion factors: T |
|---|---|---|---|---|---|---|---|---|---|
| | In | In/hr | In/in | pH | | | | | |
| Vernon: | | | | | | | | | |
| Knoco part | 0-7 | <0.06 | 0.10-0.17 | 7.9-8.4 | High | High | Low | 0.32 | 1 |
| | 7-22 | <0.06 | 0.00-0.08 | 7.9-8.4 | High | High | Low | — | |
| | 22-28 | — | — | — | — | — | — | — | |
| Waurika: | | | | | | | | | |
| 1[41]: | | | | | | | | | |
| Waurika part | 0-14 | 0.6-2.0 | 0.16-0.20 | 5.6-7.3 | Low | High | Low | 0.43 | 5 |
| | 14-33 | <0.06 | 0.13-0.17 | 6.6-8.4 | High | High | Moderate | 0.32 | |
| | 33-54 | 0.06-0.2 | 0.15-0.19 | 7.4-8.4 | Moderate | High | Moderate | 0.32 | |
| | 54-64 | 0.06-0.2 | 0.15-0.19 | 7.4-8.4 | Moderate | High | Moderate | 0.32 | |
| Renfrow part | 0-9 | 0.6-2.0 | 0.15-0.24 | 6.1-7.8 | Low | Low | Low | 0.37 | 5 |
| | 9-65 | <0.06 | 0.12-0.22 | 6.1-8.4 | High | High | Low | 0.32 | |
| Windthorst: | | | | | | | | | |
| 42 | 0-10 | 2.0-6.0 | 0.07-0.11 | 5.6-7.3 | Very low | Low | Low | 0.24 | 5 |
| | 10-32 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate | High | Low | 0.37 | |
| | 32-60 | 0.2-0.6 | 0.12-0.20 | 5.6-8.4 | Moderate | Moderate | Low | 0.37 | |
| 43, 44 | 0-10 | 0.6-2.0 | 0.12-0.17 | 5.6-7.3 | Low | Low | Low | 0.49 | 5 |
| | 10-36 | 0.2-0.6 | 0.15-0.20 | 5.6-7.3 | Moderate | High | Low | 0.37 | |
| | 36-60 | 0.2-0.6 | 0.12-0.20 | 5.6-8.4 | Moderate | Moderate | Low | 0.37 | |
| 1[45]: | | | | | | | | | |

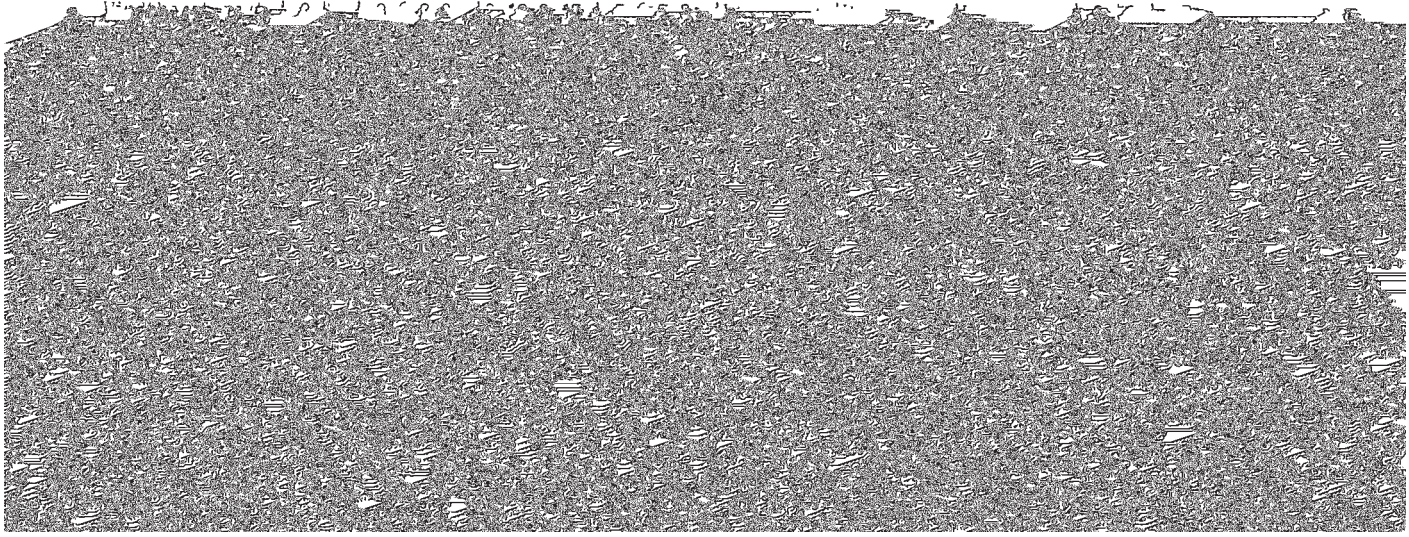


TABLE 15.—SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "hard" and "rippable." The symbol < means less than; > means greater than]

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | |
|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness |
| | | | | | Ft | | | In | |
| Aledo: 1 | C | None | — | — | >6.0 | — | — | 8–20 | Hard |
| Anocon: [1]2: | | | | | | | | | |
| Anocon part | C | None | — | — | >6.0 | — | — | >60 | — |
| Stoneburg part | B | None | — | — | >6.0 | — | — | 20–40 | Rippable |
| Bastrop: 3, 4 | B | None | — | — | >6.0 | — | — | >60 | — |
| Bolar: 5 | C | None | — | — | >6.0 | — | — | 20–40 | Rippable |
| [1]6: | | | | | | | | | |
| Bolar part | C | None | — | — | >6.0 | — | — | 20–40 | Rippable |
| Aledo part | C | None | — | — | >6.0 | — | — | 8–20 | Hard |
| Bonti: 7 | C | None | — | — | >6.0 | — | — | 20–40 | Rippable |
| [1]8: | | | | | | | | | |
| Bonti part | C | None | — | — | >6.0 | — | — | 20–40 | Rippable |
| Exray part | D | None | — | — | >6.0 | — | — | 10–20 | Hard |
| Bosque: 9, [1]10 | B | Rare to common. | Brief | May–Oct | >6.0 | — | — | >60 | — |
| Branyon: 11 | D | None | — | — | >6.0 | — | — | >60 | — |
| Chaney: 12 | C | None | — | — | >6.0 | — | — | >60 | — |
| Cona: [1]13 | C | None | — | — | >6.0 | — | — | 20–40 | Rippable |
| Duffau: 14, 15, 16 | B | None | — | — | >6.0 | — | — | >60 | — |
| [1]17: | | | | | | | | | |
| Duffau part | B | None | — | — | >6.0 | — | — | >60 | — |
| Windthorst part | C | None | — | — | >6.0 | — | — | >60 | — |

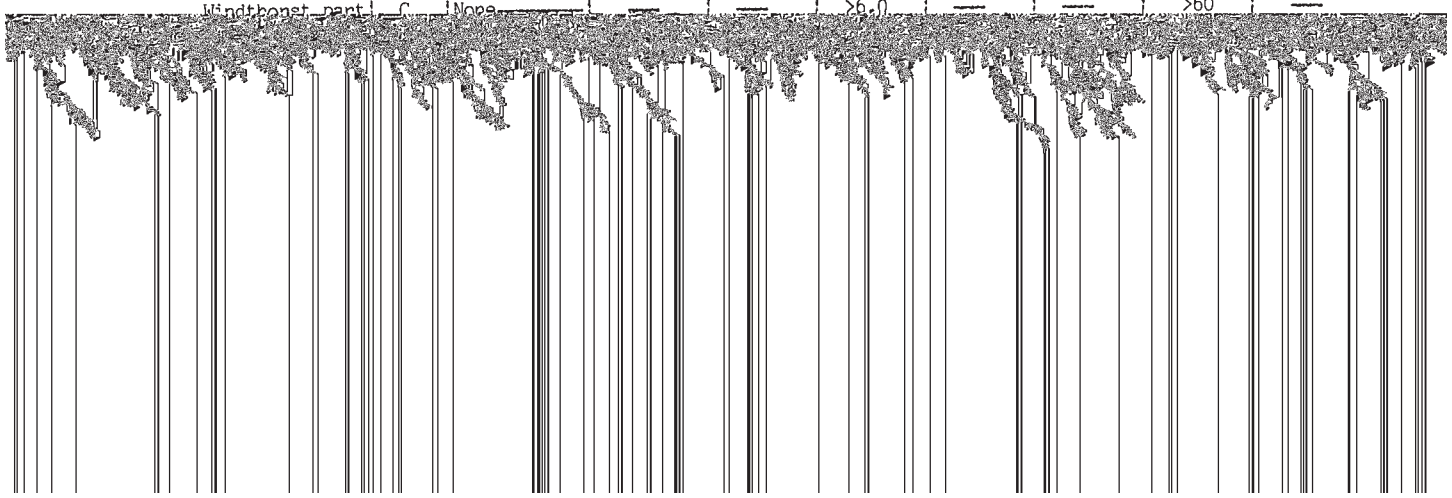


TABLE 15.—SOIL AND WATER FEATURES—Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | |
|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness |
| | | | | | Ft | | | In | |
| Lindy: | | | | | | | | | |
| 23 | C | None | — | — | >6.0 | — | — | 24-40 | Hard |
| Miller: | | | | | | | | | |
| 24, [1]25 | D | Common | Brief | Apr-Sep | >6.0 | — | — | >60 | — |
| Pulexas: | | | | | | | | | |
| 26, [1]27 | B | Common | Brief | Apr-Sep | >6.0 | — | — | >60 | — |
| Renfrow: | | | | | | | | | |
| 28 | D | None | — | — | >6.0 | — | — | >60 | — |
| Sanger: | | | | | | | | | |
| 29, 30 | D | None | — | — | >6.0 | — | — | >60 | — |
| Selden: | | | | | | | | | |
| 31 | C | None | — | — | >6.0 | — | — | >60 | — |
| Stoneburg: | | | | | | | | | |
| [1]32: | | | | | | | | | |
| Stoneburg part | B | None | — | — | >6.0 | — | — | 20-40 | Rippable |
| Anocon part | C | None | — | — | >6.0 | — | — | >60 | — |
| Teller: | | | | | | | | | |
| 33 | B | None | — | — | >6.0 | — | — | >60 | — |
| Truce: | | | | | | | | | |
| 34 | C | None | — | — | >6.0 | — | — | 40-60 | Rippable |
| [1]35: | | | | | | | | | |
| Truce part | C | None | — | — | >6.0 | — | — | 40-60 | Rippable |
| Owens part | D | None | — | — | >6.0 | — | — | 10-20 | Rippable |
| Ustolls: | | | | | | | | | |
| [1]36: | | | | | | | | | |
| Ustolls part | — | None | — | — | >6.0 | — | — | — | — |
| Rock outcrop part. | | | | | | | | | |
| Vashti: | | | | | | | | | |
| 37 | C | None | — | — | 1.5-3.0 | Perched | Oct-May | 20-40 | Hard |
| Venus: | | | | | | | | | |
| 38 | B | None | — | — | >6.0 | — | — | >60 | — |
| Vernon: | | | | | | | | | |
| 39 | D | None | — | — | >6.0 | — | — | 20-40 | Rippable |
| [1]40: | | | | | | | | | |
| Vernon part | D | None | — | — | >6.0 | — | — | 20-40 | Rippable |
| Knoco part | D | None | — | — | >6.0 | — | — | 3-12 | Rippable |
| Waurika: | | | | | | | | | |
| [1]41: | | | | | | | | | |
| Waurika part | D | None | — | — | 1.0-2.0 | Perched | Mar-May | >60 | — |
| Renfrow part | D | None | — | — | >6.0 | — | — | >60 | — |
| Windthorst: | | | | | | | | | |
| 42, 43, 44 | C | None | — | — | >6.0 | — | — | >60 | — |
| [1]45: | | | | | | | | | |
| Windthorst part | C | None | — | — | >6.0 | — | — | >60 | — |

See footnote at end of table.

TABLE 15.—SOIL AND WATER FEATURES—Continued

| Soil name and map symbol | Hydrologic group | Flooding | | | High water table | | | Bedrock | |
|---|---|---|---|---|---|---|---|---|---|
| | | Frequency | Duration | Months | Depth | Kind | Months | Depth | Hardness |
| | | | | | Ft | | | In | |
| Windthorst: | | | | | | | | | |
| Duffau part | B | None | — | — | >6.0 | — | — | >60 | — |
| Yahola: [1]46: | | | | | | | | | |
| Yahola part | B | Common to rare. | Very brief | Apr-Sep | >6.0 | — | — | >60 | — |
| Gaddy part | A | Common to rare. | Very brief | Apr-Sep | >6.0 | — | — | >60 | — |

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.—CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

| Soil name | Family or higher taxonomic class |
|---|---|
| Aledo | Loamy-skeletal, carbonatic, thermic Lithic Haplustolls |
| Anocon | Fine, mixed, thermic Udic Argiustolls |
| Bastrop | Fine-loamy, mixed, thermic Udic Paleustalfs |
| Bolar | Fine-loamy, carbonatic, thermic Typic Calciustolls |
| Bonti | Fine, mixed, thermic Ultic Paleustalfs |
| Bosque | Fine-loamy, mixed, thermic Cumulic Haplustolls |
| Branyon | Fine, montmorillonitic, thermic Udic Pellusterts |
| Chaney | Fine, mixed, thermic Aquic Paleustalfs |
| Cona | Fine, mixed, thermic Ultic Paleustalfs |
| Duffau | Fine-loamy, siliceous, thermic Udic Paleustalfs |
| *Eufaula | Sandy, siliceous, thermic Psammentic Paleustalfs |
| Exray | Clayey, mixed, thermic Lithic Rhodustalfs |
| Gaddy | Sandy, mixed, thermic Typic Ustifluvents |
| Gowen | Fine-loamy, mixed, thermic Cumulic Haplustolls |
| Hensley | Clayey, mixed, thermic Lithic Rhodustalfs |
| Knoco | Clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents |
| Lindy | Fine, mixed, thermic Udic Haplustalfs |
| Miller | Fine, mixed, thermic Vertic Haplustolls |
| Owens | Clayey, mixed, thermic, shallow Typic Ustochrepts |
| Patilo | Loamy, siliceous, thermic Grossarenic Paleustalfs |
| Pulexas | Coarse-loamy, mixed, nonacid, thermic Typic Ustifluvents |
| Renfrow | Fine, mixed, thermic Udertic Paleustolls |
| Sanger | Fine, montmorillonitic, thermic Udic Chromusterts |
| Selden | Fine-loamy, siliceous, thermic Aquic Paleustalfs |
| Stoneburg | Fine-loamy, mixed, thermic Udic Argiustolls |
| Teller | Fine-loamy, mixed, thermic Udic Argiustolls |
| Truce | Fine, mixed, thermic Udic Paleustalfs |
| Ustolls. | |
| Vashti | Fine-loamy, mixed, thermic Aquic Haplustalfs |
| Venus | Fine-loamy, mixed, thermic Typic Calciustolls |
| Vernon | Fine, mixed, thermic Typic Ustochrepts |
| Waurika | Fine, montmorillonitic, thermic Typic Argialbolls |
| Windthorst | Fine, mixed, thermic Udic Paleustalfs |
| Yahola | Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents |

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